



**REMEDIAL INVESTIGATION AND
FEASIBILITY STUDY WORK PLAN
NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS**

July 24, 2003

Submitted by:

ALCOA INC.

CITY OF EAST ST. LOUIS

Prepared by:

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MFG Project No. 020209

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1.0 INTRODUCTION

This Remedial Investigation and Feasibility Study (RIFS) Work Plan is prepared pursuant to the Administrative Order on Consent and Statement of Work (AOC/SOW) for the North Alcoa Site, East St. Louis (U.S. EPA Docket No. V-W-'03-C-728, signed December 31, 2002). Alcoa Inc. and the City of East St. Louis are respondents under the consent order with U.S. EPA. As stated in the SOW:

- a) The RI shall evaluate the nature and extent of contamination at and from the Site and also assess the risk from this contamination on human health and the environment,
- b) The RI shall provide sufficient Site data necessary to evaluate remedial technologies, and
- c) The FS Report shall evaluate alternatives for addressing the risk to human health and the environment from the contamination at and from the Site.

This RIFS Work Plan provides the background information and risk-based technical approach necessary to design and implement the RIFS in accordance with the requirement of the AOC/SOW in a manner consistent with U.S. EPA guidance. The geographic scope of the RIFS is based on a two-part definition of the Site provided in the AOC/SOW (page 4):

“Site” or “Facility” or “North Alcoa Site” shall mean the facility as that term is defined at 42 U.S.C. Section 9601(9), which includes the following areas in East St. Louis, Illinois: 1) the property located north of Missouri Avenue, which is approximately bounded by 29th St. to the west, Alton Southern Railroad to the east and Lake Drive to the north; and 2) areas located north of Missouri Avenue where hazardous substances have or may have come to the located from former Alcoa operations.

The Site boundary set forth in the first part of this definition is shown in Figure 1-1. The Site boundary, described under the second part the definition, will be delineated once the RIFS is completed and the nature and extent of contamination from former Alcoa operations has been characterized. The Site boundary will be finalized in the Record of Decision for the Site, which will be issued by U.S. EPA after public review and comment, based on the findings of the final RIFS report.

As required by the AOC/SOW, and consistent with U.S. EPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERLCA (U.S. EPA, 1988), the RIFS Work Plan describes (1) the Site Background and Setting (Section 2.0); (2) uses qualified existing data; (3) employs a risk-based approach and data quality objectives to develop the technical scope of the RIFS (Section 3.0); and

(4) identifies the data gaps that will be filled by the RIFS (Section 4.0). Appendices A and B, respectively, contain the Project Management Plan and Schedule to complete the RIFS. Detailed work plans to perform the Human Health and Ecological Baseline Risk Assessments are provided in Appendices C and D, respectively. Appendix E includes a compact disk containing all existing analytical data used in the development of this RIFS Work Plan. The project Health and Safety Plan (HASP) can be found in Appendix F. The Sampling and Analysis Plan used to guide the implementation of the RI consists of two parts: (1) the Quality Assurance Project Plan (QAPP, Appendix G-1) which describes the policy, organization, functional activities, and quality assurance and quality control protocols necessary to achieve the data quality objectives of the RIFS; and (2) the Field Sampling Plan (FSP, Appendix G-2), which provides detailed sampling and data-gathering methods that will be used on this project.

2.0 SITE BACKGROUND AND SETTING

2.1 East St. Louis Works Site History

2.1.1 Introduction

At the turn of the 19th century Alcoa, then called the Pittsburgh Reduction Company, started the first commercial production of aluminum. The founder of Alcoa, Charles Martin Hall, discovered a new electrolytic process in 1886 whereby aluminum oxide (alumina), dissolved in a bath of molten cryolite, could be reduced to aluminum metal with a powerful electric current. The Hall-Héroult process (simultaneously discovered by Paul Louis Toussaint Héroult in France) is the basis for all aluminum production today.

Commercial production of aluminum created an entirely new industry and demand rose rapidly. Initially, Alcoa purchased aluminum hydrate, a key intermediate ingredient in the transformation of aluminum ore (bauxite) to metallic aluminum, but suppliers were unable to keep up with the rising demand. Alcoa conducted experimentation into the refining of bauxite into alumina at New Kensington, PA, but soon realized it needed a dedicated facility to serve as Alcoa's first bauxite refinery. The East St. Louis area offered a ready supply of raw materials (coal, limestone, fluorspar), transportation (rail and barge), and labor, and was advantageously located between Alcoa's bauxite mines in Arkansas and its aluminum reduction plants in New York. Land was purchased southeast of the City of East St. Louis in 1902 and alumina manufacturing started a year later with the opening of Plant 1 (Figure 2.1.1-1).

The high demand for alumina in World War I and the use of South American bauxite ores resulted in construction of a second bauxite refinery and an acid plant (Plant 2) completed in 1918. Shortly thereafter production reached approximately 1 million pounds of alumina per day. A temporary shut down of Plant 2 occurred in the early thirties as a result of the Great Depression; however, by 1937, the economy improved and the facility began producing approximately 2 million pounds of alumina per day.

During World War II production increased dramatically at East St. Louis Works and led to construction of a U.S. Government funded Sinter Plant to increase alumina yield from the high silica Arkansas bauxite ore. The sintering operations proved to be uneconomical shortly after the War and this

plant was shut down in 1946 and demolished in the early 1950s. Maximum production occurred in 1943 when daily output exceeded 2 million pounds and the work force approached 2000. A large research lab was constructed to the northwest of Plant 1 in the 1940s and was Alcoa's primary research lab until the Alcoa Technical Center was built in New Kensington, PA in the mid 1960s. Although the East St. Louis Works was relatively inefficient relative to Alcoa's new refineries, demand for alumina and other specialty chemical products kept the facility operational into the late 1950s; however, by 1957, plant operations were no longer economical and a shut down and demolition program was initiated. By the mid 1960s much of the production facilities had been demolished and the land sold. Limited R&D work continued at the Site until 1977, when R&D was entirely relocated to Pennsylvania.

Major milestones for the East St. Louis Works include:

- 1902 March 10th, first land purchased. Construction begins April 5th.
 - 1903 East St. Louis Works begins alumina production using a batch process with bauxite from Alcoa's Arkansas mine. The calcined alumina is sent to Alcoa's reduction plants in Niagara Falls and Massena, New York. First year's production is 11 million pounds.
 - 1905 The Acid Plant begins operations using fluorspar from Illinois and Kentucky to manufacture aluminum fluoride, which is also used in the reduction of aluminum.
 - 1907 Pittsburgh Reduction Company renamed Aluminum Ore Company and then to Aluminum Company of America (now named Alcoa Inc.). Began hauling bauxite residue with light rail rather than mule drawn carts.
 - 1911 Facility changes to the Bayer process, an improved continuous process for alumina production.
 - 1916 Barge shipments of bauxite from Arkansas up the Mississippi River begin unloading at Fox Terminal Dock. Barge shipping continues until 1925, when all material is shipped by rail.
 - 1918 Plant 2, a second alumina and acid plant, begins alumina production using bauxite from Surinam, South America.
 - 1925 Bauxite residue is pumped to residue disposal areas rather than using light rail.
 - 1929 Change over to the dry process for aluminum fluoride production.
 - 1939 Start processing of spent potliner (SPL).
 - 1943 Year of greatest production – 829 million pounds of alumina.
 - 1944 U.S. Government owned Sinter Plant starts – uneconomical and shut down in 1946.
 - 1955 Start U.S. Government fluorspar stockpile near old Sinter Plant.
 - 1957 Refinery shuts down, demolition starts the following year.
 - 1960 Shut down all production at East St. Louis Works.
- Early to Mid 1960s - Property sales.

1977 R&D lab moved to Alcoa Technical Center in Pennsylvania.

With few exceptions, all production facilities at Alcoa's East St. Louis Works were located on an approximate 150-acre area southwest of Missouri Avenue. The facilities are shown in a 1950 aerial photo looking northwest over the plant, perpendicular to Missouri Avenue (Figure 2.1.1-2). The approximate 400-acre area northeast of Missouri Avenue, the North Alcoa Site as defined in the AOC/SOW, was primarily used for stockpiling of raw materials and the disposal of the various wastes generated by the process. Although the focus of this Remedial Investigation Work Plan is the North Alcoa Site, the various industrial processes that took place at the plant site southwest of Missouri Avenue are discussed here to identify potential materials and wastes that may be present at the North Alcoa Site.

A detailed historic plant building map illustrating the building numbering system for the production facilities is shown in Figure 2.1.1-3. Figures 2.1.1-2 and 2.1.1-3 have the same orientation.

2.1.2 Production Processes

The basic steps in the manufacturing of aluminum metal are:

- 1) Mining bauxite ore;
- 2) Refining bauxite into alumina;
- 3) Smelting alumina into metallic aluminum; and
- 4) Casting and alloying the metal.

Only the second step occurred at the East St. Louis Works. Although other ancillary manufacturing processes were performed at the facility, it was the production of alumina and aluminum fluoride from bauxite that dominated the industrial processes at East St. Louis Works.

Alumina

In general, aluminum oxides are extracted from bauxite ore in a pressurized digester with hot sodium hydroxide solution (caustic). The slurry is then thickened and filtered to remove the insoluble fraction, called red mud (bauxite residue), from the sodium aluminate liquor. Aluminum trihydrate (termed "hydrate") is then precipitated and filtered from the liquor. The liquor is recausticized and

recirculated back to the bauxite digesters. The aluminum trihydrate is then calcined in a kiln into alumina, which is typically produced as a white powder. Refining bauxite into alumina is a relatively simple process; however, during the life of the East St. Louis Works, the technology evolved substantially and many variations in the details of production occurred. The East St. Louis Works contained two bauxite refineries. Plant 1 was northwest of 35th Street and Plant 2, which did not start operations until 1918, was southeast of 35th Street (Figure 2.1.1-3). Major variations in the process, the raw materials used, and wastes generated are discussed below in their order within the process at the former East St. Louis Works.

- 1) Bauxite Handling: Bauxite ore was delivered by rail and unloaded, crushed and sieved. Although bauxite handling occurred southwest of Missouri Avenue at Buildings 105, 32, and 26, it is possible that bauxite ore may have been stockpiled for periods at the North Alcoa Site.

Bauxite ore is a reddish brown, earthy material. Much of the bauxite originated from Alcoa's mines in Bauxite, Arkansas, but later bauxite from South America was shipped to the facility for processing. Bauxite can be any material with concentrated hydrated aluminum oxide ($\text{Al}_2\text{O}_3 \cdot \text{XH}_2\text{O}$) usually in the mineral form of gibbsite, boehmite, or diaspore. Typically, bauxite ore is a lateritic soil, the intensely weathered material remaining from a parent rock with a high Al content (usually feldspars). Although aluminum is the third most abundant element in the Earth's crust (present in over 250 different minerals), it is typically tightly bound with other elements, such as silica. Only the hydrated oxide form of aluminum has proven to be economically recoverable.

- 2) Lime Burning: Although most modern bauxite refineries purchase sodium hydroxide for digestion at the former East St. Louis Works, most of the caustic was made by reacting quicklime (CaO , a white powder) with soda ash (Na_2CO_3 , also a white powder). Although the soda ash was purchased, the quicklime was manufactured at the site by "burning" powdered limestone (CaCO_3) in a kiln, driving off CO_2 . At first, coal fired vertical kilns were used for this purpose but later these were replaced with gas fired rotary kilns (Building 143 kilns). In the early plant history there is reference to "gas producers" to fire kilns which may have been a limited coal gasification process. The CO_2 from the kiln was usually used to neutralize all or some alkaline strength of the liquor prior to precipitation. All lime handling and processing likely occurred southwest of Missouri Avenue; however, it is possible that residues of limestone, lime, and soda ash may exist from stock piling at the North Alcoa Site. In the 1950s, the plant began using liquid caustic shipped in by railcars.
- 3) Digestion: Crushed bauxite containing aluminum oxides, quicklime, soda ash, and recycled caustic liquor, would be charged to a digester, heated and pressurized with steam, and agitated. The resulting slurry of red mud and sodium aluminate liquor ($\text{NaAlO}_2(\text{sol})$) would be pulled off and sent to filtration. The caustic liquor was quite alkaline, containing approximately 12.5% sodium hydroxide in concentration. For maintenance, sulfuric acid or caustic could have been used to remove the aluminum trihydrate scale that would build up wherever liquor was circulated. Building 14 and Building 114 were the primary digestion areas of the plant.

- 4) **Red Mud Filtration:** At this stage, the red mud (bauxite residue) was removed from the sodium aluminate liquor. The removal of red mud from the liquor and the subsequent washing, thickening, and disposal of the red mud saw many improvements and changes during the life of the facility. At first, only filter presses were used to strain the red mud from the liquor. Later, vertical leaf pressure filters (Kelly presses) with cotton duck filter media were used, then later rotary vacuum filters removed the red mud. The mud filter cake was washed to recover liquor and the residue transported to the residue disposal areas at the North Alcoa Site using narrow gage rail. Later, the red mud was thickened in wide cone bottomed tanks, washed, and piped to the residual disposal areas at the North Alcoa Site. The pipe-transported residue was only 20-40% solids when discharged at the residue disposal area. The percent solids increased gradually as consolidation of material occurred with time. By 1924 the alkaline red mud lake water was returned to the plant and reused in various portions of the process.

Red mud is red in color, very fine-grained (>90% passes a 200 sieve) and alkaline (pH tape pressed against the material will generally indicate a pH above 10.5). Freshly deposited residue has little compressive strength and has the consistency of pudding. Typical major constituents of red mud include:

| | |
|-----------|-------------------------|
| 30-60% | Fe_2O_3 |
| 10-20% | Al_2O_3 |
| 2-50% | SiO_2 |
| 2-10% | Na_2O |
| 2-8% | CaO |
| Trace-10% | TiO_2 |

The residue from the first 10 years of operation is different from later production in that large amounts of lime (CaCO_3) from the complete neutralization of the liquor during precipitation is expected to be present (see below). This residue was placed in residue disposal area (RDA) 1 (Figure 2.1.1-1). Also, it is likely that a large amount of cotton duck red mud filter fabric was disposed of along the bauxite residue dike areas at the North Alcoa Site.

- 5) **Precipitation:** Precipitation is the process where aluminum trihydrate $\text{Al}(\text{OH})_3$ is crystallized from the sodium aluminate liquor ($\text{NaAlO}_2(\text{sol})$). For about the first 10 years of operation, complete precipitation of the aluminum trihydrate was done in a batch process where the liquor was fully neutralized by CO_2 gas in a vessel called an agitator. Later, partial auto-precipitation using the new Bayer process was employed where seeding of the precipitators facilitated crystallization. After partial precipitation the liquor (now sodium carbonate) was recausticized and recharged to the digesters. Sulfuric acid was typically used to dissolve the large amounts of hydrate that clogged piping and valves in these process areas of the plant.
- 6) **Aluminum Hydrate Filtration:** The hydrate was removed from the sodium carbonate liquor at the "white presses" or "Kelly presses" where cotton duck was used to filter the crystals out. Again, large amounts of waste cotton duck are likely in the areas of the dikes at the residue disposal areas at the North Alcoa Site. As with red mud filtration, many improvements were made in thickening, washing and filtering the hydrate. Later classifiers, spigot thickeners, dorco (dorr) thickeners/filters were used, reducing or eliminating the need for filtration.

- 7) Calcination: Calcining of the aluminum trihydrate $\text{Al}(\text{OH})_3$ involved heating the hydrated alumina in a rotary kiln to drive off the water and produce alumina (Al_2O_3). Alumina (anhydrous aluminum oxide) is a white material in the form of powder, granules, or sometimes rolled into pellets/balls. Oil, or natural gas were used to fire the kilns; however, in the early plant history, there is reference to “gas producers” to fire kilns, which may have been a coal gasification process.

In the first year of production (1903), the facility produced 11 million pounds of alumina. In 1943, East St. Louis Works hit its maximum production at 829 million pounds of alumina as part of the concerted war effort. During the last year of alumina production, 1957, approximately 262 million pounds were manufactured. An estimate of the total mass of alumina produced during the life of the plant, is 19.5 billion pounds.

Although there are many types and different uses of alumina, the large majority of alumina produced at East St. Louis Works was smelter grade material used at Alcoa’s North American smelters for the production of aluminum metal. However, East St. Louis Works did have a Specialty Chemicals Division that produced a wide variety of alumina-based products. In the later years of the facility’s life the output of these other alumina-based products was a significant portion of the total plant’s output. Some of the product and their uses included:

- Low soda alumina, used for ceramics applications.
- Activated alumina for use as a filter, absorbent or catalyst in various wastewater or chemical processes.
- Calcium aluminate used as a cement additive.
- Tabular alumina.
- Refractory grade alumina for casting and firing into refractory brick or ceramics.
- Alumina gels used as adsorbents and desiccants.
- Hydrate fire retardant.
- Dried sodium aluminate for use in municipal water treatment.

All of the industrial operations manufacturing these products were southwest of Missouri Avenue and not associated with the North Alcoa Site. Review of the available historic literature does not indicate any raw materials, intermediates or wastes from these alumina-based products were transferred to the North Alcoa Site, although off-spec product may have been disposed there.

Fluoride (Acid) Plant

Besides alumina and alumina-based products, many fluoride products were produced at East St. Louis Works. The primary product was aluminum fluoride (a white powder, AlF_3) which on a mass basis was the second largest product manufactured at the East St. Louis Works. Maximum production rates for aluminum fluoride were likely around 60 million pounds per year. Alumina fluoride, like alumina, is primarily used in the aluminum smelting process.

In general, the process of manufacturing aluminum fluoride is simple. Aluminum trihydrate is reacted with hydrofluoric acid or hydrofluoric gas and is then calcined to anhydrous aluminum fluoride. The major process at East St. Louis Works related to this production was the generation of the hydrofluoric acid/fluorine gas. This occurred in what was called "acid plants", one at Plant 1 (Building 36) and another at Plant 2 (Building 136). Fluorspar ore (composed of the mineral fluorite, CaF_2) was reacted with sulfuric acid (H_2SO_4) in a still, liberating hydrofluoric gas which was used to fluorinate aluminum trihydrate, or as a source of fluoride for the other fluoride products. During reaction, calcium sulfate (which is the mineral gypsum, CaSO_4) would precipitate in the still. The gypsum was removed (often had to be chipped out) and disposed of at the North Alcoa Site by narrow gage rail car and clamshell bucket. Later a dry process was used where fluorspar was reacted with sulfuric acid in a rotating heated kiln with a breaker. The process is exothermic so minimal firing was needed. The gypsum was in dry powdered form leaving the kiln. Fluorine gas was liberated which was then reacted with dry alumina hydrate producing an anhydrous aluminum fluoride. This gypsum had cementitious properties and was used to buildup the red mud lake dikes that contained the bauxite residue. For a short period (1930 to 1937) a portion of the gypsum waste from the fluoride process was reprocessed into plaster products (Plaster Plant building 138). The process was discontinued as it was not profitable.

The first Acid Plant started production of aluminum fluoride in 1907, but at some point all fluoride production was moved to the Acid Plant at Plant 2. Fluorspar was obtained from a variety of sources but the majority originated from southeastern Illinois and Kentucky, where Alcoa owned and operated mines. Lead and other elements, such as silver, are associated with fluorspar and tend to remain in the gypsum.

In addition to aluminum fluoride, there were several types of fluorine-based products produced at East St. Louis Works, but on a more limited basis. The largest of this group was cryolite (Na_3AlF_6) which may have reached 40 million pounds a year for short periods when cryolite has in high demand. Cryolite

is a naturally occurring mineral that is critical to the aluminum smelting process as a fluxing agent. Early in the aluminum smelting history natural sources of cryolite were exhausted and a means to generate a synthetic cryolite was derived. East St. Louis Works produced cryolite from early in its history. Cryolite is also used as an insecticide on many fruits, vegetables and ornamental crops to protect against leaf eating pests. East St. Louis Works produced insecticide grade cryolite (dusts, wettable powders and water dispersible granulars). Some of the other fluorine-based chemicals produced at East St. Louis Works included:

- Anhydrous liquid HF;
- Sodium fluoride and sodium bi-fluoride which among other uses is the form of fluoride typically in toothpaste;
- Fluoboric acid; and
- Wolman salts for wood preservation.

All of the industrial operations manufacturing these fluoride products were southwest of Missouri Avenue and were not associated with the North Alcoa Site. Other than the gypsum, review of the available historic literature does not indicate any raw materials, intermediates or wastes from these products were transferred to the North Alcoa Site.

Other Processes

- Sinter Plant: During WWII the demand for aluminum, and therefore alumina, exceeded supply. In order to rapidly increase production, the U.S. Government agreed to finance various expansion programs with Alcoa. One such program at East St. Louis Works was the Sinter Plant. Due to the limited supply of high quality overseas alumina during the war, use of the domestic supply of bauxite (from Arkansas) was increased. However, Arkansas bauxite has a very high silica content which reduces the recoverable aluminum from the ore using the conventional Bayer Process. One means to increase the yield of aluminum oxide was to reprocess the red mud by sintering (in rotary kilns), with limestone and soda ash and returning the clinker (sintered aggregate) back for a second digestion. The kilns were fired first by coal, then natural gas.

The sinter plant was built northeast of Missouri Avenue at the southern end of the North Alcoa Site in 1944 (Figures 2.1.1-1 and 2.1.2-1). As such, the sinter plant was the only substantial industrial operation at the North Alcoa Site. Although built and operated by Alcoa, the facility was intentionally separated from Alcoa operations as it was not owned or managed by Alcoa. The plant experienced several production problems and never produced a large volume of sintered material. By early 1946, the plant was shut down and portions sold to Alcoa. The equipment was removed and the facility demolished by the early 1950s (Figures 2.1.2-2, 2.1.2-3, and 2.1.2-4). The heavy concrete foundations of the rotary kilns and materials silos remain today.

Some amount of “brown mud”, similar to red mud, from the digestion of the sintered clinker was slurried to RDA 2, just to the northeast of the Sinter Plant (Figure 2.1.1-1). This residue disposal area is sometimes referred to as the “Brown Mud Lake”; however, the volume of brown mud is likely quite small with respect to the red mud content and may only form a discrete layer within the deposit of red mud.

- Power Production: The large electrical and steam requirements of the East St. Louis Works were not readily available in the area until much later in the life of the facility. As such both Plants 1 and 2 had steam and electrical generation capacity (Buildings 10 and 110). Groundwater was softened for use in the boilers that were fired at first by coal and later by fuel oil. Two large fuel oil above ground storage tanks were constructed in 1928 to the southeast of Plant 2 when power production shifted to oil. Large amounts of coal were used in the first part of the facilities operational history; and although there is no clear record of ash and clinker disposal to the North Alcoa Site, it appears likely this material was disposed of as miscellaneous fill in this area.
- Cryolite Recovery: In 1939 a cryolite recovery process (called the Heiser Process) was started at the south end of Plant 2 in Bldg 138 (Figure 2.1.2-5). Cryolite bath was recovered from spent potliner (SPL) shipped from Alcoa’s smelters in Massena and Niagara Falls, NY. Spent potliner is the used carbon cathode from the electrolytic reduction cell for smelting aluminum. The process of recovering cryolite bath from the SPL is similar to the synthetic cryolite production that was performed at the Acid Plants at the East St. Louis Works. First, SPL was crushed to a fine granule and then leached with a hot caustic solution. The liquor was then thickened, filtered, and neutralized such that the cryolite precipitated. The precipitated cryolite was then filtered and dried with the liquor returning to the refining plant digestion.
- The residues from the SPL recovery process are typically called “black mud” and would contain carbon, have a high alkalinity, and likely contain some of the typical constituents in SPL, such as fluoride and cyanide. There is no apparent record of where SPL may have been stored prior to processing; however, there is some field evidence to suggest SPL was stored at the North Alcoa Site in an area near the intersection of the dikes for RDAs 1 and 2 (Figure 2.1.1-1). The black mud was thickened and washed in settlers and sent to the residue area as a slurry. Also there appears to be some cyanide present as a discrete layer of Prussian blue staining (ferroferric CN) in RDA 2, and may be indicative of disposal of black mud to this mud lake.
- Scale Processing: A large amount of scale from the Bayer plant (aluminum trihydrate) removed from piping and vessels was recovered and reprocessed by separate digestion in Buildings 18 and 42 (Figure 2.1.1-1). It is therefore unlikely that large amounts of hydrate scale would have been disposed of at the North Alcoa Site due to the value of the material and the presence of on-site facilities to process it.
- Plane Scrap, Dross and Skim Processing: Following WWII there was a large amount of scrap aluminum metal from military surplus. Much of this material was remelted in various Alcoa facilities. During the remelting operations some of the aluminum is lost to dross and skim created as the aluminum metal oxidizes and reacts with the flux (usually metal chloride salts). Apparently for a short period in 1945 some 37 million pounds of this material was processed to recover the aluminum at East. St. Louis Works. Dross and skim are generally aluminum oxides with some silica and chloride salts. The dross and skim were digested with hot caustic, just as bauxite is done, with the sodium aluminate liquor being incorporated into the alumina precipitation process. The process was not continued due to high cost.

2.1.3 North Alcoa Site

This section focuses on the historical activities and waste disposal that occurred at the North Alcoa Site (Alcoa properties northeast of Missouri Avenue) prior to and during operation of the East St. Louis Works.

Land Use Prior to Alcoa

Prior to Alcoa's purchase, the property use at the North Alcoa Site appears to have been two fold. First, a substantial portion of the property was the upper end of Pittsburg Lake, a large oxbow lake (meander scar of the Mississippi River) as is evident on a topographic map dating back to the turn of the 19th century (Figure 2.1.3-1). Today Pittsburg Lake is not present within the North Alcoa Site, and appears to have been largely filled with wastes and fill associated with the operations of the East. St. Louis Works (and perhaps fill from other sources) as discussed below. That portion of the North Alcoa Site to the south of former Lake Pittsburg, now partially occupied by RDA 2, was used for farming as indicated in several early aerial photos (Figures 2.1.3-2 and 2.1.3-3).

Buildings

Besides the short existence of the Sinter Plant (discussed above), a few buildings were constructed within the North Alcoa Site during Alcoa's ownership of the property, as listed below and shown on Figure 2.1.1-1:

- Cooking Utensil Warehouse (Building 50): The Aluminum Cooking Utensil Co. constructed a 46,000 square foot warehouse in stages from 1911 to 1924 for the storage of cookware products on what at the time was Alcoa property. The building has a saw-toothed roofline and is across Missouri Avenue from Plant 1 (see foreground of Figure 2.1.3-4). No cookware manufacturing was done at the facility; however, there was a small "buffing room" (Building 51) where the aluminum cookware was polished prior to packaging. The warehouse operation was closed in 1932 and subsequently the building became the supply house for the Alton and Southern Railroad, an Alcoa subsidiary at the time. The warehouse building remains today, but the buffing room was demolished.
- Alton and Southern RR offices (Building 50A): Located in front of the cooking Utensil Warehouse, these offices were built in 1928 and were originally used as offices and experimental labs for a mono-hydrated bauxite venture. They subsequently were used as office space for the Alton and Southern Railroad, an Alcoa subsidiary at the time. This building remains today as Metro East Recycling Center.

- Truck Garage (Building 52): Also built in 1911 as part of the Cooking Utensil Warehouse operations, this was a distribution truck maintenance facility. There is no record of use after 1924.
- On an aerial photo dated 1930, three other groups of buildings appear for which no information was available (Figure 2.1.3-5). One group of buildings, no longer in existence, appears in the area of what is now Upchurch Redi Mix Company near the intersection with N. 29th St. A second building is evident as the same building the Hamil Construction Company is located in today, and a third group of buildings appears to the northeast of the Hamil Construction Company building, but are no longer in existence today.

Material Stockpiling

It is evident in the aerial photos that materials were stockpiled west of the residue disposal areas during the operational period of the East St. Louis Works. No information has been found regarding what specific materials were stockpiled other than the bauxite residue and gypsum disposed of at the site.

Based on the site history, remnants of stockpiled materials remaining at the site may include:

- Coal and coal coke. During the life of the East St. Louis Works a large volume of coal and coke was used, ranging from 2 to 8 pounds for each pound of alumina produced.
- Fluorspar. The U.S. Government has stockpiled ground fluorspar on a portion of the North Alcoa Site since the mid 1950s as part of the strategic mineral reserve (Figure 2.1.1-1).
- Bauxite ore
- Limestone and lime
- Soda ash

It appears unlikely that product (hydrate, alumina, aluminum fluoride) would have been stored in bulk at the North Alcoa site since these materials required shelter.

Waste Disposal

Bauxite Residue

The largest volume of waste material present at the North Alcoa Site is bauxite residue. Using a modern value of 0.6 lb of residue generated during the manufacture of one pound of alumina, the 19.5 billion pounds of alumina produced would suggest some 6 million tons (4.7 million cubic yards at 0.8 cy/ton) of residue may have been disposed of at the North Alcoa Site; however, this value likely

underestimates the true mass/volume since East St. Louis Works likely operated in a less efficient manner than modern refineries.

Consistent with historical nomenclature, there are three large/named RDAs of approximately 40 acres each (Figure 2.1.1-1). These RDAs are all adjacent to one another and form a rough triangular shape of 120 acres with the 3 RDAs forming the apexes of the triangle (RDA 1 is the northwest apex; RDA 3 is the northeast apex; and RDA 2 is the south apex). Although not formally recognized as such, after review of the existing data it appears there is a fourth, much smaller and older impoundment, possibly an RDA, located on property not part of the North Alcoa Site between the railroad and Missouri Avenue where the research lab was constructed in the 1940s (Figure 2.1.3-5).

In addition to the three named bauxite residue disposal areas and the fourth RDA at the R&D Lab, bauxite residue may have been disposed of over a broader area of the North Alcoa Site. There is historical topographic evidence that the original Lake Pittsburg extended into the area between the RDAs 1, 2, and Missouri Avenue (some 50+ acres), which subsequently may have been filled with residue during the early history of the facility (Figure 2.1.3-1). There is also an unnamed diked area of some 20+ acres immediately north of RDA 1 and south of Lake Drive that may also contain bauxite residue (Figure 2.1.1-1). An industrial pond of unknown use between Missouri Avenue and the current location of RDA-2 is observed in historical photographs (Figure 2.1.3-6).

RDA 1, the northwestern and oldest of the large RDAs, is also likely the thickest and may contain the most residue. Although originally surrounded by gypsum dikes, the dike was breached on the western end (likely in the 1930s) to mine some of the residue. About a 5 acre area of residue was removed and the dike left open. Of particular note is that the historical photos clearly indicate the mine high wall was vertical and free standing in 1937 suggesting the residue had consolidated quite rapidly. This quick consolidation may be related to the possibility that this residue contains a larger fraction of lime than the material in RDAs 2 and 3.

RDA 2 (the southern RDA) is the youngest deposit and may also be the thinnest (least amount of residue). RDA 2 is sometimes referred to as the "Brown Pond" reflecting the contribution of brown mud from the Sinter Plant; however, as mentioned before, the actual volume of brown mud may be small relative to the volume of red mud. Based on field evidence, at some point this RDA may have received black mud from the spent potliner cryolite recovery operation, although there is no record as such. Toward the later period of the facility operation, it is clear that RDAs 2 and 3 were hydraulically

connected as the liquid level of the residue lake covered the interior dike separating the two deposits (Figure 2.1.3-7).

RDA 3 (the northeastern RDA) is of intermediate age and thickness to RDAs 1 and 2. RDA 3 is referred to as the "Red Pond" and also as the "East Lake" in historical Alcoa engineering documents. The eastern gypsum dike stretches in an arc from the south to the north. There is a smaller parallel outer dike that separates the RDA from the North Wet Area to the east and north. A main line of the Alton and Southern Railroad runs immediately adjacent to the eastern toe of the main dike. Correspondence in 1964 references lateral slippage of this dike, causing displacement of the active rail line to the east. Some investigations and remedial work was done. Reportedly the lake was drained through a ditch on the south side after the Bayer plant ceased production in November 1957. Dust became a problem along the sandy beach of residue (about 100 feet wide paralleling the dike) so some gypsum was used to pave the eastern surface of the RDA about halfway around the north curved side when operations ceased in 1961 (Figure 2.1.1-1).

Gypsum

Review of the historical process records does not provide an estimate of the volume of gypsum disposed of at the North Alcoa Site. Due to its cementitious properties and the mode of disposal (light rail and clam shell bucket from hopper cars) the gypsum was used to build up the dikes along rail lines. These dikes exist for the three main residue disposal areas, plus a smaller impoundment area north of RDA 1 (Figure 2.1.1-1). It should be expected that red and white press cotton duck filter media and other miscellaneous wastes may be present in the dike areas based on historic access by the light rail system.

Black Cinders/Coal

Near the surface of the properties southwest of the RDAs and on top of some portion of the RDAs, black vesicular cinders are present and visible. Although the source of these cinders is not certain, it appears they may be bottom ash from coal. These cinders were likely considered good fill material and used as such. In addition to cinders, waste coal was found on the properties during a prior site visit.

SPL and Black Mud

As discussed previously, there is a small area near the intersection of the dikes for RDAs 1 and 2 where black carbonaceous material is present, possibly the remnants of a former SPL stockpile from the

cryolite recovery operation (Figure 2.1.1-1). Also as discussed previously, there is some field evidence that black mud was disposed of in RDA 2.

2.2 Site Setting

2.2.1 Climate and Meteorology

The Site is located in the City of East St. Louis, in the center of the United States, near the confluence of the Missouri and Mississippi Rivers. The mid-continental location of the area provides a climate that is subject to large fluctuations without the buffering of a large water body nearby. Cold air migrating down from Canada meets the warm, moist air of the south, and the Gulf of Mexico. The result is a highly variable climate with cold, sometimes freezing, temperatures in the winter and hot weather in the summer. Weather changes from day to day are common as a result of the cold and warm air masses that move in and out of the area.

With this high variability comes frequent direct contact between the cold dry air masses of the north and the warm moist air masses of the south. These interactions can spawn violent weather including thunderstorms and even tornadoes on occasion. However, the constant changing nature of the weather in the area also prevents the occurrence of extremes in temperature. Temperatures below zero average one to two days per year and similarly temperatures above 100 degrees are expected no more than 5 days a year.

Precipitation for the area is average for the US, about 37 inches. However, the driest season is the winter, with only 18% of the annual precipitation occurring in December, January and February. The wettest period of the year is from March through July when 50% of the annual precipitation falls in this 5-month period. Annual snowfall averages about 20 inches.

Figure 2.2.1-1 is a plot of wind speeds and directions, called a "wind rose." The plot shows the frequency of winds from different directions as a series of projections from the center of the figure. The relative length of each projection is representative of the frequency of winds coming from that direction. Speeds are shown using different shading patterns.

As the figure shows, there are two major wind patterns for the area. During the cooler months of the year from November through April, the prevailing wind direction is from the west-northwest. These

winds are frequently caused by large low-pressure systems located in south-central Canada that transport winds from northwest to southeast in much of the mid-continent. Wind speeds are strongest during this time of year, averaging between 10 and 12 knots. The other pattern occurs during the warmer months from May through October, when the prevailing wind direction is from the south. These winds are caused by high-pressure systems located in the Gulf of Mexico that create gradient flow from south to north. The wind speeds associated with this pattern are typically lower, averaging from 7-9 knots. It is the interaction and competition between these two major weather systems that produce the violent and changing weather discussed above. However, as the wind rose shows, all wind directions occur from time to time in the area.

2.2.2 Soils

The Site is located in a broad alluvial valley that was a former flood plain of the Mississippi River known as the American Bottoms. Much of the native soils in the City of East St. Louis are part of the Bottomlands soils group as classified by the University of Illinois Agricultural Experimental Station (Schicht, 1965). Due to historical flooding and the need to promote development, much of this area has been built up by filling. Therefore, the majority of the surficial soils present in the City of East St. Louis today is fill material. The fill material has been found to contain clay, sand, gravel cinders (from coal burning), limestone fragments, cloth remains and organic material (IEPA, 1997). In addition to the fill soils, on-site, there are two other general types of material at the surface as a result of the former Alcoa process: bauxite residue and gypsum. There may also be a small area of remnant SPL at the surface in an area where this material may have been historically stockpiled. The spatial distribution of the on-site soil types are shown in Figure 2.2.2-1. In general, much of the bauxite residue was deposited into the three mud lakes (residue disposal areas), which was stabilized and contained by the gypsum berms.

The surficial bauxite residue generally consist of fine-grained (generally >90 % less than 200 sieve material) red or brown clay/silt material. Vegetated and unvegetated areas of bauxite residue are shown in Figure 2.2.2-2. Typically, the surficial material in RDAs 2 and 3 is redder in color than in RDA 1. This may be due to the use of limestone during the early periods of refining when RDA 1 was created. As a result of the fine-grained nature of the surficial residue, dusty conditions can occur during dry periods.

Surficial material in the vicinity of the RDA berms is comprised primarily of gypsum, which was a byproduct from the Acid Plant (Section 2.1). The soils are coarse- to fine-grained and are semi-consolidated due to the cementation of the gypsum. In addition, in some areas, large (1 to 3 foot diameter) bubble structures have formed (Figure 2.2.2-3). Most of these bubble structures are not completely competent and can be broken by walking on them.

The remainder of the Site's surficial soil appears to consist of fill material, but may also contain portions of the bauxite residue and gypsum mixed within them.

2.2.3 Surface Water

Much of the City of East St. Louis and the Site are situated in the Till Plains section of the Central Lowlands Physiographic Province (Schicht, 1965). The Site lies within the floodplain of the Mississippi River, and the topography consists of nearly level bottomland. Historically, the City of East St. Louis and the Site vicinity have been filled in to elevate the area above the floodplain (IEPA, 1997; IEPA, 1999). Drainage in the area generally flows toward the Mississippi River; however, no well-defined surface water drainage pathways have been determined from the North Alcoa Site.

The major surface water feature in the Site vicinity is the Mississippi River, which is located approximately 3 miles to the west of the Site. There are no significant surface water features between the Site and the river; however, to the east of the Site is Frank Holten State Park which contains several large recreational lakes in the area previously referred to as Pittsburgh Lake. Although these lakes drain to the south to the Harding Ditch and the Prairie Dupont Floodway (Figure 2.2.3-1) to the Mississippi River, these water bodies do not appear to be hydraulically connected to the Site via surface water pathways. This was confirmed during a Site visit by MFG and Alcoa on January 22, 2003. Therefore, any surface water discharge from areas on-site is not expected to impact the lakes at Frank Holten State Park.

Some amount of stormwater from the North Alcoa Site may find its way to sewer lines along Missouri Avenue and other adjacent roadways; however, the current status of the sewer lines and their interconnection with Site stormwater has not been evaluated. During the RI, existing information on the sewer system at the Site will be compiled and used to develop a Sewer Characterization Plan.

2.2.4 Hydrogeologic Setting

2.2.4.1 Geology

The Site is located in an area known as the American Bottoms, which consists of up to 120 feet of unconsolidated valley fill overlying Mississippian and Pennsylvanian bedrock. The valley fill is composed of recent alluvium and glacial outwash sand and gravel deposits. Generally, there are two recognized unconsolidated formations in the valley fill: (1) the Cahokia Formation and (2) the underlying Henry Formation. The lower, more permeable portion of the Cahokia and the Henry Formation make up the American Bottoms Aquifer.

The Cahokia Formation is a floodplain deposit that is typically 30 to 50 feet thick. The upper 15 to 30 feet consist of fine-grained clay and silt materials. The lower part of the formation also contains sand lenses and the sediments generally coarsen downward. The Henry Formation consists of sand and gravel glacial outwash deposits that can be up to 120 feet thick. The formation coarsens downward with gravel, cobbles, and boulders near the base of the formation. The Henry Formation comprises the majority of the American Bottoms Aquifer (Burlington Environmental, 1992).

As discussed in Section 2.2.2, fill material is present overlying the Cahokia Formation over much of the City of East St. Louis. Geoprobe borings indicate that fill covers much of the Site and consists of clay, sand, gravel, black cinders and organic material.

2.2.4.2 Hydrogeology

The American Bottoms Aquifer is very transmissive and is in hydraulic connection with the Mississippi River (Schicht, 1965). The aquifer conditions range from unconfined to confined conditions depending on the stage of the Mississippi River and the thickness of the overlying Cahokia Formation. A generalized hydrogeologic cross-section for the site vicinity is depicted in Figure 2.2.4-1.

During investigations at the Site performed by IEPA in 1996 as a part of a redevelopment study, groundwater levels were observed in the fill and upper Cahokia Formation to be between 2 and 20 feet below ground surface (IEPA, 1999). This would indicate that there are perched water zones in the fill material that overlays the Cahokia Formation at the Site. Four monitoring wells were installed into the upper portion of the American Bottoms Aquifer (lower Cahokia Formation) by Burlington Environmental

at the Illinois Power Site, and water levels were measured at approximately 8-9 feet below ground surface (Burlington Environmental, 1992). A hydrogeologic cross-section from the Illinois Power property is presented in Figure 2.2.4-2.

Groundwater flow in the American Bottoms Aquifer is generally westward toward the Mississippi River; however, localized flow directions within the aquifer have been modified by industrial groundwater use, historically. A regional potentiometric surface map for the City of East St. Louis and vicinity area was generated as part of an unpublished report by the Illinois State Water Survey (Figure 2.2.4-3), which indicates a west-northwesterly groundwater gradient in the vicinity of the Site (ISWS, 1995). Water level data obtained during the RI will be combined with available off-site water level information as appropriate to produce an updated potentiometric map.

A number of aquifer and specific capacity tests were performed on the American Bottoms Aquifer in 1952 and 1962 in St. Claire County and Madison County (Schicht, 1965). Schicht discusses the results of several specific aquifer tests, and in addition presents tables of hydraulic properties, included transmissivity values, obtained from a number of other specific capacity tests performed on industrial, municipal, irrigation and relief wells. Hydraulic conductivity data obtained from the aquifer and specific capacity tests were plotted and contoured to show the spatial distribution of the hydraulic conductivity data (Figure 23 in Schicht, 1965). Based on this figure and the relative location of the Site, the hydraulic conductivity in the vicinity of the Site is estimated to be 9.4×10^{-2} cm/sec. Because many of the wells are screened in the lower part of the Henry Formation, this value is probably most applicable to the more permeable, lower-most portion of the aquifer.

2.2.4.3 Groundwater Use

Groundwater historically pumped from the American Bottoms Aquifer was used primarily for industrial and commercial purposes (Schicht, 1965). However, there has been a significant downturn in industrial activity in the City of East St. Louis in the last few decades. In addition, an ordinance prohibiting the installation of new potable water wells was passed by the City in 1997, as discussed in Section 3.1.7. Therefore, a preliminary assessment of the current status of water wells in the vicinity of the Site was performed. Databases from the Illinois State Water Survey, Illinois State Geologic Survey and the United States Geologic Survey were queried for existing water wells in the vicinity of the Site. In all, there were approximately 46 wells listed in these databases that reportedly are located within a 1-mile

radius of the Site. Information from the databases for these wells is listed in Table 2.2.4-1. Most of the wells were installed in the 1930s and 1940s for industrial and commercial uses. Schicht (1965) indicates that due to inefficient well screen and filter pack design, historical water wells have had shortened service lives. That wells do not appear to have not been newly installed or replaced in the last several decades suggest a historical shift away from heavy utilization of groundwater in this area. The water supply for the City of East St. Louis is currently provided by the Illinois-American Water Company (IAWC). Interviews with IAWC indicate that all of the City’s water supply is produced from the Mississippi River, and there is no use of groundwater. A limited field investigation was performed to try to locate and confirm the status of the wells listed in Table 2.2.4-1. Only a few monitoring wells and one abandoned domestic well were located. Location information in the database(s) is very limited. This complicates the task of locating the wells (if they exist). It is anticipated that the majority of the wells are not being used or have been abandoned since the introduction of surface water supplies. As a part of the proposed Phase I groundwater investigation (Section 4.3), a comprehensive water well survey and outreach program will be performed to further characterize groundwater usage in the downgradient vicinity of the Site. The results of this process will be utilized in the Baseline Risk Assessment.

2.2.5 Land Use

Regional land use in the vicinity of the Site includes residential and other urban uses, industrial and commercial uses, and parks. As indicated on Figure 2.2.5-1, the property to the north and east of the Site (indicated by the yellow boundary line) is mapped as residential or urban land use. The area southwest of the Site, and south of Missouri Avenue, is mapped as industrial land use. Frank Holten State Park occurs within the transitional area east of the Site. The land use within the Site is primarily industrial/commercial. A detailed site ownership map, obtained from the county tax assessors office, is provided in Figure 2.2.5-2. Much of the Site is used for storage of bauxite residue and gypsum, and is owned by the City of East St. Louis. Alton & Southern Railroad owns rail spurs along the eastern boundary of the site, as well as inactive right-of-ways south and west of the residue disposal areas. Active industrial/commercial operations occur on the following parcels:

| <u>Owner</u> | <u>Industrial Activity</u> |
|--------------------------|----------------------------------|
| Koppers Industries, Inc. | Light rail recycling facility |
| Burrous | Government fluorspar stockpile |
| Upgrade Construction | Alorton Brick (resale of bricks) |
| Carron | Metro East Recycling Center |
| Upchurch | Upchurch Redi Mix Company |

Illinois Power
Smith

Former Maintenance Facility
Hamel Construction Company

The remaining industrial/commercial properties do not appear to be in use at the current time. Some of the inactive properties have been considered for brownfield redevelopment by various entities. Notably, a large area between the bauxite residue impoundments and Missouri Avenue was the subject of a CERCLA redevelopment study funded by U.S. EPA and conducted by IEPA (IEPA, 1999).

Recreational uses occur within the Site on the Jackie Robinson ball fields in the northwest corner of the Site, owned by Alton & Southern Railroad (Figure 2.2.5-2).

2.2.6 Ecology

The Site is dominated by a number of volunteer plant communities that have become naturally established since the cessation of Alcoa's industrial activities in the 1950s. A majority of the Site is currently vegetated by these communities and is found in varying degrees of natural succession. Only the gypsum berm areas and several patches on each of the three RDAs lack an established vegetative community.

Successional upland forests dominate in the boundary areas outside of the RDA impoundments. These forests are early to mid-successional woodlots interspersed with dense shrub/scrub habitat and old field successional areas. Also interspersed are multiple small areas of emergent wetland vegetation. According to a biological survey conducted at the Site in 1999 (Zambrana Inc., 1999), the vegetative community in the woodlots consist mainly of Siberian elm (*Ulmus pumila*), sycamore (*Plantanus occidentalis*), and cottonwood (*Populous deltoides*). The shrub layer is dominated by bush honeysuckle (*Lonicera maackii*), tall goldenrod (*Solidago altissima*), spiderwort (*Tradescantia ohioensis*) and Queen Anne's lace (*Daucus carota*). Within the more mesic areas of the Site, emergent species such as the common reed (*Phragmites communis*) and soft-stem bulrush (*Scripus validus*) are found in dense stands. On the RDA impoundments, a mixture of emergent wet vegetation and, in the more xeric portions, successional old-field communities predominate. Both RDA 2 and RDA 3 are bordered by a ring of mature sycamore trees and tree-of-heaven (*Ailanthus altissima*) while RDA 1 is primarily vegetated by a shrubby mosaic of bare ground and small woody species.

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No state or federal species of special concern were identified in the 1999 biological report (Zambrana Inc. 1999) as having more than a low potential for on-site use. A thorough discussion of the ecology and potential wildlife species that may inhabit the Site is presented in the Ecological Risk Assessment Work Plan (Appendix D).

3.0 PROJECT SCOPING

3.1 Technical Approach

Key issues, concepts, and processes used to develop the RIFS technical approach are described in the following subsections.

3.1.1 Process for Identifying Chemicals of Interest (COIs)

A list of site-wide Chemicals of Interest (COIs) has been developed for this Work Plan based on information about facility history and process descriptions (as is discussed in Section 3.2) and existing environmental datasets. U.S. EPA guidance for determining appropriate analyte lists for a site is generally focused on evaluation of environmental datasets (U.S. EPA, 1992). However, given the extensive process knowledge of the historic operations at the former East St. Louis Works and the associated industrial/environmental knowledge of current alumina manufacturing operations, the types of chemicals that would be expected to be present in the waste materials at the site are well defined. As such, the COI selection process for the RIFS Work Plan is conducted in two stages – developing a list based on historical knowledge (Alcoa Analytes) and adding to this list by compiling and screening existing, environmental datasets against conservative risk-based screening levels (COIs based on existing data). As discussed in Section 3.1.3, Phase I of the RI will include an initial sampling event for the COIs. Additionally, the EPA and Alcoa agreed that 10% of the samples would also be analyzed for the Target Analyte List (TAL)² and Target Compound List (TCL). Another risk-based screen will be used to refine the COI list in the Phase 1 risk characterization.

COIs that are carried into the baseline risk assessment after the RI will be redefined as chemicals of potential concern (COPCs) for human health risk assessment purposes and chemicals of potential ecological concern (COPECs) for ecological risk assessment purposes.

3.1.1.1 Alcoa Analytes

Historical COIs were established from research of facility documents relating to process knowledge and operational history. Much is known about the history and operations at the site (Section 2.1). Section 3.2 presents a discussion of the identification of Alcoa Analytes.

3.1.1.2 COIs Based on Existing Data

Several environmental investigation datasets have been developed. These datasets were entered into a site-wide database, but only the datasets with adequate quality assurance/quality control documentation and location information were used for screening-level decision-making purposes. These datasets are summarized and discussed in Section 3.3. To determine the COIs based on existing data, soil and sediment data from the CERCLA Redevelopment Report (IEPA, 1999), the CERCLA Integrated Site Assessment Report for the Childs Property (IEPA, 1997), the Alcoa site Phase II Report (ARDL, 2001) and an unpublished dataset of surface water and sediment (Illinois EPA, 2000) were compared with conservative screening levels.

For human health risk assessment purposes, risk-based concentrations (RBCs) from U.S. EPA Region III (as requested by U.S. EPA Region V) for residential soil were compared with analytical results of all samples collected from depths less than one foot (i.e., surface soil). Surface soils are the focus of the risk screening because soils at the surface are both the most readily accessible for possible on-site receptors as well as potentially available for wind generated off-site migration of particulates. Residential criteria for direct contact pathways were conservatively used to ensure protection of human health in the event that fugitive dust emissions from on-site could migrate to an off-site residential receptor. Although pesticide data are available for some samples, these data were not included in the evaluation since they were only measured in very low concentrations and because they are ubiquitous in the environment, especially in urban settings where they are used for pest control and vegetation management. Furthermore, they are not related to former Alcoa operational processes.

For the ecological portion of the data evaluation, site and receptor specific soil screening levels (SSLs) were developed and compared to existing soil and sediment data. Only data from soils that could readily come into contact with ecological receptors (i.e., < 1 ft bgs) were included in the analysis. Receptors ranging from 2nd trophic level consumers (small mammal herbivores) to upper trophic level

predators (coyote, raptor, and predatory waterfowl) were evaluated. The screening level ecological risk evaluation addressed both direct ingestion of abiotic media and the ingestion of prey items that may have elevated levels of COIs in their body tissues. Much of the Site has been heavily industrialized, and existing on-site habitat is primarily “volunteer” communities, which may at best have transient ecological presence. However, for the purposes of assuring conservatism in the screening level risk evaluation, all receptors were assumed to be on-site residents spending 100% of their time feeding in areas with potentially elevated COI concentrations. As with the human health screening level risk evaluation, pesticides were not included due to their low levels, lack of process use, and ubiquitous presence in the urban landscape.

It should be noted that most of the environmental samples were analyzed for volatile organic compounds (VOCs), but these were typically not detected or detected at concentrations well below screening criteria. As such, no VOCs are identified as COIs. Sections 3.4.2 and 3.5.2 discuss the specific screening processes conducted for human health and ecological receptors, respectively, and identify COIs based on the screening process.

3.1.2 Investigative Block Areas

During the development of the Work Plan, Alcoa divided the site into “Investigative Block” areas (IBs) for the purposes of the remedial investigation. The investigative block concept provides for the identification of site areas with common physical characteristics, common historical processes, and/or similar current or likely future land use (habitat) and receptors (either human health or ecological). The IBs were determined using available site information – process knowledge, photographs, maps, and analytical data – and may be modified or combined as additional information becomes available.

Starting with the development of data quality objectives and continuing throughout the Work Plan, the concept of IBs is used to focus the work to be performed in the RI and to assist in the evaluation of data for similar areas of the site. The Investigative Blocks for the site are shown in Figure 3.1.2-1. Some of the IBs have been subdivided to distinguish between slightly different historical processes and resulting waste material (and as such, different potential COIs), different physical locations and/or habitat, as well as to facilitate early action at some areas with obvious physical or chemical impacts.

The IBs are listed below:

Investigative Block 1 –Residue Disposal Areas (RDAs)

- 1a RDA 1 – Old Pond
- 1b RDA 2 – Brown Mud
- 1c RDA 3 – Red Mud

Investigative Block 2 – Gypsum Dike Areas

Investigative Block 3 – Other Areas of Alcoa Activity

- 3a Brick Works/Childs Property (area of the former Sinter Plant)
- 3b Redevelopment Area (former stockpile area)
- 3c Spent Potlining (SPL) Stockpiling Area

Investigative Block 4 – Areas with No Known Alcoa Activities

- 4a North Wet Area
- 4b Triangle Wet Area
- 4c Ball Fields
- 4d Berm Wet Area
- 4e Active Commercial Area

The distinction between IB-3 and IB-4 is based on review of historical information that provides knowledge of specific Alcoa operations that occurred in IB-3. Although Alcoa operations may have occurred in the IB-4 areas, there is little knowledge about the specific activities that may have occurred there.

3.1.3 Project Phasing

The RI consists of two phases and will provide the data needed to perform the Baseline Risk Assessments and to prepare the Feasibility Study. The data quality objective process (U.S. EPA, 2000) is used in each phase to assure that the appropriate data are collected during the RI.

The objectives of Phase 1 are to:

- Confirm the site conditions and environmental setting,
- Collect, analyze and evaluate samples of soil, surface water, sediment and groundwater to identify site-related Chemicals of Interest (COIs) that will be further characterized in the RI (as described in Section 3.1.1),
- Determine whether there are COPCs for off-site migration of particulate dust from RDA surface material, and evaluate the significance of surface dust migration from the RDAs to off-site areas.
- Assess the potential risk to off-site residents should the mining of gypsum be resumed at the Site,
- Provide data to support an initial assessment of the feasibility of implementing presumptive remedies at the site (explained in more detail in Section 3.1.5), and
- Identify whether there are any parts of the Site that are candidates for early or interim action.

Information collected during Phase 1 will be evaluated, discussed with the agency and used to identify remaining data gaps that will be addressed in Phase 2. Although the specific details of the Phase 2 RI activities will flow from the results of the Phase 1 Risk Characterization, and will be confirmed in a Phase 2 Plan Addendum to be approved by the Agency (this document is shown as a decision node in the project schedule provided in Appendix B), the general scope of Phase 2 will be to:

- If necessary, reduce the uncertainty in the characterization of risk posed to human and ecological receptors by releases from former Alcoa operations (e.g., further information on the nature and extent of contamination found in current or potential exposure pathways); and
- Provide the additional engineering data needed to assemble and screen remedial alternatives in the Feasibility Study.

3.1.4 Gypsum Mining

Some of the gypsum produced by the former Alcoa operations and deposited at the Site has been mined in the recent past. Specifically, the gypsum deposited along the southern and southeastern boundary of the RDAs has been excavated, processed and transported off-site for commercial reuse. Considerable quantities of gypsum remain at the Site.

Based on concerns over the lead content of the gypsum² and the potential for off-site transport of particulate material during gypsum mining, U.S. EPA stipulates in the AOC that gypsum mining is suspended until the potential health risks associated with dispersal of particulate dust from the mining activities are characterized. The technical approach to address this issue (Section 4.5) includes chemical analysis of the gypsum for lead and other COIs, comparison of the chemical results to risk-based screening levels, simulation of the off-site impacts by air modeling computer programs, and an assessment of whether the resumption of gypsum mining is likely to create risk to off-site residents.

Although the goal of the RIFS schedule is to resolve this issue at the end of Phase 1 (see the Project Schedule in Appendix B), there may be uncertainty in the characterization of risk associated with such activities that additional data collection and analysis may be required in Phase 2.

3.1.5 Presumptive Remedy

U.S. EPA has prepared a series of guidance documents on the use of “presumptive remedies” at certain types of contaminated sites. Presumptive remedies are preferred technologies or response actions for sites with similar characteristics. Based on review of the evaluation and cleanup activities historically performed at such sites, the Superfund program has developed presumptive remedies intended to accelerate the cleanup of certain categories of sites with common characteristics. Use of the presumptive remedy should streamline remedy selection by narrowing the universe of alternatives considered in the Feasibility Study. The national administrative record used to develop the presumptive remedy is used to shorten the screening and detailed analysis steps in the Feasibility Study. Remedy selection is based on consideration of site-specific factors as well.

There is a presumptive remedy for “metals-in-soils”³ sites (EPA 540-F-98-054) based on review of a diverse array of sites, including mining and milling, smelting, electroplating, chemical and textile manufacturing and wood treating. Many of the attributes of sites used to develop the metals-in-soils presumptive remedy are also potentially present at the North Alcoa Site, including:

² The gypsum area was sampled as part of the CERCLA Redevelopment Report (IEPA, 1999). The concentration of lead in 5 samples reported from gypsum areas ranged from 716 to 1,500 mg/Kg. The presence of lead in gypsum is thought to be due to the use of fluor spar ore in the production of hydrofluoric acid at the Acid Plant, which produced gypsum as a byproduct. The bauxite residue is relatively low in lead (e.g., samples from the bauxite residue disposal area presented in the same CERCLA Redevelopment Report, range from 7 to 300 mg/Kg.)

³ In the guidance, soils are defined as loose material on the surface and in the subsurface of the earth consisting of mineral grains and organic materials in varying proportions.

- A range in metal concentrations from small volumes of potentially principal threat wastes to large volumes of low-level threat granular material soil;
- Primary contaminants that include lead, arsenic, cadmium, zinc, copper, chromium and other metals; and
- Contaminant sources that include waste piles, landfills and sludge, including fugitive emissions.

The U.S. EPA's presumptive remedy for metals-in-soils sites is:

| Type of Contaminated Media | Presumptive Remedy |
|--|--|
| Principal threat material (highly toxic or mobile source materials) | Treatment: Reclamation/recovery (when feasible), or immobilization |
| Low-level threat material (low to moderate toxicity and relatively immobile) | Containment (engineered barriers to contact or mobilization). |

The feasibility of implementing the presumptive remedy for metals-in-soil will be evaluated during Phase 1 of the Remedial Investigation. Examples of the presumptive remedy for a potential principal threat material at the site might be the off-site treatment of discrete accumulations of SPL (known to be SPL based on process knowledge), which would be treated as listed hazardous waste (K-088⁴) if it is actively remanaged (e.g., excavated and removed). The Field Sampling Plan (Appendix G-2) describes the process to prepare and implement the SPL Removal Plan. Potential applications of the presumptive remedy for low-level threat material could be creation of a vegetated layer over all of the bauxite residue areas. Although not a principal threat material, gypsum recovery/reuse, if possible without creating adverse risk to off-site residents, would also be consistent with the philosophy of the presumptive guidance, as well as U.S. EPA's waste minimization and reuse policies.

If the implementation of a presumptive remedy at the Site appears feasible at the end of the RI Phase 1, the RI Phase 2 Plan and the Feasibility Study will be prepared to support that process.

3.1.6 Future Site Reuse

Consideration of future site use is a component of both the baseline risk assessment and the assembly and screening of remedial alternatives under CERCLA. There are various future site reuse

⁴ Spent pot liner, if managed, is classified by U.S. EPA as a listed hazardous waste (K-088) due to the leachability of cyanide from the carbonaceous portion of the spent lining. There are Land Disposal Restrictions for K-088 waste.

options for the North Alcoa Site, and the goals and objectives of redevelopment within the City of East St. Louis community play an important role in the implementation of those options.

As described in Section 2.2.5, most the Site is currently considered suitable for industrial and commercial applications, but large areas, particularly those owned by the City, remain unused. Also, there are on-site and nearby recreational areas. Implementation of remediation in a manner that is consistent with, or possibly encourages, site redevelopment will provide significant benefit to the community. Examples of such alternatives could be removal or capping of localized contamination areas between the RDAs and Missouri Avenue, such that the site becomes a better platform for expanded industrial and/or commercial development along the Missouri Avenue corridor. Use of demolition debris from the City's property condemnation program to help bring RDA 1 to closure grade could facilitate the City's program as well as the RDA closure. A fully vegetated residue disposal area could be configured to support ecologic benefits or recreational uses. The area between the RDAs and Lake Drive could be regraded as part of cleanup activities to provide linkage and recreational access between the ball fields and Frank Holten State Park.

Selection of actual reuse configurations will be performed after the RIFS data are collected and evaluated, in concert with other programs and initiatives of the City, but the RIFS technical approach to data collection presented in this Work Plan is based on the possibility of such future site redevelopment options. Furthermore, EPA has encouraged the early input on preferred future use to assure that RI data collection is consistent with future redevelopment objectives.

3.1.7 Institutional Controls

Institutional controls are non-engineered instruments, such as administrative and/or legal controls, that help to minimize the potential for human exposure to contamination. An institutional control is currently in place throughout the City of East St. Louis that prohibits the use of groundwater as a potable supply, except for such uses in existence before the effective date of the ordinance (Ordinance 97-10066, October 7, 1997). Any person violating the provisions of the ordinance is subject to fines of up to \$500 for each violation. Implementation of an RIFS, including performing a baseline risk assessment within an area subject to such an institutional control requires an understanding of the purpose of the institutional control, and how such controls could be monitored and enforced.

The City of East St. Louis ordinance, in recognition of wide-spread contamination of groundwater from many years of historical industrial operations, was created to protect the safety, health and welfare of local residents and to provide protective covenants to facilitate the redevelopment and re-use of property in the City of East St. Louis. The Illinois EPA reviewed the ordinance, as documented in a letter to the City dated February 25, 1998, and concluded that:

“...the ordinance provides an adequate level of restriction necessary to effectively prohibit the installation and use of new potable water supply wells in the City of East St. Louis are [sic] required under the language of 35 Ill. Adm. Code 742.1015(a), and is therefore acceptable for use as an institutional control, provided that the City enters in a separate memorandum of understanding (MOU) with the Illinois EPA in accordance with Sections 742.1015(a) and (i).”

The MOU between the City and IEPA was completed on June 29, 1998 (Table 3.1.7-1).

U.S. EPA issued draft guidance on February 19, 2003, entitled “Institutional Controls: A Guide to Implementing, Monitoring and Enforcing Institutional Controls at Superfund, Brownfields, Federal Facility, UST and RCRA Corrective Action Cleanups”. The guidance states that institutional controls work by limiting land or resource use and/or providing information that helps modify or guide human behavior at the site. Concerning the subject of groundwater use restrictions, the guidance states that such restrictions:

“...commonly involve water use restrictions and well construction and abandonment requirements. This is a broad category and such restrictions can take a variety of forms including the establishment of groundwater zones or protection areas; prohibitions or limitations on certain uses of groundwater in particular areas; capping or closing of wells; and limitations on the drilling of new wells....Well construction permits can also be utilized as a groundwater use restriction....These permitting programs may include requirements for well installation; licensing of well drillers; prohibitions on the drilling of new wells in areas of contamination; and requirements and controls on the operation of wells...These types of governmental controls also often have specific administrative processes that need to be completed.” (p.13)

The guidance states that the collective experience with institutional controls demonstrates that no single approach seems to be effective in ensuring the long-term effectiveness of such controls, but rather encourages “layering” of controls and information. Potential examples of such layered controls for the groundwater ordinance in the City of East St. Louis could include community outreach to assure awareness of the ordinance and creating an administrative process to ensure that water well permit

applications required by state law are distributed to the East Side Health District, which in turn notifies the state that a permit cannot be issued. The feasibility of revising the City ordinance to prohibit consumption of water from existing groundwater wells could also be evaluated, as well as the feasibility of placing similar groundwater ordinances in neighboring communities southwest of the City in the vicinity of the North Alcoa Site.

The guidance states that the most critical post-implementation aspect to ensuring the long-term effectiveness of institutional controls is periodic monitoring. Periodic reviews, including the CERCLA Five-Year Review, are a good opportunity to verify the status and performance of the institutional control. Community monitoring of the institutional controls can be fostered through public outreach activities (e.g., meetings, notices and mailings) to inform nearby residents of the purpose of the controls. Common enforcement policies include voluntary compliance (“the preferred and fastest approach”), administrative processes or legal action.

As discussed in Section 3.4, potential risk due to the consumption of groundwater containing contaminants from the Site would require 1) the presence of contaminants from the Site in groundwater at concentrations that pose risk, and 2) actual consumption of groundwater. The RI and baseline risk assessment will evaluate both of these factors. The reliability and durability of the City’s groundwater ordinance is clearly relevant to the consumption factor. Therefore one of the RI activities will be to collect data on the status, monitoring and enforcement of the ordinance (Section 4.3), as well as the status of water wells that predate the creation of the City’s groundwater ordinance.

3.2 Alcoa Analytes

As discussed in Section 1.0, the RIFS addresses potentially hazardous substances associated with former Alcoa operations at the East St. Louis Works. Review of process knowledge provides information on the main constituents associated with the raw materials, reagents, products and wastes associated with the former Alcoa operations. These constituents are referred to as the “Alcoa Analytes”. The purpose of the Alcoa Analytes is to help identify, or trace, the chemicals derived from the former Alcoa operations and to provide focus to chemicals characterized during the RIFS effort.

Not all of the Alcoa Analytes are hazardous substances that will be considered in the risk assessment (e.g., chemicals with low inherent toxicity, such as titanium, or essential nutrients, such as

calcium, iron, and sodium), but they could serve to help identify exposure areas or pathways that are influenced by the former operations. Also, not all hazardous substances associated with former Alcoa operations are listed as an Alcoa Analyte (e.g., depending on exposure pathways at other bauxite refining facilities, arsenic may be present in concentrations that could pose risk). The collection of 10% of the Phase 1 RI samples for TAL¹/TCL analysis will identify any additional hazardous substances that may be relevant to the risk assessment and feasibility study (Section 3.1.1).

Based on information presented in Section 2.1, and general process knowledge, the Alcoa Analytes for the major processes or waste streams are listed below.

Bauxite Refining/Residue Disposal Areas

Al

NaOH

Fe

Si

Ca

Ti

Note: Elements listed above are the primary components of bauxite residue and residue pore water; however, trace inorganics are also present and will be assessed using existing data and the modified TAL results. The production of NaOH used limestone, lime and soda ash; residues from former stockpiles may exist at the North Alcoa Site. Also, coal ash and clinker from coal-fired processes may have been disposed at the North Alcoa Site. Sulfuric acid used to remove aluminum trihydrate seals in liquor circulation systems would also have been codisposed with residue.

Fluoride (Acid) Plant

H₂SO₄

Fluorspar (CaF₂)

HF

Gypsum (CaSO₄)

Pb

¹ As discussed at the beginning of Section 4.0, a modified TAL Suite will be measured.

Sinter Plant

Bauxite residue
Limestone (CaCO₃)
Soda ash (Na₂CO₃)

Spent Potliner (SPL)

CN
F
Na
PAHs

Miscellaneous or non-process specific

PCBs (unlikely used due to type and age of facility, but will be verified by the RI sampling program).

3.3 Existing Chemical Data

Several environmental investigations have been performed at the Site within the past 10 years. From these investigations, soil, sediment, groundwater and surface water environmental samples have been collected and analyzed for organic and inorganic parameters. Below is a summary of previous investigations performed at the Site for which chemical data were obtained:

- CERCLA Redevelopment Assessment, Illinois EPA, 1999. The purpose of this investigation was to provide prospective land buyers information regarding environmental conditions at the former Alcoa Site. This Site was identified by the City of East St. Louis as a potential redevelopment area. During the investigation, approximately 180 soil samples, and 10 groundwater samples were collected.
- Hydrogeologic Investigation Diesel-Fuel Release, East St. Louis Service Facility, Burlington Environmental, July 21, 1992. This was a groundwater investigation at the former Illinois Power Company facility located on the western portion of the Site on 29th Street. Four monitoring wells were installed and sampled during this investigation.
- CERCLA Integrated Site Assessment, Illinois EPA, 1997. This investigation occurred at the Childs property located on Missouri Avenue, in the southern portion of the Site. The site investigation was initiated when U.S. EPA placed the site on the CERCLIS in February 1984. Seven soils samples were collected during this investigation.

- (No Title), Illinois EPA, 2002. This dataset was a set of five sediment and four surface water samples collected from the north wet area along Lake Drive. No report was associated with this data, but it appears that the samples were collected by Illinois EPA.
- Alcoa Site Phase II – East St. Louis, Illinois, Applied Research & Development Laboratory, December 5, 2001. This investigation was prepared for the U.S. Army Corps of Engineers. This work was also related to the assessment of environmental conditions for redevelopment purposes. The investigation focused on characterizing the waste located in the Red Pond (RDA 2) area. A total of 10 soil samples from 5 locations were collected and analyzed in this investigation.
- U.S. EPA Storage and Retrieval of U.S. Waters Parametric Data (STORET), U.S. EPA, 2002. This data was obtained via an internet query of the U.S. EPA STORET database. These data include surface water, sediment and tissue data, but were not related to an on-site investigation. These data were collected in areas surrounding the Site, but not within the Site boundary.
- Letter Report for Alcoa – East St. Louis, St. Clair County, Illinois, Ecology and Environment, Inc., July 5, 2000. Ecology and Environment, Inc. were tasked by the U.S. EPA to determine the extent of possible contamination in soil related to the former Alcoa operation on the property. A total of 23 soil samples were collected over various portions of the Site. NOTE: these data were determined to be unusable due to inadequate locational information, and were therefore not imported into the MFG database.

Reports containing data from these investigations were obtained by Alcoa and transmitted to MFG, where they have been reviewed for data quality, and where applicable, entered into a database. The data pertaining to these previous investigations had varied levels of quality and completeness. For example, some datasets were of high quality (e.g., IEPA 1997 and 1999) containing accurate spatial coordinates, copies of lab data sheets, lab QA/QC information, etc. Conversely, some datasets had no locational information and only summary tables of analytes with results and no qualifiers or lab QA/QC information. MFG rated the quality and completeness of each dataset on a scale of 1 to 5: 1 indicating the lowest quality and completeness and 5 indicating the highest quality and completeness (the five data scales are discussed in detail in the following bullets). The datasets were grouped by each media and analyte group (e.g., groundwater and metals, soils and organics, etc.). Any data without the minimum requirements (i.e., rated data quality level 2 or higher) were not of sufficient quality and were not entered into the database. It should be noted that in order to conservatively identify as many COIs as possible using existing data, a much lower standard of data quality is applied to the use of the existing site data for scoping and screening purposes than will be applied through the DQO process for the RI/FS data. The data assessment process used in identifying data that are adequate for screening purposes is not acceptable for the level of remedial decision making to be performed with the RI/FS data to be collected at the Site. Many of the existing datasets do not meet the rigorous QA/QC requirements of the U.S. EPA Region V DQOs per U.S. EPA guidance. The characteristics of the five data levels are:

Level 1: Data records having unknown sampling locations, sampling dates, or units of measure fail to meet the minimum requirements for data completeness, and are considered unusable and are designated Level 1. The only data not included in the initial screening were those that were designated Level 1. There was only one Level 1 dataset (Ecology and Environment, 2000) and these were from a single letter report and represented only 23 soil samples analyzed for 12 metals. The RI program will produce a much more comprehensive data set as input for the baseline risk assessment.

Level 2: Data records having reasonably known sampling dates, locations, and units of measure, but unknown sampling or analysis procedures are designated Level 2. These data are considered screening level data based on the presence of dates, locations, and units but lack of information regarding the sampling and/or analytical procedures associated with the data. Level 2 datasets include sufficient information to accurately place the data points on site maps and time-series charts.

Level 3: Data for which all the requirements of Level 2 have been met and for which acceptable sampling and analytical procedures were employed, but little or no QA/QC information is provided, are designated Level 3. These data are considered useable for site characterization, however their quality cannot be confirmed due to the absence of QA/QC information.

Level 4: Data for which all the requirements of Level 3 have been met and for which supporting information including field and laboratory QA/QC information has been provided are designated Level 4. These data may have been evaluated, and qualifiers applied, however, the data review steps cannot be repeated or verified with the provided summary QA/QC information. These data are considered fully useable.

Level 5: Data for which all the requirements of Level 4 have been met and for which a complete laboratory data package has been provided and for which the data quality has been validated are designated Level 5. These data are considered fully useable unless rejected by the data validation process needed for the baseline risk assessment.

Of the potential datasets received by MFG (summarized above), six datasets met the minimum criteria for quality and completeness for the scoping objective and were entered into the database. Table 3.3-1 shows the evaluated data sources and their corresponding data quality scores. Figure 3.3-1 shows the locations of samples collected on-site during previous investigations.

These data were queried from the database and selectively used in the preliminary ecological and human health screening process. Specifically, analytical results from surface soil and sediments (0-1 ft bgs) were compiled and compared with conservative risk-based screening criteria for human health and ecological receptors to identify COIs for ecological risk assessment and to facilitate scoping of the RI for the ecological risk assessment. More detailed discussions of the data used in the human health and ecological screening-level risk assessments are presented in Sections 3.4 and 3.5, respectively.

3.4 Human Health Risk Scoping

The human health risk scoping portion of the Work Plan: 1) discusses the objective of risk assessment in the context of the RIFS process, 2) develops the preliminary conceptual site model for human receptors, 3) provides a human health screening-level analysis of existing data to identify COIs to augment the list of Alcoa analytes discussed in Section 3.2, and 4) presents data needs for human health risk assessment. Data Quality Objectives for the human health risk assessment are summarized in Section 3.7.1, and the general methodologies for conducting the human health risk assessment for the North Alcoa Site are found in Appendix C.

As discussed in Section 3.1.1, COIs are discussed in the Work Plan as they are the basis for the analytical program recommended for the RI Phase I investigation. A Phase I risk characterization of the Phase I data will be performed to assess whether the COI list should be modified and to guide any Phase 2 data collection. Any compound that is carried into the risk assessment after the RI will be defined as a COPC for human health risk assessment purposes. The objective of the human health risk assessment is to evaluate the potential impacts of COPCs in environmental media on human receptors so that risk management is the basis of remedial decisions. Specifically, the risk assessment will address the nature of COPCs present in environmental media, the pathways of human exposure, and the degree to which the releases may pose a potential for adverse health effects. It will be a baseline risk assessment; that is, it will address the potential for adverse human health effects under current and reasonably likely future conditions in the absence of remediation. Based on the baseline risk assessment and estimates of actual and potential risks, areas of the site will either be recommended for no further action (if no adverse health effects are likely), or referred to the feasibility study to determine appropriate remedial alternatives.

The RIFS is the methodology that the Superfund program has established for characterizing the nature and extent of risks posed by uncontrolled hazardous wastes sites and for developing and evaluating remedial options. Because it is a risk-based process, it is necessary that risk assessment data needs are considered throughout the RIFS, from work plan development and project scoping to designing and implementing remedial actions identified in the Feasibility Study. The risk assessment methodology that will be used is based on the risk-based approaches described by the U.S. EPA in Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual, Part A (U.S. EPA, 1989) and various supplemental and associated guidance. This is discussed in greater detail in Appendix C of the RIFS Work Plan.

The Sampling and Analysis Plan, which consists of the QAPP and Field Sampling Plan (Appendices G-1 and G-2, respectively), has been designed to ensure that the data collected during the RI will be appropriate for quantitative risk assessment. After RI data collection, the existing data and RI data will be subject to a data evaluation following procedures recommended by U.S. EPA (1992) to ensure that these data are of adequate quality for quantitative risk assessment and to support risk management decisions. These include consideration of the following factors: data sources, completeness of documentation, adequacy of detection limits, and "data quality indicators" as defined by the U.S. EPA (1992) guidance. The data quality indicators include: sampling completeness, representativeness of sampling locations for relevant exposure areas, usability indicated by data validation results (taking into account considerations of laboratory precision and accuracy), and comparability of data analyzed by different methods. Data representativeness is one of the most important criteria that must be evaluated when selecting data for use in the quantitative risk assessment. Representativeness is the extent to which data characterize potential exposure and hence risks to human health and the environment. Data selected for use in the quantitative risk assessment will be of overall high quality.

3.4.1 Preliminary Conceptual Site Model

Preliminary Conceptual Site Models (CSMs) have been developed for the different areas of the site. Each CSM identifies the primary source material for potential release to the environment, migration to environmental media, potential exposure media, and human receptors. The CSMs will be used to focus the data collection activities of the RI so that analytical data would support a risk-based analysis and decision-making process for the site. This section briefly discusses the historic sources, migration potential, and potential exposure media. Based on the CSM, human health-related data needs are identified for the RI (Section 4.0), and these are summarized in Section 3.7. The CSM will also be refined as RI data are collected/analyzed, and the CSM will be used to develop the exposure assessment during the risk assessment.

Because of different land uses (historical, current, and likely future) as well as different chemicals that may be present due to historical processes, the site has been divided into several units, called Investigative Blocks (IBs) that have somewhat similar characteristics (Section 3.1.2). A CSM has been developed for each IB.

3.4.1.1 Source Materials

The COIs present at an IB are potentially due to the historical Alcoa operational processes that were conducted at the area. This information is discussed in greater detail in Section 2.1 of the Work Plan.

IB-1 Bauxite Residue Disposal Areas (RDAs)

As described earlier in the Work Plan, bauxite residue was generated at the facility during the refining process of bauxite to make alumina. There are three separate disposal areas within IB-1, but these are evaluated together in the human health risk screening. Refining bauxite was the primary process of Alcoa's East St. Louis Operations. The bauxite residue, which has a distinct color and texture, has been well-characterized from process knowledge and information from other facilities, as well as limited soil samples collected at the site. Bauxite residue generally contains, from highest to lowest concentrations: iron oxide, aluminum oxide, silica oxide, sodium oxide, calcium oxide, and titanium oxide.

IB-2 Gypsum Areas

In addition to the bauxite residue, gypsum was also a by-product of one of the plant processes at the former Alcoa facility (i.e., hydrofluoric acid to make anhydrous aluminum fluoride). The waste gypsum forms into a hard solid mass, and was shaped into dikes to contain residue on the property. Gypsum primarily consists of calcium sulfate although lead and fluoride are associated with the process.

IB-3 Other Areas of Historical Industrial Activity

Several different operations occurred at the IB-3 area, north of Missouri Ave. At the Brick Works/Childs Property (IB-3a), a U.S. Government Sinter Plant operated for a short time (approximately 1944 to 1946) to recover additional alumina from clinker and was later used for calcining. At the Redevelopment Area (IB-3b), industrial activities were not documented, but the area may have contained industrial lagoons or impoundments based on review of historical aerial photographs (e.g., Figure 2.1.3-6). Area IB-3c is identified as the Spent Potlining (SPL) Stockpiling Area as some SPL fragments (carbonaceous material, often with blue staining) have been observed at the surface in this area. While there are no data for this area, the Alcoa analytes associated with SPL generally are cyanide, fluoride, and PAHs.

IB-4 Areas with No Known Historical Activities

Five areas with no known specific historical Alcoa activities will be included in the risk assessment because of proximity to off-site receptors, and because of an indication that historical process-related constituents may be present (either visually from historical aerial photographs, or based on existing environmental data). These areas include: the North Wet Area (IB-4a), the Triangle Wet Area (IB-4b), the Ball Fields (IB-4c), the Berm Wet Area (IB-4d) and the Active Commercial Area (IB-4e).

3.4.1.2 Migration

A release mechanism describes the process by which a constituent has the potential to migrate from the source area and/or receiving media to the media contacted by the receptor (except in more complex situations where there may be several receiving media and release mechanisms). Migration is dependent on the physicochemical properties of the compound and the physical setting. As such, it is a necessary part of identifying complete exposure pathways and the CSM.

Currently, the process-related COIs for the different IBs include metals and PAHs. Because of the physicochemical nature of these compounds, it is anticipated that the potential release mechanisms and migration pathways for site-related COIs include:

- Particulate dust generation,
- Transport with surface water runoff,
- Leaching to subsurface soils,
- Leaching from subsurface soils to groundwater, and
- Lateral transport in groundwater.

Volatilization of COIs is not anticipated given that the process-related COIs are not very volatile. If excavation of subsurface soils (and if they were determined to be impacted) were to occur in the future, transport of subsurface contaminants in fugitive dust could occur, as well.

“Dusting” (or particulate dust generation) has been observed at the site. This is consistent with the fine-grained, dispersible nature of bauxite residue. The gypsum materials, on the other hand, are indurated and are not likely to disperse via wind entrainment in the undisturbed condition. Exposed

surface soils elsewhere at the site may be transported via fugitive dust generation although it is likely to be insignificant.

Transport of constituents from surface soils with surface water runoff is generally a pathway that is considered when assessing exposure. However, initial reconnaissance indicates that surface migration may occur within the former Alcoa property, but there do not appear to be surface migration pathways from the Site to off-site areas. A visual survey and review of a detailing topographic map will be used to identify whether there are any appropriate monitoring locations for the surface water transport pathway.

At this time, it is unknown if vertical migration of site-related constituents has occurred because there are limited existing data for much of the site. The RI will collect data to assess potential risk to construction workers that may excavate subsurface soils. Section 4.3 discusses the approach that will be used to evaluate the potential for leaching of constituents in soil to groundwater using soil data collected during the RI. Any COIs measured in soil at concentrations that could pose risk to groundwater will also be measured in groundwater, which will address the lateral transport migration pathway.

3.4.1.3 Potential Exposure Media

Exposure media are the materials that a receptor may contact. It should be noted that for some scenarios with direct contact, the exposure media can also be the receiving media. In the context of the preliminary CSM, the potential exposure media are:

- Soil,
- Air (on-site and off-site),
- Surface Water and Sediment, and
- Groundwater.

Soil

The surface soil data for the IBs with existing environmental data as well as what is known about site use (both current and future) suggest that on-site soils constitute a potential exposure media for on-site (via direct contact) and off-site (via fugitive dust generation) receptors.

Air

The only potentially complete direct pathway to human receptors via releases to air is fugitive dust generation. Fugitive dust can be generated when dry residue from the impoundment areas or surface soil from elsewhere on the Site become resuspended in the air by wind action. Fugitive dust generation from areas outside the impoundments, while it may occur, is probably insignificant given the vegetated cover for much of the area. It is unlikely that fugitive dust generation would occur at the Gypsum Dikes, unless active mining is occurring. The saturated conditions in the North and Triangle Wet Areas and the vegetation in the Ball Fields will preclude significant dust generation. Fugitive dust generation during ambient conditions will be evaluated for the RDAs and the Gypsum Dike Areas (as is, and under mining conditions).

Surface Water and Sediments

Site reconnaissance did not indicate that off-site human receptors currently access surface water at the residue areas nor is it likely that on-site receptors routinely or frequently contact this surface water and/or associated sediments. Surface water and/or sediment at the North Wet Area may be contacted by off-site receptors since they are at the periphery of the site and near public access roads. The conduct of the RIFS (e.g., site access improvements) may encourage more trespassers also. Therefore, the human health risk assessment will address incidental contact with ponded surface water as a potential exposure media. Specifically, the standing water adjacent to Lake Avenue (IB-4a) and ponded surface water on the RDAs (IB-1a, -1b, and -1C) will be evaluated.

Groundwater

Potential exposure pathways for COIs (if present) in groundwater include ingestion of groundwater from potable water wells downgradient (generally westward) of the Site, and exposure to surface water and sediments contacted by groundwater flowing downgradient from the Site. Potential risk due to the ingestion of groundwater requires (1) the use of water wells as a potable water supply, and (2) the presence of COIs above risk-based criteria in the groundwater being consumed. Exposure to surface water and sediments that receive groundwater flow from the Site also requires concentrations in groundwater above risk-based criteria. The RI will collect data to assess whether groundwater is an exposure media for these receptors (Section 4.3).

3.4.1.4 Land Use, Potential Receptors, and Exposure Pathways

The preliminary CSM identifies exposure pathways for potentially complete pathways at the site and describes the process or mechanism by which human receptors may reasonably come into contact with site-related constituents. Exposure pathways are dependent on current and future land use. An exposure pathway is defined by four elements (USEPA, 1989):

- A source material and mechanism of constituent release to the environment;
- An environmental migration or transport medium (e.g., soil, air) for the released constituents;
- A point of potential human contact with the medium of interest (e.g., potential exposure media such as soil or air); and
- An exposure route (e.g., ingestion, dermal contact, or inhalation) at the contact point.

An exposure pathway is considered "complete" if all elements are present. If complete and significant, these pathways will be quantitatively evaluated in the baseline human health risk assessment. Information related to complete exposure pathways has been used to help guide the data collection effort for the RI to ensure that data are collected to sufficiently enable risk-based decision making for the site.

Figures 3.4.1-1 through 3.4.1-5 contain the preliminary CSMs for IB-1 through IB-4. It should be noted that the preliminary CSMs are likely to be further refined after RI data collection occurs and prior to conducting the risk assessment.

3.4.1.4.1 Land Use

Current On-Site

Current on-site land use is described and mapped in Section 2.2.5. In summary, on-site use is primarily active and inactive industrial/commercial. There is minimal evidence of trespassing.

Current Off-Site

As described in Section 2.2.5, the use of surrounding properties is as follows: industrial to the south, across Missouri Avenue; residential to the north and west; and recreational to the east (Frank Holten State Park). The closest residential area is adjacent to the northern portion of the site.

Future On-Site

The City of East St. Louis and community groups would like to see portions of the property redeveloped for industrial or commercial use. There is also the revenue generating option of recovering gypsum for resale from the Gypsum Dike Areas of the Site, if mining can occur without adverse impact. A metals-in-soil presumptive remedy for IB-1 would include establishing cover on the RDAs. Redevelopment of areas of the Site for recreational purposes is also a possible future land use. Future residential use of the site is not part of any redevelopment concept for the property.

Future Off-Site

Future off-site land use is assumed to remain the same as the baseline condition as current off-site scenarios are already the most conservative (i.e., the closest, downwind area from the site is residential).

Current and Future Groundwater Use On- and Off-Site

The RI program will provide the information needed to address such use in the CSM.

3.4.1.4.2 Receptor Identification

Under current conditions, the only on-site receptors are industrial worker receptors at the Brick Works/Childs Property, the properties in the northwest corner of the Site (IB-4e), and any city workers that might perform maintenance activities such as mowing at the Ball Fields. There is little to no evidence of trespassing at the site. However, the conduct of the RIFS (e.g., site access improvements) may encourage more trespassers over the next two years. Therefore, a trespasser scenario will be evaluated for currently inactive areas of the Site (i.e., all areas except IB 4c - the Ball Fields and IB 4e - the Active Commercial Area). Current off-site receptors are residential receptors. Off-site industrial

worker receptors to the south of the site may contact fugitive dust emission from the site, but their exposure would be less than nearby residential receptors given the increased exposure frequency and duration of residents.

If redevelopment of the property occurs, future on-site receptors are construction workers during redevelopment for all IBs and industrial/commercial following redevelopment of the area between the RDAs and Missouri Avenue. Gypsum mining of the dike materials is a potential scenario specific for that area of the site. It should be noted that IB-3c, the SPL stockpiling area, is being evaluated in the RI for waste characterization and remediation, and, if identified as waste, this material will be properly disposed of off-site. The waste characterization and remediation activities planned for the SPL stockpiling area are described in Section 2.5.5 of Appendix G-2 (Field Sampling Plan).

Future scenarios for off-site are assumed to be the same as for current conditions (i.e., off-site residential scenario). The future residential scenario will vary from the current in that two of the possible on-site scenarios (construction excavation and gypsum mining) would temporarily generate a higher degree of particulate emissions. Furthermore, gypsum mining would generate dust from materials that would not be available for the inhalation pathway unless pulverized.

The following table summarizes the receptors that will be evaluated for each IB. The X denotes which receptor will be evaluated for each IB.

| Investigative Block | Current On-Site Maintenance Worker | Current/Future Off-Site Resident | Future On-Site Industrial/Commercial Worker | Future On-Site Construction Worker | Current/ ¹ Future On-Site Recreational | Future On-Site Trespasser |
|---|------------------------------------|----------------------------------|---|------------------------------------|---|---------------------------|
| 1 – Residue Disposal Area (RDA) | | X | | X | X | X |
| 2 – Gypsum Areas | | X | X | X | X | X |
| 3 – Other Areas of Alcoa Activity | | | | | | |
| 3a – Brick Works | | | X | X | | X |
| 3b – Redevelopment Area | | | X | X | | X |
| 3c – SPL Stockpile Area (will be remediated to remove waste materials, if identified) | | | | | | |
| 4 – Areas with No Known Alcoa Activities | | | | | | |
| 4a – North Boundary Area | | | | | X | X |
| 4b – Triangle Boundary Area | | | | | X | X |
| 4c – Ball Fields | X | X | | | X ¹ | |
| 4d – Berm Wet Area | | | X | X | X | X |
| 4e – Active Commercial Area | | | | X | | |

Notes:

The only current recreational receptor is at the Ballfields. All other recreational receptors are under future possible conditions.

3.4.1.4.3 Potentially Complete and Significant Exposure Pathways

This section refers to Figures 3.4.1-1 through 3.4.1-5. The following incidental ingestion of and dermal contact with constituents in soil represents potentially complete exposure pathways for the IBs with impacted or likely-impacted surface soil and a current or future receptor at the area. Wind-generation of and subsequent inhalation of particulate dust provides a potentially complete exposure

pathway for receptors downwind of IB-1 (the RDAs), IB-2 - the Gypsum Dike Areas (if future mining activities were to occur), and IB-3 - the Other Areas of Historical Industrial Activities (only if future construction activities were to occur). If the RI data identify COPCs in IB-4c soil, then the particulate inhalation pathway would be complete for this area, as well. Particulate dust generated from the Site may disperse to off-site areas and be deposited to off-site surface soil (at what would be expected to be much lower concentrations than on-site soils) and be available for incidental ingestion and dermal contact in this medium. Finally, off-site residential receptors may contact site-related constituents that laterally migrate in groundwater or from groundwater to the Mississippi River water and sediments. The potential significance of the groundwater pathway will be evaluated in the Phase I RI, and the methods for doing this are discussed in Section 4.3. The Phase I results will be used to decide whether the groundwater to surface water pathway warrants evaluation in Phase II of the RI. In the interim, the groundwater exposure pathways are shown as potentially complete in Figures 3.4.1-1 through 3.4.1-5.

3.4.2 Preliminary Human Health Risk Screen – Identifying COIs

To determine the COIs based on existing data, soil data from the CERCLA Redevelopment Report (IEPA, 1999), the CERCLA Integrated Site Assessment Report (IEPA, 1997), and the Alcoa site Phase II Report (Applied Research & Development Laboratory, 2001) were compared with conservative human health screening levels. For the human health risk-based screening, samples collected from the 0-1 ft interval were selected because these can be categorized as “surface soils” that would be most readily available for on-site contact and for off-site migration of wind-generated particles. In IB-3b (Redevelopment Area), 68 surface soil samples (0-1 ft bgs) were collected during an IEPA investigation (IEPA, 1999). Several other samples were collected from IB-1 – the RDAs and from the gypsum areas (IB-2). The IEPA (1999) samples were analyzed for metals, volatiles (VOCs), semivolatiles (SVOCs), pesticides, and polychlorinated biphenyls (PCBs). Four additional surface soil samples were collected from IB-1 (ARDL, 2001), and analyzed for metals only. A small dataset was also available for the Childs Property (IB-3a) in the southeastern portion of the Site (IEPA, 1997). This dataset included eight surface soil samples, and these samples were analyzed for metals, VOCs, SVOCs, and pesticides/PCBs. It should be noted that no data are available for IB-4c – Ball Fields or IB-4e – the Active Commercial Area. There are also no data to characterize IB-3c – the SPL Stockpile Area; however, as noted previously, this area

will be remediated to remove the waste material⁵, and will not be included in the baseline risk assessment in its current configuration.

For human health risk assessment purposes, risk-based concentrations (RBCs) from U.S. EPA Region III (as requested by U.S. EPA Region V) for residential soil were compared with analytical results of all samples collected from depths less than one foot (i.e., surface soil). Surface soils are the focus of the risk-screening because soils at the surface are both the most readily accessible for possible on-site receptors as well as potentially available for wind generation and off-site migration of particulates. Residential criteria for direct contact pathways were conservatively used to ensure protection of human health in the event that fugitive dust emissions from on-site could migrate to an off-site residential receptor. However, current and future on-site land use is not, nor is expected to be, residential as the property is zoned industrial. Much of the property is currently in disuse, and possible future use of the property would be industrial or commercial following redevelopment. It is also probable that future land use will be industrial/commercial, not residential. While residential RBCs are conservatively used in the preliminary risk screening, it should be noted that industrial RBCs generally will be used for identifying COPCs for on-site receptors when the baseline risk assessment is conducted. Refer to Appendix C for the proposed methods for conducting the baseline risk assessment.

3.4.3 Human Health COIs

Table 3.4.3-1 presents the maximum detected concentrations of analytes that were detected in any surface soil sample and the USEPA Region III residential RBCs for soil for these detected constituents. Constituents with maximum detected concentrations that exceed their respective RBCs are highlighted in Table 3.4.3-1. Many of these are identified as COIs, but others were qualitatively evaluated further on the basis of factors such as inherent toxicity, frequency of detection, and whether they are likely related to anthropogenic background rather than historic Alcoa process/operations on-site.

A number of analytes do not have risk-based human health screening criteria because they have low inherent toxicity. This includes calcium, magnesium, sodium, and potassium, which were measured at the site at varying concentrations. Iron also was measured in several soil samples in excess of the conservative, residential RBC, but it should be noted that iron was not measured at concentrations that

⁵ The waste characterization and remediation activities planned for the SPL stockpiling area are described in Section 2.5.5 of Appendix G-2 (Field Sampling Plan).

exceeded the industrial worker RBC, which is more applicable for potential on-site exposure scenarios. Calcium, iron and sodium were identified as process-related. However, U.S. EPA (1989) considers all of these compounds essential nutrients and provides a rationale for eliminating them from further evaluation. Because of the reasons listed above, these compounds are not included as COIs.

Although there were slight exceedances of the residential RBC for the results of two chlorinated hydrocarbon pesticides (dieldren and toxaphene), these are not identified as COIs for the following reasons. First, pesticides are not process-related nor historical Alcoa Analytes for the site. Second, only a small proportion of the diieldren and toxaphene results (i.e., 2 samples out of 71 and 1 sample out of 18, respectively) slightly exceed the Residential Soil RBCs for these chemicals. None of the results exceed the industrial soil RBCs, which is a realistic land use for the property. Furthermore, chlorinated pesticides are ubiquitous in the environment at low concentrations such as those measured in site samples, especially in urban settings where they are used for pest control and vegetation management.

Bis (2-ethylhexyl) phthalate was measured in one of fifteen samples collected at the Brick Works (IB-3a) in excess of the human health screening criteria. Many of the samples, however, showed phthalates present at low levels. USEPA (1989, 1999) considers phthalate esters (among a handful of other organic constituents) to be "common laboratory contaminants," and their presence in the analytical results may well be a result of the laboratory rather than the site. Furthermore, phthalates were not used for any of the site operations. Since the 1980s, the use of phthalates has increased dramatically and, as such, they are commonly found in air, soil, sediments, surface water and food products. Therefore, phthalates will not be included as COIs at the site for the following reasons. The facility ceased operations before phthalates were commonly used in manufacturing; there is no record of use of phthalates at the site; phthalates are considered by USEPA to be common laboratory contaminants; and they are ubiquitous to the environment. It should be noted, however, that this class of compounds will be included in TCL analysis proposed for 10% of the site samples. Special care will be taken to evaluate phthalate ester analytical results with respect to corresponding laboratory and trip blanks, and USEPA protocols will be used to qualify a phthalate result as "blank contamination" if the sample result is <10x the blank result for these constituents (USEPA, 1989; 1999).

Aroclor 1260, a specific mixture of PCBs, was measured in one of fifteen samples collected at the Brick Works in excess of human health screening criteria. The maximum measured concentration was 3.5 mg/kg; however, most of the 70+ samples included in the preliminary risk screening showed no detectable PCBs (Table 3.4.3-1), and those that had detectable PCBs were at concentrations below the

residential RBC. Therefore, there is a very low frequency of detection of PCBs in the existing analytical soil data. Furthermore, these are unlikely to be process- or operation-related constituents from the former Alcoa operations. PCBs were produced commercially in the United States from 1929 until 1977 and used in capacitors, transformers, hydraulic fluids, plasticizers, adhesives, paints, flame retardants, etc. All power generated at the site, prior to ceasing operations in the 1960s was by coal or gas fired power generation. There are no known operations at the site that used or generated PCBs or PCB-containing products. In addition, studies show that soils in urban areas had detected concentrations of PCBs ranging from 0.02 to 11.94 mg/kg (ATSDR, 1998), which is somewhat consistent with the samples collected at the site. Because of these reasons, PCBs will not be included as a COI for the site. It should be noted, however, that this class of compounds would be included in TCL analysis proposed for 10% of the site samples.

3.4.3.1 Summary List of Human Health COIs

In summary, on the basis of the preliminary human health screening process, the following constituents were identified as COIs for human health at one or more Investigative Block:

Aluminum, antimony, arsenic, barium, cadmium, chromium, copper, cyanide, lead, manganese, mercury, nickel, silver, thallium, vanadium, zinc, and carcinogenic PAHs: [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene].

Additionally, process knowledge adds the following Alcoa analytes as COIs potentially for human health:

Aluminum, cyanide, and fluoride.

Analytical requirements for each IB will be based on the COIs specific for that IB (i.e., for a given IB, the analyte list may be a subset of the complete list of COIs).

3.4.4 Identification of Data Needs for Human Health Risk Assessment

Based on the CSMs for the different Investigative Blocks, the following human health risk assessment data needs are identified for each investigative block. The number of samples proposed and sampling methods are presented in the Sampling and Analysis Plan (Appendix G-2).

3.4.4.1 IB-1: The RDAs

Current/Future Off-site Residential Exposure to Wind-Generated Particulates

- Surface soil samples (0-2 ft) per areas of dispersible materials within IB-1a, IB-1b, and IB-1c.
- Analytical needs per screening HHRA and process-related COIs: all samples analyzed for Al, As, Cr, V, and Pb.
- Additional analytical requirements: 10% of samples also analyzed for TCL¹/TAL list.
- Minimum of 5 samples of dispersible material also analyzed for percent silt and moisture content, to provide site-specific data for the emissions/dispersion modeling.

Future "Construction" Worker (Presumptive Remedy: including grading and revegetating RDAs)

- Surface soil samples (same as those used for off-site migration of particulates).
- Subsurface soil samples (2-10 ft bgs).
- Additional samples from each of current wet areas and vegetated areas.
- Analytical needs per screening HHRA and Process COIs: all samples analyzed for As, Cr, V, and Pb.
- Additional analytical requirements: 10% of samples also analyzed for TAL¹/TCL list.

3.4.4.2 IB-2: Gypsum Dikes

Current/Future Off-site Residential Exposure to Wind-Generated Particulates

- Randomly located surface samples (0-1 ft bgs) of gypsum.
- Analytical needs per screening HHRA: all characterization samples analyzed for Pb.

¹ As discussed at the beginning of Section 4.0, a modified TAL Suite will be measured.

- Additional analytical requirements: 10% of samples analyzed for TCL¹/TAL.
- Minimum of 5 samples of gypsum material also analyzed for percent silt and moisture content, to provide site-specific data for the emissions/dispersion modeling.

Future Gypsum Mining Scenario: Off-site Residential Exposure to Particulates Generated through Mining Activities

- Randomly located surface samples (0-1 ft bgs) of gypsum material (same samples as for first scenario).
- Additional gypsum material samples, randomly located areally and vertically.
- Analytical needs per screening HHRA: all characterization samples analyzed for Pb.
- Additional analytical requirements: 10% of samples also analyzed for TAL¹/TCL list.

3.4.4.3 IB-3: Other Areas of Historical Industrial Activity

Current/Future Industrial Worker

- Surface soil samples (0-1 ft bgs) from area IB-3a.
- Surface soil samples (0-2 ft bgs) from area IB-3b.
- No Phase I risk-assessment data needs for IB-3c because area will be remediated.
- Analytical needs per screening HHRA and Process COIs: Al, As, Cd, Cr, Cu, CN, F, Pb, Sb, V, Zn, PAHs.
- Minimum of 5 samples of gypsum material also analyzed for percent silt and moisture content.

Future Construction Worker

- Surface soil samples (0-1 ft bgs) from area IB-3a.
- Surface soil samples (0-2 ft bgs) from area IB-3b.
- Subsurface soil samples (discrete intervals within 1-10 ft bgs) from area.
- Subsurface soil samples (discrete intervals within 2-10ft bgs) from area 3a.
- No Phase I risk-assessment data needs for IB-3c because area will be remediated.
- Analytical needs per screening HHRA and Process COIs: Al, As, Cd, Cr, Cu, CN, F, Pb, Sb, V, Zn, PAHs.

3.4.4.4 IB-4: Areas with No Known Historical Activities

Current/Future On-site Maintenance Worker (IB-4c, for human health)

- Surface samples from IB-4c.
- No available data, so analytical needs for TAL¹/TCL.

Current/Future Local Recreational Receptor (IB-4c, for human health)

- Surface samples from IB-4c.
- No available data, so analytical needs for TAL¹/TCL.

Current/Future Industrial/Commercial Worker (IB-4e, for human health)

- None (The working areas are currently paved).

Future Construction Worker (IB-4e, for human health)

- Subsurface soil samples (below pavement to 10 ft bgs) from IB-4e.
- No available data, so analytical needs for TAL¹/TCL.

3.5 Ecological Risk Scoping

The AOC/SOW for the Site indicates that an Ecological Risk Assessment (ERA) is necessary. The SOW indicates that the ERA process for the Site should follow the U.S. EPA *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (U.S. EPA, 1997). The guidance proposes an 8-step approach for conducting a scientifically defensible ERA:

- 1) Screening-Level Problem Formulation and Ecological Effects Evaluation
- 2) Screening-Level Preliminary Exposure Estimate and Risk Calculation
- 3) Baseline Risk Assessment Problem Formulation

¹ As discussed at the beginning of Section 4.0, a modified TAL Suite will be measured.

- 4) Study Design and Data Quality Objectives
- 5) Field Verification of Sampling Design
- 6) Site Investigation and Analysis of Exposure and Effects
- 7) Risk Characterization
- 8) Risk Management

Briefly, steps 1 and 2 of the process are essentially scoping phases of the ERA in which existing information is reviewed to help determine the ecological components that are potentially at risk, the chemicals of potential ecological concern (COPECs), and the transport and exposure pathways that are important to the ERA. This process is conducted using conservative (i.e., screening-level) assumptions to avoid underestimating risk or omitting receptors or chemicals of concern. Step 3 of the process is the Baseline Problem Formulation. The Baseline Problem Formulation (Appendix D) uses the results of the steps 1 and 2 to identify methods for risk analysis and characterization, resulting in the identification of ERA data needs for the RIFS. Steps 1-7 of the process include formalization of data collection plans, and the implementation of the risk analysis and characterization steps. Risk Management activities of Step 8 are largely outside the scope of the Risk Assessment, but certain aspects were considered in developing the Work Plan.

3.5.1 Preliminary Problem Formulation

The purpose of this section is to present information associated with the screening-level ecological risk assessment (SLERA) that represents Steps 1 and 2 of the U.S. EPA guidance. A preliminary SLERA, including the preliminary problem formulation, was conducted using several datasets collected since the closure of the Alcoa facility (Section 3.3). The results of the SLERA have been discussed by the Risk Managers at the Site who have determined that further analysis of potential ecological risk at the Site is warranted.

3.5.1.1 Environmental Setting

The Site lies within the American Bottoms region of the Mississippi River floodplain. Historical maps of the area show that much of the Site is located in the former Pittsburgh Lake, a remnant oxbow lake of the Mississippi River. Through on-site operations, the oxbow lake has been filled in creating the Site setting that is present today.

Zambrana Inc. (1999) conducted a biological analysis that included a preliminary identification of wet habitats, vegetative cover, and habitat quality at the Site. This report describes the Site as a mixture of waste impoundments and former industrial areas that have developed some ecological habitat since the closure of the facility several decades earlier.

The types of cover that exist at the Site include:

- Open water;
- Exposed soil;
- Wet areas;
- Upland forest;
- Successional meadows;
- Old field habitat; and
- Open land.

Figure 3.5.1-1 shows a general map of the potential habitat types currently found at the Site as determined in part by Zambrana Inc. (1999), site reconnaissance and a review of aerial photography. The upland forests at the Site are generally open, early to mid-successional woodlands interspersed with shrub/scrub habitat and open or grassy areas. Species such as the sycamore, Siberian elm, and cottonwood dominate the over story. Bush honeysuckle, and goldenrod species dominate the under story. Wet habitats at the Site are dominated primarily by *Phragmites sp.* and soft bulrush with some narrow-leaved cattails present in several areas.

Multiple species of birds and mammals utilize the Site as feeding grounds within their larger home range or as their home territories (small species with limited home ranges). Of particular note are two species of semi-aquatic avian predators, the black-crowned night heron and the little blue heron. Both of these state species of special concern are known to roost in the nearby Allerton Rookery, but neither has been observed on-site (Zambrana, 1999). In general, the Site provides marginal quality habitat to those wildlife species that may use it for feeding or as a loafing area.

3.5.1.2 Potentially Complete Exposure Pathways

Complete exposure pathways are used to evaluate the exposure potential as well as the risk of direct effects on ecosystem components. In order for an exposure pathway to be considered complete, it must meet all of the following four criteria (U.S. EPA, 1997):

- 1) A source of the contaminant must be present or must have been present in the past.
- 2) A mechanism for transport of the contaminant from the source must be present.
- 3) A potential point of contact between the receptor and the contaminant must be available.
- 4) A route of exposure from the contact point to the receptor must be present.

Exposure pathways can only be considered complete if all of these criteria are met. If one or more of the criteria are not met, there is no mechanism for exposure of the receptor to the contaminant. Potentially complete pathways used in the wildlife risk analysis are shown in Figure 3.5.1.2-1.

In general, ecological receptors can be exposed to chemical stressors through direct exposure to abiotic media, or through ingestion of forage or prey that have accumulated contaminants. Exposure routes are the mechanisms by which a chemical may enter an individual receptor's body. Possible exposure routes include:

- *Absorption* across external body surfaces such as cell membrane, skin, integument, or cuticle from air, soil, or water. Absorption is not likely to be a major component of the total exposure to wildlife and, therefore, will not be evaluated quantitatively in the wildlife risk analysis.
- *Ingestion* including direct ingestion of food and incidental ingestion of soils, sediments, or water along with food.

The exposure of wildlife to COIs in soil by dermal contact (via absorption) is likely to be small due to barriers of fur, feathers, and epidermis. Likewise, since volatile organic chemicals are not expected to be COIs at the Site, and due to the uncertain nature of assessing inhalation risk to ecological receptors, inhalation of particulate forms of COIs is unlikely to be as important an exposure pathway as ingestion of contaminated materials at the Site. Thus, the ERA will focus on the ingestion pathways as the primary exposure pathway for terrestrial vertebrates.

3.5.2 Screening Level Ecological Risk Assessment

The screening-level exposure and risk calculation corresponds to Step 2 of the U.S. EPA (1997) guidance. Step 2 includes an assessment of potential ecotoxicity of stressors based on the information available prior to performing the SLERA. The result of Step 2 is a decision on whether additional ecological risk evaluation is necessary. More specifically, the SLERA is intended to support the following decisions (U.S. EPA, 1997):

- Available information is adequate to conclude there is no need for remediation at the Site on the basis of ecological risk.
- Or
- Data are adequate to indicate that risks may not be negligible and further assessment of potential ecological risks is warranted.
- Or
- Available data are not adequate to determine that risks are negligible and more evaluation is necessary to determine the need for further action.

Data that were available prior to the SLERA could not be used to show *de minimus* ecological risk at the Site, nor were there sufficient data in all areas of the Site to rule out the need for further data collection. These conclusion are based on the following:

- Potentially complete exposure pathways for COIs related to the processes used on-site exist between the soil/sediment, bauxite residues, and surface water and terrestrial ecological receptors.
- Screening-level analytical data available for use in the SLERA indicated that several COIs were present at concentrations that exceed highly conservative risk screening levels.
- Data gaps are present in several areas of the Site.

This information indicates that the potential for risks to ecological receptors cannot be eliminated at the Site based on the currently available data. Therefore, further characterization of ecological risks at the Site appears to be necessary to more accurately predict the risks to ecological receptors utilizing the areas of suitable habitat at the Site. A thorough discussion of the results of the SLERA are presented in Appendix D.

3.5.3 Constituents of Potential Ecological Concern (COPECs)

Identification of COPECs for the ERA was based primarily on exceedances of risk-based criteria in the SLERA by maximum soil and sediment COI concentrations in each Investigative Block (IB). The SLERA was completed for the potentially complete exposure pathways discussed in the screening-level problem formulation. The numerical results of the SLERA are discussed in detail in Appendix D. In general, most of the metals analyzed in the various datasets used in the SLERA exceeded at least one soil screening level (SSL) in at least one IB. The COPECs proposed for inclusion in the ERA are:

- Upland Habitats
 - Aluminum
 - Antimony
 - Arsenic
 - Barium
 - Cadmium
 - Chromium
 - Cobalt
 - Copper
 - Cyanide
 - Lead
 - Manganese
 - Mercury
 - Selenium
 - Silver
 - Thallium
 - Vanadium
 - Zinc

- Wet Areas
 - Aluminum
 - Antimony
 - Arsenic
 - Barium
 - Chromium
 - Cobalt
 - Cyanide
 - Lead
 - Manganese
 - Selenium

- Thallium
- Vanadium
- Zinc

Calcium, iron, magnesium, and potassium were excluded from SLERA analyses due to their abundance in crustal materials and their general lack of toxicity.

Bis (2-ethylhexyl) phthalate and several additional organic phthalates were measured in excess of their ecological screening criteria (di-n-butylphthalate, di-n-octylphthalate). Many of the samples, however, showed phthalates present at low levels. U.S. EPA (1988, 1989) considers phthalate esters (among a handful of other organic constituents) to be "common laboratory contaminants," and their presence in the analytical results may well be a result of the laboratory rather than the site. Furthermore, phthalates do not appear to have been used in any of the former Alcoa operations. Since the 1980s, the use of phthalates has increased dramatically and, as such, they are commonly found in air, soil, sediments, surface water and food products. Therefore, phthalates were not included as COPECs at the site for the following reasons: The facility ceased operations before phthalates were commonly used in manufacturing; there is no record of use of phthalates at the site, phthalates are considered by U.S. EPA to be common laboratory contaminants, and they are ubiquitous to the environment

Several organic pesticides were also detected in the Brick Works Investigative Block at concentrations that resulted in SHQs that were slightly greater than 1.0. However, organic pesticides were never manufactured on-site and likely represent typical soil concentrations of these pesticides in urban areas such as the Site. In addition, the low level detections (<0.02 mg/kg) and lack of reliable uptake factor information suggest that the SSLs for the organic pesticide compounds may be overly conservative. For these reasons, organic pesticides were not included as COPECs for the baseline problem formulation at the site.

Finally, PCBs, specifically aroclor 1260 and aroclor 1254, were measured in two of fifteen samples collected at the Brick Works in excess of the SSLs. PCBs were produced commercially in the United States from 1929 until 1977 and used in capacitors, transformers, hydraulic fluids, plasticizers, adhesives, paints, flame retardants, etc. All power generated at the site, prior to ceasing operations in the 1960s was by coal or gas fired power generation. There are no known operations at the site that used or generated PCBs or PCB-containing products or oils. In addition, studies show that soils in urban areas had detected concentrations of PCBs ranging from 0.02 to 11.94 mg/kg (ATSDR, 1998), which is

somewhat consistent with the samples collected at the site. Because of these reasons, PCBs were not included as a COPEC for the site (but will be included in the TCL scans during Phase 1).

3.5.4 Baseline Problem Formulation

The Baseline Risk Assessment Problem Formulation is Step 3 of the U.S. EPA ERA guidance. The objective of this step is to plan for further risk analysis based on the results of the SLERA. The Baseline Problem Formulation is presented in detail in Appendix D of this document.

3.5.4.1 Goals and Objectives

In general, the Baseline Problem Formulation has three main objectives: 1) Outline the goals and objectives for the Baseline Ecological Risk Assessment (BERA) 2) Identify the management goals for the ecology of the Site and 3) Identify the risk management decisions that the BERA will be used to support.

The goals and objectives were developed according to U.S. EPA guidance on conducting ERAs (U.S. EPA 1997, 1998) and the Data Quality Objectives (DQO) process (U.S. EPA, 2000). U.S. EPA prescribes the development of goals, objectives, and data needs for BERAs through the identification of risk management goals, assessment endpoints, risk questions, and risk measures to be used in the baseline risk analysis. Management goals define the broad objectives of the ecological risk management on which the BERA is based.

Assessment endpoints are explicit expressions of the ecological resource to be protected (U.S. EPA 1997, 1998) and provide the focus for the BERA. Identification of assessment endpoints is necessary to focus the BERA on ecologically relevant receptors, rather than attempt to evaluate risks to all potentially affected receptors. Assessment endpoints should be consistent with management policy goals and ecological values for the Site.

Risk questions, as defined by U.S. EPA (1997), are the questions the BERA will attempt to answer regarding whether or not assessment endpoints have been adversely affected by exposure to COPECs. They form the basis for identifying the specific analyses to be conducted and the data needs to perform the analysis. In some cases, risk questions may be stated as risk hypotheses (U.S. EPA, 1998),

which form the basis for identifying the specific analysis to be performed. Evaluation of risk hypotheses is not equivalent to formal statistical tests of null hypotheses (U.S. EPA, 1998).

Assessment endpoints and risk questions/hypotheses are used to identify the types of measures needed to perform the BERA. Two types of measures will be used in the ERA:

- Measures of exposure - measures that describe the location and concentration of COPECs in abiotic and biotic media that can be used to estimate exposure of receptors.
- Measures of effects - measurement of changes in an attribute of the assessment endpoint in response to exposure.

As noted previously, the baseline problem formulation process is similar to the DQO process. However, the components of the DQO process require that *a priori* identification of decision rules and statistically based decision criteria in the form of SSLs are not always applicable to risk hypotheses used in the BERA (U.S. EPA, 1998). Decision criteria were used in the SLERA. Such binary decisions are not applicable to many aspects of the BERA because of the need to describe impacts, risk, and respective sources prior to developing decision criteria for remedial actions, if any (U.S. EPA, 1998). A complete discussion of the endpoint and measures selected for analysis in the BERA is presented in Appendix D.

3.5.4.2 Management Goals

Management goals are used to identify the goals of the Site in terms of ecological risk. The ecological risk management goal on which the BERA design is based is:

- The post-remedy condition of the Site will not result in significant adverse effects on local wildlife populations, including state-endangered bird species from the nearby Allorton Rookery

Adverse effects are defined as those that result in Site-related stress to local communities of ecological receptors that utilize the Site on an occasional basis. This includes populations of several state species of special concern that inhabit a rookery near the Site and may utilize the Site on occasion. These species are not known to inhabit the Site on a regular basis.

The prediction of local community risk will take the habitat available at the Site into consideration. Several large areas of the Site are either currently used for industrial purposes or are of low enough quality that they do not represent even a short stopover habitat (i.e., gypsum berms).

3.5.4.3 Ecological Risk Management Decisions

The BERA will provide Risk Managers with a range of ecological risk data. This data will be presented for use in a weight-of-evidence approach toward determining the appropriate actions for the Site.

The fundamental decisions that the BERA is designed to support are:

- Determine whether COPECs at the Site have resulted, or are likely to result, in adverse effects to the assessment endpoints.
- If adverse effects are likely to occur, determine which COPECs, exposure pathways, and fate and transport mechanisms are most important in causing the effects.
- Determine whether adverse impacts or risks of adverse effects warrant remediation.

A thorough, technical discussion of the Baseline Problem Formulation, BERA, and Risk Management considerations is located in the BERA Work Plan in Appendix D.

3.6 Preliminary Evaluation of Treatability Studies

Because the lengthy time required to conduct some treatability studies, U.S. EPA guidance recommends that the evaluation of the need for treatability studies be conducted during project scoping (U.S. EPA, 1988). As discussed in Section 3.1.5, the presumptive remedies for metals-in-soils sites are treatment for principal threat materials and containment for low-level threat materials. The only potential principal threat material identified at this time is SPL that may remain on-site from former stockpiling for cryolite recovery. RCRA governs the treatment process for such material (K-088 listed waste if actively remanaged and disposed), so there is no need for a treatability study for the SPL material.

Containment of the low-level threat material (residue and gypsum) could involve creation of a vegetated layer over all of the bauxite residue areas, either by direct revegetation or, possibly using on-

site gypsum as an acid soil amendment for the alkaline residue. A two-phase treatability study process will be conducted to provide information to evaluate these remedial alternatives (Section 4.8.1)

3.7 Identify Data Quality Objectives (DQOs)

In general, the DQO process is a series of planning steps based on the scientific method that is designed to ensure that the type, quantity and quality of environmental data used in decision-making are appropriate for the intended application.

There are seven steps in the DQO process that include:

- 1) Stating the problem
- 2) Identifying the decision
- 3) Identifying inputs to the decision
- 4) Defining the boundaries of the study
- 5) Developing a decision rule
- 6) Specifying limits on decision errors; and optimizing the design for obtaining data.

The overall problem addressed in the RI, as stated in Section 3.1 of the QAPP (Appendix G-1), is to evaluate the nature and extent of contamination at and from the Site, assess the risk from this contamination to human health and the environment and evaluate potential remedial alternatives.

DQOs are discussed in the QAPP (Appendix G-1) and are summarized in the following sections in table format. Illinois water quality criteria are considered in the development of sufficiently sensitive analytical methods presented in the QAPP for environmental exposure pathways being investigated in the RIFS. These criteria include those found in Title 35 of the Illinois Administrative Code, Parts 302, 303 and/or 620.

Sections 3.7.1 and 3.7.2 summarize the steps of the DQO process for human health risk assessment and ecological risk assessment, respectively. The details of the DQO process for the gypsum and bauxite residue geotechnical sampling (and the initial phase of the Agronomic Treatability Study) are provided in Section 3.7.3.

3.7.1 Human Health Risk Assessment Data Quality Objectives

Step 1 is defined above, generally for all aspects of the RI based on the National Contingency Plan (NCP) mandate. Section 4.1.1 of the QAPP (Appendix G-1) describes steps 2 through 6 of the DQO process for human health risk assessment, and these are summarized in this section.

Tables 3.7.1-1 through 3.7.1-5 provide detailed information for each DQO step for Investigative Blocks 1 through 4. The DQOs for the groundwater pathway are combined for all investigative blocks and listed in Table 3.7.1-6.

The decision identification, Step 2, for the human health risk assessment is similar for the different IBs: Do COIs in soils pose potential risk to relevant receptors with potentially complete exposure pathways to this medium? The decision for groundwater is to determine whether COIs in groundwater downgradient of the site, originating from former Alcoa operations, are present or are in high enough concentration to pose potential risk to off-site receptors through ingestion of groundwater. A second decision for groundwater is to determine whether the groundwater to surface water/sediment pathway poses potential risk to human receptors.

Step 3, the primary inputs to the decision, for soil are analytical results from soil samples collected from relevant exposure media and U.S. EPA Region III RBCs for soil. The inputs to the decision for groundwater are the assessments of current institutional control and the status of existing wells, Phase I soil data, U.S. EPA Region III RBCs for the soil-to-groundwater pathway, Phase I groundwater COI data, and possibly fate and transport modeling, and the lowest of the values presented in the Illinois Class I Groundwater Standards or in the Federal U.S. EPA Maximum Contaminant Levels (MCLs).

The spatial boundaries of the study (Step 4) are the extent of each investigative block and potentially the extent of migration of soil and groundwater containing COIs derived from former Alcoa operations. The temporal boundaries of the study are defined by the sampling period, which is projected to be 2003.

Step 5 of the DQO process for HHRA, development of a decision rule, is risk-based. For soils, COIs with maximum concentrations exceeding USEPA Region III RBCs will be carried into the baseline HHRA. For groundwater, the Phase I investigation decision is two pronged: (1) Does the institutional

control and the lack of groundwater use eliminate the groundwater ingestion pathway? (2) What are the concentrations of COIs in groundwater? The latter includes comparison of soil concentrations to groundwater protection SSLs, and the comparison of measured groundwater concentrations to state and federal drinking water standards. (See Section 4.3 for more discussion on this sequential approach.)

The limits on decision errors (Step 6) are addressed in the QAPP. Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of the QAPP (Appendix G-1).

Finally, Step 7, the sample design of Phase I will allow for decision-making or for a decision to proceed with Phase II sampling based on the results of the Phase I data evaluation and the initial BLHHRA. The number of soil samples for the Phase I investigation has been selected to provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). The stratified random nature of the design is a reasonable approach to provide areal sample coverage. For groundwater, the Phase I investigation provides one upgradient well and three downgradient wells, which is based on discussions between Alcoa, the City of East St. Louis and U.S. EPA.

3.7.2 Ecological Risk Assessment Data Quality Objectives

The ecological risk assessment DQOs are identified following the same general DQO process steps. The problem statement (step 1) is the same: Evaluate nature and extent of contamination at or from the Site, but the focus is on assessing risk to the environment. Section 4.1.2 of the QAPP (Appendix G-1) describes the remaining six steps of the DQO process as they pertain to the ecological risk assessment at the Site in detail. The six steps are summarized below. Tables 3.7.2-1 through 3.7.2-4 provide detailed information for each ecological DQO step for Investigative Blocks 1 through 4.

Step 2 of the DQO process, or identifying the decisions, indicates that the three decisions necessary for the BERA are to determine whether COIs detected in soil/residue, surface water, and/or sediment are present at concentrations that could cause risk to the ecological receptors of concern (Appendix D) in IB-1, IB-3 (excluding IB-3b), and IB-4 (excluding IB-4c).

The identification of inputs to the decisions (Step 3) are derived from the results of the SLERA using existing data and the Soil Screening Levels (SSLs) calculated in the SLERA. The lowest receptor-

specific SSL for each COI represents the minimum concentration of that COI that can be used to reach the ecologically risk-based decision in the DQO process.

The spatial boundaries of the Site are defined (Step 4) as shown on Figure 3.1.2-1. Soil and sediment samples are required from the 0 to 2 ft depth interval as that interval represents the potential range of exposure to the ecological receptors of concern that may be exposed to COIs at the surface or through burrowing in the soil/residue area. For sediment sampling collection, only COI data from the upper 6 inches of the sediment are necessary since burrowing typically does not occur in wetted sediments.

The decision rules (Step 5) for samples collected from IB-1, IB-3 (excluding IB-3b), and IB-4 (excluding IB-4c) indicate that if the maximum detected concentration in each media type (soil, surface water or sediment) exceeds the lowest receptor-specific SSL it will be carried forward from the expanded SLERA into the Phase I ecological risk characterization. Risk management decisions will be made following the Phase I risk characterization regarding the necessity of Phase II data collection or the applicability of ecologically-based early action decisions.

The limits on decision errors (Step 6) are addressed in the QAPP. Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of the QAPP (Appendix G-1).

Finally, the design of data collection (Step 7) has been optimized to provide maximal information that is useful to Phase I ecological risk management decisions. Sampling design that includes the calculation of appropriate statistics, such as 95% UCLs of the mean.

3.7.3 Geotechnical and Agronomic Investigation Data Quality Objectives

Following the same general DQO process, DQOs are identified for the geotechnical and agronomic investigations. Detailed geotechnical DQO tables were completed for IB-1, IB-2, and IB-4a (Tables 3.7.3-1, 3.7.3-2, and 3.7.3-3). In addition to DQOs related to investigation of waste and gypsum geotechnical and chemical properties, topographic survey DQOs were included in the geotechnical DQO table. Agronomic geotechnical DQO tables were also prepared for IB-1 and IB-2 (Tables 3.7.3-4 and 3.7.3-5).

The problem statement (step 1) is: Obtain the geotechnical and chemical properties of the waste materials and dike gypsum samples to evaluate presumptive remedies in the Feasibility Study, and obtain topographic survey data for the existing RDAs to establish baseline survey data to the one-foot contour interval, which is also needed for the Feasibility Study.

Geotechnical data obtained from within the bauxite residue will be used to evaluate the potential for regrading activities, potential settlement that may occur over time as a result of regrading activities, and the potential for amending the bauxite residue with gypsum materials. Geotechnical data obtained from within the gypsum dike materials will be used to evaluate slope stability of the dikes for conditions that may include active mining of gypsum material dike materials and for existing and proposed dike slopes. Data obtained as part of the geotechnical investigation will also be used to estimate the extent of gypsum materials, and the level of effort anticipated for excavation and haul of the materials. Geotechnical data obtained from IB-4a will be used to evaluate the potential for placement of a stormwater retention pond to attenuative stormwater discharge peak flows.

Topographic surveys will provide baseline contours for estimates of existing slopes, extent of materials, and will assist in estimating proposed cut and fill quantities associated with various remedial alternatives.

Agronomic data will be used to evaluate the potential for direct vegetation of bauxite residue materials or amendment of bauxite residue materials to form a vegetative soil layer using on-site gypsum.

Step 2 (identify the decision) of the DQO process is: Do the waste or gypsum materials possess any geotechnical or chemical properties that may impact reclamation, and, what are the existing grades and how much fill material is required to bring the RDAs to desired contours?

Step 3 (identify inputs to the decision) includes collection of representative waste and gypsum samples and completion of testing in accordance with appropriate testing standards. Topographic survey data is to be collected for these areas at a density sufficient to establish a one-foot contour-interval.

The spatial boundaries of the Site are defined (Step 4) as shown on Figure 3.1.2-1. Geotechnical samples will be obtained throughout the entire depth of bauxite residue in IB-1 and throughout the entire depth of the gypsum dikes in IB-2. Geotechnical samples will only be obtained to depths of approximately 11 feet below ground surface (bgs) for the IB-4a area. Agronomic samples will be

obtained from 0 to approximately 11 feet bgs in the RDAs and for the entire depth of gypsum materials in the dikes.

The decision rule (Step 5) is as follows: If samples were collected and tested (and survey was completed) in accordance with appropriate standards, the data will be used to evaluate reclamation designs. The limits on decision errors (Step 6) states that material testing and reporting, and survey data collection, should be completed in accordance with appropriate standards. Finally, Step 7 (optimize design for obtaining data) states that sample frequency must be adequate to obtain representative samples of the bauxite residue and gypsum materials. The frequency of survey data points must be sufficient to provide a one-foot contour interval level of precision.

4.0 SITE CHARACTERIZATION DATA GAPS

In assembling the media-specific data gaps (and Field Sampling Plan, Appendix G-2) from the two categories of human health and ecologic risk-based screening, it became apparent that some minor modifications would simplify the data collection process and avoid potential sampling or analytical errors. Human health risk screening identified antimony, arsenic, cadmium, chromium, copper, lead, mercury, vanadium, and zinc as metal COIs. Ecological risk screening identified aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, selenium, silver, thallium, vanadium, and zinc as metal COIs. The field-sampling program will be more efficient if the human health and ecological risk samples are collocated where appropriate. At such locations, the human health metal parameters are included within the ecological risk metal parameters. Furthermore, the ecological risk metal analytes are similar to the Target Analyte List. Of the 23 metals on the TAL list, only beryllium, calcium, iron, magnesium, nickel, potassium, and sodium are not included as an ecological risk metal analyte. As discussed in Sections 3.4 and 3.5, Ca, Mg, K, Na, and Fe are not considered as COIs. Therefore, in the rest of this Work Plan, the metal analyses that will be measured at such locations in Phase 1 are the ecological parameters, which includes the human health parameters, and are termed the “modified TAL” list. Additionally, the “10% TAL/TCL scans” discussed previously as the tool to detect otherwise unknown contaminants, are termed henceforth as the “10% TCL” scans, recognizing that the existing COI list will address the potential metal issues.

4.1 Soils and Waste Characterization Data Gaps

4.1.1 Soils Data Needs

Relatively few soil data were available for use in the screening-level human health and ecological risk assessments in many of the IBs at the Site. Most soil data coverage at the Site is focused in IB-3a and IB-3b, where two large data collection efforts have been conducted by IEPA as part of the CERCLA redevelopment process (Section 3.3). Figure 3.3-1 shows the locations of existing surface and subsurface soil samples as well as the locations of sediment and surface water samples.

Data gaps were identified based on the spatial coverage of usable soils data in the human health and ecological screening-level risk assessments (Section 3.4 and Appendix D, respectively). Data gaps

were identified in the IBs where little or no data were available for estimating exposure to the applicable receptors. The following data gaps were identified for soils in the screening-level risk assessments:

Residue Disposal Areas (RDAs)

- IB-1a – No surface or subsurface soil samples were available for human health or ecological screening-level risk assessment purposes.
- IB-1b – One surface soil sample was available for screening-level risk assessment purposes.
- IB-1c – Several surface soil samples were available for the screening-level risk assessments, and a few subsurface soil samples are also part of the existing database. However, all of the samples were collected from a small area in the southeastern portion of IB-1c. Additional samples are required to determine the potential for exposure over the entire area of IB-1c.

Gypsum Dike Areas

- Only a limited dataset was available for use in the human health screening level assessment for the gypsum materials at the Site. Additional data are needed to determine the concentration COPCs in surface and subsurface gypsum materials.

Other Areas of Alcoa Activity

- IB-3a – Numerous surface soil samples were available for human health screening-level risk evaluations, and there are additional subsurface soil results in the existing database. Additional surface and subsurface soil samples are required in this IB for two purposes:
 - Increased spatial coverage of soil samples is needed.
 - The lack of adequate data quality information from the existing dataset make these data unacceptable for use in remedial decision making without at least adequate confirmatory sampling.
- IB-3b – Numerous surface soil samples were available for use in the human health and ecological screening-level risk assessments, and there are additional subsurface soil results in the existing database. However, the data gap identified in this IB include:
 - A lack of spatial coverage of samples throughout the IB, and
 - A lack of data quality parameters in the existing dataset to allow for their use in the remedial decision making process.
- IB-3c – No surface or subsurface soil samples were available for the screening-level human health or ecological risk assessments, or alternatively for waste characterization.

Areas with No Known Alcoa Activity

- IB-4a – No surface or subsurface soil samples were available for the screening-level ecological risk assessments.
- IB-4b – There are no soil data gaps in this IB. Given the current land use and identified habitat in this IB, no soils are present. Data gaps for IB-4b are discussed in Section 4.2.
- IB-4c – No surface soil samples were available for the screening-level human health risk assessment.
- IB-4d – There are no soil data gaps in this IB. Given the current land use and identified habitat in this IB, no soils are present. Data gaps for IB-4b are discussed in Section 4.2.
- IB-4e – No surface or subsurface soil samples were available for the screening-level human health risk assessment.

The Phase I Field Sampling and Analysis Plan (Appendix G-2) discusses the plan for the collection and analysis of the soil samples necessary to provide data to fill in the data gaps in each of the IBs discussed above. The goal of the Phase I soil sampling program will be to provide adequate sample numbers and spatial coverage of the areas of the Site that are relevant to the exposure estimates. These are discussed as data needs for human health and ecological risk assessment in Section 3.4 and Appendix D, respectively.

4.2 Surface Water and Sediment Data Gaps

Only a very limited set of surface water and sediment data were available during the preparation of the SLERA. Existing surface water and sediment data are limited to the open water and vegetated wet area adjacent to Lake Drive (IB-4a) and in the triangle wet area (IB-4b) (IEPA, 2002). Figure 3.3-1 shows the locations of surface water and sediment samples.

Data gaps were identified based on the spatial coverage of usable surface water and sediment data in the SLERA (Appendix D). Data gaps were identified in the IBs where little or no data were available for estimating exposure to the applicable receptors in the open water and vegetated wet area habitats:

Residue Disposal Areas (RDAs)

- IB-1a – No surface water or sediment samples were available for ecological screening-level risk assessment purposes in the open water or vegetated wet areas.

- IB-1b – No surface water or sediment samples were available for ecological screening-level risk assessment purposes in the open water or vegetated wet areas.
- IB-1c – No surface water or sediment samples were available for ecological screening-level risk assessment purposes in the open water or vegetated wet areas.

Gypsum Dike Areas

- No surface water or sediment is present in the gypsum berm areas. No data gaps for surface water or sediment were identified in the baseline ecological problem formulation.

Other Areas of Alcoa Activity

- IB-3a – No surface water or sediment is present in the Brick Works/Childs Property Area. No data gaps for surface water or sediment were identified in the baseline ecological problem formulation.
- IB-3b – No surface water or sediment samples were available for ecological screening-level risk assessment purposes in the open water or vegetated wet areas.
- IB-3c – No surface water or sediment samples were available for ecological screening-level risk assessment purposes in the open water or vegetated wet areas.

Areas with No Known Alcoa Activity

- IB-4a – Only a limited dataset was available for use in the screening level ecological risk assessment. Data were limited to the open water and vegetated wet areas adjacent to Lake Drive. In addition, information regarding data quality were lacking. Therefore, the existing data were only applicable for screening-level use.
- IB-4b – Only one sediment and one surface water sample was available for use in the screening level ecological risk assessment. Information regarding data quality were also lacking. Therefore, the existing data were only applicable for screening-level use.
- IB-4c – No surface water or sediment is present in the Ball Fields Area. No data gaps for surface water or sediment were identified in the baseline ecological problem formulation.
- IB-4d – No surface water or sediment samples were available for ecological screening-level risk assessment purposes in the vegetated wet areas.
- IB-4e – No surface water or sediment is present in the Active Commercial Areas. No data gaps for surface water or sediment were identified in the baseline ecological problem formulation.

The Phase I Field Sampling and Analysis Plan (Appendix G-2) discusses the plan for the collection and analysis of the surface water and sediment samples necessary to provide data to address the

data needs in each of the IBs discussed above. The goal of the Phase I surface water and sediment sampling program will be to provide adequate sample numbers and spatial coverage of the areas of the Site that are relevant to the exposure estimates discussed in the Ecological Risk Assessment Work Plan (Appendix D).

4.3 Groundwater

The groundwater pathway is assessed under the risk-based approach for evaluating the potential exposure of human to hazardous substances related to the former Alcoa operations. Based on the CSMs (e.g., Figure 3.4.1-1 through 3.4.1-4), there are two potentially complete groundwater exposure pathways at the Site: (1) the groundwater ingestion pathway, and (2) exposure to surface water or sediment impacted by groundwater. A phased groundwater investigation will be implemented to assess the risk posed to potential receptors through these two identified exposure pathways. A brief discussion of the details regarding each pathway is presented below.

4.3.1 Groundwater Ingestion Pathway

As discussed in Section 3.4.1, the groundwater ingestion pathway could be complete if groundwater is being used for drinking water, providing a means of exposure to contaminants present in the groundwater (if any). Based on available information, however, there are two factors that could limit the ingestion of groundwater, and therefore the completeness of this potential exposure pathway. First, a 1997 groundwater ordinance passed in the City of East St. Louis prohibits new uses of groundwater for potable purposes (Section 3.1.7). Secondly, review of water well databases in the area indicates that most wells in the vicinity of the Site are quite old (installed in the 1930s and 1940s), and were installed for industrial and commercial purposes. The databases contain no records of potable water wells installed in the last several decades. These trends, plus the fact that the City's water supply is now provided from surface water sources (Section 2.2.4.3), indicate a historical shift away from groundwater use. Therefore, the Phase I Groundwater Investigation will address two primary data quality objectives: (1) is the groundwater ingestion pathway complete (how effective is the groundwater ordinance and what is the status of water wells near the Site), and (2) do the concentrations of groundwater COIs exceed risk-based values at the Site? These results will be evaluated in the Phase I Risk Characterization to identify human health risk data gaps for the Phase 2 Investigation.

4.3.2 Groundwater to Surface Water/Sediment Pathway

The second potential exposure pathway that may be relevant is potential human exposure to surface water and/or sediment contacted by groundwater flowing downgradient from the Site. This pathway requires more investigative steps than the groundwater ingestion pathway because of the additional media and distances involved. The conceptual model of this exposure pathway requires Site COIs to migrate downward to groundwater, groundwater flowing and discharging to a surface water source (e.g., the Mississippi River, which is approximately three miles from the site) and human contact with surface water and/or sediments that contact Site COIs at concentrations above risk-based levels. Therefore this pathway will be assessed in an iterative approach. The Phase I groundwater information will be evaluated and used to assess the viability and significance of the groundwater to surface water/sediment pathway. That assessment will be presented in the Phase I Risk Characterization, which will recommend whether additional data collection or modeling is necessary to adequately address this potential exposure pathway (Section 4.3.4)

4.3.3 Phase I Groundwater Investigation

The primary purpose of the Phase I Groundwater Investigation will be to evaluate if the groundwater ingestion exposure pathway is physically complete, and whether COIs are present in groundwater at concentrations that could pose unacceptable risk to humans ingesting groundwater downgradient of the site. There are six activities that will be performed during the Phase I Groundwater Investigation. These activities are:

Physical Completeness of the Exposure Pathway

- 1) Evaluate the effectiveness of the City groundwater ordinance as an institutional control to prevent ingestion of groundwater,
- 2) Document the status of wells entered into the governmental well databases;

Presence of COIs in Groundwater at Concentrations that Pose Potential Risk

- 1) Identification of groundwater COIs,
- 2) Evaluate the physical flow pathways and hydrogeologic characteristics of the Site that would allow transport from sources to Site groundwater;

- 3) Measure the concentrations of COIs in groundwater, if present; and
- 4) Perform fate and transport modeling of measured COIs that exceed RBCs to evaluate potential off-site groundwater concentrations, if necessary.

The results of these activities will be evaluated in the Phase 1 Risk Characterization to guide the development of Phase 2 data needs. The general data needs and technical approach for each of the six activities are described below. The specific detailed plan to perform the activities is presented in Sampling and Analysis Plan (Appendices G-1 and G-2).

4.3.3.1 Evaluate Effectiveness of City Ordinance

The purpose of this evaluation is to assess whether the City ordinance on groundwater use is an effective institutional control for groundwater ingestion. In order to verify the effectiveness of the city ordinance, the following tasks will be completed:

- a) Interviews with local drilling firms to assess whether wells have been drilled or pumping and piping systems in wells have been maintained or serviced at locations within the City. Results of the interviews will be documented in a technical memorandum.
- b) Review *Applications for Permits to Construct or Deepen a Water Well* on file at the Illinois Public Health Department, and assess whether any such permits were approved within the City limits since the ordinance was passed. The Illinois Water Well Construction Code (77 Ill. Admin. Code Section 920.130) requires that this permit be approved prior to constructing or deepening a water well. The local health department, East Side Health District, will also be consulted.
- c) A community outreach program will be instituted to gather information on actual use of groundwater throughout the City, as well as educating residents about the City-wide groundwater ordinance. Details of the outreach program will be provided in an addendum to this Work Plan, but may include distribution of public information on the local public access television channel, placement of public service advertisements in community-based newspapers and community and civic groups, presentations to community-based forums, and a direct mail or telephone survey effort that queries residents about use of groundwater, and
- d) The status of the City's enforcement history of the groundwater ordinance will be evaluated.

The results of these activities will be documented in a Technical Memorandum¹. Details regarding the tasks to assess the effectiveness of the institutional controls are presented in the Field Sampling Plan (Appendix G-2; Sections 2.5.3.1 and 2.5.3.2).

¹ Technical Memorandum-2. Effectiveness of the City of East St. Louis Groundwater Ordinance.

4.3.3.2 Document the Status of Wells Entered in the Governmental Databases

While preparing this Work Plan, information regarding the status of water wells in the area was requested from the Illinois State Water Survey, the Illinois State Geologic Survey and the U.S. Geological Survey (NWIS). The information was collated, and duplicate information was parsed out. The results of the survey are presented in Table 2.2.4-1. Most of the wells were installed many years ago, which complicates the task of documenting the current status of the wells. Owner information was used in a telephone and Internet search in an attempt to contact the owner and verify the status of the wells. That effort, as well as a multi-day field investigation using reported well locations (which are typically not highly accurate), resulting in the information presented in Table 4.3.3.2-1.

Based on work-to-date, the following additional activities will be performed to document the status of historical wells:

- a) A door-to-door survey in the industrial area south of Missouri Avenue will be performed. Many of the historical industrial wells are located in this area, and the little industrial activity that remains in East St. Louis is focused in this area. The survey will include a discussion with the site manager on potential groundwater use or knowledge of wells, and if possible, a site-walk through to look for water wells.
- b) The Illinois Water Well Construction Code (77 Ill. Admin. Code Section 920.120) requires that an abandoned water well be sealed by a licensed water well driller within 30 days of abandonment, and a sealing form documenting same be submitted to the state or the local health department within 30 days of sealing. The IDPH and East Side Health District files will be reviewed for water well sealing information in the area.
- c) Sanborn fire maps in the vicinity of the site will be inspected to identify any water wells on the maps. If such wells are located, a field visit to the well location will be performed, and the current status of the well will be documented.

The results of these activities will be documented in a Technical Memorandum².

4.3.3.3 Identification of Groundwater COIs

Early in the Phase I remedial investigation, surficial soil samples will be collected to assess various ecological and human health exposure pathways. Soil samples will be analyzed for a suite of COIs as identified in the human health and ecological preliminary risk screen (Sections 3.4 and 3.5). In

² Technical Memorandum-3. Status of Existing Water Wells

addition, 10 percent of all samples will be analyzed for TCL analytes. In order to identify a list of Site-related COIs that will be measured in groundwater samples, the Phase 1 surficial soil analytical results will be evaluated using the conservative soil-to-groundwater soil screening levels (SSLs) provided by U.S. EPA (Appendix A; U.S. EPA, 1996)⁶. The SSLs were prepared to identify soils and pathways that require further characterization, and perhaps remediation, based on the potential for contaminants in soil to migrate to groundwater at concentrations in excess of MCLs. The soil-to-groundwater SSL is based on simplifying assumptions for use at a site early in the RIFS process. Soil-to-groundwater SSLs that will be used in Phase 1 are listed in Table 4.3.3.3-1. Once the SSLs have been calculated, a dilution-attenuation factor (DAF) is applied to the SSL to account for physical, chemical and biological processes that reduce the eventual contaminant concentration in the underlying aquifer. A site-specific DAF of 20.3 was calculated for the Site, but could range up to 35 depending on the actual amount of recharge occurring on the Site (U.S. EPA, 1996). However, to ensure conservatism in the identification of groundwater COIs, the default DAF of 20 will be used.

At this point all the surficial soil sample results will be compared to the selected SSL for each analyte. If the 95% upper confidence level (UCL) of the mean concentrations for an analyte exceeds the SSL, that analyte will be considered a COI for groundwater analytical sampling in the Phase I groundwater investigation.

4.3.3.4 Physical Hydrogeologic Investigations

Physical hydrogeologic data from the American Bottoms Aquifer will be collected to understand groundwater flow directions and estimate aquifer hydraulic parameters (e.g., hydraulic gradient and hydraulic conductivity). Some of the physical hydrogeologic data that will be collected include:

- 1) Hydraulic Testing – Pumping and/or slug tests will be performed on wells and piezometers screened within the aquifer. Data for the aquifer hydraulic conductivity (K) of the aquifer will be assessed. This data will be used in groundwater modeling to assess far-field fate and transport of COIs, and to develop Phase 2 data needs.
- 2) Water Level Measurement – Water levels will be measured in all wells and piezometers installed to define Site-specific groundwater flow directions, horizontal hydraulic gradients, and saturated thicknesses.

⁶ U.S. EPA has not published SSLs for all TAL/TCL chemicals that also have an MCL. An SSL was calculated for those chemicals (Table 4.3.3-1).

- 3) Stratigraphy – Stratigraphic data will be collected during drilling of borings for wells and piezometers to help build a detailed hydrostratigraphic site model. This will be the basis for designing a fate and transport model.

4.3.3.5 Nature and Extent of Potential COIs

Groundwater COIs will be measured in samples from one monitoring well installed upgradient of the RDAs and three monitoring wells installed downgradient of the RDAs. Details regarding the drilling and installation of these wells are described in the Field Sampling Plan (Appendix G-2; Section 2.6.3.1). Figure 4.3.3.5-1 shows the approximate locations of four proposed monitoring wells. Actual locations will be finalized pending the results of the Site Reconnaissance and access agreements.

Prior to constructing the wells, the drilled borings will be geophysically logged using resistivity to assess potential stratification of COIs within the American Bottoms Aquifer. The results of the geophysical logging should indicate the vertical distribution of a COI plume, if present. Resistivity logs should reveal whether layers of conductive caustic leachate are present in the aquifer. The results of the resistivity logging will aid in well screen placement and identify whether nested wells are needed for vertical delineation of constituents in groundwater. The geophysical logging may also add some insight to the borehole stratigraphy.

Upon completion and development of the four monitoring wells, groundwater samples and water levels will be collected. As stated in Section 4.3.2, the analytical suite for the groundwater samples will consist of the COIs identified by the SSL screening from the Phase I surficial soil sample results. Detection limits for COIs (as presented in the QAPP, Appendix G-1) are specified by using the lower of the two following criteria:

- Federal U.S. EPA Maximum Contaminant Levels (MCLs); or
- Illinois Class I Groundwater Standards.

The QAPP lists the potential COIs and their required method detection limit for groundwater sample analyses based on the lower of the two groundwater standards listed above.

Subsequent to sampling and analysis of the groundwater, the data will be validated and entered into the project database (see Appendix G-1 – QAPP). If COI concentrations are detected in groundwater

at concentrations above MCLs or Illinois Class 1 groundwater standards, those data will be used, along with the physical hydrogeologic data, for the fate and transport modeling described in Section 4.3.3.6.

4.3.3.6 Fate and Transport Modeling

The final task for the Phase I groundwater investigation, if COIs in groundwater at the Site exceed risk-based values, is to perform groundwater fate and transport modeling to assess potential groundwater conditions downgradient of the site and to guide the development of Phase 2 data needs. It has not been determined what level of modeling effort (i.e., analytical or numerical model) will be necessary to evaluate potential downgradient migration of COIs in groundwater. Upon completion and review of the Phase I groundwater data collection activities, MFG, Alcoa, and U.S. EPA will have a data assessment meeting to discuss the appropriate modeling strategy to be used to meet the Phase 1 goals. Once the modeling approach has been established, the Phase I fate and transport modeling activity will commence.

4.3.3.7 Phase I Data Assessment and Reporting

Upon completion of the Phase I field investigations and modeling work, all results will be compared with risk-based criteria to assess potential risk. Initially, modeled and observed groundwater COI concentrations will be compared to the lower of Federal U.S. EPA MCLs or the Illinois Class I Groundwater Standards. If any COIs detected in groundwater or in the modeled surface water pathway exceed their applicable risk screening values, additional Phase II work may be proposed to further characterize the nature and extent of COIs.

Alcoa will summarize the results of the Phase I groundwater investigations and modeling work, and submit the information to U.S. EPA with recommendations for subsequent Phase II activities, if warranted. Upon review of the Phase I Technical Memorandum, a data assessment meeting with U.S. EPA will be held to identify if Phase II investigations are warranted.

4.4 Ecological Characterization Data Gaps

The identification of ecological data gaps is detailed in Appendix D. In summary, no COI data from biota tissues were available for the SLERA. In their place, conservative bioaccumulation factors (BAFs) were used to estimate the concentrations of COIs in biota tissues. Receptors of concern at the Site may be exposed to COIs in biota tissues while ingesting prey items that may have accumulated COIs from the ingestion soils, sediments, surface water, or other biota at the Site.

In the phased approach to the RIFS, biota data were not identified as a data need for Phase I. In preference to Phase I biota tissue data collection, more extensive soil BAFs will be used in a manner similar to their use in the SLERA in the Phase I Risk Characterization. If it is determined that biota tissue data are necessary to reduce uncertainty in the Phase I Risk Characterization, biota tissue data will be collected in the Phase II RI data collection efforts. A detailed sampling and analysis plan will be prepared for the biota tissue data collection, if it is deemed necessary, prior to the initiation of the Phase II sampling event.

4.5 Air Investigation

One of the potential pathways for off-site transport of Site-related contaminants is through airborne transport of particulates. Contaminants, usually in the form of dust from in-situ materials, can become entrained in the wind, either as a direct result of wind erosion, or more typically as a result of the movement of materials and equipment on the site. Once entrained in the wind, these contaminants have the potential to be carried off-site. Impact to the community can occur through direct inhalation, or through deposition and subsequent ingestion.

There are models and established techniques for characterizing the transport, deposition and impact to the community, once the quantities of contaminant released to the atmosphere from the site are understood. The primary data gaps that must be filled in the Phase 1 concern the rate at which materials may be released by on-site activities. These information needs can generally be divided into two general categories of information: data concerning the materials themselves, and data concerning the ways in which they may become airborne.

Material data. The most important information that must be understood for the air investigation is the chemical concentrations of the materials at the site that may be subject to wind entrainment. Section 4.1 describes the efforts that will be taken to sample soils and other surficial materials on-site for chemical analysis. In addition to the chemical makeup of the soils, it is necessary to have an understanding of the physical makeup, including (1) the soil moisture content and (2) the soil grain size. Methods to be used to estimate the quantity of material emitted by the various activities and wind erosion of the site will require a knowledge of the grain size of the material. The most common grain size measure in these emission estimation methods is the percentage of silt in the on-site soils, as determined by the fraction passing a 200-mesh screen. Section 4.1 and Appendix G-2 discuss methods that will be used to sample the soils and determine these physical characteristics.

Activity Data. In addition to the material characteristics, the air quality assessment will also require information on the activities that cause particles of soils and other on-site materials to become airborne. As a first step it will be important to understand the current conditions of the site. Much of the site is currently vegetated and the soils are not easily eroded by the wind, but there are some exposed areas and maps will need to be prepared to identify the current conditions of the site. Future conditions of the site must also be understood. In addition it is important to understand all the activities that are currently on-going at the site as well as any future activities. Of particular interest is the removal activities for the gypsum material that has been practiced in the past and may be practiced in the future. Information is needed on:

- the types of vehicles and other equipment used in these activities;
- the quantities of material that are removed over time;
- the types of handling activities that the material being removed undergoes; and
- an equipment list and an estimate of the hours of activity per day for the equipment is a starting point for this investigation.

4.6 Non Media-Specific Human Health Risk Assessment Data Gaps

There are no “non media-specific” data gaps identified for the human health risk assessment, at this time. Media-specific data gaps for the human health risk assessment are presented in Section 3.4.4.

4.7 Non Media-Specific Ecological Risk Assessment Data Gaps

The Zambrana (1999) biological characterization of the Site provided considerable data regarding the presence of wet area habitats at the Site. The report also provided a general description of the overall upland ecological habitats found at the Site. However, no effort was made at preparing a site-wide habitat map that addresses both upland and wet area habitats. This lack of site-wide habitat data was identified as a non media-specific data gap in the baseline ecological problem formulation (Appendix D).

Prior to sampling at the Site a map identifying ecological habitats will be prepared to provide the data necessary to prepare the Phase I Ecological Risk Characterization that is based on the varying habitats present at the Site. This map will be prepared using the most current aerial photography available and will be field verified by a qualified ecologist using GPS equipment. Each habitat type will be described in terms of the vegetative community present and will generally follow the habitat designations described in the Zambrana (1999) report.

4.8 Additional Engineering Data Needs

Additional engineering data is needed to evaluate potential closure remedies. Additional, more detailed survey data will be needed at various locations on-site, including one foot contour interval survey data for portions of the dike system and RDAs in order to quantify cut and fill volumes associated with proposed remedial designs, and to clearly define surface water drainage pathways. City stormwater sewer capacity should be evaluated to determine if it is designed to handle potential stormwater runoff from the site.

4.8.1 Treatability Study Objectives

Treatability studies will be completed to evaluate:

- The potential for establishment of vegetation on existing bauxite residue materials; and,
- The potential for treatment of existing on-site bauxite residue materials with existing on-site gypsum material to establish a vegetative soil layer.

This treatability study is designed to effectively address technology-specific data gaps in support of development and evaluation of treatment alternatives and to provide information such that cost and performance uncertainties for specific remedial technologies and alternatives are minimized. Engineering data needs include gypsum and bauxite residue geotechnical and geochemical data for IB-1 and IB-2 to evaluate the potential for direct vegetation of the bauxite residue materials and potential for modifying the bauxite residue soil properties using gypsum. The details of the DQO process for the gypsum and bauxite residue geotechnical sampling are provided in Appendix G-2.

Alcoa will collect and analyze bauxite residue samples from RDA 1 (Old Pond), RDA 2 (Brown Pond) and RDA 3 (Red Pond) to evaluate the geochemical difference between vegetated and bare portions of the mud beds, and to provide baseline information for future vegetation efforts. In addition, gypsum located in existing dikes and stored on-site will be analyzed to evaluate its potential as a residue amendment.

For geochemical testing, sample analytes will include macro- and micronutrients, cation exchange capacity (CEC), exchangeable sodium capacity (ESP), pH, and bulk density. A complete list of analytes is shown in Table 1.0 of the FSP located in Appendix G-2.

Alcoa will collect residue samples using a decontaminated hand auger, GeoProbe sampler, or Shelby tube over the upper 24 inches of material and at depths up to 11 feet below ground surface at selected locations (coincident with geotechnical samples). The upper samples will be divided into separate 12-inch-thick composite subsamples representative of the 0-12 inch, and 12-24 inch depth intervals, respectively. The 9-11 foot samples will be analyzed as a 24-inch-thick composite sample. Sample analyses over depth will provide useful information about the variation in residue geochemistry over depth, and in water and chemical transport between surface and subsurface residue material. In addition, constituent depth profiles will provide design flexibility if amending the residues is necessary to successfully vegetate portions of the residue surface.

The aerial distribution of proposed sample locations is intended to provide information about the range of residue and gypsum geochemical characteristics at the site as effected by local topography, drainage patterns, and vegetative cover. Alcoa will use the results of the residue and gypsum tests to evaluate the existing potential for vegetating bare areas in the residue beds. This evaluation will include an assessment of whether residue amendment is necessary to alter residue geochemistry and physical characteristics and whether on-site gypsum materials could be useful to these ends. In addition, the

results of the residue and gypsum tests may be used to develop the conceptual design for a pilot vegetation study.

Representative bauxite residue and gypsum samples will be obtained throughout the full depth of materials to evaluate engineering properties. It is anticipated that excavation and haul of existing gypsum materials for potential use as a bauxite residue amendment may be required as part of the remedy for the site. Potential gypsum excavation areas include current perimeter dike locations. Dike areas may be partially excavated to obtain the gypsum materials needed for treatment of the bauxite residue material, and therefore, slope stability analysis will be performed to ensure stability of the dikes during this process. The gypsum materials will be sampled in locations as shown in Figure 2.2-1 of the FSP to evaluate existing and proposed final grade slope stability. Additional geotechnical data is required to evaluate the feasibility and potential costs associated with excavating, hauling, and mixing the gypsum materials with bauxite residue.

Existing bauxite residue material may need to be excavated and hauled short distances to achieve appropriate grading for surface water drainage. The residue may also be mixed with a gypsum amendment to establish a vegetative soil layer, if it is determined that the residue cannot be directly vegetated. Permeability of the bauxite residue will be quantified to estimate the volume of infiltration through the residue, and consolidation data will be obtained to evaluate potential short and long-term consolidation of residue materials upon completion of final grading. Types and quantities of proposed geotechnical testing are summarized in Table 2.0 of the FSP.

5.0 REFERENCES

- Applied Research and Development Laboratory (ARDL), 2001. ALCOA Site Phase II East St. Louis, Illinois.
- Burlington Environmental, 1992. Hydrogeologic Investigation Diesel-Fuel Release East St. Louis Service Facility – ESDA Incident Number 913422. July 21.
- Ecology and Environment, 2000. Letter Report for Alcoa East St. Louis St. Clair County, Illinois. July 5.
- Illinois Environmental Protection Agency (IEPA), 1997. IEPA, Bureau of Land. CERCLA Integrated Site Assessment: Childs Property.
- , 1998. Letter to City of East St. Louis.
- , 1999. IEPA, Bureau of Land CERCLA Redevelopment Assessment for the Former Alcoa Property.
- , 2000. No Title (Data related to sediment and surface water sampling on the northern portion of the Site)
- , 2002. No Title (Data set of sediment and four samples collected along Lake Drive)
- Illinois State Water Survey (ISWS), 1995. (Draft figures from an unpublished document showing potentiometric Surface and pumping data for East St. Louis), transmitted via email to MFG on March 11, 2003 by Ken Hlinka (ISWS).
- Schicht, 1965. Groundwater Development in East St. Louis Area, Illinois, Illinois State Water Survey, Report of Investigation 51.
- United States Environmental Protection Agency (U.S. EPA), 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.
- , 1989. *Risk Assessment Guidance for Superfund, Human Health Evaluation Manual Part A*. Office of Solid Waste and Emergency Response. 9285.701A. December.
- , 1992. *Guidance for Data Usability in Risk Assessment (Part A): Final*, Office of Emergency Planning and Response. 9285.7-09A. April.
- , 1996. *Soil Screening Guidance: Technical Document*, U.S. EPA Document Number: U.S. EPA/540/R-95/128. July.
- , 1997. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*. Interim Final. June.
- , 1998. *Guidelines for Ecological Risk Assessment*. U.S. EPA/630/R-95/002F. April.

- , 1999. USEPA Contract Laboratory Program Functional Guidelines for Organic Data Review. Office of Emergency and Remedial Response. OSWER 9240.1-05A-P, PB99-963506, U.S. EPA540/R-99/008. October.
- , 2000. Data Quality Objectives for Hazardous Waste Site Investigations. EPA QA/G-4HW. Final.
- , Region 3, 2002. *Risk-Based Concentrations Tables (RBCs). And Memo from Jennifer Hubbard, USEPA Toxicologist, to RBC Table Users.* Regarding the Risk-Based Concentrations Table. <http://www.epa.gov/reg3hwmd/risk/cov0402.pdf>.
- , 2002. Storage and Retrieval of U.S. Waters Parametric Data (STORET).
- , 2003. Institutional Controls: A Guide to Implementing, Monitoring and Enforcing Institutional Controls at Superfund, Brownfields, Federal Facility, UST and RCRA Corrective Action Cleanups.
- Zambrana Inc., 1999. American Bottoms Interior Flood Control Project; Biological Analysis of the Former Alcoa Site. Prepared for U.S. Army Corps of Engineers. June 14.

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TABLES

TABLE 2.2.4-1

SUMMARY OF WELL RECORDS OBTAINED FROM AGENCY DATABASES

| MFG ID | MFG Duplicate ID | Well ID | Well Name | Easting - State Plane (Feet) | Northing - State Plane (Feet) | Longitude | Latitude | Township | Range | Section | Plot | Owner | Address | Driller | Date Drilled | Depth (Feet) | Well Status | Well Use ¹ | Pumping Rate (gpm) | Permit Number | Permit Date | Data Source | Comments | | | |
|--------|------------------|-----------------|-------------|------------------------------|-------------------------------|-----------|-----------|----------|-------|---------|----------|---------------------------------------|------------------------------|-----------------------|--------------|--------------|-------------|-----------------------|--------------------|---------------|-------------|-------------|-----------------------|------------------------------|------------------------------|-----------------------|
| 14 | 77 | 121630173900 | | 2302219 31 | 707569 51 | | | | | | | | | | | | | | | | | | ISGS (Wells Coverage) | | | |
| 154 | NA | 383552090073501 | 2N 9W-29 8f | 2308062 48 | 703172 14 | -90 1265 | 38 597829 | 02N | 09W | 29 | 8F | | | | | | | UNK | | | | | | USGS NWIS | | |
| 70 | NA | 134961 | | 2306953 60 | 704084 40 | | | 02N | 09W | 30 | 1H | AL ORE CO | | BAITS | | 115 | | IC | | | | | | ISWS (Private Well Database) | | |
| 71 | NA | 134963 | | 2306953 60 | 704069 20 | | | 02N | 09W | 30 | 1H | AL ORE CO | | | 01/01/43 | 121 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 72 | NA | 134964 | | 2306938 40 | 704069 20 | | | 02N | 09W | 30 | 1H | AL ORE CO | | | 01/01/43 | 118 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 73 | NA | 134965 | | 2306953 60 | 704069 20 | | | 02N | 09W | 30 | 1H | AL ORE CO | | | 01/01/43 | 112 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 76 | NA | 244655 | | 2303456 60 | 703504 20 | | | 02N | 09W | 30 | 7G | ALTON & SOUTHERN RAILWAY | | | 08/01/44 | | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Aug 1 | |
| 57 | NA | 134968 | | 2307545 80 | 704840 40 | | | 02N | 09W | 20 | 8A | ALTON AND SOUTH RR | | | 01/01/44 | 100 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 65 | 11 | 244653 | | 2308214 00 | 702142 40 | | | 02N | 09W | 29 | 7E | ALUMINUM ORE CO | | H L WATSON | 10/01/40 | 122 | | IC | 928 | | | | | ISWS (Private Well Database) | Assumed date as Oct 1 | |
| 11 | 65 | 121630190000 | | 2309357 25 | 702892 06 | -90 12186 | 38 597017 | 2N | 9W | 29 | NW SE NW | Aluminum Ore Co | | Watson Harold L | 10/01/40 | | WATER | | | 0 | | | | | ISGS | |
| 3 | 38 | 121630191800 | | 2308130 50 | 710857 19 | -90 12614 | 38 61889 | 2N | 9W | 17 | NW SW SW | Bnchler & Co | | Watson Harold L | 12/01/45 | | WATER | | | 0 | | | | | ISGS | |
| 66 | NA | 241157 | | 2307572 60 | 702127 20 | | | 02N | 09W | 29 | 8E | CASPER SICKMANN | | | 10/01/43 | 30 | | DO | | | | | | ISWS (Private Well Database) | Assumed date as Oct 1 | |
| 53 | NA | 135016 | | 2303013 20 | 708392 00 | | | 02N | 09W | 19 | 8F | CERTAIN TEED PROD | | | | 106 | | IC | | | | | | ISWS (Private Well Database) | | |
| 77 | 14 | 135017 | | 2302272 40 | 707608 60 | | | 02N | 10W | 24 | 1E | CERTAIN TEED PROD | | | 01/01/43 | 106 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 54 | 8 | 135018 | | 2303008 40 | 708383 40 | | | 02N | 09W | 19 | 8F | CERTAIN TEED PROD | | | | 110 | | IC | | | | | | ISWS (Private Well Database) | | |
| 8 | 54 | 121630189800 | | 2302866 25 | 708219 63 | -90 14457 | 38 611652 | 2N | 9W | 19 | NW SW NW | Certain Teed Products Corp | | Watson Harold L | 12/01/42 | | WATER | | | 0 | | | | | ISGS | |
| 78 | NA | 244665 | | 2302272 40 | 707621 40 | | | 02N | 10W | 24 | 1E | CERTAIN-TEED PRODUCTS CORP | | WATSON (FINK) | 10/01/50 | 118 | | IC | | | | | | | ISWS (Private Well Database) | Assumed date as Oct 1 |
| 67 | NA | 135021 | | 2307557 40 | 702707 40 | | | 02N | 09W | 29 | 8F | CHEM TECK PROD | | | 01/01/72 | 98 | | IC | | | | | | ISWS (Private Well Database) | | |
| 38 | 3 | 134953 | | 2307531 80 | 710866 40 | | | 02N | 09W | 17 | 8B | DRUG STORE | | | 01/01/49 | 84 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 51 | NA | 135066 | | 2305727 40 | 709449 20 | | | 02N | 09W | 19 | 3H | HOME ICECREAM CO | | | 01/01/33 | 115 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 45 | NA | 246118 | | 2307345 80 | 705376 80 | | | 02N | 09W | 19 | | ILLINOIS POWER COMPANY #101 | 29th St (near Missouri Ave) | BIGNAL | | 36 | | MO | | | | | | ISWS (Private Well Database) | | |
| 42 | NA | 246119 | | 2307033 60 | 705606 00 | | | 02N | 09W | 19 | | ILLINOIS POWER COMPANY #102 | 29th St (near Missouri Ave) | BIGNAL | | 20 | | MO | | | | | | ISWS (Private Well Database) | | |
| 43 | NA | 246120 | | 2307115 40 | 705620 60 | | | 02N | 09W | 19 | | ILLINOIS POWER COMPANY #103 | 29th St (near Missouri Ave) | BIGNAL | | 18 | | MO | | | | | | ISWS (Private Well Database) | | |
| 44 | NA | 246117 | | 2307177 20 | 705473 00 | | | 02N | 09W | 19 | | ILLINOIS POWER COMPANY RW-101 | 29th St (near Missouri Ave) | BIGNAL | | 33 | | MO | | | | | | ISWS (Private Well Database) | | |
| 12 | NA | 121632622700 | | 2310146 75 | 703269 88 | -90 1191 | 38 598053 | 2N | 9W | 29 | NE NW | Industrial Truck Supply Inc (Koppers) | 3901 Missouri Ave | Kohnen, Clarence | 01/19/81 | | WATER | UNK | | 98111 | 13-Jan-81 | | | ISGS | | |
| 47 | NA | 253460 | | 2305727 40 | 709447 20 | | | 02N | 09W | 19 | 3H | JUL FISCHER DISTRIBUTOR CO #1 | | BURLINGTON ENVIR INC | | 24 | | MO | | | | | | ISWS (Private Well Database) | | |
| 46 | NA | 253459 | | 2305729 60 | 709445 20 | | | 02N | 09W | 19 | 3H | JUL FISCHER DISTRIBUTOR CO #2 | | BURLINGTON ENVIR INC | | 24 | | MO | | | | | | ISWS (Private Well Database) | | |
| 50 | NA | 253456 | | 2305731 80 | 709449 20 | | | 02N | 09W | 19 | 3H | JUL FISCHER DISTRIBUTOR CO #3 | | BURLINGTON ENVIR INC | | 24 | | MO | | | | | | ISWS (Private Well Database) | | |
| 49 | NA | 253453 | | 2305729 40 | 709449 20 | | | 02N | 09W | 19 | 3H | JUL FISCHER DISTRIBUTOR CO #4 | | BURLINGTON ENVIR INC | | 24 | | MO | | | | | | ISWS (Private Well Database) | | |
| 48 | NA | 253452 | | 2305725 40 | 709449 20 | | | 02N | 09W | 19 | 3H | JUL FISCHER DISTRIBUTOR CO #5 | | BURLINGTON ENVIR INC | | 24 | | MO | | | | | | ISWS (Private Well Database) | | |
| 75 | NA | 135085 | | 2304006 20 | 704023 40 | | | 02N | 09W | 30 | 6H | KEY CO | | | 01/01/43 | 100 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 74 | NA | 135086 | | 2304632 40 | 704115 00 | | | 02N | 09W | 30 | 5H | KEY CO | | WATSON | 01/01/43 | 118 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 13 | NA | 121630190100 | | 2304545 75 | 703925 63 | -90 1387 | 38 59986 | 2N | 9W | 30 | NE NW | Key Co | | Watson Harold L | 07/01/43 | | WATER | UNK | | 0 | | | | | ISGS | |
| 56 | NA | 135095 | | 2303016 80 | 708978 20 | | | 02N | 09W | 19 | 8G | LEMP BREWING CO | | | 01/01/46 | 720 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 52 | NA | 135199 | | 2303007 60 | 708383 00 | | | 02N | 09W | 19 | 8F | OBEAR NESTER CO | | | 01/01/43 | 104 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 55 | NA | 135200 | | 2303029 40 | 707805 00 | | | 02N | 09W | 19 | 8E | OBEAR NESTER CO | | | 01/01/43 | 104 | | IC | | | | | | ISWS (Private Well Database) | Assumed date as Jan 1 | |
| 37 | 9 | 135226 | | 2303662 40 | 704818 80 | | | 02N | 09W | 19 | | PRESTRESSED SLABS | 2400 McCasland Ave | ST CH DRILL | | 100 | | IC | | | | | | ISWS (Private Well Database) | | |
| 9 | 37 | 121632590300 | | 2305560 00 | 704910 31 | -90 13515 | 38 602563 | 2N | 9W | 19 | SW SW SE | Prestressed Slabs Inc | 2400 McCasland Ave | Miller Alfred Hampton | 10/29/86 | | WATER | IC | | 126802 | 12-Sep-86 | | | ISGS | | |
| 36 | NA | 16338890 | 12 | 2307551 20 | 702717 00 | | | 02N | 09W | 29 | 8F | SOLVAY FLUORIDES INC | 3500 Missouri Ave | | | 30 | U | LNK | | | | | | ISWS (PICs Database) | | |
| 4 | NA | 121632379800 | | 2309439 00 | 710237 38 | -90 12157 | 38 617187 | 2N | 9W | 17 | SW | State of Illinois | | Luhr Brothers Inc | 03/26/74 | | WATER | DW | | 28844 | | | | ISGS | | |
| 5 | NA | 121632396000 | W-1 | 2308691 00 | 711891 88 | -90 12418 | 38 621731 | 2N | 9W | 17 | | State of Illinois I-64 | | Luhr Brothers Inc | 07/11/75 | | WATER | DW | | 0 | | | | ISGS | | |
| 6 | NA | 121632396100 | W-2 | 2308774 75 | 711710 50 | -90 12389 | 38 621233 | 2N | 9W | 17 | | State of Illinois I-64 | | Luhr Brothers Inc | 07/16/75 | | WATER | DW | | 0 | | | | ISGS | | |
| 7 | NA | 121632396900 | W-10 | 2308781 50 | 711891 50 | -90 12386 | 38 62173 | 2N | 9W | 17 | | State of Illinois I-64 | | Luhr Brothers Inc | 07/10/75 | | WATER | DW | | 0 | | | | ISGS | | |
| 10 | 58 | 121632970700 | 16-M.v | 2308828 25 | 709499 94 | -90 1237 | 38 615163 | 2N | 9W | 20 | NE NW NW | State Street Shell | | Midwest Drilling, Inc | 09/15/99 | | WATER | | | none | | | | | ISGS | |
| 58 | 10 | 325934 | | 2308252 20 | 709609 00 | | | 02N | 09W | 20 | 7H | STATE STREET SHELL #MWS-16 | | MIDWEST DRILLING | | 35 | | MO | | | | | | ISWS (Private Well Database) | | |
| 68 | NA | 241156 | | 2307557 40 | 701577 40 | | | 02N | 09W | 29 | 8D | THEO TAYCOSKI | | | 09/01/37 | 91 | | DO | | | | | | ISWS (Private Well Database) | Assumed date as Sep 1 | |

Notes
 Well use definitions
 DO - Domestic
 DW - Dewatering
 IC - Industrial/Commercial
 MO - Monitoring
 UNK - Unknown

**TABLE 3.3-1
SUMMARY OF POTENTIAL DATA SOURCES**

| MFG Dataset ID | Title | Source Organization | Author | Published Date | MFG Data Quality Level | MinDate | MaxDate | Total Record Count | Count of Records by Media Type ¹ | | | | | | | Notes | |
|----------------|--|---|---------------|----------------|------------------------|----------|----------|--------------------|---|-----|------|-----|----|----|----|-------|---|
| | | | | | | | | | SW | GW | SL | SD | VG | FT | TI | | |
| ESL-0016 | Hydrogeologic Investigation Diesel-Fuel Release, East St Louis Service Facility | Burlington Environmental | | 07/21/92 | 4 | 04/07/92 | 04/07/92 | 144 | 0 | 144 | 0 | 0 | 0 | 0 | 0 | 0 | All groundwater data High data quality. |
| ESL-0017 | CERCLA Integrated Site Assessment - Child's Property | IL-EPA | | 09/24/97 | 2 | 04/04/96 | 11/25/96 | 589 | 0 | 0 | 589 | 0 | 0 | 0 | 0 | 0 | |
| ESL-0049 | CERCLA Redevelopment Assessment | IL-EPA | | 07/09/99 | 2 | 09/14/95 | 04/11/96 | 4230 | 0 | 180 | 4050 | 0 | 0 | 0 | 0 | 0 | 3 GW locations not know, those are level 1 |
| ESL-0051 | Letter Report for Alcoa East Saint Louis | Ecology and Environment | Brad White | 07/05/00 | 1 | 05/01/00 | 05/02/00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Data not entered due to unreliable location information. |
| ESL-0074 | ALCOA Aite Phase II East St Louis, Illinois | Applied Research & Development Laboratory | Todd Gentiles | 12/05/01 | 3 | 11/06/01 | 11/06/01 | 180 | 0 | 0 | 180 | 0 | 0 | 0 | 0 | 0 | |
| ESL-0080 | (No Title - Data for surface water and sediment samples collected in the north wet area) | IL-EPA | | 04/17/02 | 3 | 08/12/97 | 08/12/97 | 296 | 87 | 0 | 0 | 209 | 0 | 0 | 0 | 0 | Very limited documentation associated with this data set. |
| ESL-0081 | EPA STORET Data | U S EPA | | | 2 | 02/22/77 | 12/14/98 | 28667 | 27881 | 0 | 0 | 663 | | | 0 | 123 | Obtained via database query on the STORET web site |

Notes

¹Explanation of Media types.

SW - Surface water

GW - Groundwater

SL - Soil

SD - Sediment

VG - Vegetation Tissue

FT - Fish Tissue

TI - Tissue

Indicates not imported into the database due to MFG data quality level < 2

TABLE 3.4.3-1

PRELIMINARY HUMAN HEALTH RISK SCREENING OF SURFACE SOILS BY INVESTIGATIVE BLOCK

| Analyte | Units | USEPA Region 3 Residential RBC | | IB-1 (Residue Disposal Area) | IB-2 (Gypsum Area) | IB-3a (Relevel Area) | IB-3b (Brick Works) | COI for Human Health - Rationale |
|-----------------------------------|-------|--------------------------------|---|------------------------------|--------------------|----------------------|---------------------|--|
| 2,4-Dinitrotoluene | mg/kg | 1.6E+01 | n | ND | ND | 0.14 | ND | No, < res RBC |
| 2-Methylnaphthalene | mg/kg | 1.6E+02 | n | ND | ND | 1 | 0.51 | No, < res RBC |
| 4,4'-DDD | mg/kg | 2.7E+00 | | ND | ND | 0.014 | 0.015 | No, < res RBC |
| 4,4'-DDE | mg/kg | 1.9E+00 | | 0.0005 | 0.0037 | 0.014 | 0.074 | No, < res RBC |
| 4,4'-DDT | mg/kg | 1.9E+00 | | ND | 0.00053 | 0.037 | 0.15 | No, < res RBC |
| 4-Methyphenol | mg/kg | 3.9E+01 | n | ND | ND | 0.12 | ND | No, < res RBC |
| Acenaphthylene ² | mg/kg | 4.7E+02 | n | ND | ND | 0.26 | 0.51 | No, < res RBC |
| Acenaphthene | mg/kg | 4.7E+02 | n | ND | ND | ND | 0.54 | No, < res RBC |
| Acetone | mg/kg | 7.8E+02 | n | 0.023 | 0.008 | 0.15 | 0.015 | No, < res RBC |
| Aldrin | mg/kg | 3.8E-02 | | ND | ND | 0.016 | 0.004 | No, < res RBC |
| alpha-BHC | mg/kg | 1.0E-01 | | ND | ND | 0.0066 | 0.00047 | No, < res RBC |
| alpha-Chlordane | mg/kg | 1.8E+00 | | ND | 0.00061 | 0.12 | 0.089 | No, < res RBC |
| Aluminum | mg/kg | 7.8E+03 | n | 59800 | 7380 | 73800 | 60400 | Yes, > adj. res RBC |
| Anthracene | mg/kg | 2.3E+03 | n | ND | ND | 0.2 | 1.4 | No, < res RBC |
| Antimony | mg/kg | 3.1E+00 | n | 11.1 | 9 | 120 | 19.9 | Yes, > res RBC |
| Aroclor-1016 | mg/kg | 5.5E+00 | | ND | ND | 0.5 | 0.046 | No, < res RBC |
| Aroclor-1221 | mg/kg | 3.2E-01 | | ND | ND | ND | 0.094 | No, < res RBC |
| Aroclor-1232 | mg/kg | 3.2E-01 | | ND | ND | ND | 0.046 | No, < res RBC |
| Aroclor-1242 | mg/kg | 3.2E-01 | | ND | ND | ND | 0.046 | No, < res RBC |
| Aroclor-1248 | mg/kg | 3.2E-01 | | ND | ND | ND | 0.046 | No, < res RBC |
| Aroclor-1254 | mg/kg | 3.2E-01 | | ND | ND | 0.26 | 0.046 | No, < res RBC |
| Aroclor-1260 | mg/kg | 3.2E-01 | | ND | ND | 0.13 | 3.5 | No, low frequency of detection |
| Arsenic | mg/kg | 4.3E-01 | | 34.6 | 9.2 | 226 | 624 | Yes, > res RBC |
| Barium | mg/kg | 5.5E+02 | n | 80.5 | 759 | 361 | 377 | Yes, > adj. res RBC |
| Benzo(a)anthracene | mg/kg | 8.7E-01 | | ND | ND | 2.7 | 5.5 | Yes, > res RBC |
| Benzo(a)pyrene | mg/kg | 8.7E-02 | | ND | ND | 3.2 | 5.4 | Yes, > res RBC |
| Benzo(b)fluoranthene | mg/kg | 8.7E-01 | | ND | ND | 7.9 | 7.5 | Yes, > res RBC |
| Benzo(g,h,i)perylene ³ | mg/kg | 2.3E+02 | n | ND | ND | 0.93 | 4.1 | No, < res RBC |
| Benzo(k)fluoranthene | mg/kg | 8.7E+00 | | ND | ND | 8.3 | 2.3 | No, < res RBC |
| Beryllium | mg/kg | 1.6E+01 | n | ND | 0.46 | 2 | 0.9 | No, < res RBC |
| beta-BHC | mg/kg | 3.5E-01 | | ND | ND | 0.00078 | 0.0057 | No, < res RBC |
| bis(2-Ethylhexyl)phthalate | mg/kg | 4.6E+01 | | ND | 0.16 | 6.9 | 89 | No, low frequency of detection; common laboratory contaminant |
| Butylbenzylphthalate | mg/kg | 1.6E+03 | n | ND | ND | 2.8 | 0.72 | No, < res RBC |
| Cadmium | mg/kg | 7.8E+00 | n | 2.5 | 1.9 | 24.8 | 447 | Yes, > res RBC |
| Calcium | mg/kg | NA | | 256000 | 339000 | 255000 | 95900 | No, low inherent toxicity |
| Carbazole | mg/kg | 3.2E+01 | | ND | ND | ND | 0.74 | No, < res RBC |
| Chlorobenzene | mg/kg | 1.6E+02 | n | ND | ND | ND | 0.015 | No, < res RBC |
| Chromium ⁴ | mg/kg | 2.3E+01 | n | 2540 | 20.8 | 1130 | 141 | Yes, > res RBC |
| Chrysene | mg/kg | 8.7E+01 | | ND | ND | 3 | 5.4 | No, < res RBC |
| Cobalt | mg/kg | 1.6E+02 | n | 5.9 | 2.9 | 117 | 96 | No, < res RBC |
| Copper | mg/kg | 3.1E+02 | n | 85.2 | 71.2 | 592 | 43300 | Yes, > res RBC |
| Cyanide | mg/kg | 1.6E+02 | n | 0.58 | 273 | 24.9 | 1 | Yes, > res RBC |
| Cyanide, Reactive | mg/kg | 1.6E+02 | n | 0.36 | ND | ND | ND | No, < res RBC |
| Cyanide, Total | mg/kg | 1.6E+02 | n | 0.71 | ND | ND | ND | No, < res RBC |
| delta-BHC | mg/kg | 3.5E-01 | | 0.00056 | 0.035 | 0.019 | 0.0054 | No, < res RBC |
| Dibenz(a,h)anthracene | mg/kg | 8.7E-02 | | ND | ND | ND | 2 | Yes, > res RBC |
| Dibenzofuran | mg/kg | 1.6E+01 | n | ND | ND | 0.41 | 0.51 | No, < res RBC |
| Dieldrin | mg/kg | 4.0E-02 | | ND | 0.00099 | 0.0077 | 0.068 | No, ubiquitous and not process-related |
| Diethylphthalate | mg/kg | 6.3E+03 | n | ND | ND | 0.051 | 0.022 | No, < res RBC |
| Di-n-Butylphthalate | mg/kg | 7.8E+02 | n | ND | ND | 1.2 | 2 | No, < res RBC |
| Di-n-octylphthalate | mg/kg | 1.6E+02 | n | ND | ND | 1.5 | 18 | No, < res RBC |
| Endosulfan sulfate | mg/kg | 4.7E+01 | n | ND | ND | ND | 0.0079 | No, < res RBC |
| Endosulfan I | mg/kg | 4.7E+01 | n | 0.00053 | 0.00049 | 0.0077 | 0.04 | No, < res RBC |
| Endosulfan II | mg/kg | 4.7E+01 | n | ND | 0.0019 | 0.014 | 0.0089 | No, < res RBC |
| Endosulfan sulfate | mg/kg | 4.7E+01 | n | ND | ND | 0.0035 | 0.0046 | No, < res RBC |

TABLE 3.4.3-1

PRELIMINARY HUMAN HEALTH RISK SCREENING OF SURFACE SOILS BY INVESTIGATIVE BLOCK

| Analyte | Units | USEPA Region III Residential RBC | | IB-1 (Residue Disposal Area) | IB-2 (Gypsum Area) | IB-3a (Revel Area) | IB-3b (Brick Works) | COI for Human Health - Rationale |
|---------------------------|-------|----------------------------------|---|------------------------------|--------------------|--------------------|---------------------|--|
| Endrin | mg/kg | 2.3E+00 | n | ND | 0.00051 | 0.0083 | 0.033 | No, < res RBC |
| Endrin aldehyde | mg/kg | 2.3E+00 | n | ND | ND | 0.0084 | 0.011 | No, < res RBC |
| Endrin Ketone | mg/kg | 2.3E+00 | n | ND | ND | 0.016 | 0.019 | No, < res RBC |
| Ethylbenzene | mg/kg | 7.8E+02 | n | ND | ND | ND | 0.015 | No, < res RBC |
| Fluoranthene | mg/kg | 3.1E+02 | n | ND | ND | 4.2 | 8.2 | No, < res RBC |
| Fluorene | mg/kg | 3.1E+02 | n | ND | ND | ND | 0.51 | No, < res RBC |
| gamma-BHC (Lindane) | mg/kg | 4.9E-01 | n | ND | ND | 0.0046 | 0.003 | No, < res RBC |
| Gamma-Chlordane | mg/kg | 1.8E+00 | n | ND | 0.00046 | 0.025 | 0.03 | No, < res RBC |
| Heptachlor | mg/kg | 1.4E-01 | n | ND | 0.00005 | 0.0021 | 0.0026 | No, < res RBC |
| Heptachlor epoxide | mg/kg | 7.0E-02 | n | 0.00075 | 0.00054 | 0.016 | 0.0028 | No, < res RBC |
| Indeno(1,2,3-cd)pyrene | mg/kg | 8.7E-01 | n | ND | ND | 1.3 | 4.5 | Yes, > res RBC |
| Iron | mg/kg | 2.3E+03 | n | 305000 | 7530 | 115000 | 49300 | No, low inherent toxicity |
| Lead | mg/kg | 4.0E+02 | n | 291 | 1470 | 38200 | 5500 | Yes, > res RBC |
| Magnesium | mg/kg | NA | n | 1730 | 1610 | 25100 | 11600 | No, < res RBC |
| Manganese | mg/kg | 1.6E+02 | n | 183 | 139 | 1010 | 1260 | Yes, > adj. res RBC |
| Mercury | mg/kg | 2.3E+00 | n | 1.1 | 0.09 | 4.3 | 0.8 | Yes, > adj. res RBC |
| Methoxychlor | mg/kg | 3.9E+01 | n | 0.021 | 0.013 | 0.067 | 0.09 | No, < res RBC |
| Methylene Chloride | mg/kg | 8.5E+01 | n | 0.022 | 0.017 | 0.1 | 0.054 | No, < res RBC |
| Naphthalene | mg/kg | 1.6E+02 | n | ND | ND | 0.38 | 0.44 | No, < res RBC |
| Nickel | mg/kg | 1.6E+02 | n | 7.3 | 8.7 | 212 | 321 | Yes, > adj. res RBC |
| Nitrobenzene | mg/kg | 3.9E+00 | n | ND | ND | 0.061 | ND | No, < res RBC |
| Pentachlorophenol | mg/kg | 5.3E+00 | n | ND | ND | ND | 1.1 | No, < res RBC |
| Phenanthrene ³ | mg/kg | 2.3E+02 | n | ND | ND | 0.89 | 5.1 | No, < res RBC |
| Phenol | mg/kg | 2.3E+03 | n | ND | ND | 0.092 | ND | No, < res RBC |
| Potassium | mg/kg | NA | n | 226 | 808 | 3060 | 3830 | No, low inherent toxicity |
| Pyrene | mg/kg | 2.3E+02 | n | ND | ND | 3.3 | 8.2 | No, < res RBC |
| Selenium | mg/kg | 3.9E+01 | n | 3.6 | 2 | 3.2 | 14 | No, < res RBC |
| Silver | mg/kg | 3.9E+01 | n | 11.2 | 25.6 | 28.2 | 108 | Yes, > adj. res RBC |
| Sodium | mg/kg | NA | n | 29900 | 3080 | 23500 | 3470 | No, low inherent toxicity |
| Styrene | mg/kg | 1.6E+03 | n | ND | ND | ND | 0.015 | No, < res RBC |
| Tetrachloroethene | mg/kg | 1.2E+01 | n | ND | ND | ND | 0.015 | No, < res RBC |
| Thallium | mg/kg | 5.5E-01 | n | ND | ND | 1.9 | 3.4 | Yes, > adj. res RBC |
| Toluene | mg/kg | 1.6E+03 | n | ND | ND | ND | 0.013 | No, < res RBC |
| Toxaphene | mg/kg | 5.8E-01 | n | ND | ND | 0.9 | 0.15 | No, ubiquitous and not process-related |
| Vanadium | mg/kg | 5.5E+01 | n | 1820 | 25.8 | 682 | 73 | Yes, > res RBC |
| Xylenes (total) | mg/kg | 1.6E+03 | n | ND | ND | ND | 0.014 | No, < res RBC |
| Zinc | mg/kg | 2.3E+03 | n | 283 | 272 | 1430 | 51800 | Yes, > res RBC |

¹ USEPA Region III, Risk-Based Concentration (RBC) Table, April 25, 2003. RBCs followed by "n" are for noncarcinogenic effects and have been adjusted by 0.1 to correspond with a Hazard Quotient of 0.1, per Region III guidance (2002)

² RBC for acenaphthene used as surrogate

³ RBC for pyrene is surrogate for this noncarcinogenic PAH.

⁴ Results are for total chromium, which is expected to be predominantly Cr III given the likely reducing environmental conditions. RBC for Cr VI is conservatively used in this preliminary risk screening of soils

Highlight

BOLD = COI

TABLE 3.7.1-1

PHASE I HUMAN HEALTH DQOs FOR RESIDUE DISPOSAL AREAS (IB-1)

| Potential Exposure Scenario | Current/Future Off-Site Resident | Future On-Site Construction Worker (Possible Landfill Redevelopment – i.e., little intrusive activity) | |
|------------------------------------|--|---|--|
| Potential Exposure Pathway | Inhalation of Site-associated, wind-generated particulates; ingestion/dermal contact with Site-associated particulates deposited to off-site surface soil. | Ingestion/dermal contact with surface soil. | Inhalation of particulate dust mobilized from surface soil during proposed landfill development |
| 1. State the problem | Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks. | | |
| 2. Identify the decision | Do COIs in surface soil pose potential risk to off-site residents through particulate emissions and air-borne transport to off-site areas? | Do COIs in surface soil pose potential risk to future construction worker ingesting or in dermal contact with the surface soil? | Do COIs in surface soil pose potential risk to future construction worker from inhalation of particulate from surface soil? |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> • Concentrations of COIs in surface soils (depth 0-2 ft) from samples collected from 10 locations within areas of dispersible material (i.e., not continuously wet areas) of each of the three RDAs: 1a, 1b, and 1c. The areas of dispersible material are generally the concentric rings of dry, red materials in subareas 1b and 1c, and the red/white materials in the center of subarea 1a. • For Site-specific emissions modeling, percent silt and moisture content should be collected from a subset of samples of dispersible materials. • Preliminary risk screening identifies the following COIs: As, Cr, V*. Therefore, analyses required for these analytes as well as lead (per USEPA). • Measure TCL analytes in a smaller subset of surface soil samples collected within each of the three | <ul style="list-style-type: none"> • Concentrations of COIs in surface soil samples (depth 0-2 ft) and subsurface (depth 2-10 ft) soil samples collected from all subareas, dry and saturated media, of the IB-1 area. • Preliminary risk screening identifies the following COIs: As, Cr, V. Therefore, analyses required for these analytes as well as lead (per USEPA). • Measure TCL analytes in 10% of surface soil samples collected within each of the three RDAs. • QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses (per sample QAPP). • Analytical method detection limit targets are USEPA Region III RBCs. (Presented in Table 3-1 for COIs and TCL analytes.) | <ul style="list-style-type: none"> • Concentrations of COIs in surface soils (depth 0-2 ft) and subsurface (depth 2-10 ft) soil samples from samples collected from 10 locations within each area of dispersible material of the IB-1 area. • For Site-specific emissions modeling, use percent silt and moisture content collected from a subset of samples of dispersible materials (column 1). • Preliminary risk screening identifies the following COIs: As, Cr, V. Therefore, analyses required for these analytes as well as lead (per USEPA). • Measure TCL analytes in 10% of surface soil samples collected within each of the three RDAs. |

TABLE 3.7.1-1

PHASE I HUMAN HEALTH DQOs FOR RESIDUE DISPOSAL AREAS (IB-1)

| Potential Exposure Scenario | Current/Future Off-Site Resident | Future On-Site Construction Worker (Possible Landfill Redevelopment – i.e., little intrusive activity) | |
|---------------------------------------|--|---|--|
| Potential Exposure Pathway | Inhalation of Site-associated, wind-generated particulates; ingestion/dermal contact with Site-associated particulates deposited to off-site surface soil. | Ingestion/dermal contact with surface soil | Inhalation of particulate dust mobilized from surface soil during proposed landfill development |
| | <p>RDAs.</p> <ul style="list-style-type: none"> • QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. • Analytical method detection limit targets are USEPA Region III RBCs. (Presented in Table 3-1 for COIs and TCL analytes.) | | |
| 4. Define boundaries of the study | The horizontal boundaries are the original dikes of the impoundment areas. The vertical boundaries for Site-specific risk assessment are the 0 to 2 foot depth interval. The temporal boundary is sampling to occur in 2003 and 2004. | The horizontal boundaries are the original dikes of the impoundment areas. The vertical boundaries for Site-specific risk assessment are the 0 to 10 foot depth interval. The temporal boundary is sampling to occur in 2003 and 2004. | The horizontal boundaries are the original dikes of the impoundment areas. The vertical boundaries for Site-specific risk assessment are the 0 to 10 foot depth interval. The temporal boundary is sampling to occur in 2003 and 2004. |
| 5. Develop a decision rule | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be carried forward into the initial BLHHRA. | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be carried forward into the initial BLHHRA. | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be carried forward into the initial BLHHRA. |
| 6. Specify limits on decision errors | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). |
| 7. Optimize design for obtaining data | The number of samples for the Phase I investigation has been selected to provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). The stratified nature of the | The number of samples for the Phase I investigation has been selected to provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). The stratified nature of the design is expected to provide adequate | The number of samples for the Phase I investigation has been selected to provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). The stratified nature of the |

TABLE 3.7.1-1

PHASE I HUMAN HEALTH DQOs FOR RESIDUE DISPOSAL AREAS (IB-1)

| Potential Exposure Scenario | Current/Future Off-Site Resident | Future On-Site Construction Worker (Possible Landfill Redevelopment – i.e., little intrusive activity) | |
|------------------------------------|---|--|---|
| Potential Exposure Pathway | Inhalation of Site-associated, wind-generated particulates; ingestion/dermal contact with Site-associated particulates deposited to off-site surface soil. | Ingestion/dermal contact with surface soil | Inhalation of particulate dust mobilized from surface soil during proposed landfill development |
| | design is expected to provide adequate characterization of the relatively homogeneous RDA materials for inclusion in the BLHHRA. However, additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I data evaluation and the initial BLHHRA. | characterization of the relatively homogeneous RDA materials for inclusion in the BLHHRA. However, additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I data evaluation and the initial BLHHRA. | design is expected to provide adequate characterization of the relatively homogeneous RDA materials for inclusion in the BLHHRA. However, additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I data evaluation and the initial BLHHRA. |

*These analytes will be captured on a modified TAL list.

TABLE 3.7.1-2

PHASE I RISK-BASED DQOs FOR GYPSUM DIKE AREAS (INVESTIGATIVE BLOCK 2)
FUTURE OFF-SITE RESIDENT (PER HH CSM)

| Potential Exposure Scenario | Off-Site Residential Scenario | Off-Site Residential Scenario |
|--------------------------------------|--|---|
| Potential Exposure Pathways | Inhalation of Site-associated, wind-generated particulates; ingestion/dermal contact with Site-associated particulates deposited to off-site surface soil. | Inhalation of gypsum particulates generated through mining activities of surface/subsurface gypsum materials; ingestion/dermal contact with gypsum mining-particulates deposited to off-site surface soil. |
| 1. State the problem | Conduct a site investigation to assess the potential risks posed by particulate emissions from proposed gypsum mining operations; develop remedial alternatives to address the identified risks | |
| 2. Identify the decision | Do COIs in gypsum materials pose potential risk to off-site residents through wind-generated particulate emissions and air-borne transport to off-site areas? | Do COIs in gypsum materials pose potential risk to off-site residents through particulate emissions and air-borne transport to off-site areas if gypsum mining were to commence. |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> Concentrations of COIs in surface gypsum materials (0-2 ft) at 10 locations. Data needs for Site-specific emissions modeling: Measure <200-mesh fraction of <i>in situ</i> material (i.e., % silt); expected to be small proportion. Preliminary risk screening identifies Pb as a COI. Measure TCL analytes in 2 of surface gypsum samples collected within IB-2. QA/QC samples: Collect minimum of 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. Analytical method detection limit targets are USEPA Region III RBCs. (Presented in Table 3-1 for COIs and TCL analytes.) | <ul style="list-style-type: none"> Concentrations of COIs in surface and subsurface gypsum materials at 10 surface and 20 subsurface locations/depths. Data needs for Site-specific emissions modeling (in situ condition of gypsum not representative of mining activity. Instruct laboratory to pulverize, and measure silt % as an approximation of mined materials?) Preliminary risk screening identifies Pb as a COI. Measure TCL analytes in 10% of gypsum samples collected within IB-2. QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. Analytical method detection limit targets are USEPA Region III RBCs. (Presented in Table 3-1 for COIs and TCL analytes.) |
| 4. Define boundaries of the study | Figure X shows the aerial boundaries of the IB-2 area. The vertical boundaries are from 0-2 ft bgs. The temporal boundary is sampling to occur in 2003 and 2004. | Figure X shows the areal boundaries of the IB-2 area. The vertical boundaries are from the surface in these areas to the vertical extent (which is not fully defined currently). The temporal boundary is sampling to occur in 2003 and 2004. |
| 5. Develop a decision rule | If COIs or a TCL analyte from Phase I data exceeds the risk-based screening value, then that COI will be carried forward into the initial BLHHRA (incorporating site-specific <200-mesh proportion into emissions equation). | If COIs or a TCL analyte from Phase I data exceeds the risk-based screening value, then that COI will be carried forward into the initial BLHHRA. |
| 6. Specify limits on decision errors | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). |

TABLE 3.7.1-2

PHASE I RISK-BASED DQOs FOR GYPSUM DIKE AREAS (INVESTIGATIVE BLOCK 2)
 FUTURE OFF-SITE RESIDENT (PER HH CSM)

| Potential Exposure Scenario | Off-Site Residential Scenario | Off-Site Residential Scenario |
|---------------------------------------|--|--|
| Potential Exposure Pathways | Inhalation of Site-associated, wind-generated particulates; ingestion/dermal contact with Site-associated particulates deposited to off-site surface soil. | Inhalation of gypsum particulates generated through mining activities of surface/subsurface gypsum materials; ingestion/dermal contact with gypsum mining-particulates deposited to off-site surface soil. |
| 7. Optimize design for obtaining data | The number of samples for the Phase I investigation has been selected to provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). The stratified nature of the design is expected to provide adequate characterization of the relatively homogeneous RDA materials for inclusion in the initial BLHHRA. However, additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I data evaluation and the initial BLHHRA. | The number of samples for the Phase I investigation has been selected to provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). The stratified nature of the design is expected to provide adequate characterization of the relatively homogeneous RDA materials for inclusion in the initial BLHHRA. However, additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I data evaluation and the initial BLHHRA. |

TABLE 3.7.1-3

PHASE I RISK-BASED HUMAN HEALTH DQOs FOR OTHER AREAS OF ALCOA ACTIVITY (IB-3)

| Potential Exposure Scenarios | Current/Future Industrial Worker | | Future Construction Worker | |
|------------------------------------|---|---|---|----------------------------|
| Potential Exposure Pathways | Ingestion/Dermal Contact | | Ingestion/Dermal Contact | Inhalation of Particulates |
| 1. State the problem | Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks. | | | |
| 2. Identify the decision | Do COIs in surface soil pose potential risk to future industrial worker ingesting or in dermal contact with the surface soil? | Do COIs in surface/subsurface soil pose potential risk to future construction worker ingesting or in dermal contact with the surface soil? | Do COIs in surface/subsurface soil pose potential risk to future construction worker through inhalation of particulates generated from this medium during construction? | |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> Concentrations of COIs in surface soil samples (depth 0-2 ft) from previous investigation for 3a and 3b areas. (Possibly just used qualitatively because of data quality uncertainty.) Concentrations of COIs in surface soils (depth 0-2 ft) at 10 locations in area IB-3a. Concentrations of COIs in surface soils (depth 0-2 ft) at 30 locations within IB-3b. Confirmatory sampling for lead in vicinity of sample ESL-0049 (38,000 mg/kg purported result). Replace sample ESL-0049 lead result with confirmatory data, if appropriate. Preliminary risk screening identifies the following COIs in areas 3a and 3b: Sb, As, Cd, Cr, Cu, Pb, V, Zn*, PAHs. QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. (per example QAPP) Analytical method detection limit targets are USEPA Region III RBCs. (Presented in Table 3-1 for COIs and TCL analytes.) | <ul style="list-style-type: none"> Concentrations of COIs in surface (0-2 ft)/ subsurface (2-10 ft) soil samples (2-10 ft) from previous investigation for 3a and 3b areas. (Possibly just used qualitatively because of data quality uncertainty.) Concentrations of COIs in subsurface soils (discrete interval samples between depths 2-10 ft bgs) at 10 locations in area IB-3a. (HH samples only.) Concentrations of COIs in subsurface soils (discrete interval samples between depths 2-10 ft bgs) at 30 locations in area IB-3b. (HH samples only.) Include confirmatory lead sampling/analysis referenced in column 1. Preliminary risk screening identifies the following COIs in areas 3a and 3b: Sb, As, Cd, Cr, Cu, Pb, V, Zn*, PAHs. QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. (per example QAPP) Analytical method detection limit targets are USEPA Region III RBCs. (Presented in Table 3-1 for COIs and TCL analytes.) | <ul style="list-style-type: none"> Concentrations of COIs in surface/ subsurface soil samples (depth 0-2 ft) from previous investigation for 3a and 3b areas. (Possibly just used qualitatively because of data quality uncertainty.) Same samples referenced in column 2, along with strategy, and analytical targets. | |

TABLE 3.7.1-3

PHASE I RISK-BASED HUMAN HEALTH DQOs FOR OTHER AREAS OF ALCOA ACTIVITY (IB-3)

| Potential Exposure Scenarios | Current/Future Industrial Worker | Future Construction Worker | |
|---------------------------------------|---|--|--|
| Potential Exposure Pathways | Ingestion/Dermal Contact | Ingestion/Dermal Contact | Inhalation of Particulates |
| 4. Define boundaries of the study | Figure X shows the horizontal boundaries of the IB-3 areas. The vertical boundary for Site-specific risk evaluation of on-Site industrial workers is surface soil (0-2 ft area 3a; 0-2 ft area 3b). The temporal boundary is sampling to occur in 2003 and 2004. | Figure X shows the horizontal boundaries of the IB-3 areas. The vertical boundary for Site-specific risk evaluation of on-Site construction workers is surface/subsurface soil (0-10 ft). The temporal boundary is sampling to occur in 2003 and 2004. | Figure X shows the horizontal boundaries of the IB-3 areas. The vertical boundary for Site-specific risk evaluation of on-Site construction workers is surface/subsurface soil (0-10 ft). The temporal boundary is sampling to occur in 2003 and 2004. |
| 5. Develop a decision rule | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be carried forward into the initial BLHHRA. | If COIs or a TCL analyte exceeds the RBC for industrial soil screening value, then that COI will be carried forward into the initial BLHHRA. | If COIs or a TCL analyte exceeds the RBC for industrial soil screening value, then that COI will be carried forward into the initial BLHHRA. |
| 6. Specify limits on decision errors | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). |
| 7. Optimize design for obtaining data | The number of surface soil samples selected for the Phase I investigation will provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I data evaluation and the initial BLHHRA results. | The number of surface and subsurface soil samples selected for the Phase I investigation will provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I data evaluation and the initial BLHHRA results. | The number of surface and subsurface soil samples selected for the Phase I investigation will provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I data evaluation and the initial BLHHRA results. |

*These analytes will be captured on a modified TAL list.

TABLE 3.7.1-4

PHASE I HUMAN HEALTH DQOs FOR BALL FIELD AREA (IB-4c)

| Potential Exposure Scenarios | Current/Future Maintenance Worker | Current/Future Local Recreation Receptor |
|---------------------------------------|--|--|
| Potential Exposure Pathways | Incidental Ingestion/Dermal Contact | Incidental Ingestion/Dermal Contact |
| 1. State the problem | Conduct a site investigation to assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks. | |
| 2. Identify the decision | Do COIs in surface soil pose potential risk to current/future maintenance worker ingesting or in dermal contact with the surface soil? | Do COIs in surface soil pose potential risk to current/future recreational receptor ingesting or in dermal contact with the surface soil? |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> • Concentrations of COIs in 10 surface soil samples to be collected in ball field area (depth 0-2 ft) • QA/QC samples: Collect minimum of 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. (per example QAPP) • Collect 5 samples for % silt and % moisture. • No previously collected data from this area; therefore, no COIs identified from preliminary screening. Therefore, analyze all samples for TCL. • Analytical method detection limit targets are USEPA Region III RBCs. (Presented in Table 3-1 for COIs and TCL analytes.) | <ul style="list-style-type: none"> • Same data and QA/QC samples required in column 1. • Analytical method detection limit targets are USEPA Region III RBCs. (Presented in Table 3-1 for COIs and TCL analytes.) |
| 4. Define boundaries of the study | Figure X shows the horizontal boundaries of the Ball Field area, identified as IB-4c. The vertical boundary for Site-specific risk evaluation of on-site maintenance workers is surface soil (0-2 ft). The temporal boundary is sampling to occur in 2003 and 2004. | Figure X shows the horizontal boundaries of the IB-4c area. The vertical boundary for Site-specific risk evaluation of on-Site local recreational receptor is surface soil (0-2 ft). The temporal boundary is sampling to occur in 2003 and 2004. |
| 5. Develop a decision rule | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be carried forward into the initial BLHHRA. | If COIs or a TCL analyte exceeds the RBC for industrial soil screening value, then that COI will be carried forward into the initial BLHHRA. |
| 6. Specify limits on decision errors | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). |
| 7. Optimize design for obtaining data | The Phase I data will provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I data evaluation and the initial | The Phase I data will provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I data evaluation and the initial BLHHRA results. |

TABLE 3.7.1-4

PHASE I HUMAN HEALTH DQOs FOR BALL FIELD AREA (IB-4c)

| | | |
|-------------------------------------|--|---|
| Potential Exposure Scenarios | Current/Future Maintenance Worker | Current/Future Local Recreation Receptor |
| Potential Exposure Pathways | Incidental Ingestion/Dermal Contact | Incidental Ingestion/Dermal Contact |
| | BLHHRA results. | |

¹ CSM does not identify human receptors or exposure pathways for areas 4a and 4b. However, if possible remedy in area 4a includes grading surface materials in upland areas, the surface soil data collected for ecological risk assessment in this area can be used for human health risk assessment, as well.

TABLE 3.7.1-5

PHASE I HUMAN HEALTH DQOs FOR ACTIVE COMMERCIAL AREAS (IB-4e)

| Potential Exposure Scenarios | Current/Future Construction Worker |
|---------------------------------------|--|
| Potential Exposure Pathways | Incidental Ingestion/Dermal Contact |
| 1. State the problem | Conduct a site investigation to assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks. |
| 2. Identify the decision | Do COIs in surface soil pose potential risk to current/future maintenance worker ingesting or in dermal contact with the surface soil? |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> • Concentrations of COIs in 10 surface (0-2 ft) and 10 subsurface (2-10 ft) soil samples to be collected. • QA/QC samples: Collect minimum of 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. (per example QAPP). • Collect 5 samples for % silt and % moisture. • Analyze 10% of total samples for TCL. • Analytical method detection limit targets are USEPA Region III RBCs. (Presented in Table 3-1 for COIs and TCL analytes.) |
| 4. Define boundaries of the study | Figure 2.2-1 shows the horizontal boundaries of IB-4e area. The vertical boundary for Site-specific risk evaluation of on-site construction workers is subsurface soil (0-10 ft). The temporal boundary is sampling to occur in 2003 and 2004. |
| 5. Develop a decision rule | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be carried forward into the initial BLHHRA. |
| 6. Specify limits on decision errors | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). |
| 7. Optimize design for obtaining data | The Phase I data will provide a dataset size that is adequate for meaningful statistical analysis (i.e., calculating 95% UCL of mean concentrations, if necessary for BLHHRA). Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I data evaluation and the initial BLHHRA results. |

TABLE 3.7.1-6

PHASE I HUMAN HEALTH DQOs FOR GROUNDWATER PATHWAYS (ALL IBs)

| Potential Exposure Scenario | Off-Site Ingestion of Groundwater | Off-Site Exposure to Surface Water and/or Sediment Contacted by Groundwater |
|------------------------------------|---|--|
| Potential Exposure Pathways | Ingestion of potable water from wells downgradient of the Site. | Contact or ingestion by human or aquatic receptors of surface water/and or sediment contacted by groundwater from the Site. |
| 1. State the problem | Conduct a site investigation to assess the potential risks posed ingestion of groundwater downgradient of the site; develop remedial alternatives to address the identified risks | |
| 2. Identify the decision | Do COIs in groundwater downgradient of the site, originating from former Alcoa operations, pose potential risk to off-site residents or workers through ingestion of groundwater (potential risk requires both a physically complete pathway, i.e., people ingest groundwater, and the presence of COIs in groundwater at concentrations that pose potential risk). | If COIs are present in groundwater and migrate to surface water and/or sediment within the Mississippi River, or water bodies between the river and the Site, do these Site-related COIs pose potential risk to aquatic or human receptors via contact or ingestion of surface water and/or sediment? |
| 3. Identify inputs to the decision | <p><u>Physical completeness of exposure pathway</u></p> <ul style="list-style-type: none"> Assessment of the effectiveness of the institutional control within downgradient areas that prohibits the installation of potable water wells; results of community outreach to educate residents about the City-wide groundwater ordinance and to obtain information on actual use of groundwater. Documentation of the status of wells entered into governmental water well databases <p><u>Presence of COIs in groundwater at concentrations that pose potential risk</u></p> <ul style="list-style-type: none"> Comparison of COI and TCL results of Phase I surficial soil sampling to the EPA Region III soil-to-groundwater SSLs; COIs that do not pass the SSLs become Phase I Groundwater Ingestion COIs. Classification of groundwater beneath and downgradient of the Site Dissolved concentrations of groundwater COIs in groundwater at 3 downgradient and 1 upgradient locations on site, Comparison of upgradient and downgradient concentrations to identify the COIs contributed by former Alcoa operations. Estimates of hydraulic conductivity and saturated thickness measurements at each well location Water level data from the 4 monitoring well locations to prepare a potentiometric map (groundwater flow direction and hydraulic | <ul style="list-style-type: none"> SSLs for soil-to-groundwater-to-surface water pathway. Comparison of COI and TCL results of Phase I surficial soil investigations to the Site-specific SSLs for soil-to-groundwater-to-surface water pathway. COIs that do not pass the SSLs become Phase I Groundwater-to-surface water COIs. Dissolved concentrations of groundwater-to-surface water COIs in groundwater at 3 on-site downgradient and 1 on-site upgradient locations. Comparison of upgradient and downgradient concentrations to identify the COIs contributed by former Alcoa operations. Obtain data to support natural attenuation modeling (same data as groundwater ingestion pathway). Fate and transport modeling to estimate resulting concentrations of COIs in surface water and/or sediment contacted by groundwater from the Site, if necessary. QA/QC samples: Collect minimum of 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. Analytical method detection limit targets for groundwater are the lower of IL groundwater standards, OR Federal MCLs. |

TABLE 3.7.1-6

PHASE I HUMAN HEALTH DQOs FOR GROUNDWATER PATHWAYS (ALL IBs)

| Potential Exposure Scenario | Off-Site Ingestion of Groundwater | Off-Site Exposure to Surface Water and/or Sediment Contacted by Groundwater |
|---------------------------------------|---|--|
| Potential Exposure Pathways | Ingestion of potable water from wells downgradient of the Site. | Contact or ingestion by human or aquatic receptors of surface water/and or sediment contacted by groundwater from the Site. |
| | gradient) • QA/QC samples: Collect minimum of 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. • Analytical method detection limit targets are the lower of Illinois Groundwater Standards, OR Federal EPA National Recommended Water Quality Criteria: 2002. | |
| 4. Define boundaries of the study | The aerial boundaries of the Site defined in the AOC/SOW are: 1) the property north of Missouri Avenue, which is approximately bounded by 29 th St. to the west, Alton Southern Railroad to the east and Lake Drive to the north; and 2) areas located north of Missouri Ave. where hazardous substances have or may have come to be located from former Alcoa operations. The boundaries of the groundwater pathway extend downgradient from property identified in 1) above, to those areas where COIs from former Alcoa operations do not pose risk to human health or the environment. The vertical boundaries are from 0 ft bgs to the bottom of the American Bottoms Aquifer. The temporal boundary is sampling to occur in 2003 and 2004. | The aerial boundaries of the Site defined in the AOC/SOW are: 1) the property north of Missouri Avenue, which is approximately bounded by 29 th St. to the west, Alton Southern Railroad to the east and Lake Drive to the north; and 2) areas located north of Missouri Avenue where hazardous substances have or may have come to be located from former Alcoa operations. The boundaries of the groundwater pathway extend downgradient from property identified in 1) above, to those areas where COIs from former Alcoa operations do not pose risk to human health or the environment. The vertical boundaries are from 0 ft bgs to the bottom of the American Bottoms Aquifer and/or the bottom of the Mississippi River. The temporal boundary is sampling to occur in 2003 and 2004. |
| 5. Develop a decision rule | If groundwater COIs measured in Phase I exceeds the risk-based screening value (the lower of Illinois or Federal groundwater standards), then that COI will be carried forward into the Phase 1 Risk Characterization. | If the evaluation of groundwater COIs measured in Phase 1 indicates that the groundwater to surface water/sediment pathway may be complete and significant, then a Phase 2 Plan will be developed to support the risk assessment for this pathway. |
| 6. Specify limits on decision errors | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). |
| 7. Optimize design for obtaining data | The selection of 3 downgradient and 1 upgradient monitoring wells is based on discussions between Alcoa, the City and EPA, and represents a sampling design for an initial characterization consistent with EPA waste management guidance. | (same as GW ingestion criteria). In addition, modeling will be performed to estimate the concentrations that may be present in the Mississippi River due to any on site groundwater contamination. |

TABLE 3.7.2-1

PHASE I ECOLOGICAL DQOs FOR RESIDUE DISPOSAL AREAS (IB-1)

| Potential Exposure Pathway | Ingestion of surface soil and prey that may have accumulated COIs from surface soil. | Ingestion of surface water and prey that may have accumulated COIs from surface water. | Ingestion of sediment and prey that may have accumulated COIs from sediment |
|------------------------------------|---|--|---|
| 1. State the problem | Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks | Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks | Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks |
| 2. Identify the decision | <ol style="list-style-type: none"> 1) Do COIs in surface soil pose potential risk to terrestrial ecological receptors ingesting the surface soil? 2) Does potential uptake of COIs from the surface soil into prey items pose a potential ecological risk to the terrestrial receptors? | <ol style="list-style-type: none"> 1) Do COIs in surface water pose potential risk to semi-aquatic and/or terrestrial ecological receptors ingesting the surface water? 2) Does potential uptake of COIs from the surface water into prey items pose a potential ecological risk to the semi-aquatic receptors? | <ol style="list-style-type: none"> 1) Do COIs in sediment pose potential risk to semi-aquatic ecological receptors ingesting the sediment? 2) Does potential uptake of COIs from the sediment into prey items pose a potential ecological risk to the semi-aquatic receptors? |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> • Concentrations of COIs in surface soils (depth 0-2 ft) at ten locations within each of the open areas in each of the three RDAs. • Concentrations of COIs in surface soils (depth 0-2 ft) at ten locations within each of the vegetated non-wet area in each of the three RDAs. • Preliminary risk screening identifies the following COIs: Al, Sb, As, Ba, Cd, Cr, Co, Cu, CN, Pb, Mn, Hg, Se, Ag, Tl, V, Zn*. • Measure TCL analytes in 10% of the surface soil samples collected within each of the three RDAs. | <ul style="list-style-type: none"> • Concentrations of COIs in surface water at three to six locations within each of the open water areas in each of the three RDAs. • Concentrations of COIs in surface water at three to six locations within each of the vegetated wet areas in each of the three RDAs. • Preliminary risk screening identifies the following COIs: Al, Sb, As, Ba, Cr, Co, CN, Pb, Mn, Se, Tl, V, Zn*. • Measure TCL analytes in 10% of the surface water samples collected within each of the three RDAs. • QA/QC samples – Standard number of QA/QC samples is acceptable. | <ul style="list-style-type: none"> • Concentrations of COIs in sediment at three to six locations within each of the open water areas in each of the three RDAs. • Concentrations of COIs in sediment at three to six locations within each of the vegetated wet areas in each of the three RDAs. • Preliminary risk screening identifies the following COIs: Al, Sb, As, Ba, Cr, Co, CN, Pb, Mn, Se, Tl, V, Zn*. • Measure TCL analytes in 10% of the sediment samples collected within each of the three RDAs. • QA/QC samples – Standard number of QA/QC samples is acceptable. • Risk-based screening values (Lowest Receptor –specific SSL (semi-aquatic |

TABLE 3.7.2-1

PHASE I ECOLOGICAL DQOs FOR RESIDUE DISPOSAL AREAS (IB-1)

| Potential Exposure Pathway | Ingestion of surface soil and prey that may have accumulated COIs from surface soil. | Ingestion of surface water and prey that may have accumulated COIs from surface water. | Ingestion of sediment and prey that may have accumulated COIs from sediment. |
|---------------------------------------|--|--|--|
| | <ul style="list-style-type: none"> QA/QC samples – Standard number of QA/QC samples is acceptable. Risk-based screening values (Lowest Receptor –specific SSL from Eco Baseline Problem Formulation Table 3-4). | <ul style="list-style-type: none"> Risk-based screening values (Lowest Receptor –specific SSL (semi-aquatic receptors) from Eco Baseline Problem Formulation Table 3-4). | receptors) from Eco Baseline Problem Formulation Table 3-4). |
| 4. Define boundaries of the study | The horizontal boundaries are the original dikes of the impoundment areas. The vertical boundaries are the 0 to 2 foot depth interval. The temporal boundary is sampling to occur in 2003 and 2004. | The horizontal boundaries are areas of standing surface water within the original dikes of the impoundment areas. The temporal boundary is sampling to occur in 2003 and 2004. | The horizontal boundaries are the wet areas within the original dikes of the impoundment areas. The vertical boundaries are the 0 to 6 inch depth interval. The temporal boundary is sampling to occur in 2003 and 2004. |
| 5. Develop a decision rule | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be evaluated in the Phase I Eco Risk Characterization. Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I Risk Characterization | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be evaluated in the Phase I Eco Risk Characterization. Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I Risk Characterization | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be evaluated in the Phase I Eco Risk Characterization. Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I Risk Characterization |
| 6. Specify limits on decision errors | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). |
| 7. Optimize design for obtaining data | The number of samples has been selected to provide a dataset that will be acceptable to support early action ecological risk-based decisions. | The number of samples has been selected to provide a dataset that will be acceptable to support early action ecological risk-based decisions. | The number of samples has been selected to provide a dataset that will be acceptable to support early action ecological risk-based decisions |

*These analytes will be captured on a modified TAL list.

TABLE 3.7.2-2

PHASE I ECOLOGICAL DQOs FOR GYPSUM DIKE AREAS (IB-2)

| Potential Exposure Pathway | Ingestion of surface soil and prey that may have accumulated COIs from surface soil. | Ingestion of surface water and prey that may have accumulated COIs from surface water. | Ingestion of sediment and prey that may have accumulated COIs from sediment |
|---------------------------------------|---|--|---|
| 1. State the problem | No ecological habitat is currently present in IB-2. The lack of ecological habitat precludes exposure of ecological receptors to gypsum materials. | No surface water is present in IB-2 | No sediments are present in IB-2 |
| 2. Identify the decision | Since no acceptable ecological habitat is present in IB-2, decisions made regarding IB-2 should be based on the results of the Human Health Risk Assessment and other facets of the RIFS. | NA | NA |
| 3. Identify inputs to the decision | NA | NA | NA |
| 4. Define boundaries of the study | The boundaries of IB-2 are the gypsum impoundments contained within the E. St. Louis Site. | NA | NA |
| 5. Develop a decision rule | NA | NA | NA |
| 6. Specify limits on decision errors | NA | NA | NA |
| 7. Optimize design for obtaining data | NA | NA | NA |

TABLE 3.7.2-3

PHASE I ECOLOGICAL DQOs FOR OTHER AREAS OF ALCOA ACTIVITY (IB-3)

| Potential Exposure Pathway | Ingestion of surface soil and prey that may have accumulated COIs from surface soil. | Ingestion of surface water and prey that may have accumulated COIs from surface water. | Ingestion of sediment and prey that may have accumulated COIs from sediment |
|------------------------------------|--|--|---|
| 1. State the problem | Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks | Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks | Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks |
| 2. Identify the decision | <ol style="list-style-type: none"> 1) Do COIs in surface soil pose potential risk to terrestrial ecological receptors ingesting the surface soil? 2) Does potential uptake or COIs from the surface soil into prey items pose a potential ecological risk to the terrestrial receptors? | <ol style="list-style-type: none"> 1) Do COIs in surface water pose potential risk to semi-aquatic and/or terrestrial ecological receptors ingesting the surface water? 2) Does potential uptake of COIs from the surface water into prey items pose a potential ecological risk to the semi-aquatic receptors? | <ol style="list-style-type: none"> 1) Do COIs in sediment pose potential risk to semi-aquatic and/or terrestrial ecological receptors ingesting the sediment? 2) Does potential uptake of COIs from the sediment into prey items pose a potential ecological risk to the semi-aquatic receptors? |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> • Concentrations of COIs in surface soils (depth 0-2 ft) at 30 locations within each of the vegetated upland areas in IB-3b. • Current light industrial practices in IB-3a preclude significant inhabitation by ecological receptors representing the stated endpoints. No samples are necessary for the ecological risk assessment in IB-3a. • Concentrations of COIs in surface soils (depth 0 – 2 ft) at a minimum of 5 locations within IB-3c after waste characterization and remediation, if needed. • Preliminary risk screening identifies the following COIs: Al, Sb, As, Ba, Cd, Cr, Co, Cu, CN, Pb, Hg, Se, Ag, TI, V, | <ul style="list-style-type: none"> • Concentrations of COIs in surface water at 8 randomly selected surface water bodies within IB-3b. One sample will be collected from each area of habitat. • Concentrations of COIs in surface water at three locations within IB-3c after waste characterization and remediation, if needed. • Preliminary risk screening identifies the following COIs: Al, Sb, As, Ba, Cr, Co, CN, Pb, Mn, Se, TI, V, Zn*. • Measure TCL analytes in 10% of the surface water samples collected within IB-3b and IB-3c. • No persistent surface water that could provide habitat for the | <ul style="list-style-type: none"> • Concentrations of COIs in sediment (0 to 0.5 ft) at 8 randomly selected surface water bodies within IB-3b (co-located with surface water samples). One sample will be collected from each area of habitat. • Concentrations of COIs in sediment (0 to 0.5 ft) at three locations within IB-3c. • Preliminary risk screening identifies the following COIs: Al, Sb, As, Ba, Cr, Co, CN, Pb, Mn, Se, TI, V, Zn*. • Measure TCL analytes in 10% of the sediment samples collected within IB-3b and IB-3c. • No persistent wet areas that could |

TABLE 3.7.2-3

PHASE I ECOLOGICAL DQOs FOR OTHER AREAS OF ALCOA ACTIVITY (IB-3)

| Potential Exposure Pathway | Ingestion of surface soil and prey that may have accumulated COIs from surface soil. | Ingestion of surface water and prey that may have accumulated COIs from surface water. | Ingestion of sediment and prey that may have accumulated COIs from sediment |
|---------------------------------------|---|---|---|
| | <p>Zn*.</p> <ul style="list-style-type: none"> • Measure TCL analytes in 10% of the surface soil samples collected within IB-3b and IB-3c. • QA/QC samples – Standard number of QA/QC samples is acceptable. • Risk-based screening values (Lowest Receptor –specific SSL from Eco Baseline Problem Formulation Table 3-4). | <p>ecological receptors in this area are present in IB-3a.</p> <ul style="list-style-type: none"> • QA/QC samples – Standard number of QA/QC samples is acceptable. • Risk-based screening values (Lowest Receptor –specific SSL (semi-aquatic receptors) from Eco Baseline Problem Formulation Table 3-4). | <p>provide habitat for the ecological receptors in this area are present in IB-3a.</p> <ul style="list-style-type: none"> • QA/QC samples – Standard number of QA/QC samples is acceptable. • Risk-based screening values (Lowest Receptor –specific SSL (semi-aquatic receptors) from Eco Baseline Problem Formulation Table 3-4). |
| 4. Define boundaries of the study | The horizontal boundaries are shown on Figure 3.1.2-1. The vertical boundaries are the 0 to 2 foot depth interval. The temporal boundary is sampling to occur in 2003 and 2004. | The horizontal boundaries are shown on Figure 3.1.2-1. The temporal boundary is sampling to occur in 2003 and 2004. | The horizontal boundaries are shown on Figure 3.1.2-1. The temporal boundary is sampling to occur in 2003 and 2004. |
| 5. Develop a decision rule | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be evaluated in the Phase I Eco Risk Characterization. The large historical database for IB-3b will also be qualitatively utilized in the decision process for Phase I. Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I Risk Characterization | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be evaluated in the Phase I Eco Risk Characterization. Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I Risk Characterization | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be evaluated in the Phase I Eco Risk Characterization. Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I Risk Characterization |
| 6. Specify limits on decision errors | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). |
| 7. Optimize design for obtaining data | The number of samples has been selected to provide a dataset that will be acceptable to support early action ecological risk-based decisions. | The number of samples has been selected to provide a dataset that will be acceptable to support early action ecological risk-based decisions. | The number of samples has been selected to provide a dataset that will be acceptable to support early action ecological risk-based decisions. |

*These analytes will be captured on a modified TAL list.

TABLE 3.7.2-4

PHASE I ECOLOGICAL DQOs FOR AREAS WITH NO KNOWN ALCOA ACTIVITY (IB-4)

| Potential Exposure Pathway | Ingestion of surface soil and prey that may have accumulated COIs from surface soil. | Ingestion of surface water and prey that may have accumulated COIs from surface water. | Ingestion of sediment and prey that may have accumulated COIs from sediment |
|------------------------------------|---|---|---|
| 1. State the problem | Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks. | Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks. | Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with former Alcoa operations, and develop remedial alternatives to address the identified risks. |
| 2. Identify the decision | <ol style="list-style-type: none"> 1) Do COIs in surface soil pose potential risk to terrestrial ecological receptors ingesting the surface soil? 2) Does potential uptake or COIs from the surface soil into prey items pose a potential ecological risk to the terrestrial receptors? | <ol style="list-style-type: none"> 1) Do COIs in surface water pose potential risk to semi-aquatic and/or terrestrial ecological receptors ingesting the surface water? 2) Does potential uptake of COIs from the surface water into prey items pose a potential ecological risk to the semi-aquatic receptors? | <ol style="list-style-type: none"> 1) Do COIs in sediment pose potential risk to semi-aquatic and/or terrestrial ecological receptors ingesting the sediment? 2) Does potential uptake of COIs from the sediment into prey items pose a potential ecological risk to the semi-aquatic receptors? |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> • Concentrations of COIs in surface soils (depth 0-2 ft) at 10 locations within the upland portions of IB-4a. • IB-4b consists entirely of wet areas. No surface soils are present in IB-4b. • IB-4c is a recreational complex that contains no applicable ecological habitat. Therefore, no ecological risk assessment will be performed in IB-4c and no ecological risk specific sampling is necessary. • Preliminary risk screening identifies the following COIs: Al, Sb, As, Ba, Cd, Cr, Co, Cu, CN, Pb, Hg, Se, Ag, Tl, V, Zn*. • Measure TCL analytes in 10% of the surface soil samples collected | <ul style="list-style-type: none"> • Concentrations of COIs in surface water at 10 locations within IB-4a to provide maximum spatial sampling coverage of the wet areas present in IB-4a. • Concentrations of COIs in surface water at 6 locations within IB-4b. • Preliminary risk screening identifies the following COIs: Al, Sb, As, Ba, Cr, Co, CN, Pb, Mn, Se, Tl, V, Zn*. • Measure TCL analytes in 10% of the surface water samples collected within IB-4a and IB-4b. • No persistent surface water that could provide habitat for the ecological receptors in this area are present in IB-4c. • QA/QC samples – Standard number of QA/QC samples is acceptable. • Risk-based screening values (Lowest | <ul style="list-style-type: none"> • Concentrations of COIs in sediment (0 to 0.5 ft) at 10 locations within IB-4a to provide maximum spatial sampling coverage of the wet areas present in IB-4a. • Concentrations of COIs in sediment (0 to 0.5 ft) at 6 locations within IB-4b. • Preliminary risk screening identifies the following COIs: Al, Sb, As, Ba, Cr, Co, CN, Pb, Mn, Se, Tl, V, Zn*. • Measure TCL analytes in 10% of the sediment samples collected within IB-4a and IB-4b. • No sediments that could provide habitat for the ecological receptors in this area are present in IB-4c. • QA/QC samples – Standard number of QA/QC samples is acceptable. • Risk-based screening values |

TABLE 3.7.2-4

PHASE I ECOLOGICAL DQOs FOR AREAS WITH NO KNOWN ALCOA ACTIVITY (IB-4)

| Potential Exposure Pathway | Ingestion of surface soil and prey that may have accumulated COIs from surface soil. | Ingestion of surface water and prey that may have accumulated COIs from surface water. | Ingestion of sediment and prey that may have accumulated COIs from sediment |
|---------------------------------------|--|---|---|
| | <p>within the upland areas of IB-4a.</p> <ul style="list-style-type: none"> • QA/QC samples – Standard number of QA/QC samples is acceptable. • Risk-based screening values (Lowest Receptor –specific SSL from Eco Baseline Problem Formulation Table 3-4). | <p>Receptor –specific SSL (semi-aquatic receptors) from Eco Baseline Problem Formulation Table 3-4).</p> | <p>(Lowest Receptor –specific SSL (semi-aquatic receptors) from Eco Baseline Problem Formulation Table 3-4).</p> |
| 4. Define boundaries of the study | The horizontal boundaries are shown on Figure 3.1.2-1. The vertical boundaries are the 0 to 2 foot depth interval. The temporal boundary is sampling to occur in 2003 and 2004. | The horizontal boundaries are shown on Figure 3.1.2-1. The temporal boundary is sampling to occur in 2003 and 2004. | The horizontal boundaries are shown on Figure 3.1.2-1. The temporal boundary is sampling to occur in 2003 and 2004. |
| 5. Develop a decision rule | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be evaluated in the Phase I Eco Risk Characterization. Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I Risk Characterization. | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be evaluated in the Phase I Eco Risk Characterization. Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I Risk Characterization. | If COIs or a TCL analyte exceeds the risk-based screening value, then that COI will be evaluated in the Phase I Eco Risk Characterization. Additional decisions to proceed with Phase II sampling will be made based on the results of the Phase I Risk Characterization. |
| 6. Specify limits on decision errors | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). | Precision criteria for use of data are defined in Sections 4.2.1.1 and 4.2.1.2 of Appendix G-1 (QAPP). |
| 7. Optimize design for obtaining data | The number of samples has been selected to provide a dataset that will be acceptable to support early action ecological risk-based decisions. | The number of samples has been selected to provide a dataset that will be acceptable to support early action ecological risk-based decisions. | The number of samples has been selected to provide a dataset that will be acceptable to support early action ecological risk-based decisions. |

*These analytes will be captured on a modified TAL list.

TABLE 3.7.3-1

PHASE 1 GEOTECHNICAL DQOs FOR RESIDUE DISPOSAL AREAS (IB-1)

| Objective | Geotechnical Evaluation of the RDA Waste Material for Reclamation Purposes | Topography of RDA Area for Reclamation Purposes |
|---------------------------------------|---|---|
| 1. State the problem | Obtain the geotechnical properties of the waste to evaluate presumptive remedies. | Obtain topographic survey for the existing RDAs to establish baseline survey data to the one-foot contour interval. |
| 2. Identify the decision | Does the waste possess any geotechnical properties that should be considered in the FS? | What are the existing slopes and how much fill material is required to bring the RDAs to desired contours? |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> • Obtain representative samples (in general accordance with applicable ASTM procedures) of waste materials. • Perform geotechnical soil testing in general accordance with applicable ASTM procedures. • Geotechnical tests may include moisture content, unit weight, Atterberg Limits, soil classification, moisture/density relationship, permeability, consolidation tests, and sieve analysis. | <ul style="list-style-type: none"> • Obtain survey data points and aerial photographic imagery sufficient to establish a one-foot contour interval. |
| 4. Define boundaries of the study | The horizontal boundaries are the original dikes of the impoundment areas as shown in Figure 3.1.2-1. The vertical boundaries are the native materials under each RDA. The temporal boundary is sampling to occur in 2003 and 2004. | Figure 3.1.2-1 shows the areal boundary of the RDAs. The vertical boundary is the ground surface. The temporal boundary is surveying to be completed in 2003. |
| 5. Develop a decision rule | If waste properties were tested in general accordance with applicable ASTM methods, use test results for evaluation of reclamation designs in the FS. | If the survey data was completed in general accordance with accepted surveying practice, and to the one-foot contour interval, the data will be used to evaluate potential reclamation designs. |
| 6. Specify limits on decision errors | Waste material testing and reporting should be completed in general accordance with applicable ASTM procedures. | Surveys should be completed to the one-foot contour interval in accordance with generally accepted survey practice. |
| 7. Optimize design for obtaining data | Sample frequency must be adequate to obtain representative samples and should be performed in general accordance with applicable ASTM procedures. | Control points must be sufficient to provide one-foot contour interval. |

TABLE 3.7.3-2

PHASE 1 GEOTECHNICAL DQOs FOR GYPSUM DIKE AREAS (IB-2)

| Objective | Geotechnical Evaluation of Gypsum Dike Areas for Reclamation Purposes | Topography of Gypsum Dike Area for Reclamation Purposes |
|---------------------------------------|--|---|
| 1. State the problem | Obtain geotechnical properties of gypsum dike materials to evaluate presumptive remedies. | Obtain topographic survey for the existing gypsum dikes to establish baseline survey data to the one-foot contour interval. |
| 2. Identify the decision | Does the gypsum material engineering properties meet the criteria for excavation, slope stability (for existing and proposed slopes), and use as a bauxite residue amendment? | What are the existing slopes and how much cut/fill material is required to bring the dikes to desired contours? |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> • Obtain representative samples (in general accordance with applicable ASTM procedures) of the existing gypsum dikes. • Perform geotechnical soil testing in general accordance with applicable ASTM procedures. • Geotechnical tests may include blow counts, unconfined compressive strength tests, shear tests, consolidation tests, Atterberg Limits, moisture content, permeability, sieve analysis, and unit weight determination. | <ul style="list-style-type: none"> • Obtain survey data points and aerial photographic imagery sufficient to establish a one-foot contour interval. |
| 4. Define boundaries of the study | The horizontal boundaries are the original dikes of the impoundment areas as shown in Figure 3.1.2-1. The vertical boundaries are the native materials under the dikes. The temporal boundary is sampling to occur in 2003 and 2004. | Figure 3.1.2-1 shows the areal boundary of the IB2 area. The vertical boundary is the ground surface. The temporal boundary is surveying to be completed in 2003. |
| 5. Develop a decision rule | If samples were collected and tested in general accordance with applicable ASTM procedures then the data will be used to evaluate potential remedial designs. | If the survey data was completed in general accordance with accepted surveying practice, and to the one-foot contour interval, the data will be used to evaluate potential reclamation designs. |
| 6. Specify limits on decision errors | Geotechnical soil testing and reporting should be completed in general accordance with applicable ASTM procedures. | Surveys should be completed to the one-foot contour interval in accordance with generally accepted survey practice. |
| 7. Optimize design for obtaining data | Sample frequency must be adequate to obtain representative samples and should be performed in general accordance with ASTM procedures. | Control points must be sufficient to provide one-foot contour interval. |

TABLE 3.7.3-3

PHASE 1 GEOTECHNICAL DQOs FOR NORTH WET AREAS (IB-4a)

| Objective | Evaluate Soil Properties of North Wet Area Soils for Reclamation Purposes | Topography of North Wet Area for Reclamation Purposes |
|---------------------------------------|--|---|
| 1. State the problem | Obtain Wet Area soil properties to evaluate area for potential use as stormwater retention pond area. | Obtain topographic survey for the existing North Wet Area to establish baseline survey data to the one-foot contour interval. |
| 2. Identify the decision | Does the soil meet required engineering properties for use as retention pond area? | What are the existing slopes and how much fill material is required to bring the North Wet Area to desired contours? |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> • Obtain representative samples (in general accordance with applicable ASTM procedures). • Perform geotechnical soil testing in general accordance with applicable ASTM procedures. • Geotechnical tests may include moisture content, unit weight, and soil classification. | <ul style="list-style-type: none"> • Obtain survey data points sufficient to establish a one-foot contour interval. |
| 4. Define boundaries of the study | Figure 3.1.2-1 shows the areal boundary of the IB-4 North Wet Area. The vertical boundary is the ground surface. The temporal boundary is surveying to be completed in 2003. | Figure 3.1.2-1 shows the areal boundary of the IB-4 North Wet Area. The vertical boundary is the ground surface. The temporal boundary is surveying to be completed in 2003. |
| 5. Develop a decision rule | If samples were collected and tested in general accordance with applicable ASTM procedures then the data will be used to evaluate potential reclamation designs. | If the survey data was completed in general accordance with accepted surveying practice, and to the one-foot contour interval, the data will be used to evaluate potential reclamation designs. |
| 6. Specify limits on decision errors | Geotechnical soil testing and reporting should be completed in general accordance with applicable ASTM procedures. | Surveys should be completed to the one-foot contour interval in accordance with generally accepted survey practice. |
| 7. Optimize design for obtaining data | Sample frequency must be adequate to obtain representative samples and should be performed in general accordance with ASTM procedures. | Control points must be sufficient to provide one-foot contour interval. |

TABLE 3.7.3-4

PHASE 1 AGRONOMIC DQOs FOR RESIDUE DISPOSAL AREAS (IB-1)

| Objective | Agronomic Evaluation of the RDA Waste Material for Reclamation Purposes |
|---------------------------------------|---|
| 1. State the problem | Obtain the chemical properties of the residue waste materials, to evaluate presumptive remedies. |
| 2. Identify the decision | Does the waste possess any chemical properties that should be considered in the FS? |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> • Obtain representative samples of waste materials. • Perform analytical testing of waste material, including N, S, Ca, Mg, Na, K, B, Zn, Mn, Cu, Fe, P, NO₃, SO₄, CEC, ESP and pH in general accordance with applicable Association of Official Analytical Chemists (AOAC) and EPA methods. |
| 4. Define boundaries of the study | The horizontal boundaries are the original dikes of the impoundment areas as shown in Figure 3.1.2-1. The vertical boundaries are located approximately 15 feet below the existing ground surface of each RDA. The temporal boundary is sampling to occur in 2003 and 2004. |
| 5. Develop a decision rule | If waste properties were tested in general accordance with applicable AOAC and EPA methods, use test results for evaluation of reclamation designs. |
| 6. Specify limits on decision errors | Waste material testing and reporting should be completed in general accordance with applicable AOAC and EPA procedures. |
| 7. Optimize design for obtaining data | Sample frequency must be adequate to obtain representative samples and should be performed in general accordance with applicable AOAC and EPA procedures. |

TABLE 3.7.3-5

PHASE 1 AGRONOMIC DQOs FOR GYPSUM DIKE AREAS (IB-2)

| Objective | Agronomic Evaluation of Gypsum Dike Areas for Reclamation Purposes |
|---------------------------------------|--|
| 1. State the problem | Obtain chemical properties of gypsum dike materials to evaluate presumptive remedies. |
| 2. Identify the decision | Does the gypsum material chemical properties meet the criteria for use as a bauxite residue amendment? |
| 3. Identify inputs to the decision | <ul style="list-style-type: none"> • Obtain representative gypsum samples from the existing gypsum dike materials. • Perform analytical testing of gypsum material in general accordance with Association of Official Analytical Chemists (AOAC) and EPA methods, including N, S, Ca, Mg, Na, K, B, Zn, Mn, Cu, Fe, and P. |
| 4. Define boundaries of the study | The horizontal boundaries are the original dikes of the impoundment areas as shown in Figure 3.1.2-1. The vertical boundaries are the native materials under the dikes. The temporal boundary is sampling to occur in 2003 and 2004. |
| 5. Develop a decision rule | If samples were collected and tested in general accordance with applicable AOAC and EPA procedures then the data will be used to evaluate potential reclamation designs. |
| 6. Specify limits on decision errors | Analytical soil testing and reporting should be completed in general accordance with applicable AOAC and EPA procedures. |
| 7. Optimize design for obtaining data | Sample frequency must be adequate to obtain representative samples and should be performed in general accordance with AOAC and EPA procedures. |

TABLE 4.3.3.2-1

SUMMARY OF WELL SURVEY RESULTS

| Well ID | Owner | Well Survey Results |
|-----------------|--|--|
| 121630173900 | (none listed) | Talked to Superintendent. He stated that he had no knowledge of any wells on the site. Tetra Tech could not locate well. |
| 383552090073501 | (none listed) | 500 line railroad track. Tetra Tech could not locate well. |
| 134961 | AL ORE CO | Road closed down. Tetra Tech could not locate well. |
| 134963 | AL ORE CO | Road closed down. Tetra Tech could not locate well. |
| 134964 | AL ORE CO | Road closed down. Tetra Tech could not locate well. |
| 134965 | AL ORE CO | Road closed down. Tetra Tech could not locate well. |
| 244655 | ALTON & SOUTHERN RAILWAY | Vacant lot. Tetra Tech could not locate well. |
| 134968 | ALTON AND SOUTH RR | Vacant lot. Tetra Tech could not locate well. |
| 244653 | ALUMINUM ORE CO | Vacant lot. Tetra Tech could not locate well. |
| 121630190000 | Aluminum Ore Co. | Vacant lot. Tetra Tech could not locate well. |
| 121630191800 | Brichler & Co. | Residential area. Tetra Tech could not locate well. |
| 241157 | CASPER SICKMANN | Vacant lot. Tetra Tech could not locate well. |
| 135016 | CERTAIN TEED PROD | Vacant lot. Tetra Tech could not locate well. |
| 135017 | CERTAIN TEED PROD | Talked to Superintendent. He stated that he had no knowledge of any wells on the site. Tetra Tech could not locate well. |
| 135018 | CERTAIN TEED PROD | Vacant lot. Tetra Tech could not locate well. |
| 121630189800 | Certainreed Products Corp. | Vacant lot. Tetra Tech could not locate well. |
| 244665 | CERTAIN-TEED PRODUCTS CORP. | Talked to Superintendent. He stated that he had no knowledge of any wells on the site. Tetra Tech could not locate well. |
| 135021 | CHEM TECK PROD | Vacant lot. Tetra Tech could not locate well. |
| 134953 | DRUG STORE | Vacant lot. Tetra Tech could not locate well. |
| 135066 | HOME ICECREAM CO | Junk yard. Tetra Tech could not locate well. |
| 246118 | ILLINOIS POWER COMPANY #101 | Tetra Tech observed three monitoring wells on site. Wells placed around gas pumps. |
| 246119 | ILLINOIS POWER COMPANY #102 | Tetra Tech observed three monitoring wells on site. Wells placed around gas pumps. |
| 246120 | ILLINOIS POWER COMPANY #103 | Tetra Tech observed three monitoring wells on site. Wells placed around gas pumps. |
| 246117 | ILLINOIS POWER COMPANY RW-101 | Tetra Tech observed three monitoring wells on site. Wells placed around gas pumps. |
| 121632622700 | Industrial Tract Supply Inc. (Koppers) | Kopper Industries - Barry stated that the well was backfilled in 1998. Tetra Tech confirmed no well on site. |
| 253460 | JUL FISCHER DISTRIBUTOR CO. #1 | Junk yard. Tetra Tech could not locate well. |
| 253459 | JUL FISCHER DISTRIBUTOR CO. #2 | Junk yard. Tetra Tech could not locate well. |
| 253456 | JUL FISCHER DISTRIBUTOR CO. #3 | Junk yard. Tetra Tech could not locate well. |
| 253453 | JUL FISCHER DISTRIBUTOR CO. #4 | Junk yard. Tetra Tech could not locate well. |

TABLE 4.3.3.2-1

SUMMARY OF WELL SURVEY RESULTS

| Well ID | Owner | Well Survey Results |
|--------------|--------------------------------|---|
| 253452 | JUL FISCHER DISTRIBUTOR CO. #5 | Junk yard. Tetra Tech could not locate well. |
| 135085 | KEY CO | New home construction on and around the site. Tetra Tech could not locate well. |
| 135086 | KEY CO | Vacant lot. Tetra Tech could not locate well. |
| 121630190100 | Key Co. | Vacant lot. Tetra Tech could not locate well. |
| 135095 | LEMP BREWING CO | Vacant lot. Tetra Tech could not locate well. |
| 135199 | OBEAR NESTER CO | Vacant lot. Tetra Tech could not locate well. |
| 135200 | OBEAR NESTER CO | New construction of Orwells Apartments. Tetra Tech could not locate well. |
| 135226 | PRESTRESSED SLABS | Vacant lot. Tetra Tech could not locate well. |
| 121632590300 | Prestressed Slabs, Inc. | Industrial lot. Could not gain access to property. Placed several calls on (2/2/03), but did not get an answer. |
| 16338890 | SOLVAY FLUORIDES INC | Vacant lot. Tetra Tech could not locate well. Previous phone conversation by MFG (2/2/03) indicated there could have possibly been monitoring wells installed for a property transfer - but not sure. |
| 121632379800 | State of Illinois | Vacant lot. Tetra Tech could not locate well. |
| 121632396000 | State of Illinois I-64 | IDOT. Tetra Tech could not locate wells. Hwy 64 off ramp in this location |
| 121632396100 | State of Illinois I-64 | IDOT. Tetra Tech could not locate wells. Hwy 64 off ramp in this location |
| 121632396900 | State of Illinois I-64 | IDOT. Tetra Tech could not locate wells. Hwy 64 off ramp in this location |
| 121632970700 | State Street Shell | New East St. Louis school building being built on the block. Tetra Tech could not locate well. |
| 325934 | STATE STREET SHELL #MW5-16 | New Walgreens being built on this site. Tetra Tech could not locate well. |
| 241156 | THEO. TAYCOSKI | Met with property owner who showed Tetra Tech the location of the well. Well was not in use. Tetra Tech took pictures of hole. |

TABLE 4.3.3.3-1

SUMMARY OF SOILS SSLS FOR PHASE 1 SOIL SCREENING

| Chemical | SSL ¹ - DAF 20 (mg/Kg) | Source of SSL Value |
|---|-----------------------------------|---|
| 1,1,1-TRICHLOROETHANE | 2 | Calculated by MFG |
| 1,1,2,2-TETRACHLOROETHANE | 0 003 | EPA Soil Screening Guidance document |
| 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 1,1,2-TRICHLOROETHANE | 0 02 | Calculated by MFG |
| 1,1-DICHLOROETHANE | 4 | Calculated by MFG |
| 1,1-DICHLOROETHENE | 0 06 | Calculated by MFG |
| 1,2,4-TRICHLOROENZENE | 5 | Calculated by MFG |
| 1,2-DIBROMO-3-CHLOROPROPANE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 1,2-DIBROMOETHANE | 0 0004 | Calculated by MFG |
| 1,2-DICHLOROENZENE | 17 | Calculated by MFG |
| 1,2-DICHLOROETHANE | 0 02 | Calculated by MFG |
| 1,2-DICHLOROPROPANE | 0 03 | Calculated by MFG |
| 1,3-DICHLOROENZENE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 1,3-DICHLOROPROPENE (TAL/TCL-trans & cis) | 0 004 | EPA Soil Screening Guidance document |
| 1,4-DICHLOROENZENE | 2 | Calculated by MFG |
| 1-BUTANOL | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 2,4,5-TRICHLOROPHENOL | 270 | EPA Soil Screening Guidance document |
| 2,4,6-TRICHLOROPHENOL | 0 2 | Calculated by MFG |
| 2,4-DICHLOROPHENOL | 0 2 | Calculated by MFG |
| 2,4-DIMETHYLPHENOL | 9 | EPA Soil Screening Guidance document |
| 2,4-DINITROPHENOL | 0 3 | EPA Soil Screening Guidance document |
| 2,4-DINITROTOLUENE | 0 0008 | EPA Soil Screening Guidance document |
| 2,6-DINITROTOLUENE | 0 0007 | EPA Soil Screening Guidance document |
| 2-CHLOROPHENOL | 0 7 | Calculated by MFG |
| 2-CHLOROPROPANE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 2-HEXANONE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 2-METHYLNAPHTHALENE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 2-METHYLPHENOL | 15 | EPA Soil Screening Guidance document |
| 2-NITROANILINE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 2-Nitrophenol | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 3,3'-DICHLOROENZIDINE | 0 7 | Calculated by MFG |
| 3-NITROANILINE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 4,6-DINITRO-2-METHYLPHENOL | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 4-Bromophenyl-phenylether | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 4-Chloro-3-methylphenol | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 4-CHLOROANILINE | 0 2 | Calculated by MFG |
| 4-Chlorophenyl-phenylether | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 4-METHYLPHENOL | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 4-NITROANILINE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| 4-NITROPHENOL | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| ACENAPHTHENE | 121 | Calculated by MFG |
| Acenaphthene | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| ACETONE | 3 | Calculated by MFG |
| ACETOPHENONE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| ALDRIN | 1372 | Calculated by MFG |
| ALPHA-HCH | 0 0005 | Calculated by MFG |
| ALUMINUM | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| ANTHRACENE | 2486 | Calculated by MFG |
| ANTIMONY | 5 | Calculated by MFG |
| AROCLOR-1016 | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| AROCLOR-1221 | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| AROCLOR-1232 | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| AROCLOR-1242 | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| AROCLOR-1248 | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| AROCLOR-1254 | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| AROCLOR-1260 | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| ARSENIC | 29 | Calculated by MFG |
| ATRAZINE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| BARIUM | 1600 | Calculated by MFG |
| BENZ[A]ANTHRACENE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| Benzaldehyde | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| BENZENE | 0 03 | Calculated by MFG |
| Benzo(g,h,i)perylene | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| BENZO[A]PYRENE | 8 | Calculated by MFG |
| BENZO[B]FLUORANTHENE | 9 | Calculated by MFG |
| BENZO[K]FLUORANTHENE | 8 | Calculated by MFG |
| BENZOIC ACID | 113 | Calculated by MFG |
| BERYLLIUM | 63 | Calculated by MFG |
| BETA-CHLORONAPHTHALENE | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| BETA-HCH | 0 003 | EPA Soil Screening Guidance document |
| BIPHENYL | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| bis-(2-Chloroethoxy)methane | NA | Insufficient data to calculate a SSL value No SSL provided in EPA Guidance document |
| BIS(2-CHLOROETHYL)ETHER | 0 05 | Calculated by MFG |

TABLE 4.3.3.3-1

SUMMARY OF SOILS SSLs FOR PHASE 1 SOIL SCREENING

| Chemical | SSL ¹ - DAF 20 (mg/Kg) | Source of SSL Value |
|---|--------------------------------------|---|
| BIS(2-ETHYLHEXYL)PHTHALATE | 3624 | Calculated by MFG |
| BROMODICHLOROMETHANE | 0.001 | Calculated by MFG |
| BROMOMETHANE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| BROMOPHOS | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| BUTYLBENZYLPHthalate | 3226 | Calculated by MFG |
| CADMIUM | 8 | Calculated by MFG |
| Calcium | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| CAPROLACTAM | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| CARBAZOLE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| CARBON DISULFIDE | 6 | Calculated by MFG |
| CARBON TETRACHLORIDE | 0.07 | Calculated by MFG |
| CHLORDANE | 10 | Calculated by MFG |
| CHLORO BENZENE | 1 | Calculated by MFG |
| CHLOROETHANE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| CHLOROFORM | 0.001 | Calculated by MFG |
| CHLOROMETHANE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| Chromium | 38 | Calculated by MFG |
| CHROMIUM III | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| CHROMIUM VI | 38 | EPA Soil Screening Guidance document |
| CHRYSENE | 24 | Calculated by MFG |
| CIS-1,2-DICHLOROETHENE | 0.4 | Calculated by MFG |
| cis-1,3-Dichloropropene | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| COBALT | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| COPPER | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| CYANIDE (FREE) | 40 | Calculated by MFG |
| Cyclohexane | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| DDD | 560 | Calculated by MFG |
| DDE | 1788 | Calculated by MFG |
| DDT | 631 | Calculated by MFG |
| delta-BHC | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| DIBENZ[A,H]ANTHRACENE | 46 | Calculated by MFG |
| DIBENZOFURAN | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| DIBENZOFURAN | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| DIBROMOCHLOROMETHANE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| DIBUTYLPHthalate | 950 | Calculated by MFG |
| DICHLORODIFLUOROMETHANE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| DIELDRIN | 0.004 | EPA Soil Screening Guidance document |
| DIETHYLPHthalate | 470 | EPA Soil Screening Guidance document |
| DIMETHYLPHthalate | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| DIOCTYLPHthalate | 1000 | EPA Soil Screening Guidance document |
| ENDOSULFAN | 18 | EPA Soil Screening Guidance document |
| ENDRIN | 1 | Calculated by MFG |
| ETHYLBENZENE | 13 | Calculated by MFG |
| FLUORANTHENE | 4300 | EPA Soil Screening Guidance document |
| FLUORENE | 560 | EPA Soil Screening Guidance document |
| GAMMA-HCH (LINDANE) | 0.009 | Calculated by MFG |
| HEPTACHLOR | 23 | Calculated by MFG |
| HEPTACHLOR EPOXIDE | 0.7 | Calculated by MFG |
| HEXACHLOROBENZENE | 0.1 | Calculated by MFG |
| HEXACHLOROBUTADIENE | 2 | Calculated by MFG |
| HEXACHLOROCYCLOPENTADIENE | 400 | Calculated by MFG |
| HEXACHLOROETHANE | 0.5 | Calculated by MFG |
| INDENO[1,2,3-C,D]PYRENE | 14 | EPA Soil Screening Guidance document |
| IRON | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| ISOPHORONE | 0.5 | EPA Soil Screening Guidance document |
| Lead | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| Magnesium | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| MANGANESE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| MERCURIC CHLORIDE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| Mercury | 2 | Calculated by MFG |
| METHOXYCHLOR | 160 | Calculated by MFG |
| METHYL ACETATE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| METHYL ETHYL KETONE (2-BUTANONE) | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| METHYL TERT-BUTYL ETHER | 0.3 | Calculated by MFG |
| METHYLENE CHLORIDE | 0.02 | Calculated by MFG |
| METHYLMERCURY | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |
| NAPHTHALENE | 84 | EPA Soil Screening Guidance document |
| NICKEL | 130 | Calculated by MFG |
| NITROBENZENE | 0.1 | EPA Soil Screening Guidance document |
| N-NITROSODIPHENYLAMINE | 1 | EPA Soil Screening Guidance document |
| N-NITROSODIPROPYLAMINE | 0.00005 | EPA Soil Screening Guidance document |
| N-PROPYLBENZENE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document |

TABLE 4.3.3.3-1

SUMMARY OF SOILS SSLS FOR PHASE 1 SOIL SCREENING

| Chemical | SSL ¹ - DAF 20 (mg/Kg) | Source of SSL Value |
|-------------------------------|--------------------------------------|---|
| PENTACHLOROPHENOL | 0.03 | Calculated by MFG |
| Phenanthrene | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| PHENOL | 100 | EPA Soil Screening Guidance document. |
| POLYCHLORINATED BIPHENYLS | 6 | Calculated by MFG |
| Potassium | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| PYRENE | 4200 | EPA Soil Screening Guidance document. |
| SELENIUM | 5 | Calculated by MFG |
| SILVER | 34 | EPA Soil Screening Guidance document. |
| SODIUM AZIDE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| SODIUM DIETHYLDITHIOCARBAMATE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| STYRENE | 4 | EPA Soil Screening Guidance document. |
| TECHNICAL HCH | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| TETRACHLOROETHENE | 0.06 | Calculated by MFG |
| TETRAETHYLLEAD | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| THALLIUM | 0.7 | Calculated by MFG |
| TOLUENE | 12 | Calculated by MFG |
| TOXAPHENE | 31 | Calculated by MFG |
| TRANS-1,2-DICHLOROETHENE | 0.7 | Calculated by MFG |
| trans-1,3-Dichloropropene | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| TRICHLOROETHENE | 0.06 | Calculated by MFG |
| TRICHLOROFLUOROMETHANE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| VANADIUM | 6000 | EPA Soil Screening Guidance document. |
| VANADIUM SULFATE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |
| VINYL CHLORIDE | 0.01 | Calculated by MFG |
| XYLENES | 141 | Calculated by MFG |
| ZINC | 12000 | EPA Soil Screening Guidance document. |
| ZINC PHOSPHIDE | NA | Insufficient data to calculate a SSL value. No SSL provided in EPA Guidance document. |

Notes:

¹ The equation for calculating the SSL for inorganic and organic constituents can be found in chapter 2 of the U.S. EPA (1996), Soil Screening Guidance Technical Background Document (<http://www.epa.gov/superfund/resources/soil/toc.htm>)

FIGURES

FIGURES



EXPLANATION

-  Site Boundary
-  Mud Lakes
-  Railroads



AERIAL PHOTOGRAPHY: SEPTEMBER 1, 2000




NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 1-1
SITE LOCATION MAP

| | |
|--------------------|------------------------|
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| REV: 0 | BY: MCP CHECKED: BLM |

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EXPLANATION

- Site Boundary
- Plants
- Approximate Gypsum Dike Centerline
- Gypsum Dike Areas
- Mud Lakes*
- Process Areas

*Note: Residue in RDA-2 extends eastward beneath surficial gypsum layer to gypsum dike.

AERIAL PHOTOGRAPHY: SEPTEMBER 1, 2000



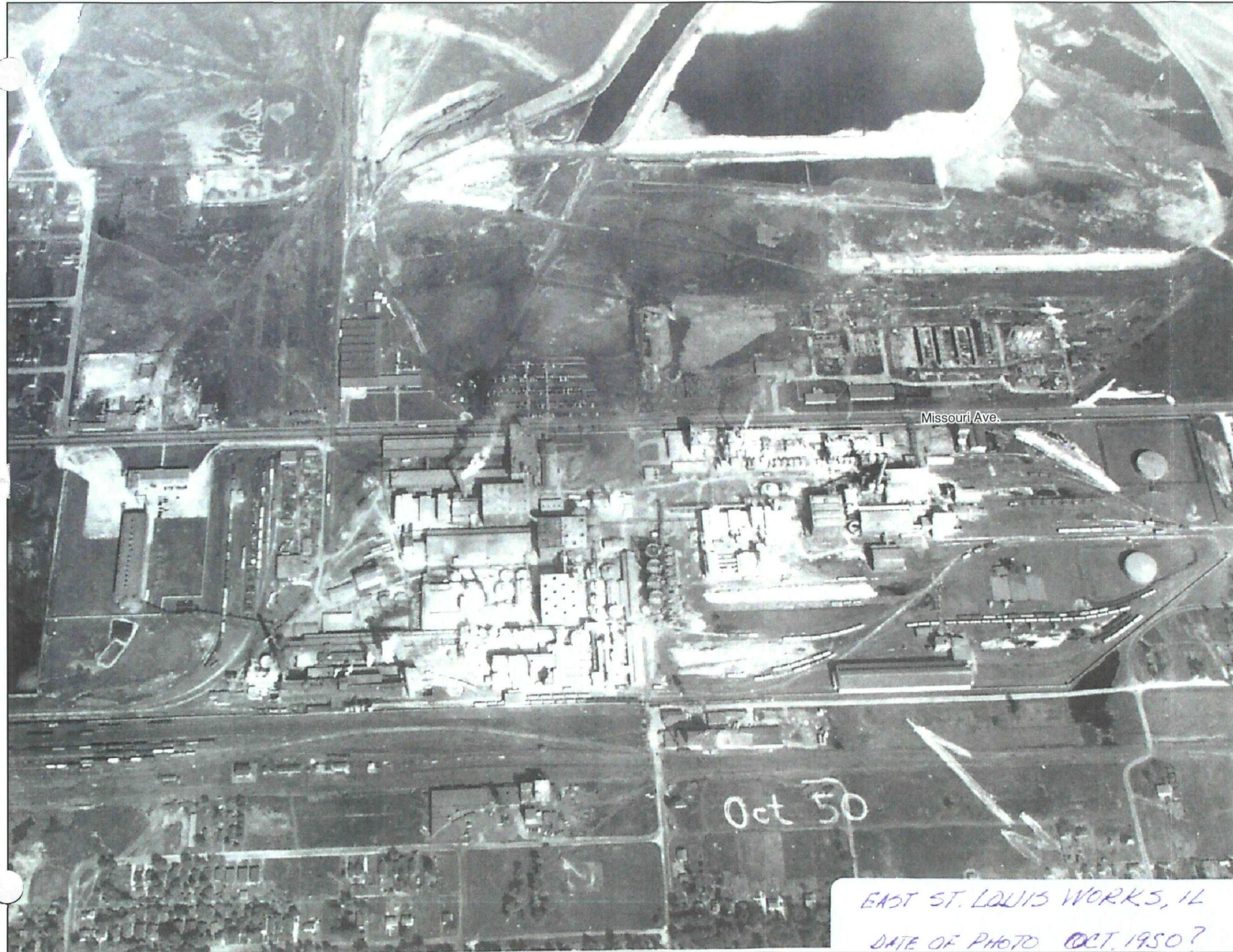
0 600 1,200 Feet

NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.1-1
FORMER ALCOA FACILITY MAP

| | |
|--------------------|------------------------|
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EAST ST. LOUIS WORKS, IL
 DATE OF PHOTO OCT. 1950?

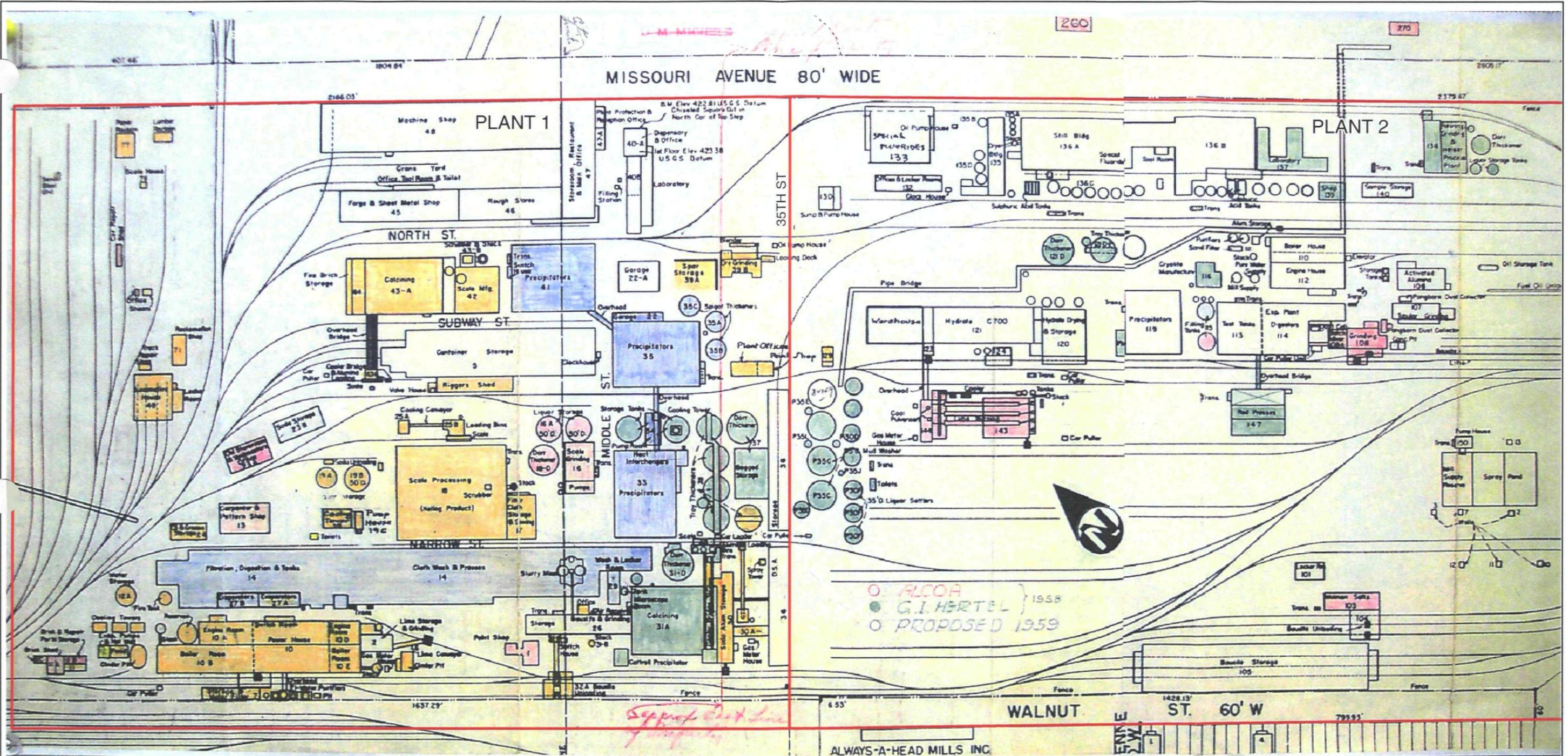


NORTH ALCOA SITE
 EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.1-2
 1950 PHOTOGRAPH OF THE ALCOA
 EAST ST. LOUIS WORKS

| | |
|--------------------|------------------------|
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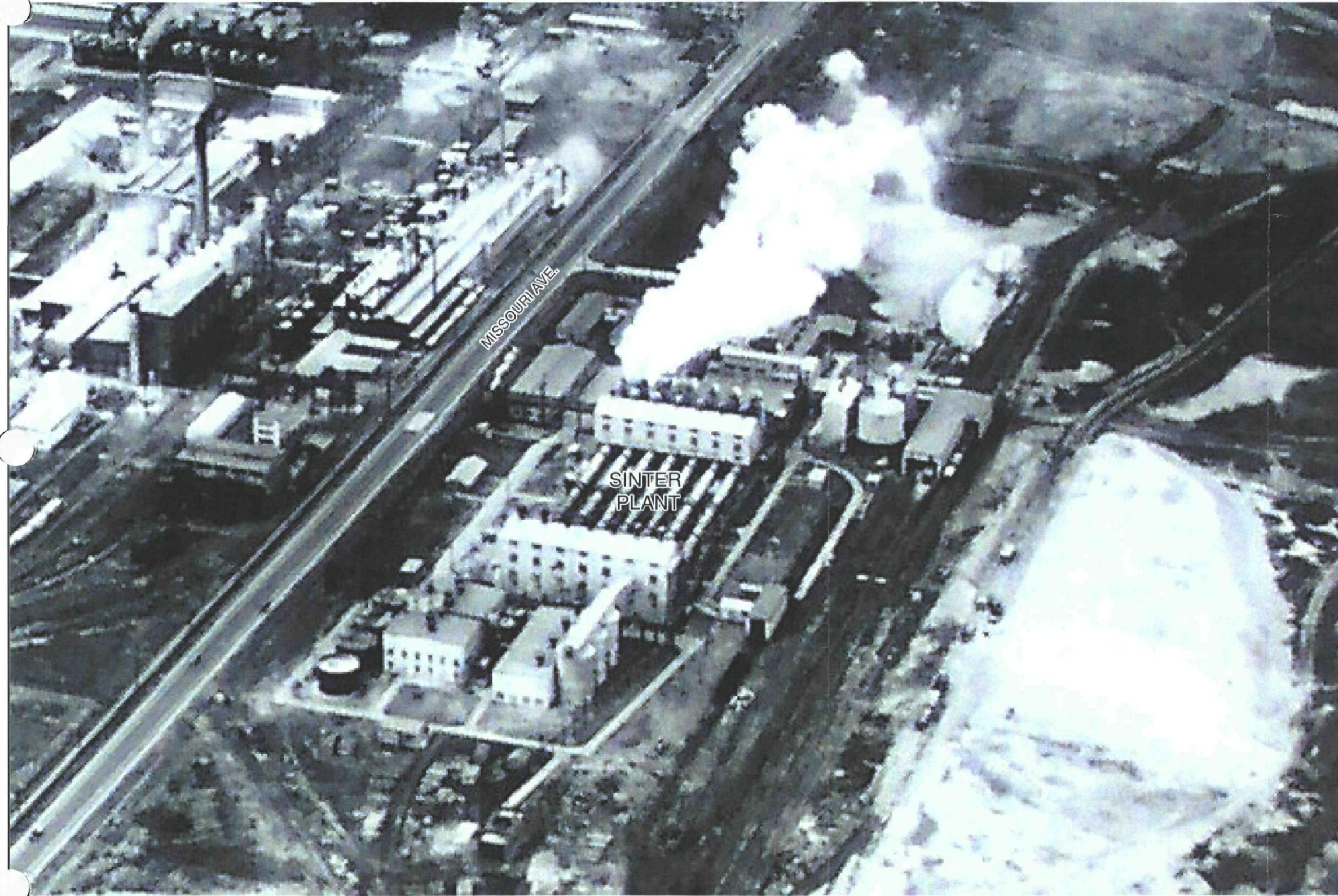
NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.1-3
DETAILED DRAWING
OF PLANTS 1 AND 2

| | |
|--------------------|------------------------|
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SINTER
PLANT

MISSOURI AVE

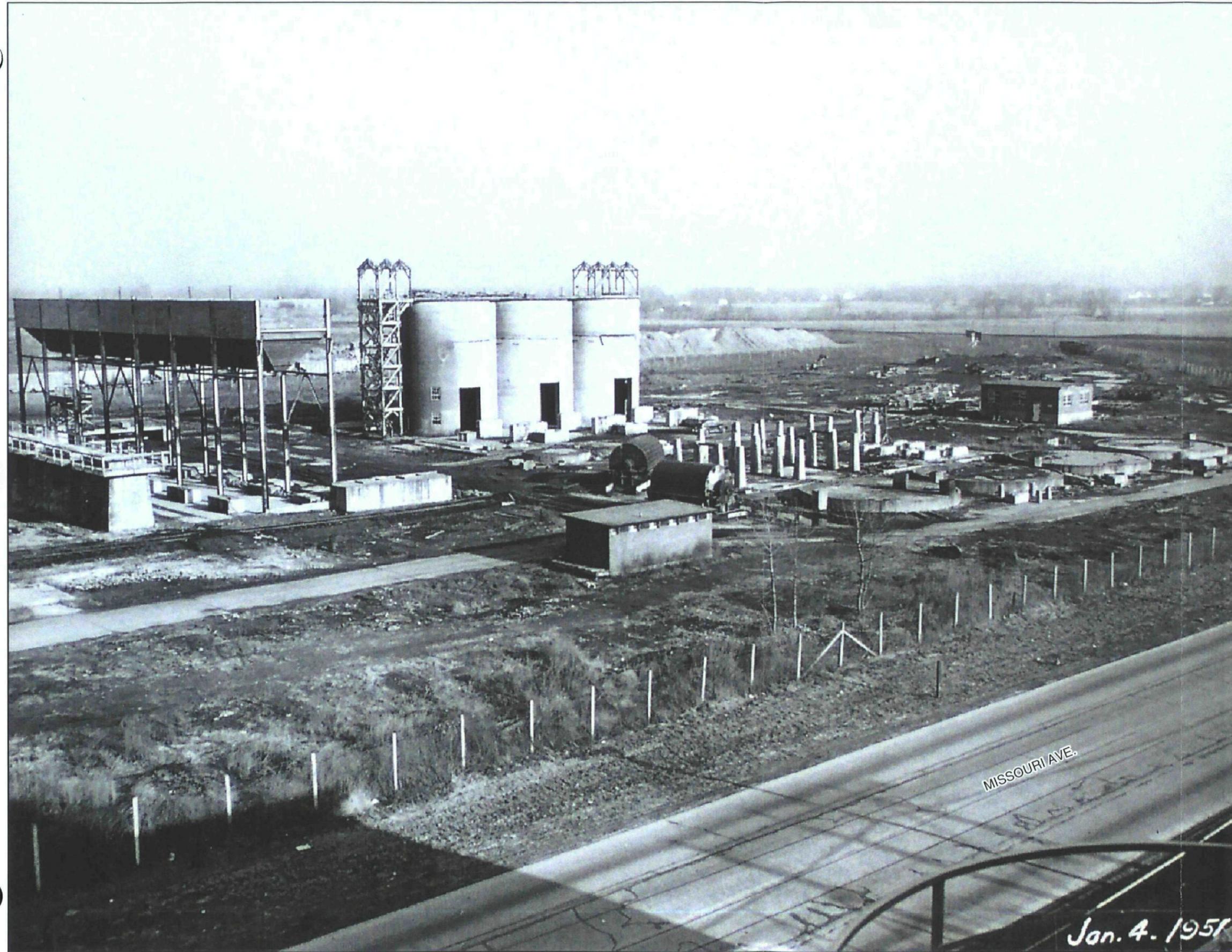


NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.2-1
1948 PHOTOGRAPH OF THE
SINTER PLANT

| | |
|--------------------|------------------------|
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NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.2-2
1951 PHOTOGRAPH OF SINTER
PLANT LOOKING EAST

| | |
|--------------------|------------------------|
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AREA OF FORMER
SINTER PLANT

MISSOURI AVE.

Nov. 24, 1951

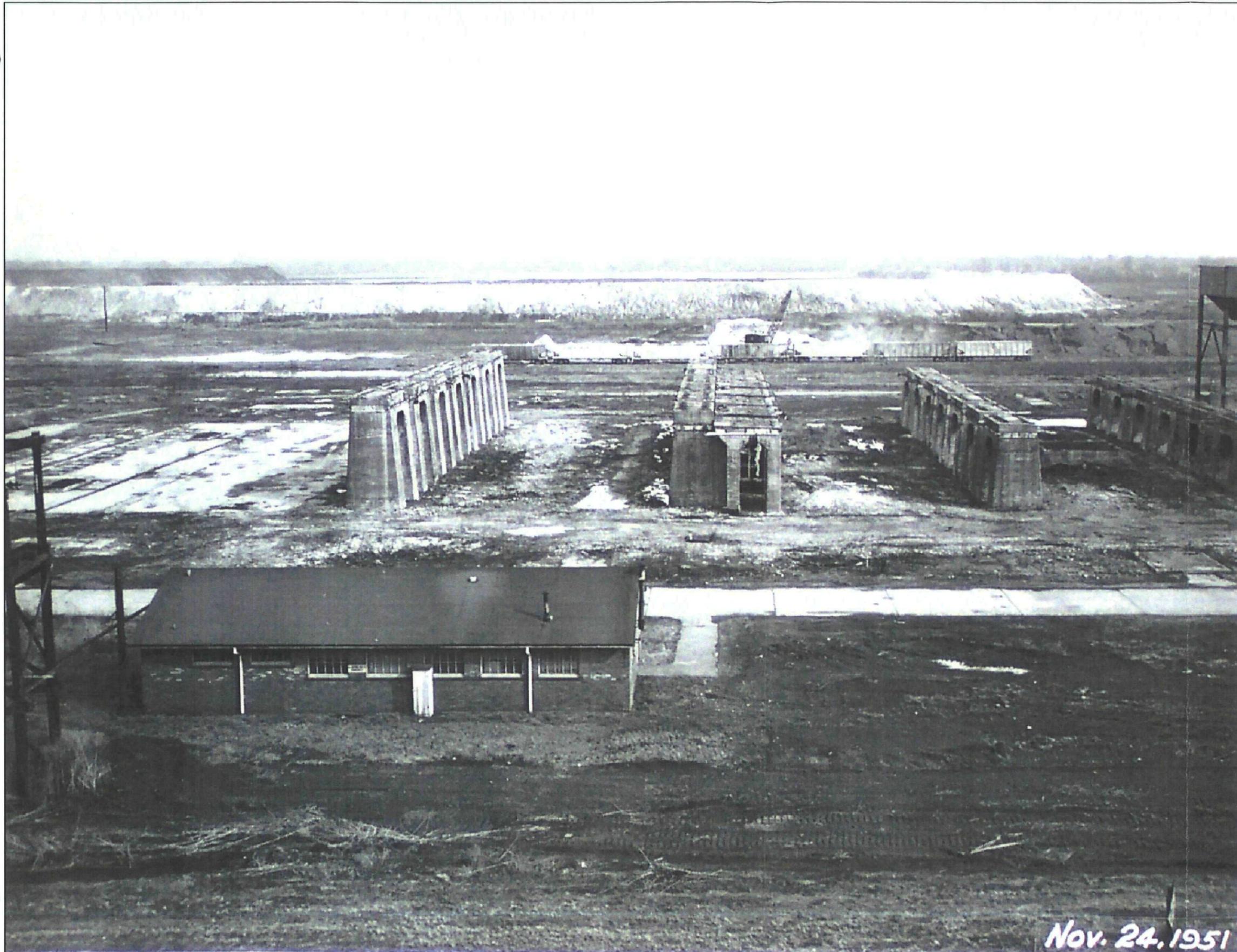


NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.2-3
1951 PHOTOGRAPH OF SINTER
PLANT LOOKING NORTH

| | |
|--------------------|----------------------|
| PROJECT: 020209.1A | DATE: JUL 15, 2003 |
| REV: 0 | BY: PJM CHECKED: BLM |

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NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.2-4
1951 PHOTOGRAPH OF SINTER
PLANT LOOKING NORTHEAST

| | |
|--------------------|------------------------|
| PROJECT: 020209.1A | DATE: JUL 16, 2003 |
| REV: 0 | BY: PJM CHECKED: BLM |

Nov. 24, 1951

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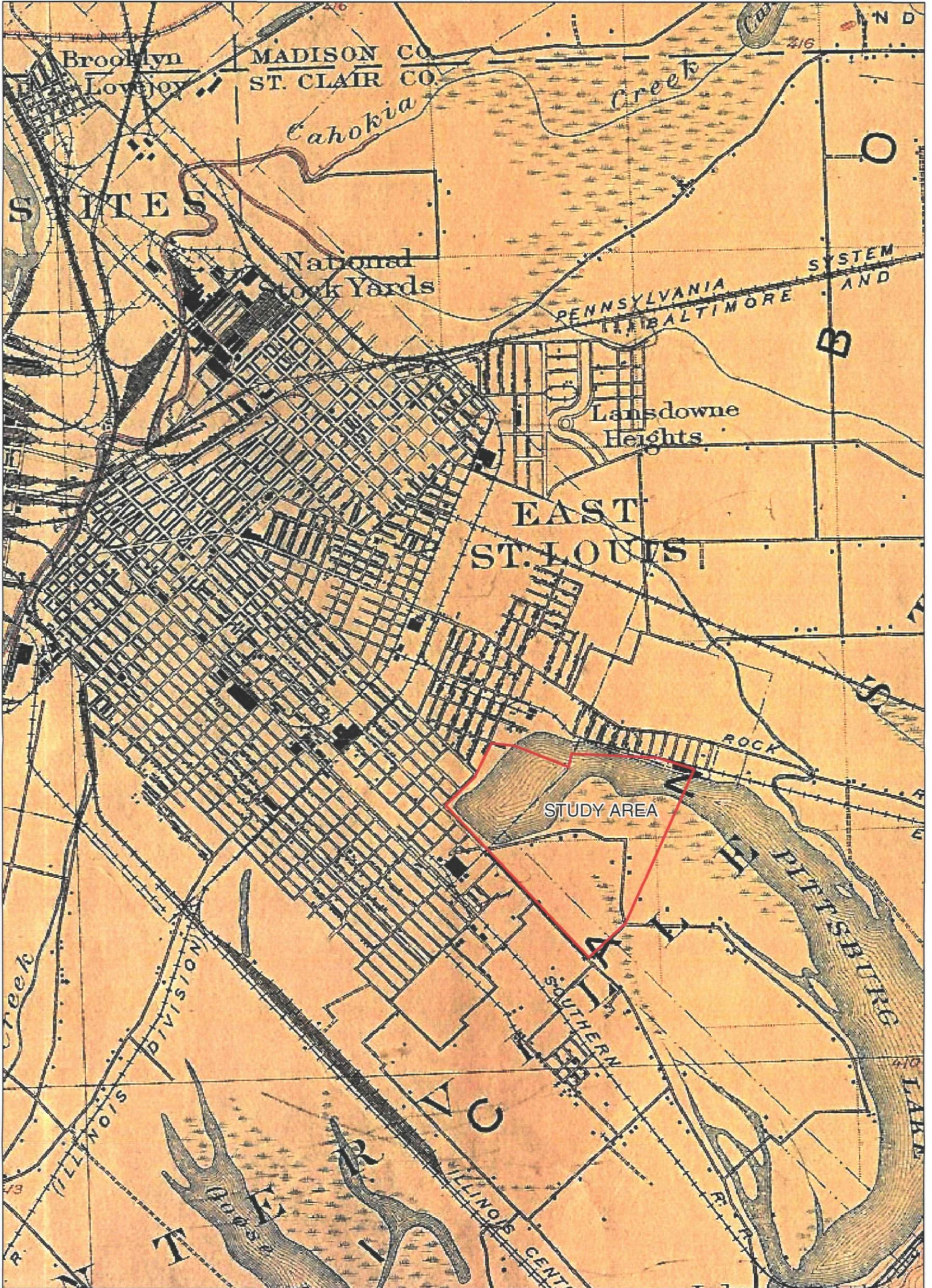


NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.2-5
PHOTOGRAPH OF CRYOLITE
RECOVERY PROCESS AREA

| | |
|--------------------|----------------------|
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| REV: 0 | BY: PJM CHECKED: BLM |

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EXPLANATION

 Site Boundary



NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.3-1

1900 TOPOGRAPHIC MAP OF
THE EAST ST. LOUIS AREA

| | |
|--------------------|----------------------|
| PROJECT: 020209.1A | DATE: JUL 15, 2003 |
| REV: 0 | BY: PJM CHECKED: BLM |

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EXPLANATION

-  Current Location of RDA1
-  Current Location of RDA2
-  Current Location of RDA3
-  Remaining Pittsburgh Lake



NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.3-2
PHOTOGRAPH OF FARMING
ACTIVITIES SOUTH OF RDA 2

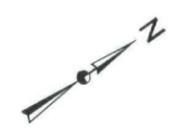
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| PROJECT: 020209.1A | DATE: JUL 15, 2003 |
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EXPLANATION

Current Location of RDA2



NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.3-3
AERIAL PHOTOGRAPH OF
AREA AROUND RDAs 1 & 3, 1937

| | |
|--------------------|------------------------|
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Aerial View of Red Mud
Spoilage Basin (Pittsburgh Lake)
1937

AERIAL SURVEYS OF PITTSBURGH



ALCOA ORE Co. EAST ST. LOUIS, ILL.

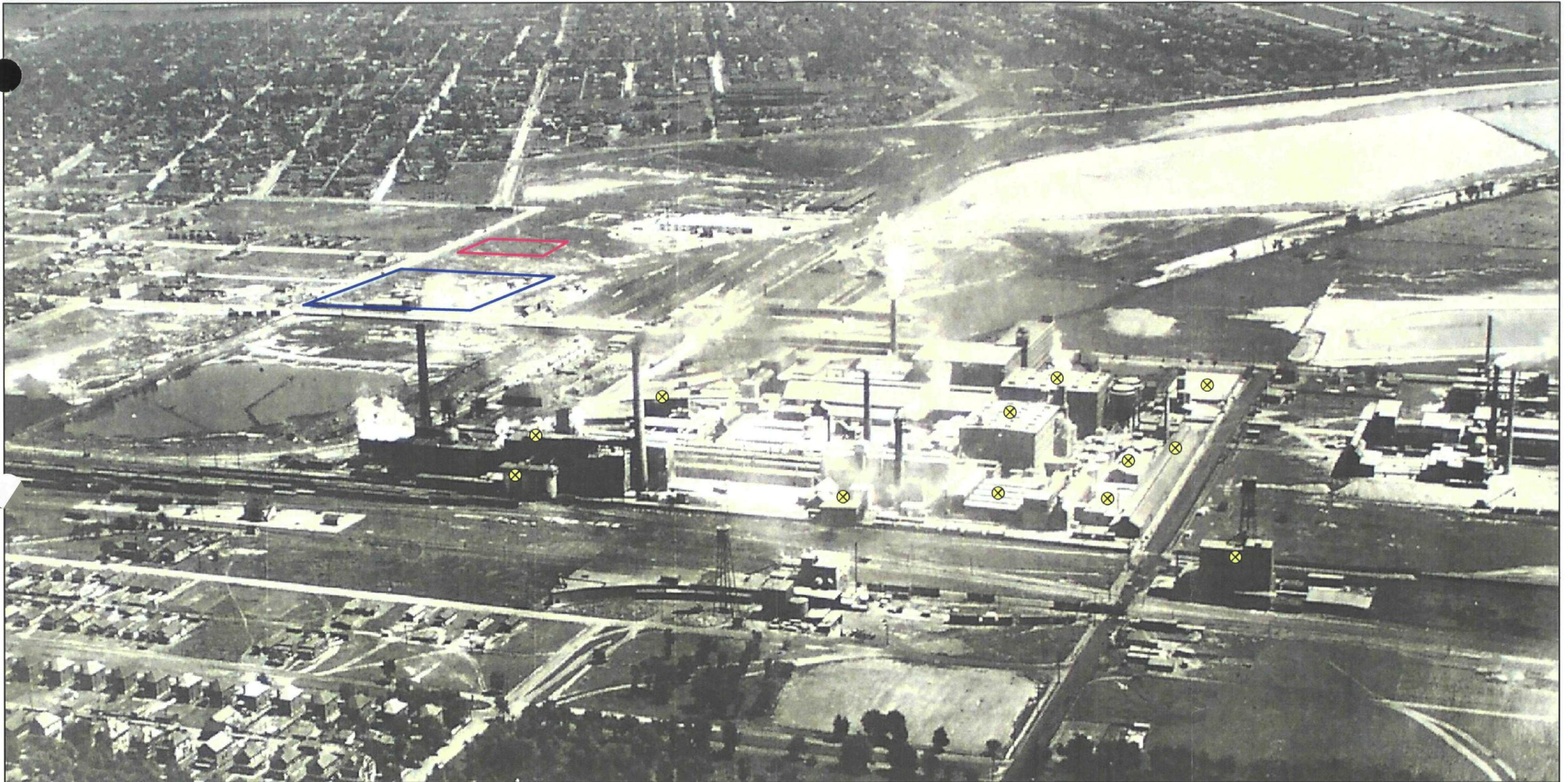


NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.3-4
AERIAL PHOTOGRAPH OF
COOKING UTENSIL WAREHOUSE
(BLDG 50), 1932

| | |
|--------------------|------------------------|
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EXPLANATION

-  Current Location of Hamil Building
-  Current Location of Upchurch RediMix
-  Buildings No Longer Present

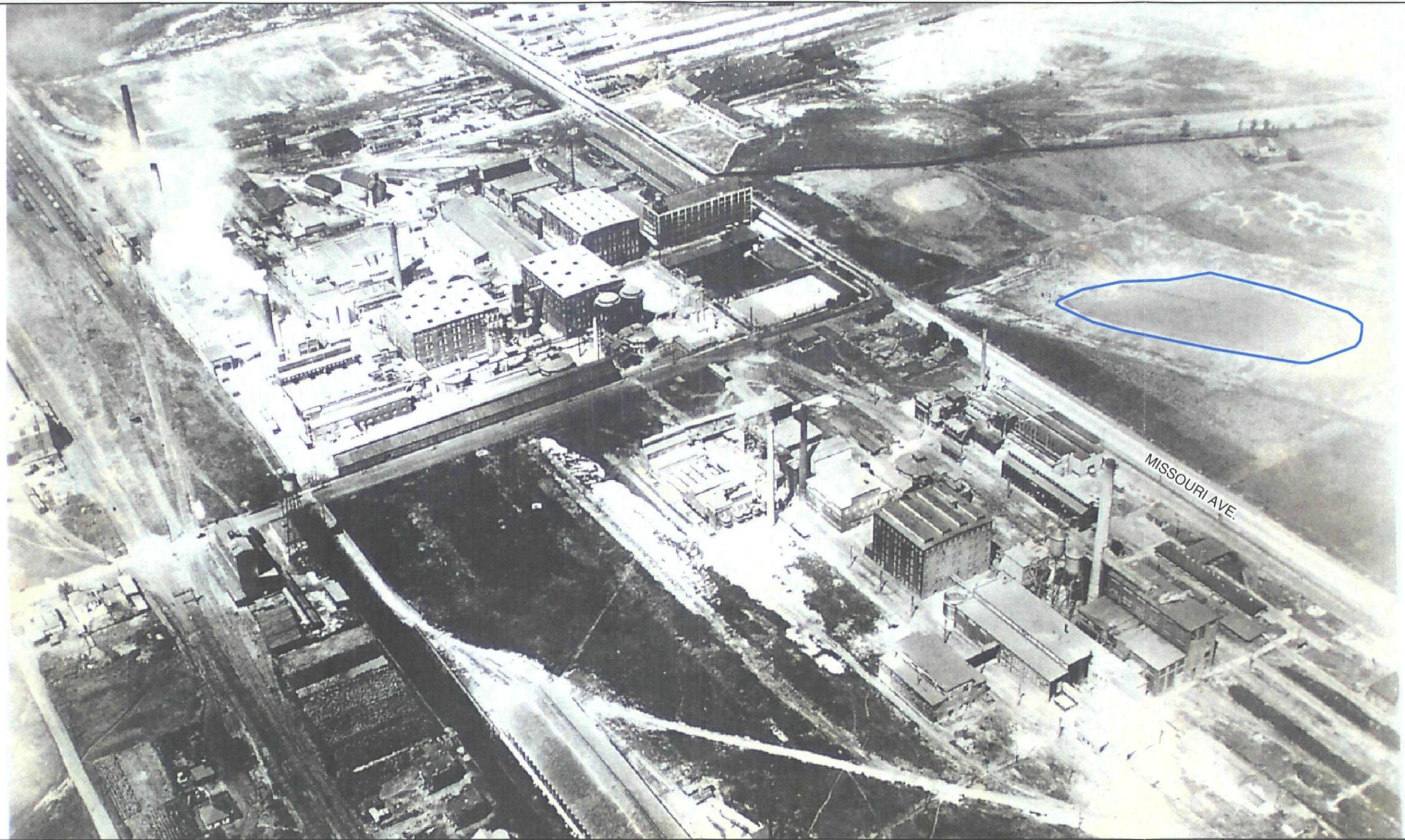


NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.3-5
AERIAL PHOTOGRAPH OF
UNKNOWN BUILDINGS AT
MISSOURI AVENUE AND 29TH ST.

| | |
|--------------------|------------------------|
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| REV: 0 | BY: PJM CHECKED: BLM |

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EXPLANATION

 Possible Industrial Lagoon

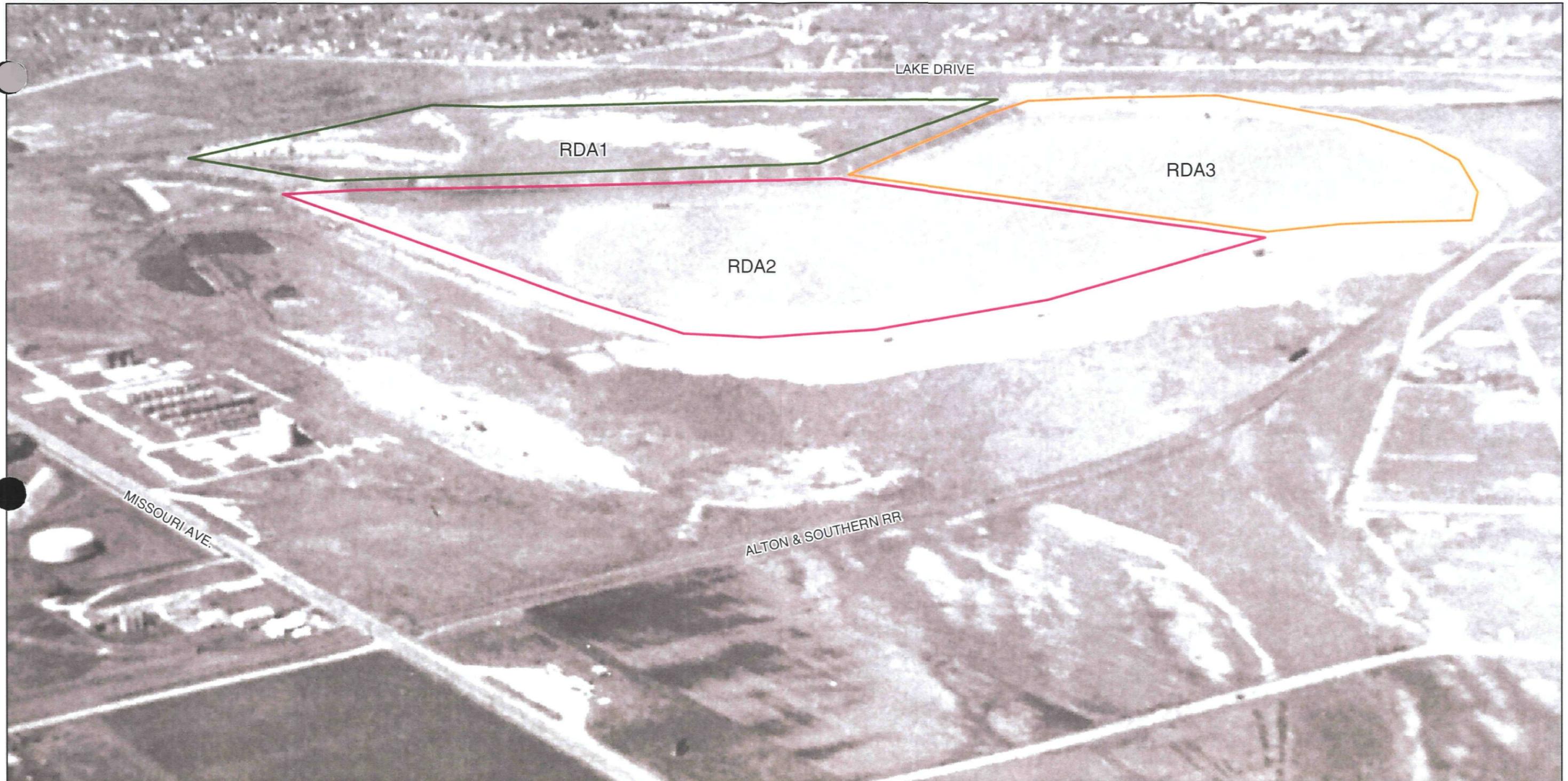


NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.3-6
AERIAL PHOTOGRAPH OF
AREA BETWEEN MISSOURI AVENUE
AND RDAs 1 & 2 IN THE LATE 1930s

| | |
|--------------------|------------------------|
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EXPLANATION

-  Current Location of RDA1
-  Current Location of RDA2
-  Current Location of RDA3



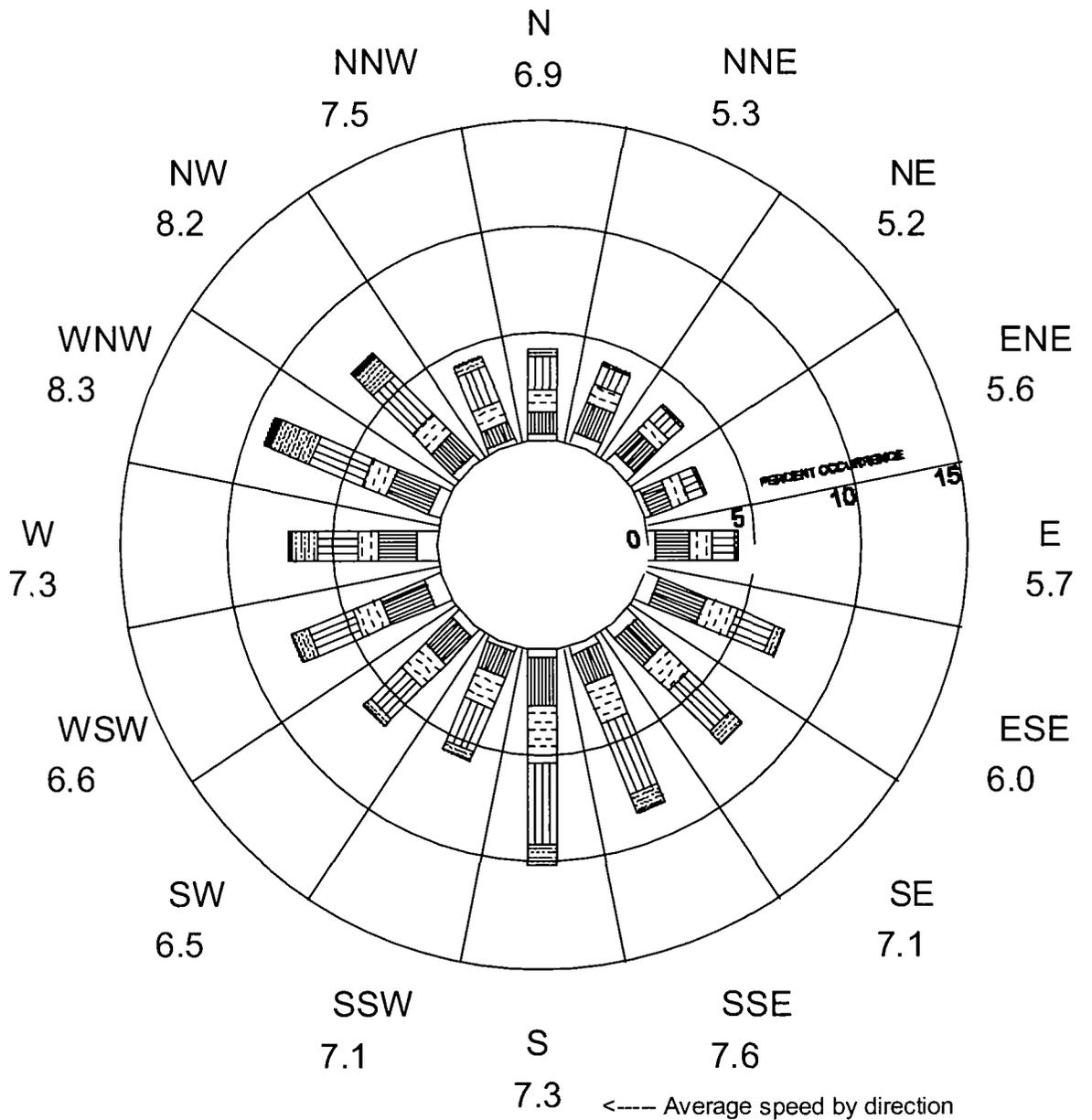
NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.1.3-7

AERIAL PHOTOGRAPH
OF RDAs, 1950

| | |
|--------------------|------------------------|
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WIND SPEED RANGE

- 0 - 4 MPH
- 4 - 7
- 7 - 10
- 10 - 15
- 15 - 25
- > 25

St. Louis Wind Rose 1987-1991

WIND FREQUENCY DISTRIBUTION

Wind rose for St. Louis based data at Lambert Airport 1987-1991.

NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.2.1-1
WIND ROSE FOR ST. LOUIS
BASED ON DATA AT LAMBERT
AIRPORT (1987-1991)

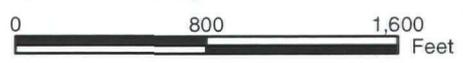
| | |
|--------------------|------------------------|
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| REV: 0 | BY: PJM CHECKED: MCP |

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EXPLANATION

- | | | |
|---|---------------|--|
|  | Site Boundary | Surficial Soil Types: |
|  | Lakes |  Bauxite Residue |
|  | Streams |  Fill |
|  | Roads |  Gypsum |
|  | Railroads |  Spent Pot Lining |



NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.2.2-1
PRELIMINARY SURFICIAL
SOIL TYPES

| | |
|--------------------|------------------------|
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NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.2.2-2

PHOTO OF RED MUD SOILS

PROJECT: 020209.1D

DATE: APR 10, 2003

REV: 0

BY: PJM

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NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.2.2-3
PHOTO OF GYPSUM BUBBLE
STRUCTURES

PROJECT: 020209.1D

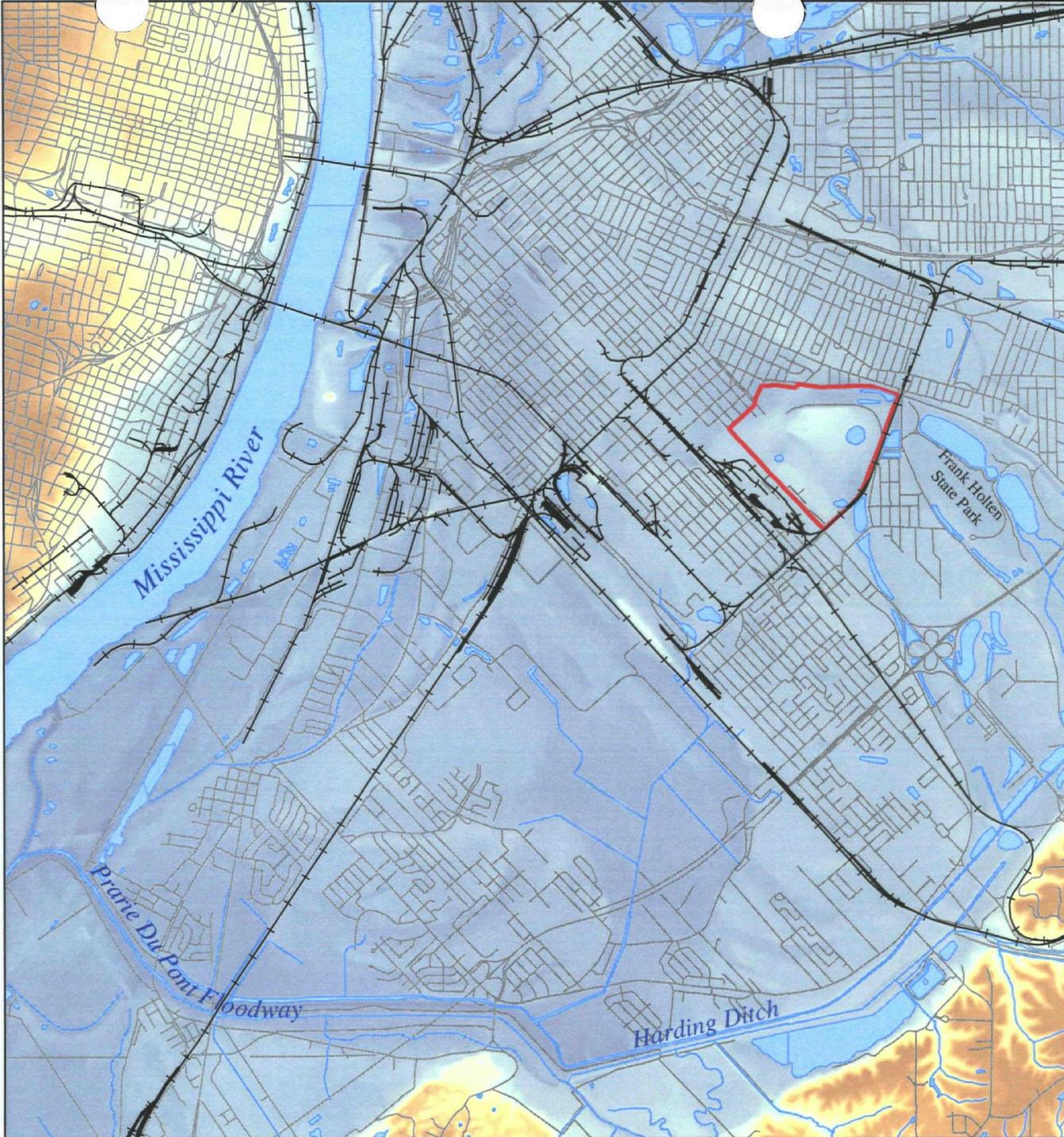
DATE: APR 10, 2003

REV: 0

BY: PJM

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EXPLANATION

-  Site Boundary
-  Lakes/Miss. River
-  Streams
-  Roads
-  Railroads

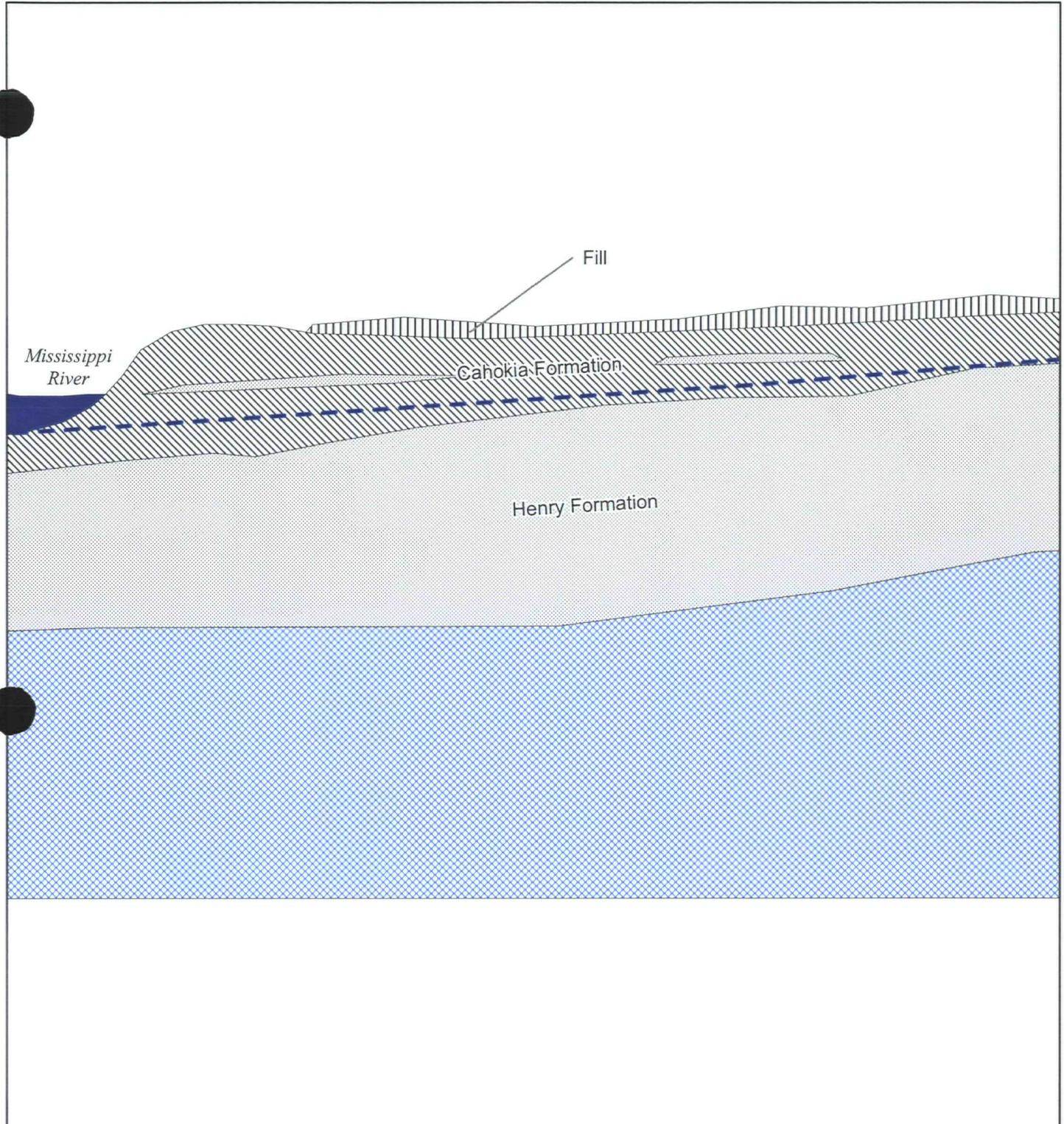


NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.2.3-1
SITE VICINITY HYDROGRAPHY

| | |
|--------------------|------------------------|
| PROJECT: 020209.1D | DATE: JUL 15, 2003 |
| REV: 0 | BY: PJM CHECKED: MCP |

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EXPLANATION

-  Fill
-  Silt and Clay
-  Sand and Gravel
-  Limestone Bedrock
-  Potentiometric Surface

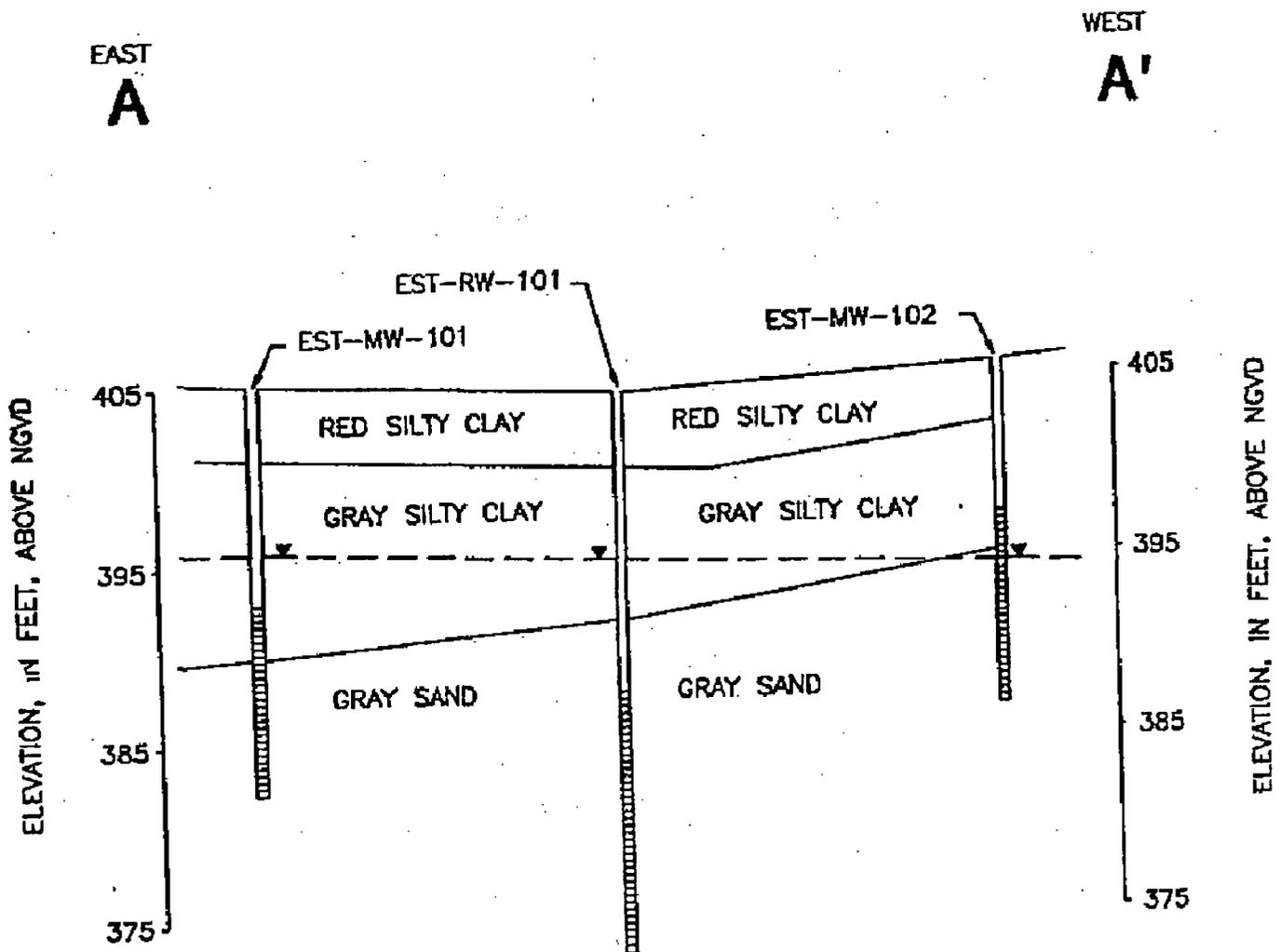
(Not to scale)

NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.2.4-1
GENERALIZED HYDROGEOLOGIC
CROSS SECTION

| | |
|--------------------|------------------------|
| PROJECT: 020209.1D | DATE: AUG 27, 2003 |
| REV: 1 | BY: PJM CHECKED: MCP |

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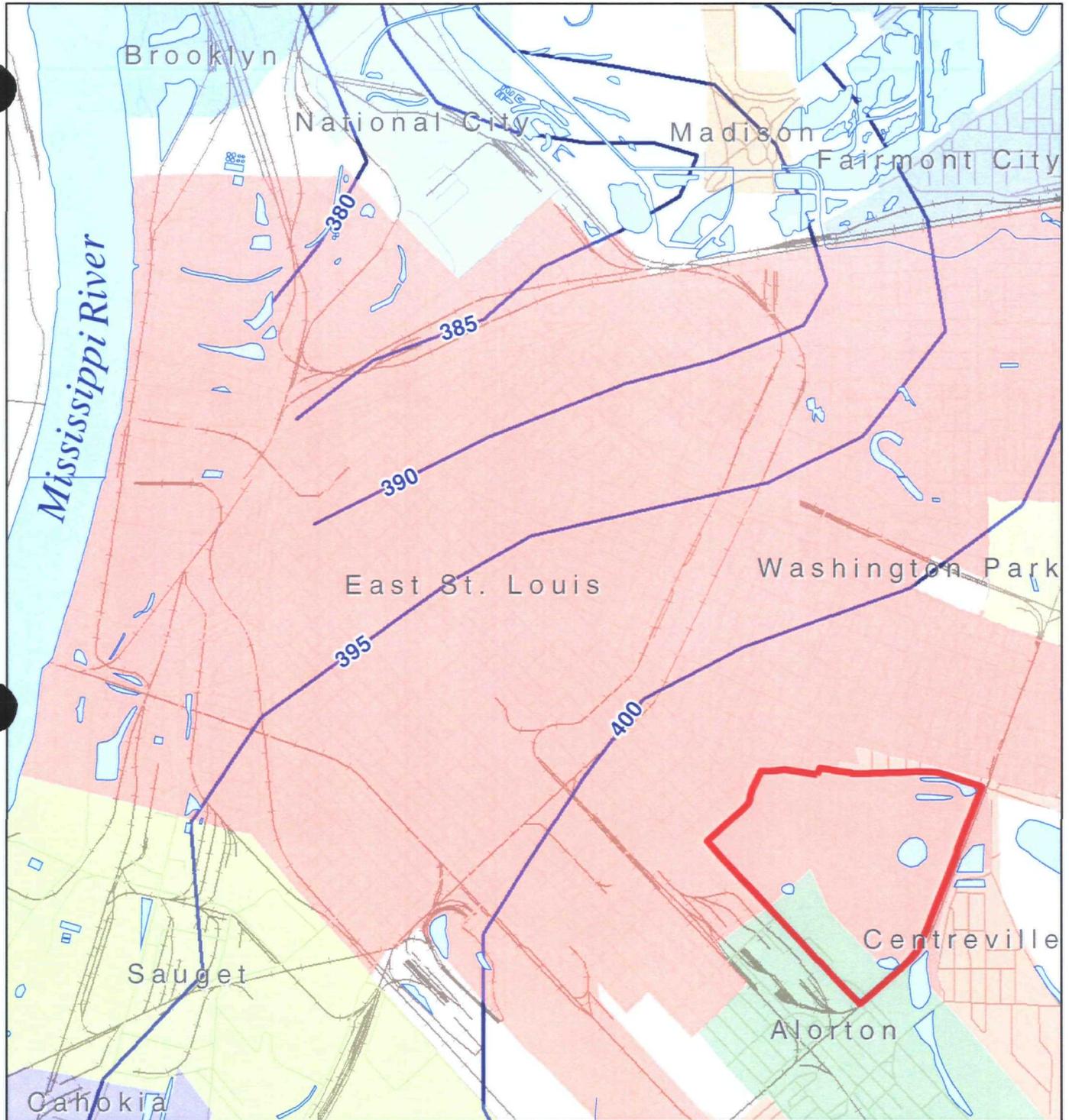
Source: Figure 3, Hydrogeologic Investigation Diesel Release, Illinois Power (Burlington Environmental, 1996).

NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.2.4-2
HYDROGEOLOGIC CROSS SECTION
ILLINOIS POWER SITE

| | |
|--------------------|------------------------|
| PROJECT: 020209.1D | DATE: JUL 15, 2003 |
| REV: 0 | BY: PJM CHECKED: MCP |

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EXPLANATION

- Site Boundary
- Potentiometric Surface (5 ft. interval)
- Lakes/Miss. River
- Streams
- Roads
- +— Railroads



Source: Illinois State Water Survey, 1995.

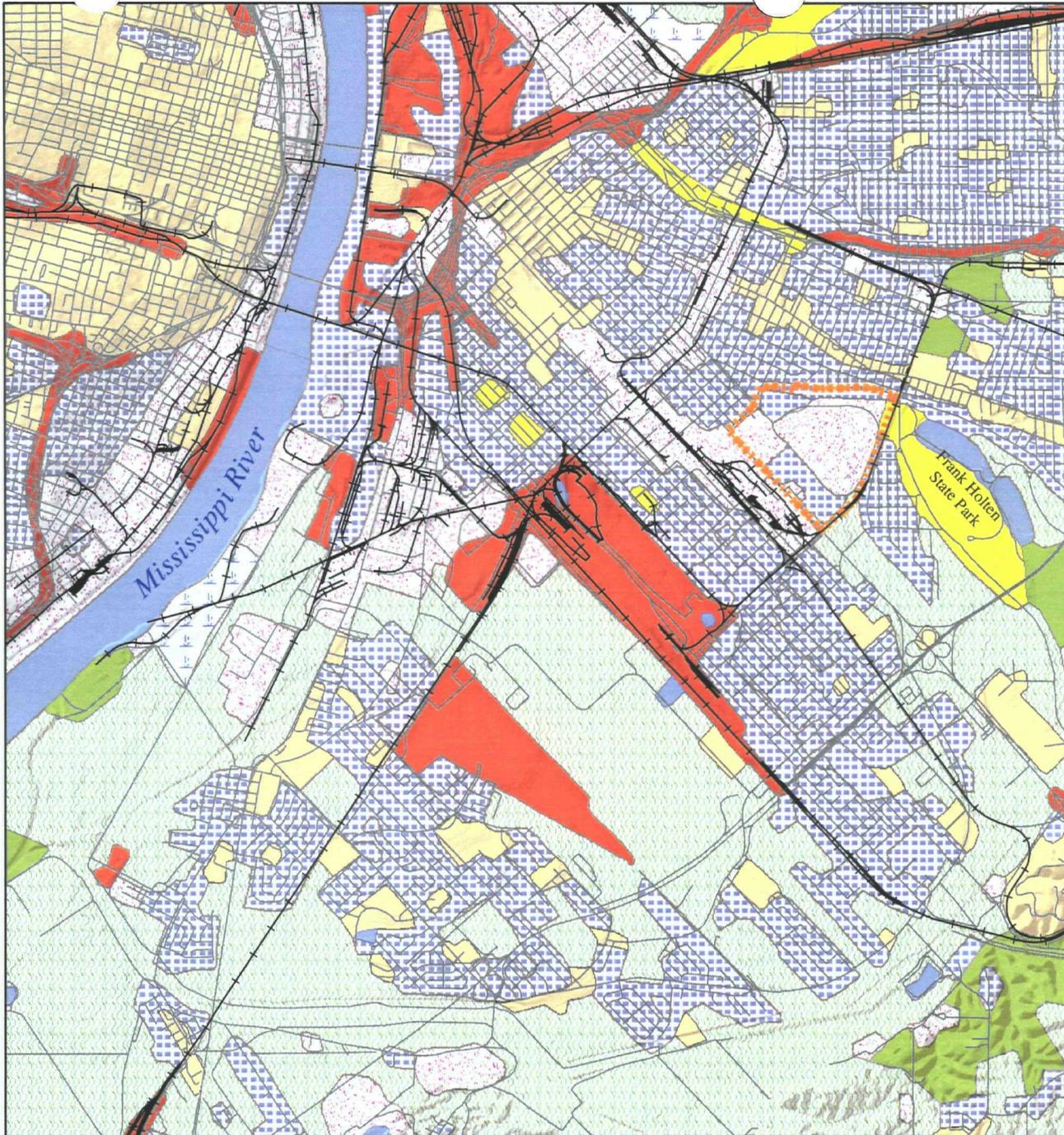
**NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS**

FIGURE 2.2.4-3

**1995 POTENTIOMETRIC SURFACE
AMERICAN BOTTOMS AQUIFER**

| | |
|--------------------|------------------------|
| PROJECT: 020209.1D | DATE: JUL 15, 2003 |
| REV: 0 | BY: PJM CHECKED: MCP |

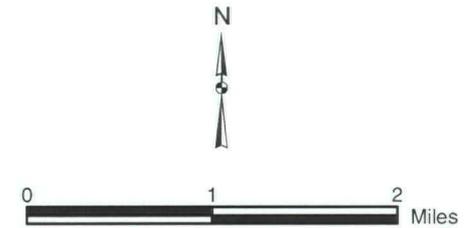
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EXPLANATION

- Site Boundary
- Roads
- Railroads
- LANDUSE/LANDCOVER**
- COMMERCIAL AND SERVICES
- AGRICULTURAL
- FOREST
- WETLAND
- INDUSTRIAL
- LAKE OR RIVER
- RESIDENTIAL / URBAN / BUILT-UP
- TRANS, COMM, UTIL
- TRANSITIONAL AREAS

LANDUSE SOURCE: BASINS 3 CDROM



NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 2.2.5-1

LAND USE MAP

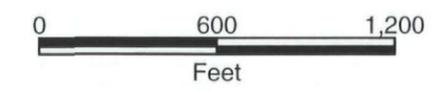
| | |
|--------------------|----------------------|
| PROJECT: 020209.1D | DATE: JUL 15, 2003 |
| REV: 0 | BY: MCP CHECKED: PJM |

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EXPLANATION

- Site Boundary
- Railroads
- Roads
- Investigative Blocks



| Investigative Block | Description |
|---------------------|-----------------------------|
| 1a | RDA 1 |
| 1b | RDA 2 |
| 1c | RDA 3 |
| 2 | Gypsum Dike Areas |
| 3a | Brick Works/Childs Property |
| 3b | Redevelopment Area |
| 3c | SPL Stockpile Area |
| 4a | North Wet Area |
| 4b | Triangle Wet Area |
| 4c | Ball Fields |
| 4d | Berm Wet Area |
| 4e | Active Commercial Area |

NORTH ALCOA SITE
 EAST ST. LOUIS, ILLINOIS
 FIGURE 3.1.2-1
 INVESTIGATIVE BLOCKS

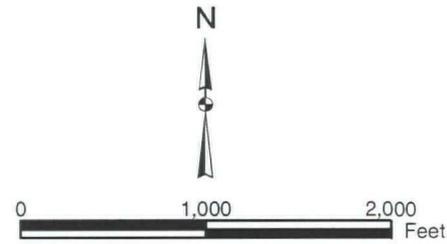
PROJECT: 020209.1 DATE: JUL 15, 2003
 REV: 0 BY: CRL CHECKED: PJM

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EXPLANATION

-  Site Boundary
-  Mud Lakes
-  Surface Water Samples
-  Sediment Samples
-  Soil Samples
-  Groundwater Samples

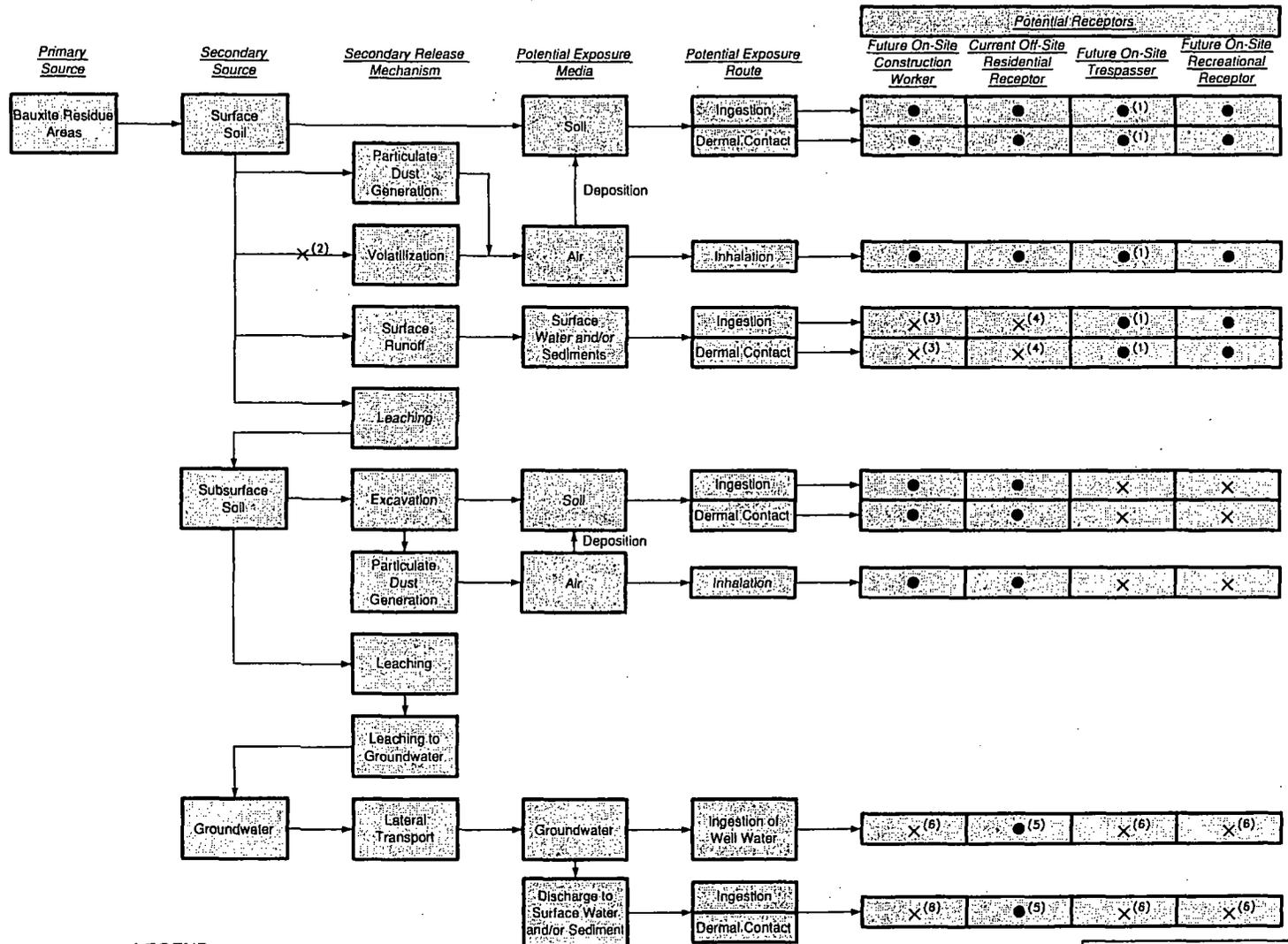


NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 3.3-1
EXISTING SAMPLE LOCATIONS

| | |
|--------------------|------------------------|
| PROJECT: 020209.1D | DATE: JUL 15, 2003 |
| REV: 0 | BY: PJM CHECKED: MCP |

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LEGEND

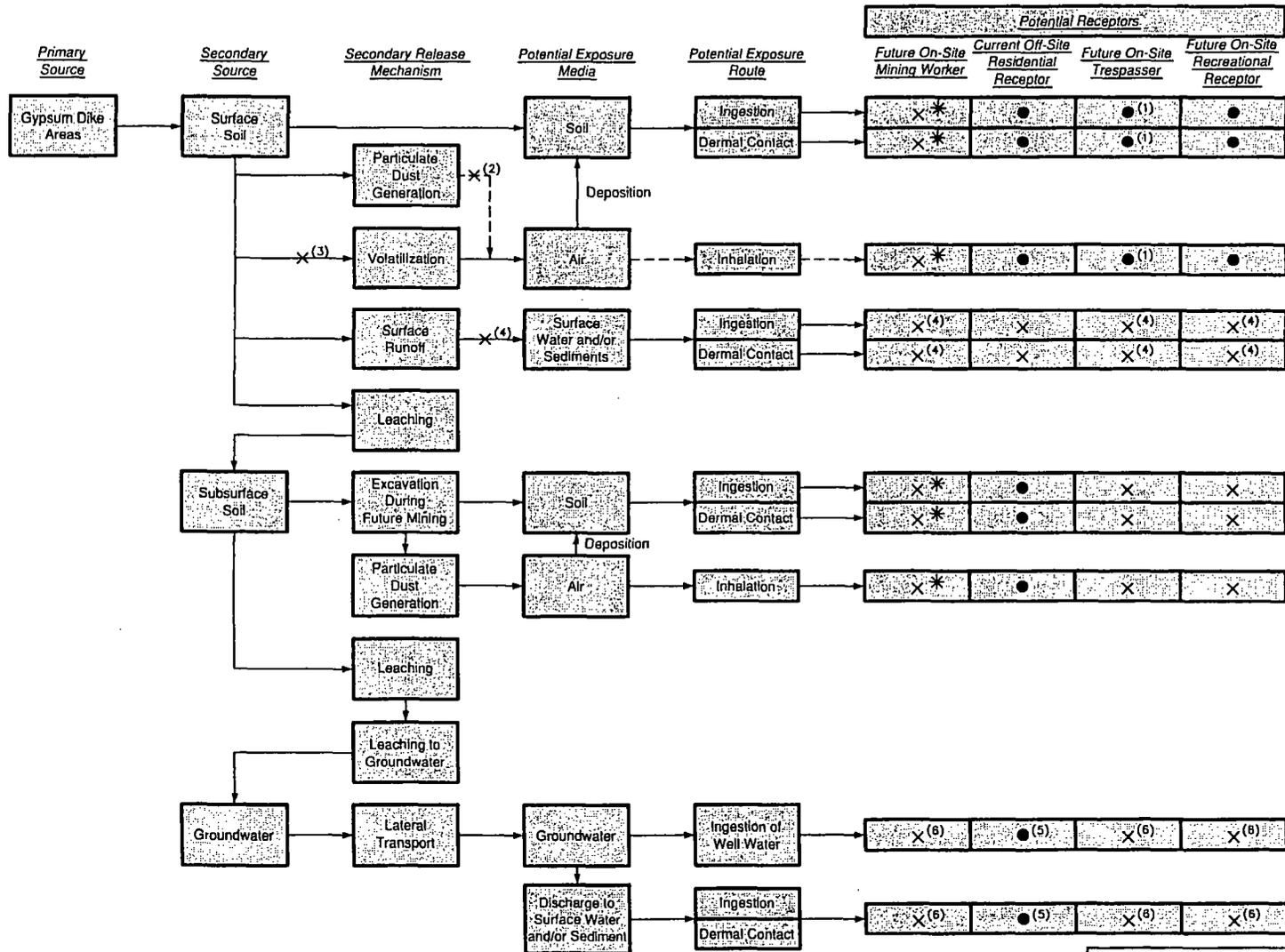
- Potentially complete
- X Incomplete
- (1) There was no evidence of trespassing at the site. However, during RIFS activities, trespassing could occur.
- (2) Site-related COPCs are not volatile.
- (3) It is unlikely that future construction workers would contact surface water regularly.
- (4) Surface water runoff is not thought to discharge off-site based on visual inspection of the site.
- (5) Phase I GW investigation will assess whether this pathway is actually potentially complete.
- (6) Exposure pathway applicable to off-site receptors only.

**FORMER NORTH ALCOA SITE
EAST ST. LOUIS, IL**

FIGURE 3.4.1-1
**PRELIMINARY CONCEPTUAL
SITE MODEL - RDAs (IB-1)**

| | |
|-----------------|----------------------|
| PROJECT: 020209 | DATE: JULY 2003 |
| REV: | BY: BWB CHECKED: BLM |

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LEGEND

- Potentially complete
- X Incomplete

- (1) There was no evidence of trespassing at the site. However, during RIFS activities, trespassing could occur.
- (2) Fugitive dust generation is not likely to occur under current conditions. If gypsum mining were to resume, this transport pathway would be complete.

- (3) Site-related COPCs are not volatile.
- (4) It is unlikely that surface water runoff transports COIs from gypsum material given site drainage characteristics. Standing water in IB-2.
- (5) Phase I GW investigation will assess whether this pathway is actually potentially complete.

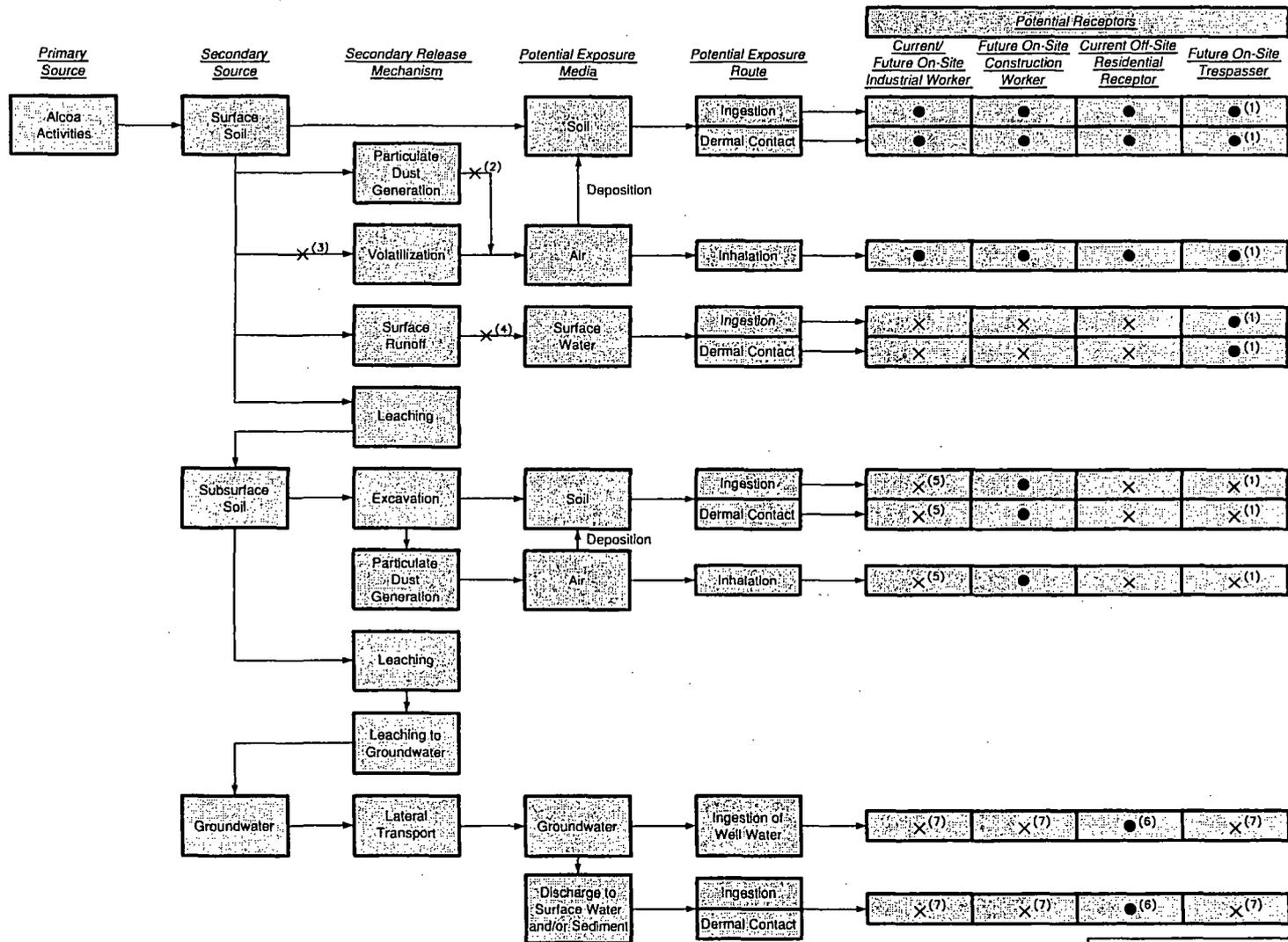
- (6) Exposure pathway applicable to off-site receptors only.
- * It is assumed that appropriate personal protective equipment will be used to control worker exposure to dust.

FORMER NORTH ALCOA SITE
EAST ST. LOUIS, IL

FIGURE 3.4.1-2
**PRELIMINARY CONCEPTUAL
SITE MODEL-
GYPSUM DIKE AREAS (IB-2)**

| | |
|-----------------|----------------------|
| PROJECT: 020209 | DATE: JULY 2003 |
| REV: | BY: BWB CHECKED: BLM |

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LEGEND

● Potentially complete

X Incomplete

(1) There was no evidence of trespassing at the site. However, during RIFS, trespassing could occur.

(2) Insignificant given the low concentrations measured at the site and the large percentage of the IB that is vegetated, but will be evaluated in RA.

(3) Site-related COPCs are not volatile.

(4) Surface water runoff is not likely a significant transport pathway since there is no evidence of erosion and the topography of the area is relatively flat.

(5) Future industrial workers would not be exposed through excavation, if it were to occur in the future.

(6) Phase I GW investigation will assess whether this pathway is actually potentially complete.

(7) Exposure pathway applicable to off-site receptors only.

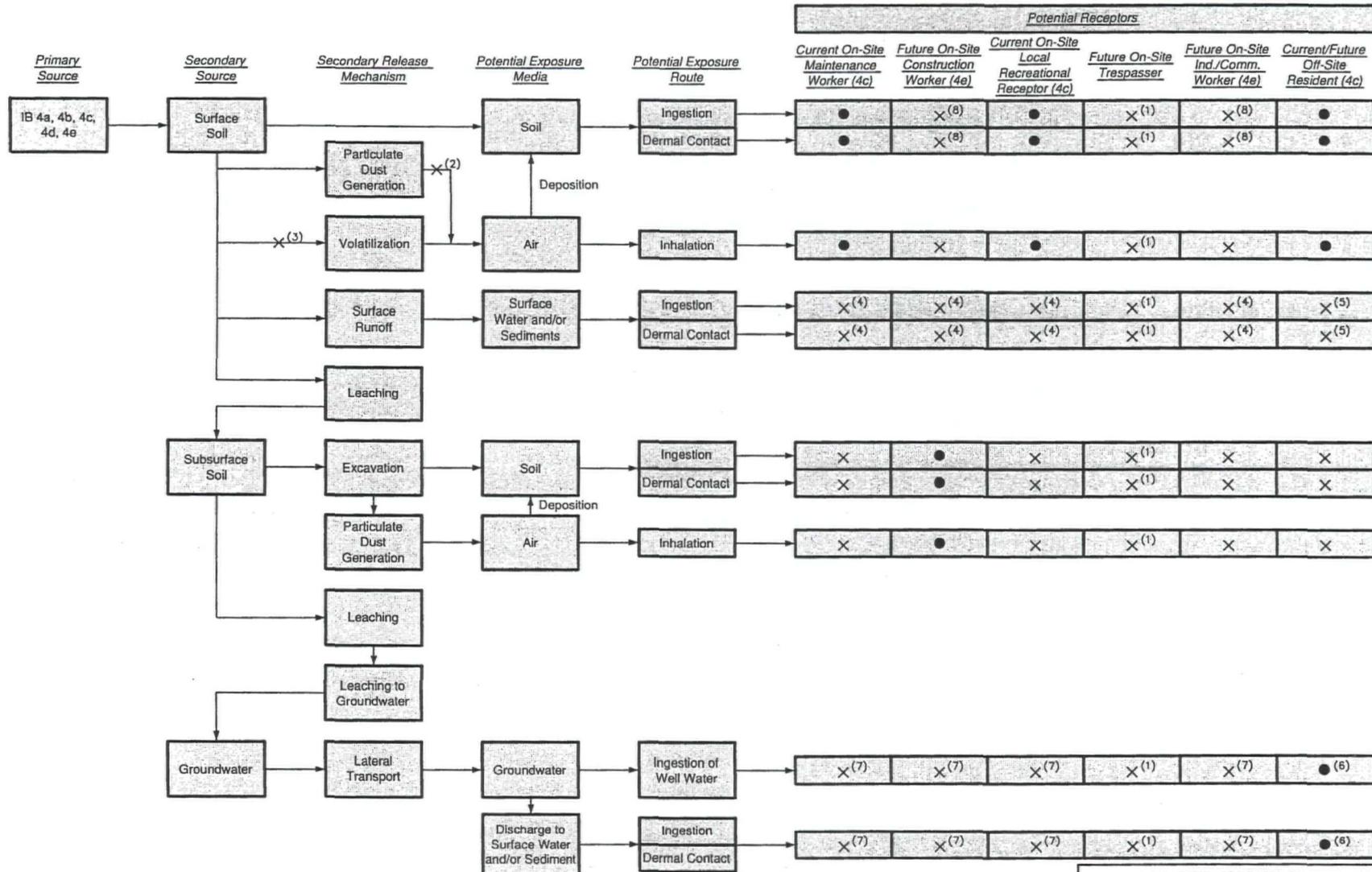
**FORMER NORTH ALCOA SITE
EAST ST. LOUIS, IL**

FIGURE 3.4.1-3

**PRELIMINARY CONCEPTUAL
SITE MODEL - OTHER
AREAS OF ALCOA ACTIVITY (IB-3)**

PROJECT: 020209 DATE: JULY 2003
REV: BY: BWB CHECKED: BLM

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LEGEND

● Potentially complete

× Incomplete

(1) There was little to no evidence of trespassing at the site.

(2) Not likely to occur due to saturated soils and/or vegetated cover.

(3) Site-related COPCs are not volatile.

(4) No standing water in IB-4c or IB-4e.

(5) Surface water runoff is not thought to discharge off-site based on visual inspection of the site.

(6) Phase I GW investigation will assess whether this pathway is actually potentially complete.

(7) Exposure pathway applicable to off-site receptors only.

(8) Area is paved, there is no surface soil.

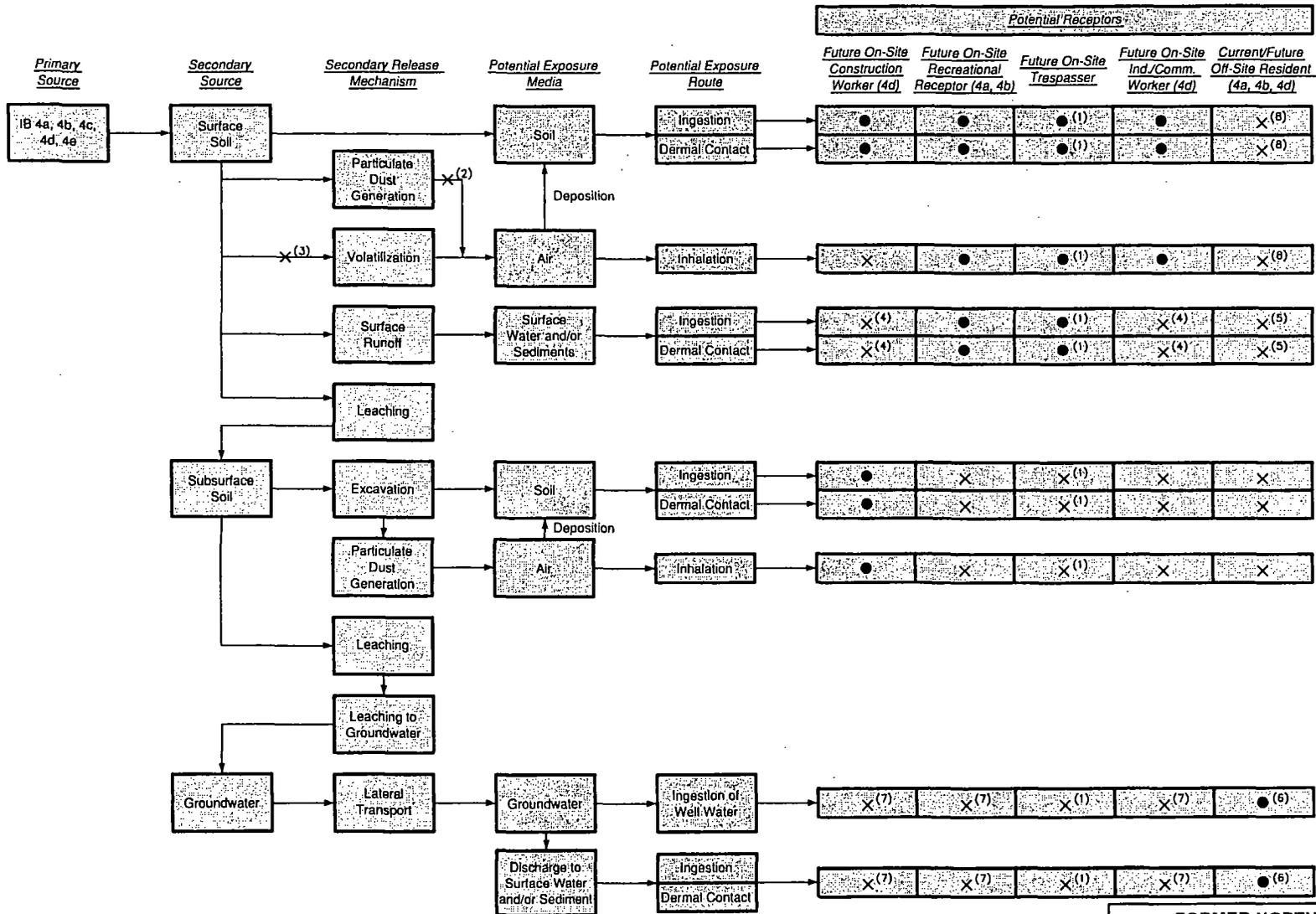
**FORMER NORTH ALCOA SITE
EAST ST. LOUIS, IL**

FIGURE 3.4.1-4

**PRELIMINARY CONCEPTUAL
SITE MODEL - AREAS OF
NO KNOWN ALCOA ACTIVITIES (IB-4C, 4E)**

PROJECT: 020209 DATE: JULY 2003
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LEGEND

- Potentially complete
- × Incomplete
- (1) There was little to no evidence of trespassing at the site. However, during RIFS, trespassing could occur.
- (2) Not likely to occur due to saturated soils and/or vegetated cover.
- (3) Site-related COPCs are not volatile.
- (4) Surface water would not remain in industrial scenario.
- (5) Surface water runoff is not thought to migrate off-site based on visual inspection of the site.
- (6) Phase I GW investigation will assess whether this pathway is actually potentially complete.
- (7) Exposure pathway applicable to off-site receptors only.
- (8) IB-4a, 4b, 4d are predominantly wet; therefore, off-site migration of particulates is not relevant.

**FORMER NORTH ALCOA SITE
EAST ST. LOUIS, IL**

**FIGURE 3.4.1-5
PRELIMINARY CONCEPTUAL
SITE MODEL - AREAS OF
NO KNOWN ALCOA ACTIVITIES (IB-4A, 4B, 4D)**

| | |
|-----------------|----------------------|
| PROJECT: 020209 | DATE: JULY 2003 |
| REV: | BY: BWB CHECKED: BLM |

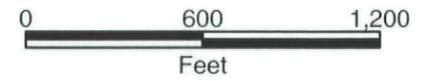
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EXPLANATION

- Site Boundary
 - Mud Lakes
 - Railroads
 - Roads
 - Parks
- HABITAT**
- Open Water
 - Open Wet Area
 - Vegetated Wet Area
 - Grassy Area
 - Industrial
 - Open
 - Recreational
 - Successional Forest

Source: MFG, 2003. Habitat digitized from USGS DOQs - NE portion of Cahokia DOQ (June 28, 2001) and NW portion of French Village DOQ (December 30, 1999).



NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 3.5.1-1
PRELIMINARY HABITAT MAP

| | |
|-------------------|------------------------|
| PROJECT: 020209.1 | DATE: JUL 15, 2003 |
| REV: 0 | BY: PJM CHECKED: MCP |

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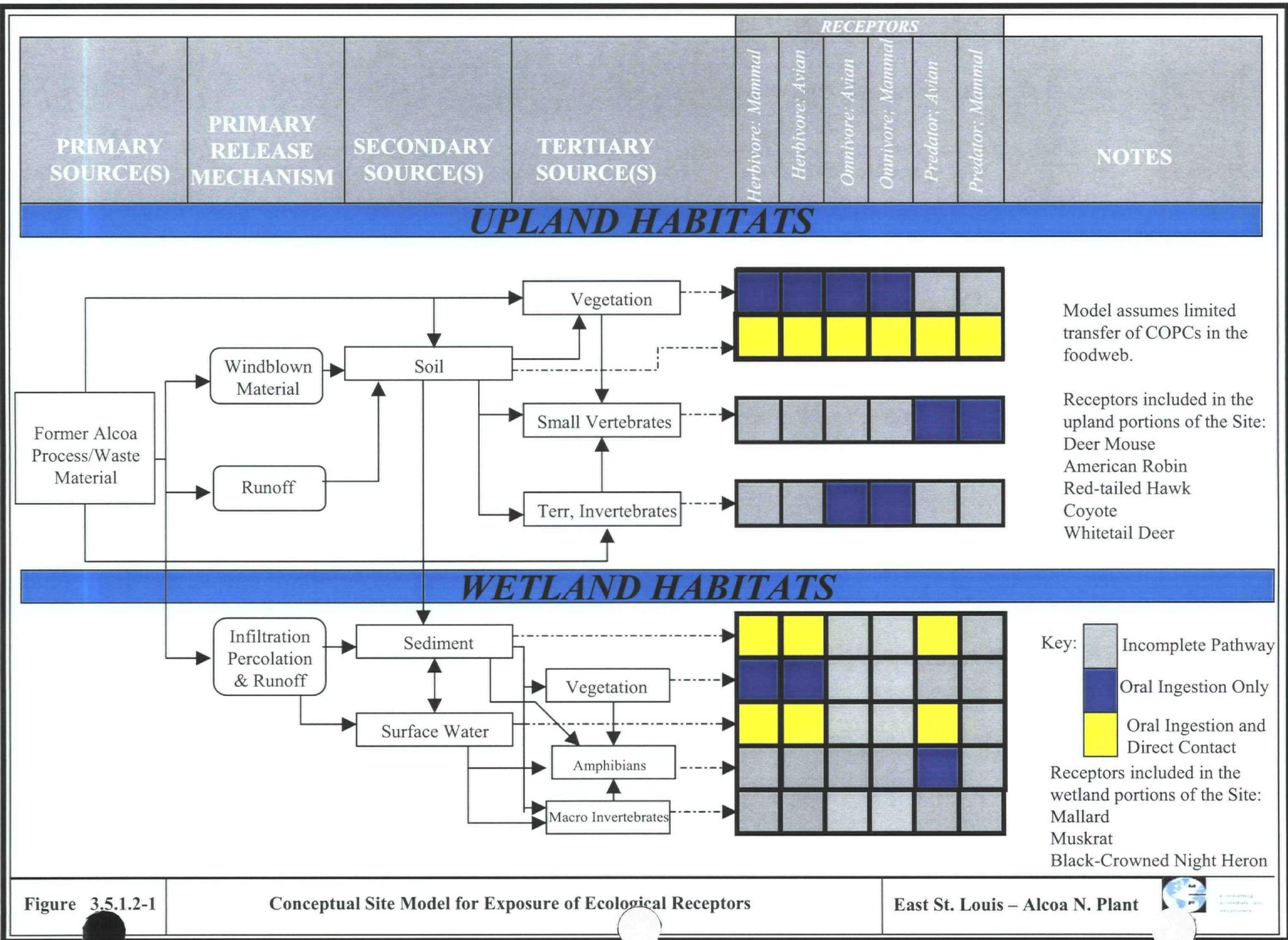


Figure 3.5.1.2-1

Conceptual Site Model for Exposure of Ecological Receptors

East St. Louis – Alcoa N. Plant





EXPLANATION

- Site Boundary
- ◆ Proposed Monitoring Wells (Final locations to be verified)



NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE 4.3.3.5-1
PROPOSED MONITORING
WELL LOCATIONS

| | |
|--------------------|------------------------|
| PROJECT: 020209.1D | DATE: JUL 15, 2003 |
| REV: 0 | BY: PJM CHECKED: BLM |

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July 24, 2003

APPENDIX A
PROJECT MANAGEMENT PLAN

APPENDIX A
PROJECT MANAGEMENT PLAN

1.0 INTRODUCTION

Consistent with U.S. EPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA-540/G-89/004), project management activities are specified in this plan to define relationships and responsibilities for the implementation, reporting and management of RIFS tasks.

Responsibilities of the agencies and Respondents, and procedures for coordination among these entities are defined in the AOC/SOW, and are not discussed here.

2.0 RIFS PROJECT ORGANIZATION AND STAFFING

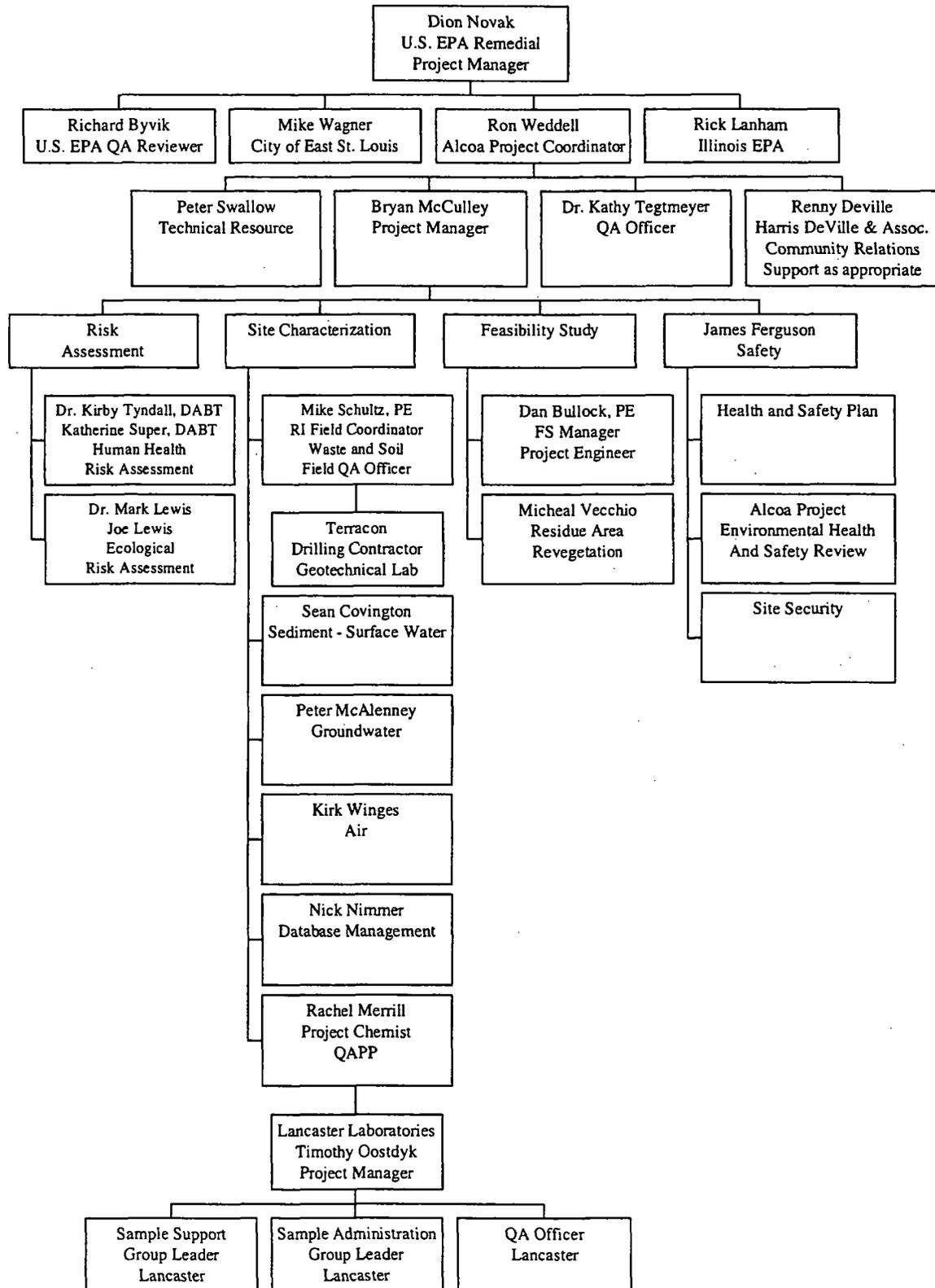
Alcoa Inc., the City of East St. Louis and contractors are conducting the response activities required under the AOC. MFG, Inc. is the lead contractor, and will utilize subcontractors as necessary to efficiently complete the project. Lancaster Laboratories will provide chemical analytical support, and Terracon will provide drilling and geotechnical laboratory support. Alcoa, Inc. is also engaging the services of Harris, DeVille & Associates, Inc. to support community relations activities as appropriate.

An overall organization chart is attached. Mr. Dion Novak is the Remedial Project Manager assigned by U.S. EPA to this project. Mr. Rick Landham is representing the State of Illinois on the project. The Alcoa Project Coordinator, Mr. Ron Weddell, is responsible for overseeing the implementation of the RIFS. Mr. Wagner has been identified as the lead contact for the City's involvement in this project. The RIFS work tasks and AOC/SOW deliverables will be managed by Mr. Bryan McCulley. Other staff as designated will serve the functions indicated on the organizational chart. Any changes in staffing will be documented in the monthly progress report to U.S. EPA.

3.0 QUALIFICATIONS

Section 26 of the AOC requires that U.S. EPA be notified of the names, titles, and qualifications of the personnel, including contractors, subcontractors, consultants and laboratories to be used in carrying out work. Within the first 30 days of the effective date of the AOC/SOW, Alcoa provided to U.S.EPA the qualifications of the personnel proposed to work on the project. Qualifications of personnel that will be added to project team, if any, will be provided to U.S. EPA in the required monthly reports for the duration of the project.

**North Alcoa Site, East St. Louis
Project Organization**



July 24, 2003

APPENDIX B
SCHEDULE

APPENDIX B

SCHEDULE

The anticipated project schedule is shown in the attached Gantt chart. The actual schedule may need to be modified based on changing field conditions, weather, modifications in scope, and other factors. Proposed significant changes to the schedule will be reviewed and approved by U.S. EPA prior to implementation. Changes in schedule will be documented in the monthly progress report.

Significant issues considered in the development of this schedule are:

- It is assumed that the RIFS Work Plan will be approved on or about July 31, 2003 as previously discussed with U.S. EPA (Site Reconnaissance will begin prior to the approval date to facilitate completion of the overall project)
- There is insufficient time to complete and approve the results of the Phase 1 ecological sampling and risk characterization, and development of a Phase 2 ecological sampling plan, prior to the likely onsite of winter conditions. Biota sampling is not feasible during those conditions. Therefore the Phase 2 ecological sampling is proposed for late spring, 2004.
- The time period for agency review of major deliverables is assumed to be one month. Actual review times will, of course, be governed by the agency.
- The time period for the SPL removal action is uncertain. Once the SPL area is initially investigated by test pits, a removal plan including a specific schedule will be prepared for agency review and approval.



July 24, 2003

APPENDIX C
HUMAN HEALTH RISK ASSESSMENT WORK PLAN

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| C.3.2-5 | Current/Future Off-Site Residential Receptors (IB-1, IB-2, IB-3, IB-4c), |
| C.3.2-6 | Future On-Site Construction Worker (IB-1, IB-2, IB-3, IB-4d, and IB-4e), |
| C.3.2-7 | Future Recreational Receptors for Soil (IB-1, IB-2), |
| C.3.2-8 | Future Recreational Receptors for Standing Water (IB-1, IB-4a, IB-4b, IB-4d), |
| C.3.2-9 | Future Recreational Receptors for Sediment (IB-1, IB-4a, IB-4b, IB-4d), |
| C.3.2-10 | Future Trespasser for Soil during RIFS (IB-1, IB-2, IB-3), |
| C.3.2-11 | Future Trespasser for Standing Water during RIFS (IB-1, IB-3b, IB-4a, IB-4b, IB-4d), and |
| C.3.2-12 | Future Trespasser for Sediment during RIFS (IB-1, IB-3b, IB-4a, IB-4b, IB-4d). |

1.0 INTRODUCTION

This Appendix of the RI Work Plan describes the general methodologies that will be followed in conducting the human health risk assessment for the East St. Louis Site. Section 3.4 of the RI Work Plan presents the Human Health Risk Assessment Scoping procedures, developing the preliminary conceptual site model (CSM), identifying chemicals of interest (COIs) for human health based on process knowledge and preliminary risk screening of existing data, and data needs identified specifically for the human health risk assessment. Section 3.7.1 includes Data Quality Objectives (DQOs) for human health risk assessment.

As discussed in Section 3.1.1, COIs are discussed in great detail in the Work Plan as they are the basis for the analytical program recommended for the RI, and preliminary risk screening of existing site data was used to identify the majority of COIs (Section 3.4.3 of the work plan). Data collected during the RI for risk assessment will be evaluated to identify chemicals of potential concern (COPCs), those chemicals that will be carried into the human health risk assessment. The objective of the human health risk assessment in the RI/FS process is to evaluate the potential impacts of COPCs in environmental media on human receptors so that risk management is the basis of remedial decisions. Specifically, the risk assessment will address the nature of COPCs present in environmental media, the pathways of human exposure, and the degree to which the releases may pose a potential for adverse health effects. It will be a baseline risk assessment; that is, it will address the potential for adverse human health effects under current and reasonably likely future conditions in the absence of remediation. Based on the baseline risk assessment and estimates of actual and potential risk, areas of the site will either be recommended for no further action (if no adverse health effects are likely), or for a presumptive remedy/focused feasibility study to determine appropriate response action objectives.

The RI/FS is the methodology that the Superfund program has established for characterizing the *nature and extent of risks posed by uncontrolled hazardous wastes sites and for developing and evaluating remedial options*. Because it is a risk-based process, it is necessary that risk assessment data needs are considered throughout the RI/FS, from Work Plan development and project scoping to designing and implementing remedial actions identified in the Feasibility Study. The risk assessment methodology that will be used is based on approaches described by the U.S. EPA in Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual, Part A (U.S. EPA, 1989) and various supplemental and associated guidance (e.g., U.S. EPA, 1991a, b, c; 1992a, b, c; 1994; 1996; 1997a, b; 1998a, b; 1999a, b; 2001a, b; 2002a, b, c; 2003a, b, c).

As is standard procedure and consistent with U.S. EPA RAGS, the baseline human health risk assessment of the East St. Louis former Alcoa site will consist of the following components:

- Data Evaluation and Identification of COPCs (Hazard Identification);
- Exposure Assessment: (including receptor characterization, exposure pathways, and chemical intakes);
- Human Toxicity Assessment; and
- Risk Characterization and Uncertainty Analysis.

The risk assessment process can be summarized as the following: COPCs are identified in potential exposure media. Exposure doses of COPCs are estimated for receptors having the potential to contact these chemicals through different potentially complete exposure routes. The estimated exposure doses are combined with the toxicity assessment information to characterize the risk of the exposure. The calculated risks are compared with acceptable levels of risk to provide the basis for making risk-based management decisions for the site.

The methods that are proposed for conducting the steps of the human health risk assessment are presented below.

2.0 DATA EVALUATION AND IDENTIFICATION OF COPCS

This section describes the general data evaluation procedures that will be used to ensure that data included in the risk assessment are of sufficient quality for quantitative risk assessment, as per U.S. EPA (1992a) guidance. This section also presents the methods that will be followed to identify COPCs for the human health risk assessment for applicable exposure media from the CSM.

Based on a preliminary human health risk screening and process knowledge that was presented in Section 3.4.2 of the RI Work Plan, COIs for human health were identified (Section 3.4.3). From the COIs (and additional modified TAL/TCL analyses), the RI dataset will be used to identify COPCs, which are compounds that get carried into the risk assessment.

2.1 Data Evaluation

A data evaluation will be performed to identify whether previously collected data are of sufficient quality to be included in the risk assessment. The majority of previously collected on-site soil data (>100 samples collected in an approximately 40 acre area; IEPA, 1997) are from the area from Missouri Avenue northeast to the RDA, identified formerly as the proposed CERCLA Redevelopment Area (IB-3b) and the Brick Works/Childs Property (IB-3a). However, the data quality of the IEPA (1997) and other existing datasets has not been documented to meet U.S. EPA QA/QC requirements. Furthermore, there have been very few soil samples collected from the remaining 180 acres of the site. Therefore, a primary focus of the RI soil data collection will be on collecting analytical data that will support risk assessment (human health as well as ecological) so that risk-based management decisions can be made.

The QAPP and Field Sampling Plan, which were developed concurrently with the RI Work Plan, have been designed to ensure that the data collected during the RI will be appropriate for quantitative risk assessment. After RI data collection, the existing data and RI data will be subject to a data evaluation following procedures recommended by U.S. EPA (1992a) to ensure that these data are of adequate quality for quantitative risk assessment and to support risk management decisions. These include consideration of the following factors: data sources, completeness of documentation, adequacy of detection limits, and "data quality indicators" as defined by the U.S. EPA (1992a) guidance. The data quality indicators include: sampling completeness, representativeness of sampling locations for relevant exposure areas, useability indicated by data validation results (taking into account considerations of laboratory precision

and accuracy), and comparability of data analyzed by different methods. Data representativeness is one of the most important criteria that must be evaluated when selecting data for use in the quantitative risk assessment. Representativeness is the extent to which data characterize potential exposure and hence risks to human health and the environment. Data selected for use in the quantitative risk assessment should be of overall high quality.

2.2 Identifying COPCS in Soil

Once the data collection, chemical analysis, and data evaluation/validation are completed, the data will be analyzed to identify COPCs for the human health risk assessment. Data collected from environmental media that are relevant for human exposure will be evaluated to identify COPCs, and these environmental media are discussed in Section 3.4.1 (describing the Conceptual Site Models) of the Work Plan. Table C.2-1 (per U.S. EPA, 1998) presents the format for dataset summary and risk screening. Separate tables will be prepared for each data set for specific risk scenarios.

U.S. EPA RAGS (1989) recommends considering the following factors in identifying COPCs for carrying through a quantitative risk assessment: 1) a "concentration-toxicity screen" to limit the number of chemicals that are included in a quantitative risk assessment while also ensuring that all chemicals that may contribute significantly to the overall risk are addressed, 2) blank contamination, 3) background concentrations (for inorganic chemicals), and 4) frequency of detection. The primary method for identifying COPCs will be screening maximum detected concentrations of constituents in soil against conservative, risk-based concentration levels. However, considerations of blank contamination, frequency of detection, and background level screening may be employed if these prove useful based on the results of RI sampling.

Concentration/Toxicity Screening

Risk-based screening criteria such as U.S. EPA Region 3 Risk-Based Concentrations (RBCs) will be used to identify COPCs for the quantitative risk assessment. (Please note that the most recent version of the RBC Tables that is available at the time of final Work Plan preparation is EPA Region 3, 2003a.) The maximum detected concentrations of detected analytes in environmental media (e.g., soil) will be compared with the risk-based screening criteria to identify those constituents that are likely to contribute the most significantly to site risk. RBCs are calculated for residential and industrial land use based on

conservative default exposure assumptions for these land uses. RBCs values that are based on potential carcinogenic endpoints incorporate a 10^{-6} target risk, which is the lower end of U.S. EPA's typical acceptable risk range. U.S. EPA Region 3 RBC guidance (2003b) recommends that when RBCs based on noncarcinogenic endpoints are used as screening criteria in a risk assessment, that these RBCs be adjusted to incorporate a conservative hazard quotient (HQ) of 0.1, so that the screening process does not eliminate COPCs, which in combination may yield an overall HQ greater than 1. In the baseline risk assessment, this adjustment of RBCs will be done in the screening to identify COPCs.

Both residential and industrial soil RBCs will be used in the screening process for COPCs. Current and future on-site land use is not, nor is expected to be, residential as the property is zoned industrial. The property is currently in disuse, and probable future use of the property would be industrial or commercial following redevelopment. Therefore, industrial RBCs will be used to identify COPCs for on-site direct contact pathways.

There is residential land use on nearby properties, so residential RBCs will be used to identify COPCs for the following scenarios: off-site deposition of soil particles and off-site migration of soil particles that may be inhaled, and for screening data at the Ball Fields given their close proximity to residential areas and current land use.

It is possible that this step of the human health risk assessment will identify areas that require no remediation because risks are shown to be acceptable based on risk-based screening.

Blank Contamination

Constituents that are qualified as blank contaminants or identified as laboratory contaminants in the samples will be eliminated as COPCs in the risk assessment. According to U.S. EPA (1989), the following chemicals are considered to be common laboratory contaminants: acetone, phthalates, 2-butanone, and methylene chloride. If upon an initial screening against U.S. EPA Region 3 RBCs, any of these constituents are preliminarily identified as COPCs, then a closer evaluation of the laboratory data will be conducted to determine whether these can be qualified as blank contaminants. That is, if the sample concentration of any of these common laboratory contaminants is less than ten times the concentration in an associated blank, the constituent will be identified as a blank contaminant (U.S. EPA, 1989; 1999) and eliminated as a COPC in the risk assessment. Per U.S. EPA (1989; 1999; 2002), constituents other than common laboratory contaminants that are detected in a blank sample may also be

eliminated as COPCs if the sample concentration is less than five times the concentration in the associated blank.

Frequency of Detection

An evaluation of frequency of detection will be conducted on analytical data. Constituents that are infrequently detected are not likely to contribute significantly to overall exposure in that medium (U.S. EPA, 1989). Therefore, in the baseline human health risk assessment, analytes that are detected in less than 5% of samples will generally not be identified as COPCs.

Background

Illinois state-wide background concentrations for inorganic constituents for metropolitan and non-metropolitan areas are available (35 Illinois Administrative Code (IAC) 740; 35 IAC 742). The East St. Louis Site fits the metropolitan area designation. Inorganic constituents whose maximum detections are greater than risk-based screening values but lower than these background levels will not be identified as COPCs for the quantitative risk assessment.

COPCs that are identified using the above-described methods will be carried through the quantitative risk assessment.

2.3 Groundwater Risk Evaluation and Identifying COPCs

As discussed in Section 3.4.1, the groundwater ingestion pathway could be complete if groundwater is being used for drinking water, providing a means of exposure to contaminants present in the groundwater (if any). Based on available information, however, there are two factors that could limit the ingestion of groundwater, and therefore the completeness of this potential exposure pathway. First, a 1997 groundwater ordinance passed in the City of East St. Louis prohibits new uses of groundwater for potable purposes (Section 3.1.7). Secondly, review of water well databases in the area indicates that most wells in the vicinity of the Site are quite old (installed in the 1930's and 1940's), and were installed for industrial and commercial purposes. The databases contain no records of potable water wells installed in the last several decades. These trends, plus the fact that the City's water supply is now provided from surface water sources (Section 2.2.4.3), indicate a historical shift away from groundwater use. Therefore,

the Phase 1 Groundwater Investigation will address two primary data quality objectives: (1) is the groundwater ingestion pathway complete (how effective is the groundwater ordinance and what is the status of water wells near the Site), and (2) do the concentrations of groundwater COIs exceed risk-based values at the Site? These results will be evaluated in the Phase 1 Risk Characterization to identify human health risk data gaps for the Phase 2 Investigation.

Migration of potentially contaminated groundwater to the Mississippi River would result in potential exposure media. Therefore, a second potential exposure pathway that may be relevant is the groundwater to surface water and/or sediment exposure to human receptors. This pathway is somewhat more complicated to conceptualize and investigate than the groundwater ingestion pathway. The conceptual model of this pathway starts with impacted groundwater flowing and discharging to a surface water source (e.g., the Mississippi River, which is approximately three miles from the site). At that point both the surface water body and the associated riverbed sediments could be impacted to some degree with contaminants that were present in groundwater. However, prior to evaluating the significance of the groundwater to surface water pathway, characterization of site groundwater is needed to determine whether the groundwater is impacted and to what extent.

Frank Holten State Park's Reservoir I is the closest surface water body to the site, but previous groundwater flow determination indicated that Reservoir I is upgradient of the site and that regional groundwater flow is toward the Mississippi River. Surface water at the nearby State Park also does not appear to be connected with the site surface water-features as there is no evidence of culverts or other structures that would allow flow between the two areas. However, a visual survey and review of a detailing topographic map will be used to confirm this lack of a surface water transport pathway.

Section 4.3.3.1 discusses the proposed methods for verifying the effectiveness of the city ordinance, and Sections 4.3.3.2 discusses the plan to assess the status of historical wells. This information will be used to evaluate the physical completeness of the groundwater ingestion pathway.

Groundwater samples will be collected from wells installed during Phase I of the RI. Groundwater COIs will be identified from the comparison of soil-to-groundwater SSLs to soil data (described in Section 4.3.3.3). Phase I COPCs for groundwater will be identified by comparing analytical groundwater data with Federal EPA Maximum Contaminant Levels (MCLs) and/or Illinois groundwater standards. If COPCs are identified in groundwater samples above these risk-based values, then groundwater modeling will be conducted to assess the potential fate and transport of the COPCs. The risk

assessment tasks for groundwater through the Phase I investigation will consist of assessing the effectiveness of the groundwater ordinance, determining whether there are Site-related COPCs present in groundwater at concentrations that exceed drinking water standards, and assessing the potential fate and transport of these COPCs. No further quantitative risk evaluation of groundwater is anticipated for the Phase I investigation than what is described here and in greater detail in Section 4.3. This information will be evaluated in the Phase I Risk Evaluation, which will identify any remaining groundwater ingestion and/or groundwater-to-surface water pathway data gaps necessary to conduct the baseline risk assessment.

3.0 EXPOSURE ASSESSMENT

The exposure assessment estimates the extent of human contact with COPCs by characterizing potentially exposed populations, identifying actual or potential routes of exposure, and estimating the extent of human exposure. The exposure assessment will identify possible exposure pathways that are appropriate for each potential receptor.

3.1 Preliminary Conceptual Site Model

As described in the main body of the RI Work Plan, the site has been divided into several units, called Investigative Blocks (IB), based on different land use (historical, current, and likely future) as well as different chemicals that may be present due to historical processes. A separate preliminary Conceptual Site Model (CSM) has been developed for each IB, as discussed in Section 3.4.1 and shown in Figures 3.4.1-1 through 3.4.1-5. The IBs are identified as: IB-1) Residue Disposal Areas; IB-2) Gypsum Dike Areas; IB-3) Other Areas of Alcoa Activity – IB-3a Brick Works/Childs Property, IB-3b Redevelopment Areas, IB-3c SPL Area; and IB-4) Areas with No Known Alcoa Activity – IB-4a North Wet Area, IB-4b Triangle Wet Area, Ball Fields, IB-4d Berm Wet Area, and IB-4e Active Commercial Area. Each preliminary CSM identifies the primary source material for potential release to the environment, migration to environmental media, potential exposure media, and human receptors. The CSMs will be used to focus the data collection activities of the RI so that analytical data would support a risk-based analysis and decision-making process for the site. Based on the preliminary CSM, human health-related data needs are identified for the RI, and these are summarized in Section 3.4.4. The preliminary CSM will also be refined as RI data are collected/analyzed, and the refined CSM will be used to develop the exposure assessment during the risk assessment.

A CSM identifies exposure pathways for potentially complete pathways at the site and describes the process or mechanism by which human receptors may reasonably come into contact with site-related constituents. Exposure pathways are dependent on current and future land use. An exposure pathway is defined by four elements (U.S. EPA, 1989):

- A source material and mechanism of constituent release to the environment;
- An environmental migration or transport medium (e.g., soil, air) for the released constituents;

- A point of potential human contact with the medium of interest (e.g., potential exposure media such as soil or air); and
- An exposure route (e.g., ingestion, dermal contact, or inhalation) at the contact point.

An exposure pathway is considered "complete" if all elements are present. If complete and significant, these pathways will be quantitatively evaluated in the baseline human health risk assessment. Information related to potentially complete exposure pathways will be used to help guide the data collection effort for the RI to ensure that data are collected to sufficiently enable risk-based decision making for the site. The preliminary CSMs for IB-1 through IB-4 (Figures 3.4.1-1 through 3.4.1-5, respectively) identify receptors and the potentially complete exposure pathways. Furthermore, Table C.3.1-1, which is consistent with U.S. EPA (1998) RAGs, summarizes the exposure media, receptors, exposure pathways, and whether they will be quantitatively evaluated in the risk assessment if COPCs are identified in the specific medium. This table as well as the CSMs are preliminary and may be modified as RI data are collected and analyzed.

For the complete exposure pathways, the degree of exposure is estimated, and the methods for quantifying exposure are presented in Section 3.2.

3.2 Quantification of Exposure

Exposure is defined as the contact rate of an organism with an environmental medium containing a chemical or physical agent. Intake is the quantification of exposure, and by convention this is normalized for body weight of the receptor and daily exposure. The resulting intake is expressed as a dose in units of mg chemical/Kg body weight per day (U.S. EPA, 1989). Exposure point concentrations (EPCs) will be calculated by methods presented in the following subsection, and EPCs for COPCs in environmental media will be incorporated to estimate potential human intake via complete exposure pathways. If COPCs for off-site migration of particulate dust are identified (i.e., site soil concentrations are greater than residential soil criteria), then air particulate modeling of emissions, dispersion, and deposition would be conducted to estimate off-site soil and air concentrations of RDA- and gypsum-associated constituents. Intake (dose) will be calculated following U.S. EPA guidance (U.S. EPA, 1989; 1997a). For noncarcinogens, an average daily dose (ADD) is calculated based on an averaging time equivalent to exposure duration. For potentially carcinogenic constituents, a lifetime average daily dose LADD is calculated based on an averaging time of a lifetime, or 70 years. The following equation will be used to estimate exposure for incidental ingestion of soil (U.S. EPA, 1989):

$$ADD_{ing} = (C \times IR \times EF \times ED) / (BW \times AT)$$

where:

| | | |
|--------------------|---|--|
| ADD _{ing} | = | average daily intake of compound (mg/Kg BW-day); |
| C | = | exposure concentration in media (mg/kg); |
| IR | = | intake rate (mg/day); |
| EF | = | exposure frequency (days/year); |
| ED | = | exposure duration (years); |
| BW | = | body weight (Kg); and |
| AT | = | averaging time (days). |

This equation is modified slightly when estimating dermal and inhalation exposure and includes pathway-specific parameters such as skin surface area, soil-to-skin adherence factor, absorption factor, etc.

U.S. EPA has published several documents that contain statistical data on the various factors used in assessing exposure. The documents include U.S. EPA (1989), the *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part B)* (U.S. EPA, 1991a), the *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors* (U.S. EPA, 1991b), the *Exposure Factors Handbook* (U.S. EPA, 1997a), and *Dermal Exposure Assessment Guidance* (U.S. EPA, 1992d; 2001a). Generally, U.S. EPA-recommended default exposure assumptions will be used in risk assessment in the absence of site-specific data.

The goal of the exposure assessment is to estimate reasonable maximum exposure (RME) as well as average exposure (central tendency or CT) for populations that may be exposed to COPCs at the facility. In keeping with U.S. EPA guidance (U.S. EPA, 1992b), the RME is to provide a reasonable, high-end (i.e., conservative) estimate of exposure that focuses on exposure in the actual population. RME is considered a high-end exposure that is still within a possible range, and this is estimated by combining upper range and average exposure assumptions (U.S. EPA, 1992b). Using the 95% upper confidence limit (UCL; i.e., a conservative estimate of the mean) as the EPC to calculate exposure is consistent with the RME approach. The CT represents average exposures, and the inclusion of this analysis indicates how conservative the RME estimates may be, compared with more common exposure levels. This is taken into account in the uncertainty analysis of the risk assessment and the risk management decision-making process.

3.2.1 EPC Calculations

Exposure-specific constituent concentrations will be incorporated into the exposure assessment using methodologies described in U.S. EPA guidance (U.S. EPA, 2002b). The general procedure that is recommended by U.S. EPA (U.S. EPA, 2002b) and that will be used to estimate a 95 percent upper confidence limit on the mean concentration (95% UCL) for site COPCs in the risk assessment is described below:

- Data Sorted By Investigative Block. Initially, data for each potential exposure media from each Investigative Block will be sorted separately.
- Distribution Testing. Appropriate statistical tests (e.g., Shapiro-Wilk test) will be conducted to determine the distribution of each data set.
- Estimation of Concentration Term. The 95% UCL of the mean will be calculated and used as the concentration term assuming the appropriate distribution (U.S. EPA, 2002b). When calculating the 95% UCL for the data set, one half the instrument detection limit will be used as the surrogate value in the calculation if the COPC concentration was not measured at or above the instrument detection limit in a particular sample.

For direct exposure pathways (e.g., incidental ingestion of soil and dermal contact with soil), the 95% UCL concentration in soil will be used to assess potential intake for on-site receptors. According to U.S. EPA guidance (U.S. EPA, 2002b), if the data set fits a normal distribution, then the Student's t method will be used to calculate the 95% UCL. However, if the data fits a lognormal distribution, the lognormal theory based formulas for computing the Minimum Variance Unbiased Estimate (MVUE) of the population mean and the standard deviation will be used to calculate a 95% UCL of the mean (per U.S. EPA, 2002b). Finally, if the data set is neither normally or lognormally distributed, an appropriate distribution-free method per U. S. EPA (2002b) will be used to calculate a 95% UCL of the mean. Distribution testing and statistical calculations for estimating the concentration terms used to quantify exposure will be provided, in detail, in the risk assessment.

Table C.3.2-1, which is consistent with U.S. EPA (1998), is provided to show the format that will be used for summarizing the EPCs and the basis for their calculation.

For the generation of fugitive dust released from soil pathway, transport modeling will be conducted using an appropriate transport model to estimate the maximum exposure point concentration for air. This value will be used as the off-site residential EPC in the risk assessment.

3.2.2 Air Modeling

A potentially complete pathway for exposure of local residents to COIs from on-site soils is through airborne dust generated from these soils and transport off-site via wind. The two primary materials, the residue from the previous alumina production processes (IB-1), and the gypsum used to build berms (IB-2), both contain trace quantities of COIs. Accordingly, dust produced on the site may also contain these COIs. If carried off-site by the action of the wind, this dust represents a pathway for transport of COIs to the community.

The risk assessment will evaluate the impact of this airborne pathway by scientifically characterizing each of the steps in the process for both the current baseline condition and under a future mining scenario. They are:

- formation of the dust,
- transport and dispersion of the dust by the wind, and
- intake by the receptors.

Dust Formation

The formation of dust will be characterized through an emission inventory. Emissions can generally be divided into two categories: natural sources of emission and man-made sources of emission. By far the most important are the man-made sources of emission. These include the movement of personnel and materials by heavy-equipment on the site. Vehicles, front-end loaders, dozers, scrapers and any equipment to crush or otherwise process materials removed from the site are examples of sources of emission. Natural sources of emission include wind erosion and other minor sources. It should be noted that wind erosion could be aggravated by human activities on the site, since the removal of vegetation and surface layers can expose surfaces more susceptible to wind erosion.

Emission rates from these sources will be estimated from published emission factors by the EPA and others. In general these emission factors can be tailored to the site by adjustment parameters such as on-site silt content and moisture content. The emission factors are combined with activity factors such as the quantity of material to be removed, to generate an estimate of the emission rate of dust. Finally, measurements of chemical concentrations of COIs in the on-site materials will allow emission rates to be developed for individual COIs.

Transport and Dispersion

The EPA and others have developed computer models that simulate atmospheric behavior and can be used to characterize the transport and dispersion to off-site areas of any dust produced on the site. The model to use for the current analysis will be selected as part of the project. Based on the information available at present, it is expected that the Industrial Source Complex Short Term Version 3 (ISCST3) model will be used in the current analysis. The ISCST3 model is presently recommended by EPA for analysis of fugitive dust impacts and is well-suited to the current project. However, other models such as CALPUFF and AERMOD will also be considered and may potentially be used if they are judged in the initial evaluation to be more appropriate for the application. The selected model will combine the emission information from above with meteorological data representative of the area to calculate the transport and dispersion of dust particles in the study area. Meteorological data will be taken from a nearby airport. Lambert Airport in St. Louis has a long record of high quality data, and is expected to be used in the current analysis. Consideration will be given to other meteorological data, including the nearby Parks Airport to the south of the site, but it is expected that the higher quality and more complete data at Lambert Airport may be the data of choice.

Intake at the Receptor

There are two primary mechanisms for impact of airborne COIs to nearby residents. First, they may be directly inhaled. In most studies, however, intake by ingestion is more important than inhalation. Ingestion generally involves deposition of the airborne dust on surfaces in the community. So the exposure assessment must define not only the airborne concentrations of dust in the community areas, but also the deposition rates of dust particles in the community areas. All of the air quality models being considered for the current analysis will have the capability to compute both the airborne concentrations of dust from the site as well as the deposition rate of dust from the site.

In summary, the exposure assessment will use published emission factors to estimate the rates of emission from natural and man-made activities on the site. Air quality models will use these emission rates and representative meteorological data to estimate the ambient concentrations and deposition rates of COIs contained in the dust in the surrounding community.

3.2.3 Receptor-Specific Exposure Quantification

This section describes the exposure assumptions and specific exposure factors that will be used in the baseline human health risk assessment if, after RI data collection and risk screening, COPCs are identified. As noted previously, Table C.3.1-1 summarizes the different receptors that are proposed to be assessed for each IB, and the exposure pathways that will be quantitatively evaluated in the risk assessment. The following receptors and exposure pathways may be quantitatively evaluated in the baseline risk assessment if COIs are identified in these media:

Current/Future On-Site Maintenance Worker at the Ball Fields (IB-4c)

This receptor would be evaluated for:

- Incidental ingestion of COPCs in surface soil;
- Dermal contact with COPCs in surface soil; and
- Inhalation of particulates generated by wind erosion.

Direct contact exposure to soil will be evaluated since these areas may be routinely mowed or subject to other maintenance-type activities.

Current/Future On-Site Local Recreation Receptor (Youth) at the Ball Fields (IB-4c)

This receptor would be evaluated for:

- Incidental ingestion of COPCs in surface soil;
- Dermal contact with COPCs in surface soil; and
- Inhalation of particulates generated by wind erosion.

Direct contact exposure to soil will be evaluated since the Ball Fields are in active use by the community.

Current/Future On-Site Industrial/Commercial Worker (IB-3a, IB-4e); Future On-Site Industrial/Commercial Worker (IB-1, IB-2, IB-3)

This receptor is assumed to have the potential to contact surface soil during the performance of his or her job. Contacting soil is more likely with an industrial than a commercial worker, but also may be infrequent for an industrial worker whose position is indoors. However, for the purposes of providing a conservative, baseline assessment, default industrial worker exposure factors will be applied. The following exposure pathways will be evaluated for this receptor assuming future industrial redevelopment and no remediation of the site:

- Incidental ingestion of COPCs in surface soil;
- Dermal contact with COPCs in surface soil; and
- Inhalation of particulates generated by wind erosion.

Future On-Site Construction Worker (IB-1, IB-2, IB-3, IB-4d, IB-4e)

This receptor is assumed to be engaged in excavation activities, which would provide the potential for contacting COPCs in subsurface as well as surface soils. The following exposure pathways would be potentially complete and therefore quantitatively evaluated for this receptor:

- Incidental ingestion of COPCs in surface¹ and/or subsurface soil;
- Dermal contact with COPCs in surface¹ and/or subsurface soil; and
- Inhalation of particulates generated from on-site surface¹ and/or subsurface soil through excavation activities.

The construction worker scenario will be evaluated on a subchronic basis (i.e., less than seven years per U.S. EPA, 1989) since it is assumed that construction activities would be short-term.

Future On-Site Construction Worker at the Residue Disposal Areas (IB-1) – Presumptive Remedy Development

A presumptive remedy that is being considered for the RDAs is regrading to improve surface water drainage and vegetating. Therefore, a “construction worker” receptor is evaluated for this potential

¹ Surface soils will not be considered in IB-4e, the Active Commercial Area, as it is paved.

future scenario. This receptor is assumed to be engaged in significant regrading activities, which would provide the potential for contacting COPCs in surface and subsurface soils (e.g., from 0-10 ft bgs). The following exposure pathways would be potentially complete and therefore quantitatively evaluated for this receptor:

- Incidental ingestion of COPCs in surface/subsurface soil;
- Dermal contact with COPCs in surface/subsurface soil; and
- Inhalation of particulates generated from on-site surface soil through soil moving activities.

Again, this construction worker scenario is assumed to be of relatively short-term duration, and therefore the risk assessment considers this subchronic exposure (i.e., less than seven years per U.S. EPA, 1989).

Current/Future Off-Site Resident – Particulate Migration and Deposition Potential (IB-1, IB-2, IB-3, IB-4c, IB-4e)

This receptor is considered for potential exposure to on-site soil particulates that may migrate to air and be deposited in off-site soil. This receptor will be quantitatively evaluated for current/future baseline conditions only if COPCs are identified for potentially dispersible on-site soils.

The off-site residential scenario would be evaluated for a child and adult receptor. As is a common, conservative convention in human health risk assessment, noncarcinogenic exposures will be considered first for a child age 0-6 years, since this receptor has a combination of smaller body weight and potentially higher intake by some pathways relative to the adult receptor. Exposure to potentially carcinogenic COPCs will be evaluated over an exposure duration that overlaps childhood and adulthood. Also, by conservative convention in risk assessment, the intakes, exposure durations, and body weight will be age-averaged assuming a portion of exposure as a young child, as an adolescent, and the rest as an adult. Therefore, for the RME evaluation, 30 years of the upperbound exposure duration for residential exposure is portioned as 6 years of exposure as a 0-6 year-old, 8 years as an adolescent, and 14 years as an adult. For the CT evaluation, this exposure is proportioned down to the average residential exposure duration (9 years; U.S. EPA, 1997a).

Future Gypsum Mining Scenario (IB-2)

A gypsum-mining scenario will be evaluated in the risk assessment as well to assess the potential off-site risk associated with this activity. Gypsum mining would generate a higher degree of particulate emissions potential than wind-erosion of surface soil and, therefore, a future off-site residential scenario for exposure to particulates generated from mining activities will be quantitatively evaluated in the risk assessment. The mining worker is not proposed for quantitative risk evaluation because it is assumed that OSHA Health and Safety protocols (such as, personal protective equipment or other engineering controls) would be employed to reduce exposure for this receptor. Therefore, exposure via the inhalation of particulate dust, and incidental ingestion of and dermal contact with the gypsum dust will not be evaluated for the worker engaged in mining activities.

Future Recreational Receptor (IB-1, IB-2, IB-4)

Future recreational development is possible for much of the former Alcoa site. This includes IB-1, IB-2, and IB-4 except for the active commercial area (IB-4e). IB-3 is marked for possible industrial redevelopment, so is not included in the areas for potential recreational redevelopment.

The recreational receptors would be evaluated for potential contact with COPCs in surface soil in all IBs except for those that are predominately wet (e.g., IB-4a, IB-4b). The following exposure pathways will be evaluated for this receptor:

- Incidental ingestion of COPCs in surface soil;
- Dermal contact with COPCs in surface soil; and
- Inhalation of particulates generated by wind erosion.

Recreational receptors also have the potential for contacting standing water and sediment in wet portions of the IBs that could be redeveloped for this use. The following exposure pathways may be complete with these media:

- Inadvertent Dermal contact with standing water;
- Incidental ingestion of COPCs in sediment; and
- Dermal contact with COPCs in sediment.

Incidental ingestion of standing water is not likely as these are not deep enough for significant contact such as swimming and, in many areas, having an unappealing appearance for contacting at all. Furthermore, including IB-1 standing water areas in an evaluation of future recreational receptors is very conservative because it is anticipated that any site remedy would include eliminating standing water in the RDAs.

Future Trespasser Receptor

Under current conditions, there is no evidence that trespassing is occurring. However, during the RIFS, the access roads that will be built to accommodate investigation equipment may attract trespassers. Therefore, a trespassing scenario will be evaluated for nearly all areas of the Site during the RIFS (approximately 3 years duration). A trespasser would have the opportunity to contact COPCs in surface soil in the following IBs: IB-1, IB-2, and IB-3. A number of the IB-4 areas do not have surface soil because they are wet areas (however, standing water and sediment are potential exposure media for this receptor, which is discussed below). The exposure pathways that may be complete for this receptor with surface soil are:

- Incidental ingestion of COPCs in surface soil;
- Dermal contact with COPCs in surface soil; and
- Inhalation of particulates generated by wind erosion.

This receptor could also contact standing water and sediment. The same exposure pathways and rationale would hold for the trespasser's potential to contact these media.

- Inadvertent Dermal contact with standing water;
- Incidental ingestion of COPCs in sediment; and
- Dermal contact with COPCs in sediment.

Summary of Receptor Exposure Factors

The following lists Appendix C tables that summarize the proposed exposure assumptions for RME and CT evaluations for specific receptors and exposure media.

Table C.3.2-2 Current/Future On-Site Maintenance Worker (IB-4c),

| | |
|----------------|---|
| Table C.3.2-3 | Current/Future On-Site Local Recreational Receptor (IB-4c), |
| Table C.3.2-4 | Current/Future On-Site Industrial/Commercial Worker (IB-1, IB-2, IB-3 IB-4d and IB-4-e), |
| Table C.3.2-5 | Current/Future Off-Site Residential Receptors (IB-1, IB-2, IB-3, IB-4c), |
| Table C.3.2-6 | Future On-Site Construction Worker (IB-1, IB-2, IB-3, IB-4d, and IB- 4e), |
| Table C.3.2-7 | Future Recreational Receptors for Soil (IB-1, IB-2), |
| Table C.3.2-8 | Future Recreational Receptors for Standing Water (IB-1, IB-4a, IB-4b, IB-4d), |
| Table C.3.2-9 | Future Recreational Receptors for Sediment (IB-1, IB-4a, IB-4b, IB-4d), |
| Table C.3.2-10 | Future Trespasser for Soil during RIFS (IB-1, IB-2, IB-3), |
| Table C.3.2-11 | Future Trespasser for Standing Water during RIFS (IB-1, IB-3b, IB-4a, IB-4b, IB-4d), and |
| Table C.3.2-12 | Future Trespasser for Sediment during RIFS (IB-1, IB-3b, IB-4a, IB-4b, IB-4d). |

Exposure dose algorithms are also presented in Tables C.3.2-2 to C.3.2-12 for each exposure pathway, as recommended by U.S. EPA (1998) and generally follow the equation shown in Section 3.2. It should be noted that the exposure assumptions for the off-site residential receptor do not vary for the different emissions generating scenarios that may be evaluated; however, the EPCs estimated for the emissions scenarios may differ, resulting in varied dose estimates for the off-site receptors.

4.0 TOXICITY ASSESSMENT

The toxicity assessment provides a description of the relationship between a dose of a chemical and the anticipated incidence of an adverse health effect (Preuss and Ehrlich, 1987). The purpose of toxicity assessment is to provide a quantitative estimate of the inherent toxicity of COPCs to incorporate into the risk characterization. Toxicity values are derived from the quantitative dose response association and are correlated with the quantitative exposure assessment in the risk characterization.

For risk assessment purposes, toxic constituent effects are separated into two categories of toxicity: carcinogenic effects and noncarcinogenic effects. This division relates to the currently-held U.S. EPA policy position that the mechanisms of action for these endpoints differ. Generally, the U.S. EPA has required that potentially carcinogenic chemicals be treated as if minimum threshold doses do not exist (U.S. EPA, 1986), whereas noncarcinogenic effects are recognized as threshold phenomena.

In this site-specific risk assessment, lead is a possible COPC based on evaluation of the previous investigation data. Lead is uniquely evaluated for toxicity in U.S. EPA human health risk assessment, and this is described below.

4.1 Carcinogenic Effects

Potential carcinogenic effects resulting from human exposure to constituents are estimated quantitatively using cancer slope factors (CSFs), which represent the theoretical increased risk per milligram of constituent intake/kilogram body weight/day (mg/Kg-day)⁻¹ or unit risks, which are the theoretical increased risk per exposure concentration. CSFs or unit risks are typically derived for "known or probable" human carcinogens. CSFs or unit risks are used to estimate a theoretical upper-bound lifetime probability of an individual developing cancer as a result of exposure to a particular lifetime daily dose of a potential carcinogen. Constituents that are believed to be carcinogenic may also have non-cancer effects. Potential health risks for these constituents are evaluated for both cancer and other types of effects as described below.

4.2 Non-carcinogenic Effects

Conversely, it is widely accepted that noncarcinogenic biological effects of chemical substances occur only after a threshold dose is achieved (Klaassen, 1996). This threshold concept of noncarcinogenic effects assumes that a range of exposures up to some defined threshold can be tolerated without appreciable risk of harm. Adverse effects may be minimized at concentrations below the threshold by pharmacokinetic processes, such as decreased absorption, distribution to non-target organs, metabolism to less toxic chemical forms, and excretion (Klaassen, 1996). Reference dose (RfD) values and reference concentrations (RfCs) are developed by the U.S. EPA RfD Work Group on the basis of a wide array of noncarcinogenic health effects. The RfD and RfC are estimates of the daily maximum level of exposure to human populations (including sensitive subpopulations) that are likely to be without an appreciable risk of deleterious effects during a lifetime (U.S. EPA, 1989). RfDs are expressed in units of daily dose (mg/Kg-day) while RfCs are expressed as an air concentration (mg/m³). Both incorporate uncertainty factors to account for limitations in the quality or quantity of available data.

4.3 Sources for Toxicity Criteria

There are a variety of toxicity databases that regulatory agencies rely on for the purposes of quantifying the toxicity of chemicals in the environment. Per U.S. EPA (1989), the primary source for toxicity information in the risk assessment will be U.S. EPA's Integrated Risk Information System (IRIS; U.S. EPA, 2003a). If RfDs for non-carcinogens or CSFs for possible carcinogens are not available in IRIS, the next source to be consulted will be the Health Effects Assessment Summary Tables (HEAST; U.S. EPA, 1997b). If appropriate criteria are not available in either IRIS or HEAST, then U.S. EPA Region 5 will be consulted to aid in identifying appropriate provisional toxicity criteria.

4.4 Lead

Under current U.S. EPA policy, there is considered to be no exposure dose to lead that is without some level of risk for adverse health effects. Therefore, U.S. EPA has not derived a RfD or RfC for lead. The most sensitive receptors for lead exposure are very young children, and U.S. EPA has developed an exposure model for young children, the Integrated Exposure Uptake Biokinetic (IEUBK) Model (U.S. EPA, 2003b), and it is U.S. EPA policy that the IEUBK Model be used to assess lead risks in for

residential scenarios (U.S. EPA, 1994; 1998b). For industrial worker receptors, a separate lead toxicity/exposure model (U.S. EPA, 2003c), as discussed below, would be applied in the risk assessment for on-site exposures if lead is identified as a COPC for industrial exposure.

4.4.1 Lead Toxicity and Exposure Assessment for Young Children

Young children are considered especially sensitive to lead as the developing central nervous system is especially vulnerable to lead toxicity. Furthermore, young children may engage in behaviors (such as eating soil or paint chips) that potentially predispose them to higher exposures. The uptake of lead from ingestion tends to be higher for young children than older receptors. Rather than describe an acceptable dose level for intake of lead, U.S. EPA and other health organizations (e.g., Centers for Disease Control - CDC) evaluate acceptable lead exposure based on blood lead levels. U.S. EPA has developed the IEUBK Model (U.S. EPA, 2002, 2003b) that predicts blood lead level for infants and young children (0-7 years of age) based on cumulative exposures from environmental media such as soil, air, and lead paint sources as well as from food and drink sources. This model has been "validated" for children, only, and is not recommended for evaluating adult exposures to lead. It should be noted that lead paint exposure likely has the greatest impact on blood lead levels and this factor can greatly obscure the contribution from other sources in highly urbanized areas such as East St. Louis.

If following RI data collection and risk-screening of dispersible soil, lead is identified as a COPC for off-site residential exposure, then the IEUBK model will be used to evaluate risk to the child off-site resident. It is anticipated that there will be no quantitative risk analysis for off-site adult residential receptors to lead since there is no validated residential lead model for adults. Therefore, the adult exposure will be qualitatively compared with the child.

The default inputs for food, water, and paint would be incorporated into the IEUBK model. A more detailed discussion of the assumptions, default inputs, and mechanics of the IEUBK model will be provided in the human health risk assessment if site-associated lead is identified as a COPC for off-site residential exposure.

4.4.2 Lead Toxicity and Assessment Using the Adult Lead Exposure Model

The U.S. EPA Technical Review Workgroup (TRW) for lead recommends a model it developed for evaluating “non-residential adult” risk to lead in soil. The TRW lead model (U.S. EPA, 2003c) addresses the most sensitive receptor under a non-residential adult scenario, the developing fetus of a pregnant woman worker exposed to lead in soil. The TRW lead model correlates soil lead intake by women of childbearing age to blood lead concentrations using simplified biokinetic assumptions (a biokinetic slope factor). The blood lead level in the population of adult women is then related to an estimate of the 95th percentile fetal blood lead level ($PbB_{fetal, 0.95}$) with a proportionality constant.

If lead is identified as a COPC through RI data collection and risk screening, then the TRW lead model will be used to conservatively evaluate the potential risk to relevant on-site worker receptors. A more detailed discussion of the Model and its assumptions will be presented in the risk assessment if site-associated lead is identified as a COPC.

5.0 RISK CHARACTERIZATION AND UNCERTAINTY ANALYSIS

Risk characterization is the integration of the exposure and toxicity information to make quantitative estimates and/or qualitative statements regarding potential risk to human health. This section describes the risk characterization process for possibly carcinogenic COPCs, for noncarcinogenic COPCs, and for lead. There are elements of uncertainty in each step of the risk assessment, and it is important to the risk management decision-making process that the sources of uncertainty are discussed.

5.1 Risk Characterization

The methods for conducting risk characterization for potential carcinogens, noncarcinogens and lead are discussed below.

5.1.1 Potential Carcinogenic Risks

Potential carcinogenic effects are characterized in terms of the excess probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. For chemicals that exhibit carcinogenic effects, U.S. EPA has developed a model that is based on the theory that one or more molecular events as a result of exposure to a potential carcinogenic compound can evoke changes in a single cell or a small number of cells that can lead to tumor formation. This non-threshold theory of carcinogenesis suggests that any level of exposure to a carcinogen can result in some finite possibility of generating the disease. It should be noted that this is a very conservative approach, and U.S. EPA's more recent Cancer Assessment Guidelines (1996, 1999b) recognize that there are "threshold" carcinogens, as well. To characterize the potential for carcinogenic effects, an LADD is combined with a CSF to calculate a probability that an individual would develop cancer over a lifetime of exposure to a specific COPC, with the following equation:

$$Risk = LADD \times CSF_{oral}$$

Theoretical excess lifetime cancer risks are evaluated based on an acceptable cancer risk range of 1×10^{-6} to 1×10^{-4} . U.S. EPA (1991c) indicates that carcinogenic effects at a site should first be evaluated based on the 1×10^{-4} cancer risk level, but depending on site-specific conditions, a range of $1 \times$

10^{-6} to 1×10^{-4} may be used. Typically, cancer risks less than 1×10^{-6} are considered *de minimis* while cancer risks less than 1×10^{-4} are considered acceptable.

5.1.2 Noncarcinogenic Effects

For noncarcinogenic compounds, a potential hazard is expressed as a hazard quotient (HQ), which is the ratio of an ADD for a site-specific receptor to an acceptable or RfD for that chemical. The HQ is calculated as follows:

$$HQ = \frac{ADD}{RfD}$$

An RfD is developed with the assumption that the degree of toxicity of noncarcinogenic compounds is based on the ability of organisms to repair and detoxify after exposure to a compound. The repair and detoxification mechanisms must be exceeded by some critical concentration (threshold) before the health effect is manifested. This threshold view holds that a range of exposures from just above zero to some finite value (i.e., the RfD) can be tolerated by an individual without an appreciable risk of adverse effects.

HQs are summed for all chemical intakes to yield a hazard index (HI) for each exposure pathway. An HI equal to or less than 1 indicates that no adverse noncarcinogenic health effects are expected to occur from cumulative exposure to multiple chemicals and exposure pathways. An HI greater than 1, however, does not provide a prediction of the severity or probability of the effects, but rather provides an indication that such effects may occur, especially in sensitive subpopulations. An HI above 1 indicates the need for further evaluation. For example, effects of different chemicals are not necessarily additive (although the HI approach assumes additivity), nor do all chemicals affect the same target organ. Thus, U.S. EPA recommends that if an HI exceeds 1, further evaluation should occur to categorize hazards based on chemical-specific and route-specific toxicity (i.e., which chemicals act on the same target organ, by which route of entry) (U.S. EPA, 1989).

5.1.3 Lead

The IEUBK Model incorporates an estimate of population variability (population standard deviation), and uses this to project a distribution of blood lead concentrations in the exposed population. If

lead is identified as a COPC in dispersible fractions of on-site soil for off-site migration of particulates, then off-site air and soil lead concentrations will be modeled, and these potential exposure levels incorporated into the IEUBK model to estimate a population blood lead distribution. Then the estimated population blood lead distribution will be compared with acceptable targets, per U.S. EPA (2003b).

For non-residential adult receptors (i.e., worker receptors), the TRW lead model (U.S. EPA, 2003c) will be used to estimate a 95th percentile fetal blood lead level. $PbB_{fetal, 0.95}$ are estimated from maternal blood lead level estimates, and the latter are modeled by incorporating soil lead concentrations and assumptions of maternal intake through incidental ingestion of soil. The acceptable goal is that the $PbB_{fetal, 0.95}$ is less than 10 ug/dl (that is, consistent with CDC health goals, that less than 5% of the child population exceeds a blood lead level of 10 ug/dl).

5.2 Uncertainty Analysis

Uncertainties are inherent in every aspect of a quantitative risk assessment. The inclusion of site-specific factors can decrease uncertainty, although significant uncertainty persists in even the most site-specific and accurate risk assessments. Worst-case assumptions and default values, which conform to the U.S. EPA guidance, add a conservatism to human health risk assessments. This conservatism is intentionally included in order to bias the assessment toward protection of human health.

A careful and comprehensive analysis of the critical areas of uncertainty in a risk assessment is an important part of the risk assessment process. U.S. EPA (1989) guidance stresses the importance of providing a complete analysis of uncertainties so that risk management decisions take these uncertainties into account when evaluating risk assessment conclusions. The uncertainty analysis provides a context for better understanding the assessment conclusions by identifying the uncertainties that have most significantly affected the assessment results. Therefore, sources of uncertainty in the identification of COPCs, exposure assessment, and toxicity assessment sections of the risk assessment report will be identified and qualitatively evaluated in the baseline human health risk assessment.

6.0 REFERENCES

- Klaassen, C.D., H.O. Amdur, and J.E. Doull, 1986. *Cassarett and Doull's Toxicology – The Basic Science of Poisons, Third Edition*. MacMillan Publishing Company: New York, NY.
- Preuss, P.W. and A.M. Ehrlich, 1987. *The Environmental Protection Agency's Risk Assessment Guidelines*. *J. Air Pollution Control Assoc.* 37:784-791.
- U.S. EPA, 1986. *Guidelines for Carcinogenic Risk Assessment*. Federal Register. 51:33992.
- , 1988a. *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analysis (Functional Guidelines for Organics)*. Office of Emergency and Remedial Response.
- , 1988b. *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis*. Office of Emergency and Remedial Response.
- , 1989. *Risk Assessment Guidance for Superfund, Human Health Evaluation Manual Part A*. Office of Solid Waste and Emergency Response. 9285.701A. December.
- , 1991a. *Risk Assessment Guidance for Superfund Volume I – Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)*. Publication 9285.7-01B. December.
- , 1991b. *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors*. OSWER Directive 9285.6-03. March 25.
- , 1991c. *The Role of the Baseline Risk Assessment In Remedy Selection*. Office of Emergency and Remedial Response. Washington, DC. OSWER Directive 9355.0-30. April.
- , 1992a. *Guidance for Data Usability in Risk Assessment (Part A). Final*. Office of Emergency Planning and Remedial Response. 9285.7-09A. April.
- , 1992b. *Guidelines for Exposure Assessment*. *Fed. Reg.* 57(104). May 29.
- , 1992c. *Dermal Exposure Assessment: Principles and Applications*. EPA 600/8-91/011B. January.
- , 1994. *OSWER Directive: Revised Interim Soil Lead (Pb) Guidance for CERCLA Sites and RCRA Corrective Action Facilities [OSWER Dir #9355.4-12]* (August 1994).
- , 1996. *Proposed Guidelines for Carcinogenic Risk Assessment*. Office of Research and Development. EPA/600/P-92/003C. April.
- , 1997a. *Exposure Factors Handbook*. Office of Research and Development. EPA/600/P-95/002F. August.
- , 1997b. *Health Effects Assessment Summary Table*. Solid Waste and Emergency Response. EPA-540-R-97-036. July.

- , 1998a. *RAGS D Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part D - Standardized Planning, Reporting and Review of Superfund Risk Assessments)*. U.S. EPA/540-R-97-033. January.
- , 1998b. *OSWER Directive: Clarification to the 1994 Revised Interim Soil Lead (Pb) Guidance for CERCLA Sites and RCRA Corrective Action Facilities* [OSWER Dir #9200.4-27P] (August 1998).
- , 1999a. U.S. EPA Contract Laboratory Program Functional Guidelines for Organic Data Review. Office of Emergency and Remedial Response. OSWER 9240.1-05A-P, PB99-963506, EPA540/R-99/008. October.
- , 1999b. Guidelines for Carcinogen Risk Assessment. Review Draft. NCEA F-0644. July.
- , 2001a. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)*. Interim Office of Emergency and Remedial Response. EPA/540/R/99/005. OSWER 9285.7-02EP. PB99-963312. September.
- , 2001b. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*. . Office of Research and Development. OSWER 9355.4-24. March.
- , 2002a. *U.S. EPA Contract Laboratory Program Function Guidelines for Inorganic Data Review - Final*. Office of Emergency and Remedial Response. OSWER 9240.1-35 EPA 540-R-01-008. July 2002
- , 2002b. *Calculating Upper Confidence Limits for Exposure Point Concentrations at hazardous Waste Sites*. Office of Emergency and Remedial Response U.S. Environmental Protection Agency Washington, D.C. 20460. OSWER 9285.6-10 December 2002.
- , 2002c. *User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) Windows® version* [EPA 9285.7-42] (16-bit version: October 2001; 32-bit version: May 2002)
- , 2003a. Integrated Risk Information System (IRIS). On-line database.
- , 2003b. *Integrated Exposure Uptake Biokinetic Model for Lead in Children, Windows® version (IEUBKwin v1.0 build 253)* (March, 2003) 32-bit version
- , 2003c. *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil* [EPA-540-R-03-001, OSWER Dir #9285.7-54] (January 2003).
- , Region 3. 2003b. *Memo from Jennifer Hubbard, U.S. EPA Toxicologist, to RBC Table Users. Regarding the Risk-Based Concentrations Table.*
<http://www.epa.gov/reg3hwmd/risk/cov0403.pdf>

TABLES

TABLE C 2-1
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN *EXAMPLE TABLE FOR RI WORK PLAN*
 FORMER ALCOA EAST ST LOUIS OPERATIONS, EAST SAINT LOUIS, IL

| | |
|---------------------|-------------------------|
| Scenario Timeframe: | current/future |
| Medium: | surface soil |
| Exposure Medium: | on-Site Industrial Soil |

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (N/C) (4) | Potential ARAR/TBC Value | Potential ARAR/TBC Source | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|----------------|------------|----------|--|--|-------|-----------------------------------|---------------------|---------------------------|---|-------------------------|---------------------------------------|--------------------------|---------------------------|-----------------|--|
| | | | | | | | | | max detect | | Industrial RBC | | | | |

Footnote Instructions

- (1) Define the "(Qualifier)" codes used for the "Minimum Concentration" and "Maximum Concentration"
- (2) Specify source(s) for the "Concentration Used for Screening".
- (3) Specify source(s) for the "Background Value"
- (4) Specify source(s) for the "Screening Toxicity Value"
- (5) Define the codes used for the "Rationale for Selection or Deletion".

TABLE C.3.1-1

PRELIMINARY SELECTION OF EXPOSURE PATHWAYS(1)
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|--------------------|--|---|----------------------------|------------------------------|--------------|----------------|------------------|--|
| Current/Future | On-Site Surface Soil (IB-4: 4a-North, 4b-Triangle, and 4d Wet Areas; and 4c-Ball Fields) | Surface Soil | On-Site | Maintenance | Adult | Ingestion | Quantitative | Quantitative for IB-4c (the Ball Fields) only. Areas 4a, 4b, and 4d are wet areas that are not maintained. |
| | | | On-Site | Maintenance | Adult | Dermal | Quantitative | Quantitative for IB-4c (the Ball Fields) only. Areas 4a, 4b, and 4d are wet areas that are not maintained. |
| | On-Site Surface Soil (IB-4 4e) | Surface Soil | On-Site - IB-4e | Industrial/Commercial Worker | Adult | Ingestion | None | The IB-4e area is paved, therefore surface soils are not available for contacting in this area. |
| | | | On-Site - IB-4e | Industrial/Commercial Worker | Adult | Dermal | None | The IB-4e area is paved; therefore surface soils are not available for contacting in this area. |
| | On-Site Surface Soil (IB-3a) | Surface Soil | On-Site - IB-3a | Industrial/Commercial Worker | Adult | Ingestion | Quantitative | |
| | | | On-Site - IB-3a | Industrial/Commercial Worker | Adult | Dermal | Quantitative | |
| | On-Site Surface Soil from IB-1- RDAs; IB-2, IB-3; IB-4c | Deposition of Particulates to Off-Site Soil | Off-Site Residential Areas | Residential | Child | Ingestion | Quantitative | |
| | | | Off-Site Residential Areas | Residential | Child | Dermal | Quantitative | |
| | | | Off-Site Residential Areas | Residential | Adult | Ingestion | Quantitative | |
| | | | Off-Site Residential Areas | Residential | Adult | Dermal | Quantitative | |
| | | Dispersion of Particulates to Off-Site Air | Off-Site Residential Areas | Residential | Child | Inhalation | Quantitative | |
| | | | Off-Site Residential Areas | Residential | Adult | Inhalation | Quantitative | |

TABLE 3.1-1

PRELIMINARY SELECTION OF EXPOSURE PATHWAYS(1)
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|---|------------------------|---|----------------------------|---------------------|-------------------|----------------|------------------|--|
| Current/Future | Groundwater | Groundwater | On-Site | Industrial | Adult | Ingestion | None | No wells are presently used on site. Municipal ordinance prohibits installation of drinking well. |
| | | | Off-Site Residential Areas | Residential | Child | Ingestion | Qualitative | Municipal ordinance prohibits installation of drinking well. Phase I investigation will evaluate the efficacy of the ordinance and characterize COIs in groundwater via risk screening, not quantitative risk assessment at this time. |
| | | | Off-Site Residential Areas | Residential | Adult | Ingestion | Qualitative | Municipal ordinance prohibits installation of drinking well. Phase I investigation will evaluate the efficacy of the ordinance and characterize COIs in groundwater via risk screening, not quantitative risk assessment at this time. |
| | Off-Site Surface Water | Surface Water/Sediment | Frank Holten Park | Local Resident | Child | Ingestion | None | No apparent surface discharge from site to off-site surface water. In addition, there is no evidence of over-land connection of surface water at the site to the Park. |
| | | | Frank Holten Park | Local Resident | Adult | Ingestion | None | No apparent surface discharge from site to off-site surface water. In addition, there is no evidence of over-land connection of surface water at the site to the Park. |
| | Future | On-Site Surface Soil (IB-1, IB-2, IB-3) | Surface Soil | On-Site | Industrial Worker | Adult | Ingestion | Quantitative |
| On-Site | | | | Industrial Worker | Adult | Dermal | Quantitative | |
| Dispersion of Particulates in On-Site Air | | | On-Site | Industrial Worker | Adult | Inhalation | Quantitative | |
| Surface Soil | | | On-Site | Trespasser | Youth | Ingestion | Quantitative | There are no indications of current trespassing on property. However, trespassing during RIFS activities is possible. |
| | | | On-Site | Trespasser | Youth | Dermal | Quantitative | There are no indications of current trespassing on property. However, trespassing during RIFS activities is possible. |
| Dispersion of Particulates in On-Site Air | | | On-Site | Trespasser | Youth | Inhalation | Quantitative | There are no indications of current trespassing on property. However, trespassing during RIFS activities is possible. |

TABLE C.3.1-1

PRELIMINARY SELECTION OF EXPOSURE PATHWAYS(1)
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|-----------------------|---|--|----------------------------|------------------------|-----------------|-------------------|---------------------|--|
| Future | On-Site Surface Soil (IB-1, IB-2, IB-3) | Surface Soil | On-Site | Trespasser | Adult | Ingestion | Qualitative | There are no indications of current trespassing on property. However, trespassing during RIFS activities is possible. Adult will be qualitatively compared to more conservative youth receptor for this short-term scenario. |
| | | | On-Site | Trespasser | Adult | Dermal | Qualitative | There are no indications of current trespassing on property. However, trespassing during RIFS activities is possible. Adult will be qualitatively compared to more conservative youth receptor for this short-term scenario. |
| | | Dispersion of Particulates in On-Site Air | On-Site | Trespasser | Adult | Inhalation | Qualitative | There are no indications of current trespassing on property. However, trespassing during RIFS activities is possible. Adult will be qualitatively compared to more conservative youth receptor for this short-term scenario. |
| | On-Site Surface Soil (IB-1, IB-2) | Surface Soil | On-Site | Recreational | Youth | Ingestion | Quantitative | |
| | | | On-Site | Recreational | Youth | Dermal | Quantitative | |
| | | Dispersion of Particulates in On-Site Air | On-Site | Recreational | Youth | Inhalation | Quantitative | |
| | On-Site Surface and/or Subsurface Soil at Residue Disposal Areas (IB-1), Other Areas of Alcoa Activity (IB-3), and Active Commercial Area (IB- 4e) | Surface and/or Subsurface Soil | On-Site | Construction Worker | Adult | Ingestion | Quantitative | |
| | | | On-Site | Construction Worker | Adult | Dermal | Quantitative | |
| | | Dispersion of Construction- generated Particulates in Air | On-Site | Construction Worker | Adult | Inhalation | Quantitative | |
| | | | Off-Site Residential Areas | Residential | Child | Inhalation | Quantitative | |
| | | | Off-Site Residential Areas | Residential | Adult | Inhalation | Quantitative | |

TABLE 3.1-1

PRELIMINARY SELECTION OF EXPOSURE PATHWAYS(1)
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|--------------------|--|---|----------------------------|------------------------|--------------|----------------|------------------|---|
| Future | Gypsum Dike Materials (Mining Scenario) | Gypsum material | On-Site | Gypsum Mining Receptor | Adult | Ingestion | None | Assume that OSHA Health and Safety protocols, such as use of PPE, will be employed to minimize exposure for this receptor |
| | | | On-Site | Gypsum Mining Receptor | Adult | Dermal | None | Assume that OSHA Health and Safety protocols, such as use of PPE, will be employed to minimize exposure for this receptor |
| | | Dispersion of Gypsum Particulates during mining | On-Site | Gypsum Mining Receptor | Adult | Inhalation | None | Assume that OSHA Health and Safety protocols, such as use of PPE, will be employed to minimize exposure for this receptor |
| | | | Off-Site Residential Areas | Residential | Child | Inhalation | Quantitative | |
| | | | Off-Site Residential Areas | Residential | Adult | Inhalation | Quantitative | |
| | | Deposition of Gypsum Particulates to Off-Site Soil | Off-Site Residential Areas | Residential | Child | Ingestion | Quantitative | |
| | | | Off-Site Residential Areas | Residential | Child | Dermal | Quantitative | |
| | | | Off-Site Residential Areas | Residential | Adult | Ingestion | Quantitative | |
| | | | Off-Site Residential Areas | Residential | Adult | Dermal | Quantitative | |
| | | Wet Areas (portions of IB-1, IB-4a, IB-4b, and IB-4d) | Standing Water/Sediment | On-Site | Recreational | Youth | Dermal | Quantitative |
| | Wet Areas (portions of IB-1, IB-3b, IB-4a, IB-4b, and IB-4d) | Standing Water/Sediment | On-Site | Trespasser | Youth | Dermal | Quantitative | There are no indications of current trespassing on property. However, trespassing during RIFS activities is possible. |

Note:
(1) Preliminary assessment of potentially complete exposure pathways prior to data collection. This table will be modified to remove exposure pathways for media with no COPCs identified in the Baseline RA.

TABLE C.3.2-1.
 EXPOSURE POINT CONCENTRATION SUMMARY -EXAMPLE TABLE FOR RI WORK PLAN
 Current Conditions - Surface Soil and Particulate Generation
 FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|---------------------|------------------|
| Scenario Timeframe: | Current/Future |
| Medium: | Surface soil/air |
| Exposure Medium: | Surface soil/air |

| Exposure Point | Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL (Distribution) (1) | Maximum Concentration (Qualifier) | Exposure Point Concentration | | | |
|----------------------------|-------------------------------|-------------------|-----------------|-------------------------------|-----------------------------------|------------------------------|-----------|----------|-----------|
| | | | | | | RME Value | Statistic | CT Value | Rationale |
| On-Site Surface Soil | | mg/kg | | | | | | | |
| On-Site Air | | mg/m ³ | | | | | | | |
| Off-Site Air | | mg/m ³ | | | | | | | |
| Off-Site Soil (Deposition) | | mg/kg | | | | | | | |

Footnote Instructions:

- Specify any assumptions made in calculating the "95% UCL" term.
- (1) Define the codes describing the type of distribution for the "95% UCL" term.
- (2) Define the codes used for the "EPC Statistic".

TABLE C.3.2-2 RME and CT
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
CURRENT/FUTURE ON-SITE MAINTENANCE WORKER AT IB-4c - BALL FIELDS
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|---------------------|---|
| Scenario Timeframe: | Current/Future |
| Medium: | On-Site Surface Soil |
| Exposure Point: | On-Site Surface Soil/Air |
| Receptor: | Current/Future On-Site Maintenance Worker |
| Receptor Age: | Adult |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | CT Value | CT Rationale/Reference ⁽¹⁾ | Intake Equation Dose (mg/Kg-day) |
|--------------------------------------|------------------------------------|--------------------|-------------------------|-----------|--|--------------------|---------------------------------------|--|
| All | Concentration Soil (EPC) | Cs | mg/kg | TBD | | TBD | | |
| | Exposure Duration (Total Exposure) | ED | years | 25 | EPA 1991b | TBD ⁽²⁾ | | |
| | Body Weight - Adult | BW | Kg | 70 | EPA 1991b | 70 | EPA 1991b | |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | 25550 | EPA 1989 | |
| | Averaging Time - non-carcinogen | AT-N | days | 9125 | EPA 1989 | TBD | EPA 1989 | |
| Incidental Ingestion of Surface Soil | Ingestion Rate of Soil (Adult) | IR | mg/day | 100 | EPA 1997a | 50 | EPA 1997a | $\frac{Cs \times IR \times EF_{ing} \times ED \times CF1}{BW \times AT}$ |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| | Exposure Frequency-Ing | EF _{ing} | days/yr | 52 | Prof Judg | 26 | Prof Judg | |
| Dermal Contact | Exposed Skin Surface Area - Adult | SA | cm ² /event | 3300 | EPA 1997a ⁽³⁾ | 3300 | EPA 1997a ⁽³⁾ | $\frac{Cs \times SA \times AF \times Abs \times EF_{derm} \times ED \times CF1}{BW \times AT}$ |
| | Adherence Factor - Adult Worker | AF | mg soil/cm ² | 0.105 | EPA 2001a | 0.021 | EPA 2001a | |
| | Exposure Frequency-dermal | EF _{derm} | events/yr | 52 | Prof Judg | 26 | Prof Judg | |
| | Absorbance - Chemical Specific | Abs | % | Chem | | Chem | | |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| Inhalation of Particulates | Concentration Air (Modeling) | Ca | mg/m ³ | TBD | | TBD | | $\frac{Ca \times InhR \times EF_{ing} \times ED}{BW \times AT}$ |
| | Exposure Frequency-Inh | EF _{inh} | days/yr | 250 | EPA 1991b | TBD | | |
| | Inhalation Rate - Adult Worker | InhR | m ³ /hr | 2.5 | EPA 1997a | 1.5 | EPA 1997a | |
| | Exposure Time | ET | hr/day | 8 | EPA 1991b | 8 | EPA 1991b | |

Notes:

⁽¹⁾ References are found in reference section of Appendix C.

⁽²⁾ Propose to use Bureau of Labor Statistics Data for CT estimate of Employment Tenure

⁽³⁾ Assumes worker wears long pants and short-sleeved shirt.

TABLE C.3.2-3 RME and CT
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
CURRENT/FUTURE ON-SITE LOCAL RECREATIONAL RECEPTOR⁽¹⁾ AT IB-4c - BALL FIELDS
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|--------------------|---|
| Scenario Timeframe | Current/Future |
| Medium: | On-Site Surface Soil |
| Exposure Point: | On-Site Surface Soil/Air |
| Receptor: | Current/Future On-Site Local Recreational Recepto |
| Receptor Age: | Child: 6-16 yrs (Youth baseball league) |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽²⁾ | CT Value | CT Rationale/Reference ⁽²⁾ | Intake Equation Dose (mg/Kg-day) |
|--------------------------------------|-------------------------------------|--------------------|-------------------------|-----------|--|----------|---------------------------------------|--|
| All | Concentration Soil (EPC) | Cs | mg/kg | TBD | | TBD | | |
| | Exposure Duration (Total Exposure) | ED | years | 10 | EPA 1997a | 5 | Prof Judg | |
| | Body Weight - Child 6-16 yr | BW | Kg | 40 | EPA 1997a | 40 | EPA 1997a | |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | 25550 | EPA 1989 | |
| | Averaging Time - non-carcinogen | AT-N | days | 3650 | EPA 1989 | TBD | EPA 1989 | |
| Incidental Ingestion of Surface Soil | Ingestion Rate of Soil | IR | mg/day | 100 | EPA 1997a | 50 | EPA 1997a | $\frac{Cs \times IR \times EF_{ing} \times ED \times CF1}{BW \times AT}$ |
| | Conversion Factor | CF1 | kg/mg soil | 1 E-06 | | 1.E-06 | | |
| | Exposure Frequency-Ing | EF _{ing} | days/yr | 26 | Prof Judg ⁽³⁾ | 26 | Prof Judg ⁽³⁾ | |
| Dermal Contact | Exposed Skin Surface Area - 6-16 yr | SA | cm ² /event | 3800 | EPA 1997a ⁽⁴⁾ | 3100 | EPA 1997a ⁽⁴⁾ | $\frac{Cs \times SA \times AF \times Abs \times EF_{derm} \times ED \times CF1}{BW \times AT}$ |
| | Adherence Factor - Soccer player | AF | mg soil/cm ² | 0.25 | EPA 2001a ⁽⁵⁾ | 0.039 | EPA 2001a ⁽⁵⁾ | |
| | Exposure Frequency-dermal | EF _{derm} | events/yr | 26 | Prof Judg | 26 | Prof Judg | |
| | Absorbance - Chemical Specific | Abs | % | Chem | | Chem | | |
| Inhalation of Particulates | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1 E-06 | | $\frac{Ca \times InhR \times EF_{ing} \times ED}{BW \times AT}$ |
| | Concentration Air (Modeling) | Ca | mg/m ³ | TBD | | TBD | | |
| | Exposure Frequency-Inh | EF _{inh} | days/yr | 250 | EPA 1991b | TBD | | |
| | Inhalation Rate - Youth (6-16) | InhR | m ³ /hr | 1.9 | EPA 1997a ⁽⁶⁾ | 1.2 | EPA 1997a ⁽⁶⁾ | |
| | Exposure Time | ET | hr/day | 2 | EPA 1991b | 2 | EPA 1991b | |

Notes:

⁽¹⁾ Youth baseball league participants

⁽²⁾ References are found in reference section of Appendix C.

⁽³⁾ Assumes receptor visits Ball Fields 2x per week in spring for both RME and CT. (This factor may be fine-tuned with League-specific data.)

⁽⁴⁾ Uses calculated ratio of 95th percentile child/adult whole body surface area (0.66) to adjust adult "outdoor activity" SA (5800 cm² per Table 6-16 of EPA, 1998a) for RME. 50th percentile ratio child/adult (0.617 times 5000 cm²) for CT.

⁽⁵⁾ Conservatively uses male soccer-player data. This value may be finetuned later to include female soccer-player data

⁽⁶⁾ Table 5-23: short-term inhalation rate for heavy exertion (RME) and moderate exertion (CT)

TABLE C.3.2-4 RME and CT
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
FUTURE ON-SITE INDUSTRIAL/COMMERCIAL WORKER (Current/Future: IB-3, IB-4e; Future: IB-1, IB-2, IB-4d)
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|------------------------------------|--|
| Scenario Timeframe: Current/Future | |
| Medium: | On-Site Surface Soil |
| Exposure Point: | On-Site Surface Soil/Air |
| Receptor: | Current/Future On-Site Indust/Commerc Worker |
| Receptor Age: | Adult |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | CT Value | CT Rationale/Reference ⁽¹⁾ | Intake Equation Dose (mg/Kg-day) |
|--------------------------------------|------------------------------------|--------------------|-------------------------|-----------|--|--------------------|---------------------------------------|--|
| All | Concentration Soil (EPC) | Cs | mg/kg | TBD | | TBD | | |
| | Exposure Duration (Total Exposure) | ED | years | 25 | EPA 1991b | TBD ⁽²⁾ | | |
| | Body Weight - Adult | BW | Kg | 70 | EPA 1991b | 70 | EPA 1991b | |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | 25550 | EPA 1989 | |
| | Averaging Time - non-carcinogen | AT-N | days | 9125 | EPA 1989 | TBD | EPA 1989 | |
| Incidental Ingestion of Surface Soil | Ingestion Rate of Soil (Adult) | IR | mg/day | 100 | EPA 1997a | 50 | EPA 1997a | $\frac{Cs \times IR \times EF_{ing} \times ED \times CF1}{BW \times AT}$ |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| | Exposure Frequency-Ing | EF _{ing} | days/yr | 250 | EPA 1991b | TBD | | |
| Dermal Contact | Exposed Skin Surface Area - Adult | SA | cm ² /event | 3300 | EPA 1997a | 3300 | EPA 1997a | $\frac{Cs \times SA \times AF \times Abs \times EF_{derm} \times ED \times CF1}{BW \times AT}$ |
| | Adherence Factor - Adult Worker | AF | mg soil/cm ² | 0.105 | EPA 2001a | 0.021 | EPA 2001a | |
| | Exposure Frequency-dermal | EF _{derm} | events/yr | 250 | EPA 1991b | TBD | | |
| | Absorbance - Chemical Specific | Abs | % | Chem | | Chem | | |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| Inhalation of Particulates | Concentration Air (Modeling) | Ca | mg/m ³ | TBD | | TBD | | $\frac{Ca \times InhR \times EF_{ing} \times ED}{BW \times AT}$ |
| | Exposure Frequency-Inh | EF _{inh} | days/yr | 250 | EPA 1991b | TBD | | |
| | Inhalation Rate - Adult Worker | InhR | m ³ /hr | 2.5 | EPA 1997a | 1.5 | EPA 1997a | |
| | Exposure Time | ET | hr/day | 8 | EPA 1991b | 8 | EPA 1991b | |

Notes:

⁽¹⁾ References are found in reference section of Appendix C.

⁽²⁾ Propose to use Bureau of Labor Statistics Data for CT estimate of Employment Tenure

TABLE C.3.2-5 RME and CT
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
CURRENT/FUTURE OFF-SITE RESIDENT (IB-1, IB-2, IB-3, IB-4c)
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|--------------------|---|
| Scenario Timeframe | Current/Future |
| Medium: | Deposition from On-Site |
| Exposure Point: | Off-Site Surface Soil/Air |
| Receptor: | Current/Future Off-Site Resident |
| Receptor Age: | Carcinogenic (Lifetime) Exposure - Age Adjusted Factor Approach Noncarcinogenic exposure - 0 - 6 years |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | CT Value | CT Rationale/Reference ⁽¹⁾ | Intake Equation Dose (mg/Kg-day) |
|--------------------------------------|--|-------------------|-------------|-----------|--|----------|---------------------------------------|---|
| All | Concentration Soil (EPC) | Cs | mg/kg | TBD | | TBD | | Deposition Modeling from On-Site Particulate Generation. Three scenarios will be evaluated in RA: baseline conditions, future construction-generation of particulates, future gypsum-mining generation of particulates. |
| | Exposure Duration (Total Exposure) | ED | years | 30 | EPA 1997a | 9 | EPA 1997a | |
| | Exposure Duration - Adult | ED-A | years | 14 | EPA 1991a | 4 | Prof Judg | |
| | Exposure Duration - Youth | ED-Y | years | 10 | EPA 1991a | 3 | Prof Judg | |
| | Exposure Duration - Child | ED-C | years | 6 | EPA 1991a | 2 | Prof Judg | |
| | Body Weight - Adult | BW-A | Kg | 70 | EPA 1991b | 70 | EPA 1991b | |
| | Body Weight - Youth | BW-Y | Kg | 40 | EPA 1997a | 40 | EPA 1997a | |
| | Body Weight - Child | BW-C | Kg | 15 | EPA 1997a | 15 | EPA 1997a | |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | 25550 | EPA 1989 | |
| Averaging Time - non-carcinogen | AT-N | days | 2190 | EPA 1989 | 730 | EPA 1989 | | |
| Incidental Ingestion of Surface Soil | Ingestion Rate of Soil (Adult and Youth) | IR-A/Y | mg/day | 100 | EPA 1997a | 50 | EPA 1997a | $\frac{Cs \times SI_{adj} \times EF_{ing} \times CF1}{AT}$ |
| | Ingestion Rate of Soil (Child) | IR-C | mg/day | 200 | EPA 1997a | 100 | EPA 1997a | |
| | Soil Ing. Factors - Age Adjusted | SI _{adj} | mg-y/Kg-day | TBD | | TBD | calc - final EFs | |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| | Exposure Frequency-Ing | EF _{ing} | days/yr | 350 | EPA 1991b | 350 | EPA 1991b | |

TABLE C.3.2-5 RME and CT
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
CURRENT/FUTURE OFF-SITE RESIDENT (IB-1, IB-2, IB-3, IB-4c)
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|--------------------|---|
| Scenario Timeframe | Current/Future |
| Medium: | Deposition from On-Site |
| Exposure Point: | Off-Site Surface Soil/Air |
| Receptor: | Current/Future Off-Site Resident |
| Receptor Age: | Carcinogenic (Lifetime) Exposure - Age Adjusted Factor Approach Noncarcinogenic exposure - 0 - 6 years |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | CT Value | CT Rationale/Reference ⁽¹⁾ | Intake Equation Dose (mg/Kg-day) |
|----------------------------|--|--------------------|--------------------------|-----------|--|----------|---------------------------------------|---|
| Dermal Contact | Exposed Skin Surface Area - Adult ⁽²⁾ | SA-A | cm ² /event | 2875 | EPA 1997a | 2,500 | EPA 1997a | $\frac{C_s \times S D_{adj} \times E F_d \times A b_s \times C F_1}{A T}$ |
| | Exposed Skin Surface Area - Youth ⁽²⁾ | SA-Y | cm ² /event | 1,900 | EPA 1997a | 1,540 | EPA 1997a | |
| | Exposed Skin Surface Area - Child ⁽²⁾ | SA-C | cm ² /event | 995 | EPA 1997a | 860 | EPA 1997a | |
| | Adherence Factor - Adult | AF-A | mg soil/cm ² | 0.055 | EPA 2001a | 0.011 | EPA 2001a | |
| | Adherence Factor - Child and Youth | AF-C/Y | mg soil/cm ² | 0.3 | EPA 2001a | 0.04 | EPA 2001a | |
| | Exposure Frequency - Dermal | EF _{derm} | events/yr | 350 | EPA 1991b | 350 | EPA 1991b | |
| | Soil Dermal Factors - Age Adjusted | SD _{adj} | mg soil-y/Kg | TBD | | TBD | | |
| | Absorbance - Chemical Specific | Abs | % | Chem | | Chem | | |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| Inhalation of Particulates | Concentration Air (Modeling) | Ca | mg/m ³ | TBD | | TBD | | $\frac{C_a \times I n h_{adj} \times E F_{inh} \times C F_1}{A T}$ |
| | Exposure Frequency-Inh | EF _{inh} | days/yr | 350 | EPA 1991b | 350 | EPA 1991b | |
| | Inhalation Rate - Adult | InhR-A | m ³ /day | 13 | EPA 1997a | 13 | EPA 1997a | |
| | Inhalation Rate - Youth | InhR-Y | m ³ /day | 13 | EPA 1997a | 13 | EPA 1997a | |
| | Inhalation Rate - Child | InhR-C | m ³ /day | 6.5 | EPA 1997a | 6.5 | EPA 1997a | |
| | Inhalation Factors - Age Adjusted | Inh _{adj} | m ³ -y/Kg-day | TBD | | TBD | calc - final EFs | |

Notes:

⁽¹⁾ References are found in reference section of Appendix C.

⁽²⁾ Adult SA calc as % of total body SA: 5%winter, 10%spring/fall, 25%summer (per EPA 1997a sect 6.2.5). CT-20,000 crf; RME-23,000 cm² per EPA 1997a.

Youth/Child: age-appropriate total body SA (per Table 6-16 EPA, 1997a) to adult times seasonal percentages from EPA 1997a (Section 6.2.5).

TABLE C.3.2-5 RME and CT (Contin.)
 PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
 CURRENT/FUTURE OFF-SITE RESIDENT
 FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

Equations for Age-adjusted Intake factors

Incidental Ingestion of Soil
$$SI_{adj} = \left(ED_c \times \frac{IR_c}{BW_c} \right) + \left(ED_y \times \frac{IR_y}{BW_y} \right) + \left(ED_a \times \frac{IR_a}{BW_a} \right)$$

Dermal Contact with Soil
$$SD_{adj} = \left(ED_c \times \frac{SA_c \times AF_c}{BW_c} \right) + \left(ED_y \times \frac{SA_y \times AF_y}{BW_y} \right) + \left(ED_a \times \frac{SA_a \times AF_a}{BW_a} \right)$$

Inhalation of Particulate
$$Inh_{adj} = \left(ED_c \times \frac{InhR_c}{BW_c} \right) + \left(ED_y \times \frac{InhR_y}{BW_y} \right) + \left(ED_a \times \frac{InhR_a}{BW_a} \right)$$

TABLE C.3.2-6 RME and CT
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
FUTURE ON-SITE CONSTRUCTION WORKER (IB-1, IB-2, IB-3, IB-4d, IB-4e)
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|---------------------|------------------------------------|
| Scenario Timeframe: | Future |
| Medium: | On-Site Surface Soil |
| Exposure Point: | On-Site Surface Soil/Air |
| Receptor: | Future On-Site Construction Worker |
| Receptor Age: | Adult |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | CT Value | CT Rationale/Reference ⁽¹⁾ | Intake Equation Dose:(mg/Kg-day) |
|--------------------------------------|------------------------------------|--------------------|-------------------------|-----------|--|----------|---------------------------------------|--|
| All | Concentration Soil (EPC) | Cs | mg/kg | TBD | | TBD | | |
| | Exposure Duration (Total Exposure) | ED | years | 3 | Prof Judg | 1 | Prof Judg | |
| | Body Weight - Adult | BW | Kg | 70 | EPA 1991b | 70 | EPA 1991b | |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | 25550 | EPA 1989 | |
| | Averaging Time - non-carcinogen | AT-N | days | 1095 | EPA 1989 | 365 | EPA 1989 | |
| Incidental Ingestion of Surface Soil | Ingestion Rate of Soil (Adult) | IR _{cw} | mg/day | 330 | EPA 2001b | 165 | Prof Judg | $\frac{Cs \times IR_{cw} \times EF_{ing} \times ED \times CF1}{BW \times AT}$ |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| | Exposure Frequency-Ing | EF _{ing} | days/yr | 180 | Prof Judg | 90 | Prof Judg | |
| Dermal Contact | Exposed Skin Surface Area - Adult | SA | cm ² /event | 3300 | EPA 2001b | 3300 | EPA 2001b | $\frac{Cs \times SA_{cw} \times AF_{cw} \times Abs \times EF_{derm} \times ED \times CF1}{BW \times AT}$ |
| | Adherence Factor - Adult Worker | AF | mg soil/cm ² | 0.3 | EPA 2001b | 0.14 | EPA 2001b | |
| | Exposure Frequency-dermal | EF _{derm} | events/yr | 180 | Prof Judg | 90 | Prof Judg | |
| | Absorbance - Chemical Specific | Abs | % | Chem | | Chem | | |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| Inhalation of Particulates | Concentration Air (Modeling) | Ca | mg/m ³ | TBD | | TBD | | $\frac{Ca \times InhR_{cw} \times EF_{ing} \times ED}{BW \times AT}$ |
| | Exposure Frequency-Inh | EF _{inh} | days/yr | 180 | Prof Judg | 90 | Prof Judg | |
| | Inhalation Rate - Adult Worker | InhR _{cw} | m ³ /hr | 2.5 | EPA 1997a | 1.5 | EPA 1997a | |
| | Exposure Time | ET | hr/day | 8 | Prof Judg | 8 | Prof Judg | |

Notes:

⁽¹⁾ References are found in reference section of Appendix C.

TABLE C.3.2-6 RME and CT
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
FUTURE ON-SITE CONSTRUCTION WORKER (IB-1, IB-2, IB-3, IB-4d, IB-4e)
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|---------------------|------------------------------------|
| Scenario Timeframe: | Future |
| Medium: | On-Site Surface Soil |
| Exposure Point: | On-Site Surface Soil/Air |
| Receptor: | Future On-Site Construction Worker |
| Receptor Age: | Adult |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | CT Value | CT Rationale/Reference ⁽¹⁾ | Intake Equation Dose (mg/Kg-day) |
|--------------------------------------|------------------------------------|--------------------|-------------------------|-----------|--|----------|---------------------------------------|--|
| All | Concentration Soil (EPC) | Cs | mg/kg | TBD | | TBD | | |
| | Exposure Duration (Total Exposure) | ED | years | 3 | Prof Judg | 1 | Prof Judg | |
| | Body Weight - Adult | BW | Kg | 70 | EPA 1991b | 70 | EPA 1991b | |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | 25550 | EPA 1989 | |
| | Averaging Time - non-carcinogen | AT-N | days | 1095 | EPA 1989 | 365 | EPA 1989 | |
| Incidental Ingestion of Surface Soil | Ingestion Rate of Soil (Adult) | IR _{sw} | mg/day | 330 | EPA 2001b | 165 | Prof Judg | $\frac{C_s \times IR_{sw} \times EF_{ing} \times ED \times CF_1}{BW \times AT}$ |
| | Conversion Factor | CF ₁ | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| | Exposure Frequency-Ing | EF _{ing} | days/yr | 180 | Prof Judg | 90 | Prof Judg | |
| Dermal Contact | Exposed Skin Surface Area - Adult | SA | cm ² /event | 3300 | EPA 2001b | 3300 | EPA 2001b | $\frac{C_s \times SA_{cw} \times AF_{cw} \times Abs \times EF_{derm} \times ED \times CF_1}{BW \times AT}$ |
| | Adherence Factor - Adult Worker | AF | mg soil/cm ² | 0.3 | EPA 2001b | 0.14 | EPA 2001b | |
| | Exposure Frequency-dermal | EF _{derm} | events/yr | 180 | Prof Judg | 90 | Prof Judg | |
| | Absorbance - Chemical Specific | Abs | % | Chem | | Chem | | |
| | Conversion Factor | CF ₁ | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| Inhalation of Particulates | Concentration Air (Modeling) | Ca | mg/m ³ | TBD | | TBD | | $\frac{Ca \times InhR_{cw} \times EF_{ing} \times ED}{BW \times AT}$ |
| | Exposure Frequency-Inh | EF _{inh} | days/yr | 180 | Prof Judg | 90 | Prof Judg | |
| | Inhalation Rate - Adult Worker | InhR _{cw} | m ³ /hr | 2.5 | EPA 1997a | 1.5 | EPA 1997a | |
| | Exposure Time | ET | hr/day | 8 | Prof Judg | 8 | Prof Judg | |

Notes:

⁽¹⁾ References are found in reference section of Appendix C.

TABLE C.3.2-7 RME and CT
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
FUTURE ON-SITE RECREATIONAL RECEPTOR (IB-1, IB-2) - SOIL
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|---------------------|--------------------------------------|
| Scenario Timeframe: | Future |
| Medium: | On-Site Surface Soil |
| Exposure Point: | On-Site Surface Soil/Air |
| Receptor: | Future On-Site Recreational Receptor |
| Receptor Age: | Youth (6-16) |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | CT Value | CT Rationale/Reference ⁽¹⁾ | Intake Equation Dose (mg/Kg-day) |
|--------------------------------------|--|--------------------|-------------------------|-----------|--|----------|---------------------------------------|--|
| All | Concentration Soil (EPC) | Cs | mg/kg | TBD | | TBD | | |
| | Exposure Duration (Total Exposure) | ED | years | 10 | Prof Judg | 3 | Prof Judg | |
| | Body Weight - Youth | BW | Kg | 40 | EPA 1991b | 40 | EPA 1991b | |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | 25550 | EPA 1989 | |
| | Averaging Time - non-carcinogen | AT-N | days | 3650 | EPA 1989 | 1095 | EPA 1989 | |
| Incidental Ingestion of Surface Soil | Ingestion Rate of Soil -Youth | Iry | mg/day | 100 | EPA 2001b | 50 | Prof Judg | $\frac{Cs \times IR \times EF_{ing} \times ED \times CF1}{BW \times AT}$ |
| | Conversion Factor | CF1 | kg/mg soil | 1 E-06 | | 1.E-06 | | |
| | Exposure Frequency-ing ⁽³⁾ | EF _{ing} | days/yr | 78 | Prof Judg | 19 | Prof Judg | |
| Dermal Contact | Exposed Skin Surface Area - Youth | SA | cm ² /event | 3800 | EPA 1997a ⁽²⁾ | 3100 | EPA 1997a ⁽²⁾ | $\frac{Cs \times SA \times AF \times Abs \times EF_{derm} \times ED \times CF1}{BW \times AT}$ |
| | Adherence Factor - Youth | AF | mg soil/cm ² | 0.3 | EPA 2001b | 0.04 | | |
| | Exposure Frequency-dermal ⁽³⁾ | EF _{derm} | events/yr | 78 | Prof Judg | 19 | Prof Judg | |
| | Absorbance - Chemical Specific | Abs | % | Chem | | Chem | | |
| Inhalation of Particulates | Conversion Factor | CF1 | kg/mg soil | 1 E-06 | | 1.E-06 | | |
| | Concentration Air (Modeling) | Ca | mg/m ³ | TBD | | TBD | | |
| | Exposure Frequency-Inh ⁽³⁾ | EF _{inh} | days/yr | 78 | Prof Judg | 19 | Prof Judg | |
| | Inhalation Rate - Youth | InhR-y | m ³ /hr | 1.2 | EPA 1997a ⁽⁴⁾ | 1.2 | EPA 1997a | |
| | Exposure Time | ET | hr/day | 2 | Prof Judg | 1 | Prof Judg | $\frac{Ca \times InhR \times EF_{ing} \times ED}{BW \times AT}$ |

Notes

⁽¹⁾ References are found in reference section of Appendix C.

⁽²⁾ Uses calculated ratio of 95th percentile child/adult whole body surface area (0.66) to adjust adult "outdoor activity" SA (5800 cm² per Table 6-16 of EPA, 1998a) for RME 50th percentile ratio child/adult (0.617 times 5000 cm²) for CT

⁽³⁾ Assumes RME EF of 3x/wk summer months; 1x/wk spring and fall. CT assumes 1x/wk summer months; 1x/mo spring and fall months.

⁽⁴⁾ Short-term inhalation rate for moderate activities to be used for both RME and CT.

**TABLE C.3.2-8 RME
 PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
 FUTURE ON-SITE RECREATIONAL (IB-1, IB-4a, IB-4b, IB-4d) - STANDING WATER
 FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL**

| | |
|----------------------------|---------------------------|
| Scenario Timeframe: Future | |
| Medium: | On-Site Standing Water |
| Exposure Point: | On-Site Standing Water |
| Receptor: | Future On-Site Trespasser |
| Receptor Age: | Youth (6-16) |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | Intake Equation Dose ⁽²⁾ (mg/Kg-day) |
|----------------|--|----------------|------------------------|-----------|--|--|
| Dermal Contact | Body Weight - youth | BW | Kg | 70 | EPA 1991b | For inorganic COPCs: $\frac{C_w \times K_p \times S_A \times E_T \times E_F \times E_D \times C_F}{B W \times A T}$ |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | |
| | Averaging Time - noncarc. | AT-nc | days | ED*365 | EPA 1989 | |
| | Partition Coefficient | Kp | cm/hr | Chem Spec | EPA 2001a | |
| | Conversion Factor | CF2 | L/cm ³ | 1.E-03 | | |
| | Concentration Water | Cw | mg/L | TBD | | |
| | Exposure Duration | ED | years | 10 | | |
| | SA - Youth hands and feet ⁽³⁾ | SA | cm ² /event | 1620 | EPA 1997a | |
| | Exposure Frequency ⁽⁴⁾ | EF | days/yr | 26 | EPA 1991b | |
| Exposure Time | ET | hr | 0.5 | Prof Judg | | |

Notes:

⁽¹⁾ References are found in reference section of Appendix C.

⁽²⁾ Methods for calculating intake via dermal pathway from water from EPA, 2001a.

⁽³⁾ Per Table 6-16, EPA 1997a

⁽⁴⁾ Assumes inadvertent exposure to standing water, 1x/wk spring and summer when standing water is more likely present.

TABLE C.3.2-9 RME and CT
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
FUTURE ON-SITE RECREATIONAL RECEPTOR (IB-1, IB-4a, IB-4b, IB-4d) - SEDIMENT
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|---------------------|--------------------------------------|
| Scenario Timeframe: | Future |
| Medium: | On-Site Sediment |
| Exposure Point: | On-Site Sediment |
| Receptor: | Future On-Site Recreational Receptor |
| Receptor Age: | Youth (6-16) |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | CT Value | CT Rationale/Reference ⁽¹⁾ | Intake Equation Dose (mg/Kg-day) |
|----------------------------------|--|--------------------|-------------------------|-----------|--|----------|---------------------------------------|--|
| All | Concentration Sediment (EPC) | Cs | mg/kg | TBD | | TBD | | |
| | Exposure Duration (Total Exposure) | ED | years | 10 | Prof Judg | 3 | Prof Judg | |
| | Body Weight - Youth | BW | Kg | 40 | EPA 1991b | 40 | EPA 1991b | |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | 25550 | EPA 1989 | |
| | Averaging Time - non-carcinogen | AT-N | days | 3650 | EPA 1989 | 1095 | EPA 1989 | |
| Incidental Ingestion of Sediment | Ingestion Rate of Sediment -Youth ⁽²⁾ | IR | mg/day | 10 | Prof Judg | 5 | Prof Judg | $\frac{Cs \times IR \times EF_{ing} \times ED \times CF1}{BW \times AT}$ |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| | Exposure Frequency-Ing ⁽³⁾ | EF _{ing} | days/yr | 26 | Prof Judg | 13 | Prof Judg | |
| Dermal Contact | Exposed Skin Surface Area - Youth hands ⁽⁴⁾ | SA | cm ² /event | 850 | EPA 2001b | 680 | EPA 2001b | $\frac{Cs \times SA \times AF \times Abs \times EF_{derm} \times ED \times CF1}{BW \times AT}$ |
| | Adherence Factor - Youth | AF | mg soil/cm ² | 1 | EPA 1992c | 0.5 | Prof Judg | |
| | Exposure Frequency-dermal ⁽³⁾ | EF _{derm} | events/yr | 26 | Prof Judg | 13 | Prof Judg | |
| | Absorbance - Chemical Specific | Abs | % | Chem | | Chem | | |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |

Notes:

⁽¹⁾ References are found in reference section of Appendix C.

⁽²⁾ Incidental ingestion rate of sediment is assumed to be 0.1 of default soil ingestion rate.

⁽³⁾ Assumes inadvertent exposure, 1x/wk spring and summer when standing water and sediment are more likely present. CT is assumed to be 1/2 RME.

⁽⁴⁾ Per Table 6-16, EPA 1997a.

TABLE C.3.2-10 RME and CT
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
FUTURE ON-SITE TRESPASSER (IB-1, IB-2, IB-3) - SOIL - DURING RI/FS PERIOD ONLY
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|---------------------|---------------------------|
| Scenario Timeframe: | Future |
| Medium: | On-Site Surface Soil |
| Exposure Point: | On-Site Surface Soil/Air |
| Receptor: | Future On-Site Trespasser |
| Receptor Age: | Youth (6-16) |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | CT Value | CT Rationale/Reference ⁽¹⁾ | Intake Equation Dose (mg/Kg-day) |
|--------------------------------------|--|--------------------|-------------------------|-----------|--|----------|---------------------------------------|--|
| All | Concentration Soil (EPC) | Cs | mg/kg | TBD | | TBD | | |
| | Exposure Duration (Total Exposure) | ED | years | 3 | Prof Judg | 1 | Prof Judg | |
| | Body Weight - Youth | BW | Kg | 40 | EPA 1991b | 40 | EPA 1991b | |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | 25550 | EPA 1989 | |
| | Averaging Time - non-carcinogen | AT-N | days | 1095 | EPA 1989 | 365 | EPA 1989 | |
| Incidental Ingestion of Surface Soil | Ingestion Rate of Soil -Youth | IR | mg/day | 100 | EPA 2001b | 50 | Prof Judg | $\frac{Cs \times IR \times EF_{ing} \times ED \times CF1}{BW \times AT}$ |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| | Exposure Frequency-Ing ⁽²⁾ | EF _{ing} | days/yr | 20 | Prof Judg | 10 | Prof Judg | |
| Dermal Contact | Exposed Skin Surface Area - Youth ⁽³⁾ | SA | cm ² /event | 3800 | EPA 1997a | 3100 | EPA 1997a | $\frac{Cs \times SA \times AF \times Abs \times EF_{derm} \times ED \times CF1}{BW \times AT}$ |
| | Adherence Factor - Youth | AF | mg soil/cm ² | 0.3 | EPA 2001b | 0.04 | | |
| | Exposure Frequency-dermal ⁽²⁾ | EF _{derm} | events/yr | 20 | Prof Judg | 10 | Prof Judg | |
| | Absorbance - Chemical Specific | Abs | % | Chem | | Chem | | |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| Inhalation of Particulates | Concentration Air (Modeling) | Ca | mg/m ³ | TBD | | TBD | | $\frac{Ca \times InhR \times EF_{ing} \times ED}{BW \times AT}$ |
| | Exposure Frequency-Inh ⁽²⁾ | EF _{inh} | days/yr | 20 | Prof Judg | 10 | Prof Judg | |
| | Inhalation Rate - Youth | InhR | m ³ /hr | 12 | EPA 1997a ⁽⁴⁾ | 1.2 | EPA 1997a | |
| | Exposure Time | ET | hr/day | 2 | Prof Judg | 1 | Prof Judg | |

Notes:

⁽¹⁾ References are found in reference section of Appendix C.

⁽²⁾ Assumes for the RME approximately 1x/wk summer months; 1x/mo spring and fall months. CT is 1/2 the RME.

⁽³⁾ Uses calculated ratio of 95th percentile child/adult whole body surface area (0.66) to adjust adult "outdoor activity" SA (5800 cm² per Table 6-16 of EPA, 1998a) for RME.

50th percentile ratio child/adult (0.617 times 5000 cm²) for CT.

⁽⁴⁾ Short-term inhalation rate for moderate activities to be used for both RME and CT.

TABLE C.3.2-11 RME
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
FUTURE ON-SITE TRESPASSER (IB-1, IB-3b, IB-4a, IB-4b, IB-4d) - STANDING WATER - DURING R/VFS PERIOD ONLY
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|---------------------|---------------------------|
| Scenario Timeframe: | Future |
| Medium: | On-Site Standing Water |
| Exposure Point: | On-Site Standing Water |
| Receptor: | Future On-Site Trespasser |
| Receptor Age: | Youth (6-16) |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | Intake Equation Dose ⁽²⁾ (mg/Kg-day) |
|----------------|--|----------------|------------------------|-----------|--|--|
| Dermal Contact | Body Weight - youth | BW | Kg | 70 | EPA 1991b | For inorganic COPCs: $\frac{C_w \times K_p \times S_A \times E_T \times E_F \times E_D \times C_F}{B_W \times A_T}$ |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | |
| | Averaging Time - noncarc. | AT-nc | days | ED*365 | EPA 1989 | |
| | Partition Coefficient | Kp | cm/hr | Chem Spec | EPA 2001a | |
| | Conversion Factor | CF2 | L/cm ³ | 1.E-03 | | |
| | Concentration Water | Cw | mg/L | TBD | | |
| | Exposure Duration | ED | years | 3 | EPA 1991b | |
| | SA - Youth hands and feet ⁽³⁾ | SA | cm ² /event | 1620 | EPA 1997a | |
| | Exposure Frequency ⁽⁴⁾ | EF | days/yr | 10 | EPA 1991b | |
| Exposure Time | ET | hr | 0.5 | Prof Judg | | |

Notes:

⁽¹⁾ References are found in reference section of Appendix C.

⁽²⁾ Methods for calculating intake via dermal pathway from water from EPA, 2001a.

⁽³⁾ Per Table 6-16, EPA 1997a

⁽⁴⁾ Assumes inadvertent exposure to standing water 1/2 of the times on-site as trespasser.

TABLE C.3.2-12 RME and CT
PROPOSED EXPOSURE ASSUMPTIONS FOR DAILY INTAKE CALCULATIONS
FUTURE ON-SITE TRESPASSER (IB-1, IB-3b, IB-4a, IB-4b, IB-4d) - SEDIMENT - DURING RI/FS PERIOD ONLY
FORMER ALCOA EAST ST. LOUIS OPERATIONS; EAST ST. LOUIS, IL

| | |
|---------------------|---------------------------|
| Scenario Timeframe: | Future |
| Medium: | On-Site Sediment |
| Exposure Point: | On-Site Sediment |
| Receptor: | Future On-Site Trespasser |
| Receptor Age: | Youth (6-16) |

| Exposure Route | Parameter Definition | Parameter Code | Units | RME Value | RME Rationale/Reference ⁽¹⁾ | CT Value | CT Rationale/Reference ⁽¹⁾ | Intake Equation Dose (mg/Kg-day) |
|----------------------------------|--|--------------------|-------------------------|-----------|--|----------|---------------------------------------|--|
| All | Concentration Sediment (EPC) | Cs | mg/kg | TBD | | TBD | | |
| | Exposure Duration (Total Exposure) | ED | years | 3 | Prof Judg | 1 | Prof Judg | |
| | Body Weight - Youth | BW | Kg | 40 | EPA 1991b | 40 | EPA 1991b | |
| | Averaging Time - carcinogen | AT-C | days | 25550 | EPA 1989 | 25550 | EPA 1989 | |
| | Averaging Time - non-carcinogen | AT-N | days | 1095 | EPA 1989 | 365 | EPA 1989 | |
| Incidental Ingestion of Sediment | Ingestion Rate of Sediment -Youth ⁽²⁾ | IR | mg/day | 10 | EPA 2001b | 5 | Prof Judg | $\frac{Cs \times IR \times EF_{ing} \times ED \times CF1}{BW \times AT}$ |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1.E-06 | | |
| | Exposure Frequency-Ing ⁽³⁾ | EF _{ing} | days/yr | 10 | Prof Judg | 10 | Prof Judg | |
| Dermal Contact | Exposed Skin Surface Area - Youth hands ⁽⁴⁾ | SA | cm ² /event | 850 | EPA 2001b | 680 | EPA 2001b | $\frac{Cs \times SA \times AF \times Abs \times EF_{derm} \times ED \times CF1}{BW \times AT}$ |
| | Adherence Factor - Youth | AF | mg soil/cm ² | 1 | EPA 1992c | 0.5 | Prof Judg | |
| | Exposure Frequency-dermal ⁽³⁾ | EF _{derm} | events/yr | 10 | Prof Judg | 10 | Prof Judg | |
| | Absorbance - Chemical Specific | Abs | % | Chem | | Chem | | |
| | Conversion Factor | CF1 | kg/mg soil | 1.E-06 | | 1 E-06 | | |

Notes:

- ⁽¹⁾ References are found in reference section of Appendix C.
- ⁽²⁾ Incidental ingestion rate of sediment is assumed to be 0.1 of default soil ingestion rate
- ⁽³⁾ Assumes inadvertent exposure to sediment 1/2 of the times on-site as trespasser. Same value for RME and CT.
- ⁽⁴⁾ Per Table 6-16, EPA 1997a

July 24, 2003

APPENDIX D
ECOLOGICAL RISK ASSESSMENT WORK PLAN

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1.0 INTRODUCTION

The Statement of Work (SOW) for a Remedial Investigation and Feasibility Study (RI/FS) at the Former Alcoa Site, East St. Louis, St. Clair County, Illinois, provided as an attachment to Administrative Order on Consent (AOC), indicates that an Ecological Risk Assessment (ERA) is necessary as part of the RI/FS for the former North Alcoa facility in East St. Louis (Site). The first step toward the completion of the RI/FS is the preparation of an RI/FS Work Plan that details the necessary investigative and assessment techniques to be used in the RI/FS. Included in the RI/FS Work Plan is a Baseline Problem Formulation for the potential ecological risks at the Site posed by releases of hazardous substances from former Alcoa operations.

The SOW indicates that the ERA process for the Site should follow the U.S. EPA *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (U.S. EPA, 1997). The guidance proposes an 8-step approach for conducting a scientifically defensible ERA:

- 1) Screening-Level Problem Formulation and Ecological Effects Evaluation
- 2) Screening-Level Preliminary Exposure Estimate and Risk Calculation
- 3) Baseline Risk Assessment Problem Formulation
- 4) Study Design and Data Quality Objectives
- 5) Field Verification of Sampling Design
- 6) Site Investigation and Analysis of Exposure and Effects
- 7) Risk Characterization
- 8) Risk Management

Briefly, steps 1 and 2 of the process are essentially scoping phases of the ERA in which existing information is reviewed to help determine the ecological components that are potentially at risk, the chemicals of potential ecological concern (COPECs), and the transport and exposure pathways that are important to the ERA. This process is conducted using conservative (i.e., screening-level) assumptions to avoid underestimating risk or omitting receptors or COPECs. Step 3 of the process is the Baseline Problem Formulation, presented in this document, that uses the results of the screening-level assessment to identify methods for risk analysis and characterization, resulting in the identification of ERA data needs for the RI/FS. Steps 1-7 of the process include formalization of data collection plans, and the implementation of the risk analysis and characterization steps. Risk Management activities of Step 8 are

largely outside the scope of the Risk Assessment, but certain aspects may be considered in developing the Work Plan.

The following sections provide the data from Steps 1 and 2 and present the Baseline Ecological Problem Formulation (Step 3).

1.1 Purpose and Scope

The purpose of this document is to present information associated with the screening-level ecological risk assessment (SLERA) that represents Steps 1 and 2 of the U.S. EPA guidance as well as providing the baseline problem formulation and work plan for completing the BERA.

A preliminary SLERA was conducted using several datasets collected since the closure of the Alcoa facility (Table 1-1). The results of this SLERA have been discussed by the Risk Managers at the Site who determined that further analysis of potential ecological risk at the Site is warranted. This document presents the results of the preliminary SLERA as well as the results of the Scientific Management Decision Point (SMDP) discussion held with representatives from Alcoa, U.S. EPA Region V and the City of East St. Louis in March 2003. This document also includes the Baseline Problem Formulation for the BERA

This document contains the following elements included in the U.S. EPA guidance (1997):

Step 1

- A description of the Site setting
- Identification of the preliminary Constituents of Interest (COIs)
- The preliminary conceptual site exposure model (CSEM) identifying incomplete and potentially complete exposure pathways

Step 2

- Conservative screening-level exposure and risk calculations
- Identification of COPECs

Step 3

- Identification of assessment endpoints based on the management goals for the Site.
- General approach, including risk questions and measurement endpoints for evaluating risk to the assessment endpoints.

A two-tiered sampling strategy is also presented. The goals of this approach are to fill in the data gaps identified in the screening-level problem formulation and to provide a preliminary plan to collect site-specific biotic tissue data, where necessary, for use in the BERA.

The Data Quality Objectives Process (DQO) is formally implemented in the RI/FS Work Plan to identify the types and quantities of samples from each Phase that will be needed. A detailed Phase I Sampling and Analysis Plan (Step 4) is also presented in the RI/FS Work Plan.

2.0 SCREENING LEVEL PROBLEM FORMULATION

2.1 Environmental Setting

The Alcoa North Plant Site (Site) lies within the American Bottoms region of the Mississippi River flood plain. Historical maps of the area show that much of the Site is located in the former Pittsburgh Lake, a remnant oxbow lake of the Mississippi River. Through on-site operations, the oxbow lake has been filled in creating the Site setting that is present today.

Zambrana Inc. (1999) conducted a biological analysis that included a preliminary identification of wet habitats, vegetative cover, and habitat quality at the Site. This report describes the Site as a mixture of waste impoundments and former industrial areas that have developed some ecological habitat since the closure of the facility several decades earlier.

The types of cover that exist at the Site include:

- Open water
- Exposed soil
- Wet areas
- Upland forest
- Successional meadows
- Old field habitat
- Open land

Figure 2-1 shows a general map of the potential habitat types currently found at the Site as determined in part by Zambrana Inc (1999), Site reconnaissance and a review of aerial photography. The upland forests at the Site are generally open, early to mid-successional woodlands interspersed with shrub/scrub habitat and open or grassy areas. Species such as the sycamore, Siberian elm, and cottonwood dominate the over story. Bush honeysuckle, and goldenrod species dominate the under story. Wet habitats at the Site are dominated primarily by *Phragmites sp.* and soft bulrush with some narrow-leaved cattails present in several areas.

Multiple species of birds and mammals utilize the Site as feeding grounds within their larger home range or as their home territories (small species with limited home ranges). Of particular note are two species of semi-aquatic avian predators, the black-crowned night heron and the little blue heron. Both of these state species of special concern are known to roost in the nearby Allorton Rookery, but neither has been observed on-site (Zambrana 1999). In general, the Site provides marginal quality habitat to those wildlife species that use it for feeding or as a loafing area. The Zambrana report indicates; "No evidence was found during the Site visits or during correspondence with IDNR personnel to indicate that any threatened or endangered species are utilizing the Alcoa site. Great egret, little blue heron, and black-crowned night herons were observed flying over the site but were not observed to utilize the site for foraging or nesting."

2.2 Nature and Extent of Potential Contamination

Data on the nature and extent of potential contamination at the Site were available from several reports (Table 1-1). Datasets included extensive soil sampling in the southern portions of the Site as well as limited data from the brown and red mud residue disposal areas (RDAs) and gypsum berms. A limited surface water and sediment data set is available for the wet areas bounding the Site to the north adjacent to Lake Drive (Figure 2-2). The following sections summarize the available data as well as the breakdown of "Investigative Blocks" on-site and a presentation of the sources and transport mechanisms present on-site.

2.3 Primary Sources and Transport Mechanisms

The primary sources of elevated levels of COIs at the Site originating from former Alcoa operations are residues from several processes including bauxite refining, sintering, production of hydrofluoric acid, and spent pot liners reprocessing and are discussed in detail in the RI/FS Work Plan.

2.4 Potentially Complete Exposure Pathways

Identification of potentially complete exposure pathways is used to evaluate the exposure potential as well as the risk of direct effects on ecosystem components. In order for an exposure pathway to be considered complete, it must meet all of the following four criteria (EPA 1997):

- 1) A source of the contaminant must be present or must have been present in the past.
- 2) A mechanism for transport of the contaminant from the source must be present.
- 3) A potential point of contact between the receptor and the contaminant must be available.
- 4) A route of exposure from the contact point to the receptor must be present.

Exposure pathways can only be considered complete if all of these criteria are met. If one or more of the criteria are not met, there is no mechanism for exposure of the receptor to the contaminant. Potentially complete pathways used in the wildlife risk analysis are shown in Figure 2-3.

In general, biota can be exposed to chemical stressors through direct exposure to abiotic media, or through ingestion of forage or prey that have accumulated contaminants. Exposure routes are the mechanisms by which a chemical may enter an individual receptor's body. Possible exposure routes include:

Absorption across external body surfaces such as cell membrane, skin, integument, or cuticle from air, soil, or water. Absorption is not likely to be a major component of the total exposure to wildlife and, therefore, will not be evaluated quantitatively in the wildlife risk analysis.

Ingestion including direct ingestion of food and incidental ingestion of soils, sediments, or water along with food.

The quantification of receptor-specific exposures via inhalation or dermal absorption was not evaluated because of a lack of appropriate exposure and toxicity data. The exposure of animals to contaminants in soil by dermal contact is likely to be small due to barriers of fur, feathers, and epidermis. Since volatile organic chemicals are not expected to be COIs at the Site, and due to the uncertain nature of assessing inhalation risk to ecological receptors, inhalation of particulate forms of COIs is unlikely to be as important exposure pathways as ingestion of contaminated materials at the Site. Thus, the ERA focuses on the ingestion pathways as the primary exposure route for terrestrial vertebrates.

3.0 SCREENING-LEVEL EXPOSURE ESTIMATE AND RISK ESTIMATES

The screening-level exposure and risk calculation corresponds to Step 2 of the U.S. EPA (1997) guidance. Step 2 includes an assessment of potential ecotoxicity of stressors based on the information available prior to performing the SLERA. The result of Step 2 is a decision on whether additional ecological risk evaluation is necessary. More specifically, the SLERA is intended to support the following decisions (U.S. EPA, 1997):

- Available information is adequate to conclude there is no need for remediation at the Site on the basis of ecological risk.

Or

- Data are adequate to indicate that risks may not be negligible and further assessment of potential ecological risks is warranted.

Or

- Available data are not adequate to determine that risks are negligible and more evaluation is necessary to determine the need for further action.

Data that were available prior to the SLERA could not be used to show *de minimus* ecological risk at the Site, nor were there sufficient data in all areas of the Site to rule out the need for further data collection. These conclusion are based on the following:

- Potentially complete exposure pathways for COIs related to the processes used on-site exist between the soil/sediment, bauxite residues, and surface water and terrestrial ecological receptors.
- Screening-level analytical data available for use in the SLERA indicated that several COPECs were present at concentrations that exceed highly conservative risk screening levels.
- Data gaps are present in several areas of the Site.

This information indicates that the potential for risks to ecological receptors cannot be eliminated at the Site based on the currently available data. Therefore, further characterization of ecological risks at the Site appears to be necessary to more accurately predict the risks to ecological receptors utilizing the areas of suitable habitat at the Site.

The following sections present a thorough discussion of the technical approach and results of SLERA for the Site that was used to reach the above conclusions.

3.1 Technical Approach

The technical approach for the SLERA follows U.S. EPA (1997) guidance closely. The areas of the Site where there are potentially complete exposure pathways from elevated COPEC concentrations in soils/sediment to wildlife receptors were divided into Investigative Blocks based on current and potential future land use. The Investigative Blocks (Figure 2-4) with some ecological habitat were evaluated in the SLERA where data were available.

- Old Pond RDA (RDA – 1)
- Brown Mud RDA (RDA – 2)
- Red Mud RDA (RDA – 3)
- Redevelopment Area
- SPL Area
- North Wet Area – very low habitat quality
- Triangle Wet Area

The SLERA compares maximum concentrations of COIs in each Investigative Block to receptor and COPEC specific risk-based screening criteria. The risk-based screening criteria developed for the SLERA represent concentrations of COIs that are associated with exposures that would be very likely to show no toxicity to the ecological receptors inhabiting the Site. The criteria that were developed were both COI and receptor specific based on the screening level assessment endpoints presented in the following subsections.

3.1.1 Potential Receptors

Several representative groups of wildlife species were identified as Receptors of Concern (ROCs) for use in the SLERA. Each group of receptors represents a group of species (feeding guild) with similar habitat use and feeding habits that could potentially inhabit the terrestrial habitats at the Site.

Representative species groups that may utilize the habitats at the Site are described briefly below.

Mammals

Several general groups of mammalian receptors that are expected to be present at the Site were utilized as ROCs in the SLERA. These included the omnivorous small mammals such as *Peromyscus* spp. (e.g., deer mouse), large herbivores (whitetail deer), and predators (e.g., coyote).

Omnivorous Small Mammal

Of the three major groups of mammalian receptors that may potentially utilize the upland portions of the Site, the small mammals may be the most diverse and complex. Habitat type plays a major role in the presence and abundance of the various species of small mammals. Since diversity of habitats plays a major role in the distribution of small mammal species, it would be impossible to assess risk to all species expected to be present in each of the various habitat patches found at the Site. Therefore, a generalized small mammalian receptor that can be used to represent a wide variety of naturally occurring species found at the Site was selected as a wildlife receptor species.

This generalized small mammal represents a conservative median of feeding habits and other physical parameters and is generically represented by the deer mouse (*Peromyscus maniculatus*). Dietary composition was assumed to be an equal mix of terrestrial invertebrates and terrestrial plant tissue in order to assess the potential exposures to a receptor ingesting a general mix of prey types at the Site.

Large Herbivorous Mammal

Ungulates can be important from a risk assessment perspective because of their longer lives and higher ingestion rates of vegetation growing at the Site. It is likely that a local population of whitetail deer (*Odocoileus virginianus*) does utilize the site for feeding. The quality of habitat found on-site is also likely acceptable to support a small population of whitetail deer. However, during the two winter/spring 2003 Site visits, very few physical signs of whitetail deer usage were noted. It is likely that the habitats found in Frank Holten State Park and the adjacent golf course also support the same population of deer. Therefore, the Site should be viewed as a portion, along with off-site habitats, of the entire home range of the local population of deer.

The white-tailed deer ROC represents the potential for risks to a large herbivorous mammal that may periodically utilize the terrestrial habitats at the Site for feeding or loafing behavior.

Mammalian Predators

Predators potentially present include omnivores such as the spotted or striped skunks and the raccoon. Larger predators likely include the coyote (*Canis latrans*), which is used as an ROC in the SLERA to estimate the potential exposure, through bioaccumulation of COIs through the foodchain by predatory species that may feed at the Site on occasion as part of its larger home range.

Semi-Aquatic Mammalian Herbivores

Habitat for semi-aquatic mammals on-site is limited, however, several of the wet areas may have sufficient available habitat to support transient individuals periodically. Therefore, the muskrat (*Ondatra zibethicus*), a semi-aquatic herbivorous mammal, was evaluated as a ROC in the SLERA. This ROC was evaluated only in the habitats it would be likely to utilize (i.e., marshy areas and open water).

Omnivorous Birds

A suite of common songbirds likely utilizes the habitats at the Site periodically. Most small birds have flexible diets that emphasize specific types of plant or animal material during certain seasons. For example, many species consume flower buds, leaf buds, fruit, or seeds during most of the year but shift to insect prey as a protein source for forming eggs and feeding young. Most species are somewhat opportunistic, feeding on whatever food source is most abundant or particularly nutritious/palatable at a given time. A generalized avian receptor, represented by the American robin (*Turdus migratorius*), a member of the omnivorous feeding guild was used to represent the species utilizing the habitats at the Site.

Avian Predators

Representative avian predators (raptors) for the study area include the red-tailed hawk and Swainson's hawk, both of which are large, diurnal species; the great horned owl, a large, nocturnal species; and smaller species such as the American kestrel may utilize the on-site habitats for a portion of the year.

A generalized avian predator, represented by the red-tailed hawk (*Buteo jamaicensis*) is used as an ROC in the SLERA to estimate the potential exposure, through bioaccumulation of COIs through the foodchain, by predatory species periodically present at the Site.

Semi-Aquatic Avian Herbivore

The aquatic and semi-aquatic habitats present at the Site represent a potential stop-over point for avian waterfowl such as the mallard (*Anas platyrhynchos*). Mallards are typically herbivorous and will be evaluated in the SLERA in the appropriate habitat types including wet areas and open water.

Semi-Aquatic Avian Predator

Two state endangered species, the black crowned night heron (*Nycticorax nycticorax*) and the little blue heron (*Egretta caerulea*), are known to nest in the Allerton Rookery (near the Site) and have been observed flying over the site (Zambrana Inc. 1999). A lack of quality aquatic habitat necessary for these ROCs makes it highly unlikely that either species would utilize the Site on more than an occasional basis. However, given the special status of these species in the State of Illinois, the black crowned night heron was evaluated as a ROC in the SLERA.

3.1.2 Data Used in the Screening-level Exposure and Risk Estimates

Several datasets were available for use in the SLERA including a total of 137 soil, 5 sediment, and 5 surface water data points from four sources. The locations of samples used in the SLERA are shown on Figure 2-2.

In the CERCLA redevelopment area Investigative Block (IEPA, 1999), 120 total soil samples were available. Of the 120 samples, 68 were collected from the top 12 inches of soil. Accessibility to these surficial soils may provide an exposure route to the ROCs, making them applicable for use in the SLERA for the upland species. Several of these samples were collected from the brown and red mud RDAs and the gypsum berms. These samples were analyzed for metals, volatiles, semi volatiles, pesticides, and polychlorinated biphenyls (PCBs).

A small dataset was also available for the Childs Property in the southeastern portion of the Site (IEPA, 1997). This dataset included nine total samples, eight of which were collected at less than one foot of depth. These samples were analyzed for metals, volatiles, semi volatiles, and pesticides.

Eight total samples (4 surface soil) were collected from the red mud pond, RDA 3 (ARDL, 2001). These samples were analyzed for metals only.

Finally, a set of five collocated surface water and sediment samples were collected from the North Wet Area Investigative Block adjacent to Lake Drive on the north boundary of the Site. These sediment and surface water samples were analyzed for metals, volatiles, semi-volatiles, and pesticides.

3.1.3 Toxicity Reference Values

Risk assessment is typically conducted by comparing estimates of site exposure to COIs to toxicity reference values (TRVs) which represent the threshold for exposure above which adverse ecological effects cannot be ruled out. The process for developing TRVs is discussed below.

Screening level risks to the ROCs were predicted using soil-screening levels (SSLs) that have been derived for each ROC using the receptor food and soil intake parameters presented in Table 3-1. SSLs were calculated using the equations presented in the following subsections. Use of SSLs allows a simple comparison of the maximum concentration of COIs in the soil/sediment (assumed to be a worst-case potential soil concentration).

No standardized toxicity criteria have been developed for terrestrial ROCs. Consequently, toxicity data in the scientific literature were reviewed to characterize the toxicity of the COIs selected for evaluation. The derivation of terrestrial SSLs for each of the ROCs selected for evaluation in the SLERA is discussed below.

As discussed earlier, risks to terrestrial wildlife from the ingestion of prey and soil were selected for evaluation. Dose-based toxicological benchmarks compiled by Oak Ridge National Laboratory (Sample et al., 1996) and values found in other literature sources were used to evaluate the potential for adverse effects to the wildlife ROCs (Table 3-2). The SSL values presented in the following sections were from chronic No Observed Adverse Effects Levels (NOAELs) derived from bioassay studies of

laboratory birds and mammals. The selected benchmarks were generally based on measurements of survival, growth, or reproduction in the laboratory.

A TRV was selected from the available scientific literature for each COI using the following criteria:

- Doses based on the receptor species selected for evaluation were used preferentially; however, if toxicity information was not available for these species, doses for animals within the same class as the receptor species were used.
- Data for reproductive or developmental effects were used preferentially over other endpoints. Reproductive and developmental effects represent a more sensitive measure of wildlife effects than mortality. Therefore, these effects were chosen in preference to the less sensitive mortality endpoint for assessing ecological risk to the receptors of concern.
- Chronic data were used in preference to sub chronic or acute data, and NOAELs were used in preference to Lowest Adverse Effects Levels (LOAELs) and effects measurements.

TRVs were not available for each receptor class (avian vs. mammalian) or for each COI and no inter-class extrapolations were conducted due to the inherent uncertainty involved. . Where appropriate, surrogate values were, however, used in intra-class extrapolations for COIs with no available TRVs. The use of surrogate values introduces considerable uncertainty into the risk assessment process and risks may be over- or under-estimated through the use of surrogate values. Care was taken to only use surrogate values for COIs with similar chemical structures or similar toxicities to minimize the uncertainty to the extent possible. Those COIs with no TRVs available will be discussed as COIs of uncertain risk in the Risk Characterization section.

Many of the COIs did not have chronic NOAEL values presented in the Sample et al. (1996) text. Also in many cases, chronic NOAELs were not presented in the source of the TRV. Therefore, conversions were necessary to approximate a chronic NOAEL from the endpoint presented in the original study. The conversion factors presented in Sample et al. (1996) were used for this purpose.

3.2 Screening Level Exposure and Risk Estimates

SSLs were compared to maximum detected COI concentrations in each Investigative Block. These comparisons were termed screening-level hazard quotients (SHQs), which are ratios of the

maximum detected concentrations to the SSLs. As outlined by USEPA (1997) guidance, COIs with SHQs greater than 1.0 using conservative SSLs cannot be eliminated from further analysis in BERA and must be carried forward through the baseline problem formulation as COPECs (Step 3).

Maximum detected COI concentrations for each Investigative Block are presented in Tables 3-5 and 3-6 for surface soil and sediment respectively. The SHQs calculated by dividing these concentrations by the SSLs are presented in Tables 3-7 and 3-8.

3.2.1 American Robin

In the Brick Works Investigative Block, the American robin had SHQs greater than 1.0 for the metals aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, selenium, silver, thallium, vanadium, and zinc. Several organic COIs also were present at concentrations resulting in SHQs greater than 1.0, including aroclor-1260, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, di-n-octylphthalate, endrin and phenanthrene.

In the Redevelopment Area Investigative Block, the American robin had SHQs greater than 1.0 for the metals aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, selenium, silver, thallium, vanadium, and zinc. The only organic COIs detected at a concentration that resulted in SHQs greater than 1.0 were bis(2-ethylhexyl)phthalate, di-n-butylphthalate, and di-n-octylphthalate.

In the Brown Mud RDA Investigative Block, the American robin has SHQs greater than 1.0 for the metals aluminum, chromium, cobalt, copper, lead, vanadium, and zinc. No organic COIs were detected in the Brown Mud RDA at concentrations that resulted in SHQs greater than 1.0.

In the Red Mud RDA Investigative Block, the American robin has SHQs greater than 1.0 for the metals aluminum, cadmium, chromium, cobalt, lead, mercury, selenium, silver, vanadium, and zinc. No organic COIs were detected in the Red Mud RDA at concentrations that resulted in SHQs greater than 1.0.

3.2.2 Red-Tailed Hawk

In the Brick Works Investigative Block, the red-tailed hawk had SHQs greater than 1.0 for the metals aluminum, cadmium, chromium, cobalt, copper, lead, selenium, vanadium, and zinc. Several organic COIs (bis(2-ethylhexyl)phthalate, dieldrin, endrin, endrin aldehyde, endrin ketone, di-n-butylphthalate, and di-n-octylphthalate) were also detected in the Brick Works Investigative Block at concentrations that resulted in SHQs that were slightly greater than 1.0. However, organochlorine pesticides were never manufactured on-site and likely represent typical soil concentrations of these pesticides in urban areas such as the Site. In addition, the low level detections (<0.02 mg/kg) and lack of reliable uptake factor information suggest that the SSLs for the endrin compounds are overly conservative.

In the Redevelopment Area Investigative Block, the red-tailed hawk had calculated SHQs greater than 1.0 for the metals aluminum, cadmium, chromium, cobalt, copper, lead, vanadium, and zinc. In addition, several organic pesticides (endrin, endrin aldehyde, endrin ketone) were also detected in the Brick Works Investigative Block at concentrations that resulted in SHQs that were slightly greater than 1.0. However, organochlorine pesticides were never manufactured on-site and likely represent typical soil concentrations of these pesticides in urban areas such as the Site. In addition, the low level detections (<0.02 mg/kg) and lack of reliable uptake factor information, it is likely that the SSLs for the endrin compounds are overly conservative. Di-n-butylphthalate also had a SHQ greater than 1.0.

In the Brown Mud RDA Investigative Block, the red-tailed hawk had SHQs greater than 1.0 for the metals aluminum, chromium, lead, vanadium, and zinc. No organic COIs were detected at concentrations that resulted in SHQs greater than 1.0 to the red-tailed hawk in the Brown Mud RDA Investigative Area.

In the Red Mud RDA Investigative Block, the red-tailed hawk had SHQs greater than 1.0 for the metals aluminum, chromium, lead, vanadium and zinc.

3.2.3 Deer Mouse

In the Brick Works Investigative Block, the deer mouse had SHQs greater than 1.0 for the metals aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, selenium, thallium, vanadium, and zinc. Also detected at a concentration that resulted in an SHQ greater than 1.0 for the deer mouse were aroclor-1260 and dieldrin.

In the Redevelopment Area Investigative Block, the deer mouse had SHQs greater than 1.0 for the metals aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, lead, selenium, and vanadium. Both aroclor-1254 and aroclor-1260 were detected at concentrations in the Redevelopment Area Investigative Block at concentrations that resulted in SHQs greater than 1.0 for the deer mouse. No other organic COIs had SHQs greater than 1.0 in the Redevelopment Area Investigative Block.

In the Brown Mud RDA Investigative Block, the deer mouse had SHQs greater than 1.0 for the metals aluminum, antimony, arsenic, barium, chromium, cobalt, and vanadium. No organic COIs were detected at concentrations that resulted in SHQs greater than 1.0 for the deer mouse.

In the Red Mud RDA Investigative Block, the deer mouse had SHQs greater than 1.0 for the metals aluminum, antimony, arsenic, barium, cadmium, chromium, selenium, and vanadium. No organic COIs were detected at concentrations that resulted in SHQs greater than 1.0 for the deer mouse.

3.2.4 Coyote

In the Brick Works Investigative Block, the coyote had SHQs greater than 1.0 for the metals aluminum, arsenic, cadmium, copper, selenium, vanadium and zinc. Dieldrin was the only organic COI detected at a concentration that results in an SHQ greater than 1.0 for the mammalian predator.

In the Redevelopment Area Investigative Block, the coyote had SHQs greater than 1.0 for the metals aluminum, chromium, lead, selenium, and vanadium. No organic COIs were detected at concentrations that would result in SHQs greater than 1.0 for the coyote.

In the Brown Mud Investigative Block, the coyote had SHQs greater than 1.0 for the metals aluminum, chromium, and vanadium only.

In the Red Mud Investigative Block, the coyote had SHQs greater than 1.0 for the metals aluminum chromium, selenium and vanadium.

3.2.5 Whitetail Deer

In the Brick Works Investigative Block, the whitetail deer had SHQs greater than 1.0 for the metals aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, selenium, vanadium, and zinc. No organic COIs were detected at concentrations that result in SHQs greater than 1.0 for the whitetail deer.

In the Redevelopment Area Investigative Block, the whitetail deer had SHQs greater than 1.0 for the metals aluminum, antimony, arsenic, barium, chromium, cobalt, lead, selenium, and vanadium.

In the Brown Mud Investigative Block, the whitetail deer had SHQs greater than 1.0 for the metals aluminum, antimony, chromium, and vanadium.

In the Red Mud Investigative Block, the whitetail deer had SHQs greater than 1.0 for the metals aluminum, chromium, selenium, and vanadium.

3.2.6 Mallard

Screening level HQs (SHQs) were calculated for the mallard in the two on-site wet areas that had data available for the SLERA. In the Northern Wet Area Investigative Block, the mallard had SHQs greater than 1.0 for the metals chromium, lead, selenium, vanadium, and zinc. No organic COPECs had SHQs greater than 1.0 for the mallard.

In the Triangle Wet Area Investigative Block, the mallard had SHQs greater than 1.0 for the metals lead and vanadium only.

3.2.7 Black-Crowned Night Heron

The state endangered black-crowned night heron was conservatively evaluated as an on-site resident in the two wet areas that had data available for the SLERA. In the North Wet Area Investigative Unit, SHQs greater than 1.0 were calculated for the metals aluminum, chromium, lead, selenium, vanadium, and zinc.

In the Triangle Wet Area Investigative Block, the black-crowned night heron had SHQs greater than 1.0 for the metals aluminum, lead, vanadium, and zinc only.

3.2.8 Muskrat

The muskrat was evaluated as the mammalian receptor that could potentially inhabit the wet habitats on-site. In the North Wet Area Investigative Block, the muskrat had SHQs greater than 1.0 for the metals aluminum, antimony, arsenic, barium, chromium, cobalt, manganese, selenium, thallium, and vanadium. No organic COIs had SHQs greater than 1.0 for the muskrat.

In the Triangle Wet Area, the muskrat had SHQs greater than 1.0 for the metals aluminum, antimony, arsenic, barium, chromium, lead, selenium, thallium and vanadium.

3.3 Summary of the SLERA

- The rationale for proceeding with the BERA is based on several lines of evidence:
- Knowledge of historical processes at the Site
- Elevated concentrations of metals in the bauxite residue and other Alcoa process materials disposed of at the Site.

Results of the SLERA that cannot rule out the potential for adverse effects to wildlife receptors utilizing the ecological habitats at the Site.

Receptor specific screening-level SSLs were developed for each constituent detected in surface soil/sediment samples at the Site. Data from several sources were utilized in the SLERA. Multiple metal

and several organic COPECs were identified in the SLERA and are presented in Section 4.2. In general, if a COI had a SHQ greater than 1.0 for any receptor in an Investigative Block, that COPEC was carried forward into the Baseline Problem Formulation for further analysis in the BERA.

Bis (2-ethylhexyl) phthalate and several additional phthalates were measured in excess of their ecological screening criteria (di-n-butylphthalate, di-n-octylphthalate). Many of the samples, however, showed phthalates present at low levels. U.S. EPA (1988a, 1988b, 1989, 1999, 2002) considers phthalate esters (among other organic constituents) to be "common laboratory contaminants," and their presence in the analytical results may well be a result of the laboratory rather than the site. Furthermore, phthalates do not appear to have been used in any of the former Alcoa operations. Since the 1980s, the use of phthalates has increased dramatically and, as such, they are commonly found in air, soil, sediments, surface water and food products. Therefore, phthalates will not be included as COPECs at the site for the following reasons: The facility ceased operations before phthalates were commonly used in manufacturing; there is no record of use of phthalates at the site, phthalates are considered by U.S. EPA to be common laboratory contaminants, and they are ubiquitous to the environment. It should be noted, however, that this class of compounds would be included in target analyte list (TAL) analysis proposed for 10% of the site samples. Special care will be taken to evaluate phthalate ester analytical results with respect to corresponding laboratory and trip blanks, and U.S. EPA protocols will be used to qualify a phthalate result as "blank contamination" if the sample result is <10x the blank result for these constituents. However, it is unlikely that phthalates would be excluded in the risk assessment if they were detected at concentrations above risk-screening levels and not demonstrable as blank contaminants.

Organochlorine pesticides were never manufactured on-site and likely represent typical soil concentrations of these pesticides in urban areas such as the Site. In addition, the low level detections (<0.02 mg/kg) and lack of reliable uptake factor information suggest that the SSLs for the organochlorine pesticide compounds are overly conservative. For these reasons, the organochlorine pesticides will not be carried forward as COPECs in the BERA.

Finally, polychlorinated biphenyls (PCBs), specifically aroclor 1260 and aroclor 1254, were measured in two of fifteen samples collected at the Brick Works in excess of the SSLs. The maximum measured concentration was 3.5 mg/kg; however, most samples showed no detectable PCBs. PCBs were produced commercially in the United States from 1929 until 1977 and used in capacitors, transformers, hydraulic fluids, plasticizers, adhesives, paints, flame retardants, etc. All power generated at the site, prior to ceasing operations in the 1960s was by coal or gas fired power generation. There are no known

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operations at the site that used or generated PCBs or PCB-containing products or oils. In addition, studies show that soils in urban areas had detected concentrations of PCBs ranging from 0.02 to 11.94 mg/kg (ATSDR, 1998), which is somewhat consistent with the samples collected at the site. Because of these reasons, PCBs will not be included as a COPEC for the site. It should be noted, however, that this class of compounds would be included in TAL analysis proposed for 10% of the site samples. As such, it is unlikely that PCBs would be excluded in the risk assessment if they were detected at concentrations above risk-screening levels in these samples.

4.0 BASELINE RISK ASSESSMENT PROBLEM FORMULATION

The Baseline Risk Assessment Problem Formulation is Step 3 of the U.S. EPA ERA guidance. The objective of this step is to plan for further risk analysis based on the results of the SLERA. Section 3.3 presented a thorough summary of the SLERA.

4.1 Constituents of Potential Ecological Concern

Identification of COPECs for the BERA was based primarily on exceedances of risk-based criteria in the SLERA by maximum soil and sediment COI concentrations in each Investigative Block. The SLERA was completed for the potentially complete exposure pathways discussed in the screening-level problem formulation. The SHQs are presented in Table 3-7 for surface soils and Table 3-8 for sediments. In general, most of the metals analyzed in the various datasets used in the SLERA exceeded at least one SSL in at least one Investigative Block. The COPECs proposed for inclusion in the BERA are:

- **Upland Habitats**
 - Aluminum
 - Antimony
 - Arsenic
 - Barium
 - Cadmium
 - Chromium
 - Cobalt
 - Copper
 - Cyanide
 - Lead
 - Mercury
 - Selenium
 - Silver
 - Thallium
 - Vanadium
 - Zinc

- **Wet Areas**
 - Aluminum
 - Antimony

- Arsenic
- Barium
- Chromium
- Cobalt
- Cyanide
- Lead
- Manganese
- Selenium
- Thallium
- Vanadium
- Zinc

Calcium, iron, magnesium, and potassium were excluded from SLERA analyses due to their abundance in crustal materials and their general lack of toxicity.

4.2 Ecosystems Potentially at Risk

Ecosystems that are potentially at risk occur in areas of the Site where exposure to ecological receptors has the potential to occur and where concentrations of COPECs are elevated to potentially ecotoxic levels, as described by the SLERA. The areas of the Site that have the potential to support ecological receptors are described below. These areas have been defined using Site aerial photography, existing Site reports (Zambrana, 1999) and Site visits. In general, these habitat areas coincide with the Investigative Blocks discussed in Sections 2 and 3.

- 1) Residue Disposal Areas (RDAs) – The three large RDAs located in the center of the Site compose a large section of marginal upland and wet area habitat that could be utilized by off-site and limited on-site receptors on occasion. A large proportion of the RDAs are vegetated. In the wet areas of the Brown Mud RDA and the Red Mud RDA, large stands of *Phragmites* and other rushes form dense areas cover on the RDAs. In the less mesic sections of the RDAs, successional and shrub scrub forest dominates. Open water areas on the RDAs likely serve only as stopover points for waterfowl on occasion. It is unlikely, due to the low quality of habitat and lack of palatable aquatic vegetation, that waterfowl use the open water areas of the RDAs for extended periods of time
- 2) Redevelopment Area – The area to the south and west of the three large RDAs, bounded by Missouri Avenue to the South is described as the CERCLA Redevelopment Area. Mature hardwood forests dominate this area with some wet area habitat interspersed. Several small open water features are found just to the south of the RDAs. These small areas may contain standing water throughout much of the year. This area also includes the SPL Area Investigative Block.

- 3) North Wet Areas – This area of potential ecological habitat encompasses two Investigative Blocks, the North Wet Area and the Triangle Wet Area. This section of potential ecological habitat is primarily made up of low quality marshy wet habitat possibly perched atop residue materials. The north wet area is geographically bounded by Lake Drive to the north and the gypsum berms from the Old Pond and Red Mud Pond to the south. The habitats in this section of the site are a mix of non-vegetated wet areas to areas of emergent vegetation such as Phragmites and bulrush. Some non-vegetated marsh areas are also present just south of Lake Drive. The upland portions of this area are dominated by elms and sycamore in the canopy with a primarily honeysuckle under story.

One area of habitat of moderate quality (Zambrana Inc 1999) is the Triangle Wet Area Investigative Block. This triangle of habitat is isolated from the rest of the Site by a series of gypsum berms appear to have isolated this area from the rest of the Site.

- 4) Non-habitat Investigative Blocks – The gypsum berms, brick works, Childs property and ball fields Investigative Blocks (Figure 2-4) do not represent areas of potential ecological habitat. These areas either represent areas of current light-industrial activities, recreational activities, and or areas that have no value as ecological habitats (gypsum berms). Therefore, these areas will not be considered further in the BERA.

Areas 1 through 3 described above have the potential to be affected by elevated COPEC concentrations related to past Site activities and deposited bauxite residue. A conceptual exposure model is presented in Section 2 that graphically depicts the potential exposure of ecological receptors to COPECs in the areas described above.

4.3 ERA Goals and Objectives

The ERA goals and objectives were developed according to U.S. EPA guidance on conducting ERAs (U.S. EPA, 1997; 1998) and the Data Quality Objectives (DQO) process (U.S. EPA, 1994). U.S. EPA prescribes the development of goals, objectives, and data needs for BERAs through the identification of risk management goals, assessment endpoints, risk questions, and risk measures to be used in the baseline risk analysis. Management goals define the broad objectives of the ecological risk management on which the BERA is based.

Assessment endpoints are explicit expressions of the ecological resource to be protected (U.S. EPA, 1997; 1998) and provide the focus for the BERA. Identification of assessment endpoints is necessary to focus the BERA on ecologically relevant receptors, rather than attempt to evaluate risks to all potentially affected receptors. Assessment endpoints should be consistent with management policy goals and ecological values for the Site.

Risk questions, as defined by U.S. EPA (1997), are the questions the BERA will attempt to answer regarding whether or not assessment endpoints have been adversely affected by exposure to COPECs. They form the basis for identifying the specific analyses to be conducted and the data needs to perform the analysis. In some cases, risk questions may be stated as risk hypotheses (U.S. EPA, 1998) which form the basis for identifying the specific analysis to be performed. Evaluation of risk hypotheses is not equivalent to formal statistical tests of null hypotheses (U.S. EPA, 1998).

Assessment endpoints and risk questions/hypotheses are used to identify the types of measures needed to perform the BERA. Two types of measures will be used in the ERA:

- Measures of exposure - measures that describe the location and concentration of COPECs in abiotic and biotic media that can be used to estimate exposure of receptors.
- Measures of effects - measurement of changes in an attribute of the assessment endpoint in response to exposure.

As noted previously, the baseline problem formulation process is similar to the DQO process. However, the components of the DQO process require that *a priori* identification of decision rules and statistically based decision criteria in the form of SSLs are not always applicable to risk hypotheses used in the BERA (U.S. EPA, 1998). Decision criteria were used in the SLERA (Section 3). Such binary decisions are not applicable to many aspects of the BERA because of the need to describe impacts, risk, and respective sources prior to developing decision criteria for remedial actions, if any (U.S. EPA, 1998). The following section describes the Problem Formulation process for the Alcoa North Plant BERA.

4.3.1 Identification of Management Goals and Objectives

4.3.1.1 Management Goals

Management goals are used to identify the goals of the Site in terms of ecological risk. The ecological risk management goal on which the BERA design is based is:

- The post-remedy condition of the Site will not result in significant adverse effects on local wildlife populations, including state-endangered bird species from the nearby Allorton Rookery

Adverse effects are defined as those that result in Site-related stress to local communities of ecological receptors that utilize the Site on an occasional basis. This includes populations of several state species of special concern that inhabit a rookery near the Site and may utilize the Site on occasion. Please note that these species are not known to inhabit the Site on a regular basis.

The prediction of local community risk will take the habitat available at the Site into consideration. Several large areas of the Site are either currently used for industrial purposes or are of low enough quality that they do not represent even a short stopover habitat (i.e., gypsum berms).

4.3.1.2 Decisions

The BERA will provide Risk Managers with a range of ecological risk data. This data will be presented for use in a weight-of-evidence approach toward determining the appropriate actions for the Site.

The fundamental decisions that the BERA is designed to support are:

- Determine whether COPECs at the Site have resulted, or are likely to result, in adverse effects to the assessment endpoints.
- If adverse effects are likely to occur, determine which COPECs, exposure pathways, and fate and transport mechanisms are most important in causing the effects.
- Determine whether adverse impacts or risks of adverse effects warrant remediation.

4.3.2 Assessment Endpoints, Approach Objectives and Risk Questions

Assessment endpoints were identified based on ecological relevance, potentially complete exposure pathways, potentially exposed taxonomic groups that may be sensitive to COPEC, and site management goals (U.S. EPA, 1998). Terrestrial exposure pathways include exposure of wildlife to contaminated soils, surface water and prey items. Semi-aquatic exposure pathways include exposure of semi-aquatic wildlife to contaminated sediments, surface water and prey items. The proposed assessment endpoints and rationale for their inclusion are summarized below.

Omnivorous birds (community composition, survival, growth, and reproduction):

Ecological relevance: Migratory and resident birds provide a food source for avian and mammalian predators. In addition, these small avian receptors can be important in the dispersal of seeds and the control of insect populations.

Susceptibility to COPECs: Several COPECs can cause sublethal and lethal effects in birds. The primary exposure routes are through ingestion of soil, prey items, and water.

Relevance to Management Goals: The potential exists for direct effects on birds utilizing the habitat areas at the Site due to exposure to elevated concentrations of COPECs in soils or prey tissues.

Raptors (survival, growth, reproduction):

Ecological relevance: Migratory and resident raptor species make up the top trophic level in patches of habitat such as those found at the Site. Raptors are regularly seen hunting at the Site, although it is unlikely that the Site supports populations of raptors that feed solely at the Site. Rather, the Site likely represents a portion of the total hunting grounds for the local community of raptors.

Susceptibility to COPECs: Several COPECs can cause sublethal and lethal effects in birds. The primary exposure routes are through ingestion of contaminated soil, prey items, and water.

Relevance to Management Goals: The potential exists for direct effects on raptors ingesting prey items for the Site. Because of their typically large home ranges, only a few individuals would potentially be affected at a given time. The Site is not expected to support a resident population of raptors.

Omnivorous Small Mammals (community composition, survival, growth, reproduction):

Ecological Relevance: Small mammals are critical components of local food webs in most habitat types. Significant long-term reductions on local small mammalian populations could affect predator populations.

Susceptibility to COPECs: Several COPECs can cause sublethal or lethal effects in small mammals. The primary exposure route is through the ingestion of COPECs in soil, prey items, and water.

Relevance to Management Goals: Due to their relatively small home ranges, small mammals may represent the most highly exposed taxonomic group at the Site.

Ruminants (survival, growth, and reproduction):

Ecological Relevance: The whitetail deer is a primary consumer of vegetation at the Site. While it is not likely that the Site supports a resident population of whitetail deer, it is likely that individuals inhabiting adjacent properties may utilize the habitats on-Site for feeding and loafing purposes on occasion.

Susceptibility to COPECs: Several COPECs can cause sublethal and lethal effects in mammals. The primary exposure route is through the ingestion of soil, plant material, and water.

Relevance to Management Goals: The whitetail deer that may utilize the Site represent a group of species described as charismatic megafauna. Charismatic megafauna are large, visible species that are typically have high aesthetic values attached to them by the general public.

Mammalian Predators (survival, growth, reproduction):

Ecological Relevance: Mammalian predators, such as the coyote, represent the top trophic level consumer at the Site. As with the raptor, it is unlikely that the Site supports a population of mammalian predators. Likely, only transient individuals from adjacent properties visit the Site for feeding and migratory purposes visit the Site on a temporary basis.

Susceptibility to COPECs: Several COPECs can cause sublethal and lethal effects in mammals. The primary exposure route is through the ingestion of soil, plant material, and water.

Relevance to Management Goals: Large mammalian predators typically have large home ranges and require an area larger than the Site. However, some individuals may occasionally utilize the habitats at the Site for feeding purposes.

Semi-Aquatic Waterfowl (survival, growth, and reproduction):

Ecological Relevance: Migratory populations of waterfowl represent a potential primary consumer in the areas of standing water at the Site. It is highly unlikely that the Site supports a resident population of migratory waterfowl, however, it is expected that several individuals of the local waterfowl community may utilize the open water and wet area habitats at the Site for feeding and loafing on an occasional basis.

Susceptibility to COPECs: Several COPECs can cause sublethal and lethal effects in birds. The primary exposure routes are through ingestion of sediment, aquatic vegetation, and water.

Relevance to Management Goals: The potential exists for direct effects on waterfowl utilizing the wet area habitat areas at the Site due to exposure to elevated concentrations of COPECs in sediments or aquatic vegetation.

Semi-Aquatic Avian Predator (survival, growth, and reproduction):

Ecological Relevance: Two species of migratory semi-aquatic avian predators that are listed as state species of special concern may nest in an off-site rookery near the Site. These species, while not expected to inhabit the Site except as transient individuals, would represent an upper trophic level predator in the semi-aquatic habitats at the Site.

Susceptibility to COPECs: Several COPECs can cause sublethal and lethal effects in birds. The primary exposure routes are through ingestion of sediment, semi-aquatic prey items, and water.

Relevance to Management Goals: The potential exists for direct effects on semi-aquatic avian predators utilizing the wet area habitat areas at the Site due to exposure to elevated concentrations of COPECs in sediments and aquatic prey items.

Semi-Aquatic Mammal (survival, growth, and reproduction):

Ecological Relevance: Semi-aquatic mammals, such as the muskrat, may be present at the Site in small numbers. Potentially adequate habitat exists in several areas of the Site. These receptors represent the primary consumers in the wet area habitats at the Site.

Susceptibility to COPECs: Several COPECs can cause sublethal and lethal effects in mammals. The primary exposure routes are through the ingestion of sediment, aquatic vegetation, and water.

Relevance to Management Goals: The potential exists for direct effects on semi-aquatic mammalian herbivores utilizing the wet area habitats at the Site due to exposure to elevated concentrations of COPECs in sediments and aquatic vegetation.

4.3.3 Objectives of the BERA

For the wildlife receptors at the Site, visual impacts from risk are not easily observable. Therefore, additional data and analyses are necessary to characterize potential risks to the assessment endpoints. Thus, the overall approach to the BERA has two main objectives:

- 1) Evaluate the potential that elevated levels of risk have occurred or are likely to occur for wildlife receptors utilizing the habitats at the Site. Risk characterization for wildlife will focus on the comparison of estimated exposures of receptors to ecotoxicological benchmarks. The baseline analysis will provide a full range of potential risk estimates taking into account a range of potential Site usage to more accurately reflect exposure and potential risks to local populations of wildlife receptors and both NOAEL and LOAEL based TRVs. Estimates of the bioavailability of COPECs from soil/sediment will also be considered.
- 2) Evaluate the potential future Site land use patterns in terms of risks to the assessment endpoints. The current land use patterns at the Site are likely to change following implementation of remedial action at the Site. The BERA will be used to predict potential risk to the wildlife receptors given a range of proposed remedies at the Site.

Risk hypotheses and measurements are listed in Table 4-1. The risk hypotheses can be classed into two basic categories (U.S. EPA, 1998):

- 1) **Exposure Assessment.** Available data indicates that ecological receptors in areas with elevated COPEC concentrations in soil/sediment have the potential for risk. Exposure assessment is based on several factors including habitat usage and bioavailability of the COPEC to the receptor. Both of these factors will be incorporated into the exposure assessment
- 2) **Effects Assessment.** The effects assessment consists of measures of endpoints that can be indicative of ecological risk. This includes measures at levels of ecological organization including the local populations (reproduction and growth) and community (abundance and mortality).

4.3.4 Identification of Data Gaps

Data available at the time this Problem Formulation document was prepared included:

- Metals and organics data in soils from a large dataset in the CERCLA Redevelopment Area, Brick Works, and Childs Property Investigative Blocks. (IEPA 1999, 2000)
- Limited number of metals and organics data from the Red Mud RDA and Brown Mud RDA Investigative Blocks. (IEPA 1999 and ARDL 2001)
- Limited number of surface water and sediment samples for metals and organics from the North Wet Area and Triangle Wet Area Investigative Blocks (IEPA, 2002).

Additional data collection is planned for those areas identified in the SLERA as having insufficient data to adequately conduct a screening level risk analysis. The collection of these data are generally outlined in the Technical Approach (Section 4.4) and are discussed in the sampling and analysis plans in the RI/FS Work Plan.

The following data gaps have been identified:

- COPEC concentrations in several on-site habitats that have been under-characterized in previous investigations. These Investigative Blocks include the Red Mud RDA, Brown Mud RDA, Old RDA, SPL Area, North Wet Area, Berm Wet Area and Triangle Wet Area. Additional data gaps have also been identified in the surface water and sediment of the Redevelopment Area.
- COPEC concentrations in background or reference area soils, sediment, and surface water.
- COPEC concentrations in biota tissues that may be consumed by upper trophic level receptors on-site (as necessary to reduce uncertainty in the risk assessment).
- COPEC concentrations in biota tissue that may be consumed by upper trophic level receptors in background or reference locations (as necessary to reduce uncertainty in the risk assessment).

The technical approach toward sampling and risk analysis of the data collection necessary to fill in these data gaps and to utilize the existing data are discussed in the following sections.

4.4 Technical Approach

Due to the gaps in the screening-level data that were discussed above, sampling for the BERA will be conducted in two separate Phases. Phase I will be utilized to fill in the data gaps and to complete the habitat based exposure characterization for the Site, and will include primarily abiotic media. Phase I will be integrated with other RI/FS field data collection activities. Results of Phase I will be used to identify more specific ERA data needs, if any, for the receptors and COPECs. If deemed necessary, following the completion of Phase I, a sampling and analysis plan addendum will be submitted that outlines the methods necessary for the completion of the Phase II data collection. Phase II will likely include the collection of collocated soil/sediment and biota samples to determine the degree to which COPECs are present in the prey tissues at the Site. The technical approach to Phase I and Phase II sampling is presented in the following sections.

4.4.1 Phase I Data Collection

4.4.1.1 Types of Data to be Collected

As discussed in Section 4.3.3, there are several data gaps at the Site that must be addressed to complete the exposure characterization at the Site. Phase I data collection will be used to fill in those gaps.

Abiotic media samples will be collected in a systematic sampling design stratified by habitat types and Investigative Blocks. Samples will be collected from soil/residue, sediments, and surface water in limited numbers throughout the Site. The purpose of this data collection will be to fill in the data gaps necessary to complete the exposure characterization for the Site.

The results of the exposure characterization to be completed following Phase I data collection will be used to focus the additional data collection that may be necessary in Phase II of the exposure characterization. Phase II data will be needed if the results of the Phase I data indicate that further characterization of potential exposure to the assessment endpoints is warranted in order to reduce the uncertainty associated with using generic BCFs to estimate prey tissue concentrations at the Site. If the Phase I data are deemed to be adequate to justify the results of the Phase I exposure characterization using the Management Goals for the Site, then biotic tissue data collected under Phase II may not be necessary.

Samples of abiotic media will be collected from the following investigative blocks in Phase I:

Surface Soil/Residue

- Old RDA
- Red Mud RDA
- Brown Mud RDA
- SPL Area
- Redevelopment Area

Sediment and Surface Water

- Standing water in each RDA
- North Wet Area
- Triangle Wet Area
- SPL Area
- Redevelopment Area Isolated Wet Areas

Table 4-2 identifies the habitats where samples will be collected as well as the proposed number of samples to be collected in each area. For Phase I, surface waters, sediments, and soil/residue samples will be collected according to a systematic stratified sampling design. Stratification is based on the various habitat types found in the different Investigative Blocks. The design is systematic because for each habitat identified, Phase I sampling will include only a moderate number of samples. Random assignment of a small number of samples in a given habitat area could easily result in a clustering of samples that provides inadequate spatial representation of a given area. This process is applied for locating sample sites for each area except for the redevelopment area.

In this southern portion of the site, numerous (16) isolated wet areas exist. These areas are relatively small in size relative to the other habitats within the boundaries of the Site. Seven of these isolated wet areas will be randomly selected and samples for sediments and surface waters if present. Sites were numbered, one through sixteen, and eight of the sites were randomly selected in the RI/FS Work Plan for sampling.

Sampling in each habitat will require that a specific number of samples be collected at pre-selected locations. These locations will be identified in the RI/FS Work Plan.

**TABLE 4-2
HABITATS AND NUMBER OF SAMPLES TO BE COLLECTED**

| Investigative Block | Habitats | # Samples | Types | Strategy |
|----------------------------|---------------------------------------|---|--|---|
| North Wet Area | North Wet Area | 5 SW/SD 10 SS | Paired SW and sediments Surface Soil | Preliminary characterization of COPEC concentrations; Non random sampling stratified by habitats to achieve spatial representativeness |
| | Wet Area #2 | 5 | Paired SW and sediments | |
| | Berm wet area | 3 | Paired SW and sediments | |
| Triangle Wet Area | Triangle Wet Area | 6 | Paired SW and sediments | |
| Residue Disposal Areas | Red Pond | 3 SW/SD 10 SS Vegetated 10 SS Unvegetated | Paired SW and sediments Soil/Residue | Preliminary characterization of COPEC concentrations; Non random sampling stratified by habitats to achieve spatial representativeness |
| | Brown Pond | 6 SW/SD 10 SS Vegetated 10 SS Unvegetated | Paired SW and sediments Soil/Residue | |
| | Old Pond | 5 SW/SD 10 SS Vegetated 10 SS Unvegetated | Paired SW and sediments Soils/Residue | |
| SPL Area | SPL Wet Areas grassy area | 3 SW/SD 10 SS | Paired SW and sediments Surface Soil | Preliminary characterization of COPEC concentrations; Non random sampling stratified by habitats to achieve spatial representativeness |
| Redevelopment Area | Isolated wet areas | 8 SW/SD | Sediments and SW if present | 15 Process Area pocket wet areas identified - sample 7 randomly selected isolated wet areas |
| Redevelopment Area | Surface Soils | 30 SS | Surface soil | Further characterization of COPEC concentrations; Random sampling locations. |
| Reference Area | Similar wet areas to on site habitats | 3 SW/SD 5 SS | Paired SW and sediments Surface soil | Identify appropriate reference area to assess natural and anthropogenic background |

Spatial distribution of sample sites will be achieved using the gridded sampling strategies outlined in the Field Sampling Plan (RI/FS Work Plan Appendix E).

Coordinates derived from placement of sample locations on site maps will be used to locate actual sampling sites. A GPS receiver like the Trimble Pro XRS will be utilized to navigate to sampling sites. The Pro XRS or similar units utilize real-time corrections to achieve latitude and longitude with sub-meter accuracy. Accuracy of the Site location is important so that there is a high degree of confidence in where each sample is collected, and if need be, the site can be reacquired for future efforts.

Surface Soil and sediment samples will be collected from the upper 24 inches of material to represent the most likely potential exposure concentration for the assessment endpoints (including burrowing mammals). Surface water samples will be collected as grab samples utilizing a peristaltic

pump to minimize the disturbance of bottom sediments and to limit the amount of particulate material collected in the water sample. A detailed discussion of sample site selection and sampling and analysis techniques is provided in the RI/FS Work Plan (Appendix E).

4.4.1.2 Phase I Data Use

Abiotic data collected in Phase I will be used in a manner identical to the historical data in the SLERA (Section 2). Maximum concentrations from each media in each Investigative Block will be compared to the SSLs developed and presented in Section 2.

SHQs will be calculated for each Investigative Block using the screening-level assessment endpoints and receptors. Those COPEC/Receptor pairs that show *de minimus* risk in this analysis will be eliminated from further evaluation.

Those receptor/COPEC pairs that cannot be eliminated using conservative assumptions will be carried forward into a more detailed exposure characterization and risk evaluation. This exposure characterization will take into account that most of the species that may utilize this Site likely utilize more than one Investigative Block on-site. Statistical measures of exposure point concentrations (EPCs) including the 95th UCL geometric mean over several groups of Investigative Blocks or Site-wide will be evaluated as EPCs in the exposure characterization. Statistical testing to determine the distributions of the data will be conducted and data transformations will be made following U.S. EPA guidance (U.S. EPA, 2002). In addition, statistical comparisons following U.S. EPA guidance (U.S. EPA, 2002) will be conducted to compare COPEC concentrations on-site to those collected in background samples. If a COPEC is found to be within background concentrations the COPEC will be discussed in terms of its relationship to background.

Also included in the detailed exposure characterization will be the presentation of alternative TRVs, such as the Lowest Adverse Effects Level (LOAEL) and literature-based estimates of soil-bioavailability for metal COPECs. The Phase I Risk Characterization will present the ranges of potential risks to the assessment endpoints and makes recommendations regarding whether Phase II sampling is necessary to adequately predict ecological risk.

In addition, a spatially explicit estimate of ecological risk will also be performed using the data collected in Phase I. Each available data point will be compared to the back-calculated receptor specific SSLs in order to obtain greater resolution of the potential "hot spots" at the Site and to provide better focus to further risk analysis. This enhanced SLERA will not replace the traditional SLERA, but rather will augment the data available for planning the Phase II data collection for use in the BERA.

The Risk Characterization will be presented in a manner that provides maximal ecological risk data to the Risk Managers to aid in the decision process.

The completed Phase I Risk Characterization will be documented and submitted to U.S. EPA in a Technical Memorandum (TM) within a reasonable time-frame following data validation. At this point, interim decisions will be required from EPA and Alcoa risk managers. If the results of the Phase I Risk Characterization are adequate to support remediation decisions at the Site, additional sampling for ecological risk assessment purposes in Phase II may not be warranted. For example, Phase I data may be adequate to determine whether a soil cover is needed to attenuate exposure pathways from residue to upper trophic level consumers. Additional sampling may then be focused on Feasibility Study data needs such as determining the type and extent of remedy. Independent decisions for each Investigation Block are anticipated. If uncertainties involved with predicting food-chain risk at the Site are too great to make acceptable risk-based decisions at the Site, then Phase II may be necessary to collect biological tissue samples. If the need for Phase II ERA sampling is identified, then decisions from Risk Managers will include which COPEC/receptors pair for which more detailed analysis is needed, and the Investigation Blocks for which risk analysis is necessary.

4.4.2 Plans for Phase II Data Collection

Based on the results of the Phase I data and Risk Characterization, Phase II sampling may be necessary in several areas of the Site. The Phase II data collection will be defined in detail in appropriate addenda to the RI/FS Work Plan. Since it is currently not possible to predict exactly what types of data will be necessary for the completion of BERA, only a general discussion of the Phase II data collection is presented in the following sections.

4.4.2.1 Types of Data to be Collected

It is anticipated that the results of the Phase I Risk Characterization may require that further data be collected from several of the habitat based Investigative Blocks on-site to reduce the uncertainty inherent in estimating prey tissue concentrations using generic BCFs. The data to be collected in Phase II (if necessary) will likely include collocated abiotic and biotic samples, for example:

- Terrestrial and Wetland Vegetation
- Terrestrial Invertebrates
- Small Mammals
- Amphibians

These collocated samples will be collected to establish Site-specific BCFs to be used in the modeling of potential risk to the upper trophic level receptors that may utilize the habitats on-Site.

4.4.2.2 Phase II Data Use

4.4.2.2.1 Assessment of Risk to Receptors

Risks of impact to local wildlife populations from exposure to COPECs will be assessed using methods very similar to those used in the Phase I Risk Characterization for estimating exposure as intake from environmental media (U.S. EPA, 1998). Screening-level exposure estimates (Section 3) were conducted using maximum concentrations from each Investigative Block to assess risk to the wildlife receptors. The SLERA analyses also used generic literature derived BCFs for estimating the concentration of COPECs in prey tissue for the upper trophic level wildlife receptors.

The analyses conducted in the Phase I Risk Characterization will include statistically based concentrations (i.e., 95th UCL, median, mean) from abiotic media and generic BCFs calculated using data from surface soil or sediment samples.

Where it is deemed to be necessary following the Phase I Risk Characterization, the Phase II Risk Characterization will use collocated abiotic and biotic prey tissue samples to calculate site-specific BCFs to be used to more accurately estimate prey tissue concentrations.

NOAEL based TRVs were used to calculate SSLs in the SLERA. In contrast, the Phase I and Phase II Risk Characterizations will use a range of NOAEL and LOAELs to determine the range of potential risk to the wildlife receptors.

In the Phase II Risk Characterization, the exposure analysis conducted in Phase I will be recalculated using site-specific BCFs to estimate total concentrations of COPECs in prey items. Exposures will be estimated for populations within the boundaries of the Site. For those receptors that have home ranges larger than the Site, an Area Use Factor (AUF) will be used to modify the exposure estimate. This additional data collection and Risk Characterization may be needed to reduce uncertainty following the Phase I Risk Characterization.

Risk estimates will be provided both on a habitat or Investigative Block basis and Site-wide for wide ranging receptors. This will provide the risk manager with more data resolution to use when making risk management decisions in the future. Data collected in the Phase I, Phase II, and data of acceptable quality from the currently available historical data will be used in the BERA.

Statistical analyses, such as linear regressions, will be conducted on the soil/sediment and tissue samples. If the correlation coefficient between the BCF and soil concentrations exceeds 0.5, prey tissue concentrations will be calculated using the regression equation to predict uptake of COPECs into biota. If the correlation is lower than 0.5 alternative relationships between the BCF and soil/residue concentrations will be evaluated (i.e., non-linear or threshold). If no relationships are identified, other statistical representations of BAF, including median, 75th and 95th percentiles will be evaluated in a sensitivity analysis and presented in the Phase II Risk Characterization where necessary.

This approach will result in more representative data on the distribution of COPECs in biota because: (1) data on COPEC content in soils will be available from more locations than biota and (2) biota samples will be collected from Phase II sampling that is focused on the areas of the Site that are most likely to present a potential for risk to wildlife receptors.

Additional analysis will be conducted on those COPECs that are associated with exposures that exceed TRVs. The analysis will include the calculation of COPEC concentrations in soils that would result in exposures equal to the TRVs. These calculated concentrations will be similar to the SSLs, except they will be calculated using a range of literature based COPEC specific bioavailability factors (AFs). It is well known that some COPECs are typically molecularly bound to soil/sediment particles and

are, therefore, not completely bioavailable to the wildlife receptor. This decreased bioavailability results in lower exposures to the receptor. For those COPECs that are subjected to the bioavailability analysis, a full range of potential bioavailabilities will be evaluated and presented in the BERA.

Risks will be estimated using the hazard quotient approach as discussed in the SLERA and in the Phase I Risk Characterization. If the HQ is less than 1.0 (indicating the exposure concentration or dose is less than the TRV), the occurrence of adverse effects is unlikely. If the HQ is equal to or greater than 1.0 (indicating the exposure is equal to or greater than the TRV), there is a potential for adverse effects to occur (U.S. U.S. EPA, 1997a). However, there is no clear consensus from either U.S. EPA guidance or the scientific literature concerning the significance of the level of departure from one. The Tri-Services Procedural Guideline for conducting ecological risks assessment (Wentzel et al., 1996) cites Menzie et al.'s (1992) HQ interpretation:

- HQ < 1: No Significant Risk;
- 1 < HQ < 10: Small Potential for Adverse Effects;
- 10 < HQ < 100: Significant Potential for Adverse Effects; and
- > 100: Expected Adverse Effects.

Wentzel et al. (1996) points out that no statistical analysis supports this interpretation; however, it is a convention that is used and accepted based on best professional judgment. One further complicating issue is that an HQ greater than one by itself does not indicate the magnitude of effect nor provide a measure of potential population-level effects (Menzie et al., 1992). For instance, a high sediment HQ for a chemical may be the result of a small, isolated area of high concentration rather than widespread contamination, and may not indicate potential population/ community-level effects because, no matter how high the HQ is above 1.0, the risk is limited to receptors in the vicinity of the high-concentration area. For this reason, the distribution of COPECs at levels above TRVs will be examined to provide information about the potential spatial extent of adverse effects.

5.0 REFERENCES

- Aulerich, R. J., R. K. Ringer, and S. Iwamoto, 1974. Effects of dietary mercury on mink. *Arch. Environ. Contam. Toxicol.* 2: 43-51.
- Aulerich, R.J., R.K. Ringer, M.R. Bleavins, et al., 1982. Effects of supplemental dietary copper on growth, reproductive performance and kit survival of standard dark mink and the acute toxicity of copper to mink. *Journal of Animal Science* 55: 337-343.
- Carriere, D., K. Fischer, D. Peakall, and P. Angehrn, 1986. Effects of dietary aluminum in combination with reduced calcium and phosphorus on the ring dove (*Streptopelia risoria*). *Water, Air, and Soil Pollution* 30: 757-764.
- Duphar, B.V., 1985. MRID No. 00146147. U.S. Environmental Protection Agency. FOI, Washington, D.C.
- Eisler, R., 1987. Polycyclic aromatic hydrocarbon hazards to fish, wildlife, and invertebrates: a synoptic review. Biological Report 85(1.11) U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, MD.
- Gasaway, W. C. and I. O. Buss, 1972. Zinc toxicity in the mallard. *J. Wildl. Manage.* 36: 1107-1117.
- Heinz, G. H., D. J. Hoffman, and L. G. Gold, 1989. Impaired reproduction of mallards fed an organic form of selenium. *J. Wildl. Mgmt.* 53: 418-428.
- HSDB, 1998. Hazardous Substance Database. On Line.
- Hudson, R. H., R. K. Tucker, and M. A. Haegele, 1984. Handbook of toxicity of pesticides to wildlife. U.S. Fish and Wildl. Serv. Resour. Publ. 153. 90 pp.
- Illinois Environmental Protection Agency (IEPA), 1999. IEPA, Bureau of Land CERCLA Redevelopment Assessment for the Former Alcoa Property.
- Johnson, D., Jr., A.L. Mehring, Jr., and H.W. Titus, 1960. Tolerance of chickens for barium. *Proceedings of the Society for Experimental Biology and Medicine* 104: 436-438.
- Lamb, J. C., IV, R. E. Chapin, J. Teague, A. D. Lawton, and J. R. Reel, 1987. Reproductive effects of four phthalic acid esters in the mouse. *Toxicol. Appl. Pharmacol.* 88: 255-269.
- Menzies, C. A., D. E. Burmaster, J. S. Freshman, and C. A. Callahan, 1992. Assessment of methods for estimating ecological risk in the terrestrial component: a case study at the Baird and McGuire Superfund site in Holbrook, Massachusetts. *Environ. Toxicol. Chem.* 11: 245-260.
- Ondreicka, R., E. Ginter, and J. Kortus, 1966. Chronic toxicity of aluminum in rats and mice and its effects on phosphorus metabolism. *British Journal of Industrial Medicine* 23: 305-313.
- Pershagen, G. and M. Vahter, 1979. Arsenic—a toxicological and epidemiological appraisal. *Naturvardsverket Rapp. SNV PM 1128, Liber Tryck, Stockholm.* 265 pp.

Rosenfeld, I. and O. A. Beath, 1954. Effect of selenium on reproduction in rats. *Proc. Soc. Exp. Biol. Med.* 87: 295-297.

Registry of Toxic Effects of Chemical Substances (RTECS), 1995. *On-line*.

Sample, B.E., D.M. Opresko and W. Suter, 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Health Sciences Research Division, Oak Ridge, Tennessee.

Schafer, E.W., Jr., W.A. Bowles, Jr., and J. Hurlbut, 1983. The acute oral toxicity, repellency, and hazard potential of 998 chemicals to one or more species of wild and domestic birds. *Archives of Environmental Contamination and Toxicology* 12: 355-382.

United States Biomedical Research and Development Laboratory, 1989. Organic Explosives and Related Compounds: Environmental and Health Considerations. Technical Report # 8901. Fort Detrick, MD.

United States Environmental Protection Agency (U.S. EPA), 1989a. Risk Assessment Guidance for Superfund—Volume II Environmental Evaluation Manual. Interim Final. Office of Emergency and Remedial Response. EPA/540/1-89/001. March. Washington, D.C.

———, 1995. Quality Criteria for Water 1995. Draft. Health and Ecological Criteria Division, Office of Water. Washington, D.C.

———, 1994. Integrated Risk Information System (IRIS). Office of Health and Environmental Assessment. Environmental Criteria and Assessment Office. Cincinnati, Ohio.

———, 1997. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*. Interim Final. June.

———, 1998. *Guidelines for Ecological Risk Assessment*. EPA/630/R-95/002F. April.

———, 2002. Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites - OSWER 9285.7-4. September.

Wentsel, R.S., LaPoint, T.W., Simini, M., Checkai, R.T., Ludwig, D., and Brewer, L., 1996. Tri-Service Procedural Guidelines for Ecological Risk Assessments, U.S. Army Edgewood Research, Development, and Engineering Center, Aberdeen Proving Ground, Maryland.

White, D.H. and M.T. Finley, 1978. Uptake and retention of dietary cadmium in mallard ducks. *Environmental Research* 17: 53-59.

Zambrana Engineering, Inc, 1999. *American Bottoms Interior Flood control Project Biological Analysis of the Former Alcoa Site*, US Army Corps of Engineers. June.

TABLES

Table 1
Data Used in the Screening Level Ecological Risk Assessment
Alcoa North Plant, East St. Louis, IL

| Title | Author | Agency | Date | Data Type | Description |
|--|-----------------------------------|---|-----------|-------------------------------|---|
| CERCLA Integrated Site Assessment: Childs Property | IL-EPA | IL-EPA | 24-Sep-97 | Site Investigation | Site investigation of the Childs property. Includes data regarding geology, soil samples, groundwater sample, surface water samples, source identification and migration pathways. |
| CERCLA Redevelopment Assessment | IL-EPA | IL-EPA | 09-Jul-99 | Site Investigation | Site investigation report containing abundant site information, groundwater samples, soil samples, tables, figures. |
| Site Phase II East St.Louis, Illinois | ARDL - US Army Corps of Engineers | Applied Research & Development Laboratory | 05-Dec-01 | Report | Report containing results, figures and tables for 10 soil samples from 5 locations collected in the Red Pond area. A second document included is a fax of what looks like a more complete lab data package than what accompanies the original report. |
| Sediment and Surface water data | Peter Sorenson | IL-EPA | 17-Apr-02 | Field Notes and Chemical Data | 2 faxes from IL-EPA to USEPA. The first are lab results for 6 sediment and 5 surface water samples. The second are the sampling field notes for the sediment and surface water samples. No sample location information. |

Table 1
 Receptor Parameters Used in the Screening Level Risk Analysis
 Alcoa North Plant, East St. Louis, IL

| Receptor | Scenario | Body Weight (kg) | Dietary Composition | | | | Ingestion Rate of Food (mg/kg BW/day) | Ingestion Rate of Water (mg/kg BW/day) | Fraction Soil | |
|-----------------|----------|------------------|---------------------|------------------------------------|-----------------------|----------------------------|---------------------------------------|--|---------------|----------------------------|
| | | | Seed (percent) | Terrestrial Invertebrate (percent) | Bird Tissue (percent) | Mammalian Tissue (percent) | | | | Amphibian Tissue (percent) |
| American Robin | Upland | 0.081 | 1 | 0 | 0 | 0 | 0 | 1.21 | 0.28 | 0.1 |
| Coyote | Upland | 15.5 | 0 | 0 | 0 | 1 | 0 | 0.042 | 0.075 | 0.02 |
| Deer Mouse | Upland | 0.0187 | 0.5 | 0.5 | 0 | 0 | 0 | 0.21 | 0.19 | 0.02 |
| Red-Tailed Hawk | Upland | 1 | 0 | 0 | 0 | 1 | 0 | 0.3 | 0.05 | 0.05 |
| Whitetail Deer | Upland | 45.4 | 1 | 0 | 0 | 0 | 0 | 0.035 | 0.044 | 0.05 |
| Mallard | Wet Area | 1.04 | 1 | 0 | 0 | 0 | 0 | 0.0556 | 0.0606 | 0.1 |
| Muskrat | Wet Area | 1.14 | 1 | 0 | 0 | 0 | 0 | 0.34 | 0.44 | 0.1 |
| Night Heron | Wet Area | 0.883 | 0 | 0.1 | 0 | 0.1 | 0.8 | 0.066 | 0.0131 | 0.1 |

Source: USEPA, 1993. Wildlife Exposure Factors Handbook
 Black-crowned night heron information was gathered from several internet resources.

Table 3-2
 No Observed Adverse Effects Level (NOAEL) Based Toxicity
 Reference Values (TRVs) Used in the Screening Level Ecological Risk Assessment
 Alcoa North Plant, East St. Louis, IL.

| Receptor | COPEC | Study Receptor | TRV (mg/kg/day) | Source |
|-----------------------|---------------------|----------------------|-----------------|--|
| Inorganic COIs | | | | |
| Bird | Aluminum | Quail | 963 | Carriere et al. 1986 |
| Bird | Antimony | Bird | NA | No Value Available |
| Bird | Arsenic | Quail | 17.5 | Stanley et al. 1994 |
| Bird | Barium | Chicken | 194 | Johnson et al. 1960 |
| Bird | Beryllium | Quail | 49 | Friberg 1979 |
| Bird | Cadmium | Mallard Duck | 1.7 | White & Finley 1978 |
| Bird | Chromium | Black Duck | 1.3 | CEPA 1994 |
| Bird | Cobalt | Quail | 2.5 | Friberg 1979 |
| Bird | Copper | Quail | 28 | Jackson & Stevenson 1981 |
| Bird | Cyanide | Bird | NA | No Value Available |
| Bird | Iron | Quail | 390 | Wiseman 1987 |
| Bird | Lead | American Kestrel | 4 | Sample et al. (1996) |
| Bird | Manganese | Japanese Quail | 977 | Sample et al. (1996) |
| Bird | Mercury | Japanese Quail | 0.5 | Sample et al. (1996) |
| Bird | Nickel | Mallard Duck | 77 | Sample et al. (1996) |
| Bird | Selenium | Mallard Duck | 0.3 | Heinz et al. 1989 |
| Bird | Silver | Quail | 9 | Friberg 1979 |
| Bird | Thallium | Mallard Duck | 2 | Hudson et al. 1984 |
| Bird | Vanadium | Mallard Duck | 2.4 | Kubena et al. 1986 |
| Bird | Zinc | Chicken | 10 | Gasaway & Bus 1972 |
| Organic COIs | | | | |
| Bird | 2-Butanone (MEK) | Bird | NA | No Value Available |
| Bird | 2-Methylnaphthalene | Bird | NA | No Value Available |
| Bird | 4-4'-DDD | Brown Pelican | 0.003 | DDT used as a surrogate |
| Bird | 4-4'-DDE | Brown Pelican | 0.003 | DDT used as a surrogate |
| Bird | 4-4'-DDT | Brown Pelican | 0.003 | Sample et. al (1996) |
| Bird | Acenaphthene | Bobwhite Quail | 19.4 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | Acenaphthylene | Bobwhite Quail | 19.4 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | Acetone | Various | 1290 | Value caclulated in a literature survey. |
| Bird | Alpha-BHC | Japanese Quail | 0.4 | Sample et. al (1996) |
| Bird | alpha-Chlordane | Red-Winged Blackbird | 2.14 | Sample et. al (1996) |
| Bird | Anthracene | Bobwhite Quail | 19.4 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | Aroclor-1016 | Screech Owl | 0.41 | Not available. Aroclor 1242 used as a surrogate. |
| Bird | Aroclor-1221 | Screech Owl | 0.41 | Not available. Aroclor 1242 used as a surrogate. |

Table 3-2
 No Observed Adverse Effects Level (NOAEL) Based Toxicity
 Reference Values (TRVs) Used in the Screening Level Ecological Risk Assessment
 Alcoa North Plant, East St. Louis, IL.

| Receptor | COPEC | Study Receptor | TRV (mg/kg/day) | Source |
|----------|----------------------------|----------------------|-----------------|--|
| Bird | Aroclor-1232 | Screech Owl | 0.41 | Not available. Aroclor 1242 used as a surrogate. |
| Bird | Aroclor-1242 | Screech Owl | 0.41 | Sample et. al (1996) |
| Bird | Aroclor-1248 | Ringnecked Pheasant | 0.18 | Not available. Aroclor 1254 used as a surrogate. |
| Bird | Aroclor-1254 | Ringnecked Pheasant | 0.18 | Sample et. al (1996) |
| Bird | Aroclor-1260 | Ringnecked Pheasant | 0.18 | Not available. Aroclor 1254 used as a surrogate. |
| Bird | Benzo(a)anthracene | Bobwhite Quail | 19.4 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | Benzo(a)pyrene | Bobwhite Quail | 19.4 | Sample et. al (1996) |
| Bird | Benzo(b)fluoranthene | Bobwhite Quail | 19.4 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | Benzo(g,h,i)perylene | Bobwhite Quail | 19.4 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | Benzo(k)fluoranthene | Bobwhite Quail | 19 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | beta-BHC | Japanese Quail | 0.4 | Sample et. al (1996) |
| Bird | bis(2-ethylhexyl)phthalate | Ringed Dove | 1.1 | Sample et. al (1996) |
| Bird | Butylbenzylphthalate | Bird | NA | No Value Available |
| Bird | Carbazole | Bird | NA | No Value Available |
| Bird | Carbon Disulfide | Bird | NA | No Value Available |
| Bird | Cholormethane | Bird | NA | No Value Available |
| Bird | Chrysene | Bobwhite Quail | 19.4 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | delta-BHC | Japanese Quail | 0.4 | Sample et. al (1996) |
| Bird | Dibenz(a,h)anthracene | Bobwhite Quail | 19.4 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | Dibenzofuran | Red-Winged Blackbird | 6.32 | Schafer et al. (1983) |
| Bird | Dieldrin | Barn Owl | 0.077 | Sample et al. (1996) |
| Bird | Diethylphthalate | Ringed Dove | 0.11 | Not available. DNBT used as a surrogate |
| Bird | Di-n-butylphthalate | Ringed Dove | 0.11 | Sample et. al (1996) |
| Bird | Di-n-octylphthalate | Ringed Dove | 0.11 | Not available. DNBT used as a surrogate |
| Bird | Endosulfan I | Gray Partridge | 10 | Sample et. al (1996); Value for endosulfan |
| Bird | Endosulfan II | Gray Partridge | 10 | Sample et. al (1996); Value for endosulfan |

Table 3-2
 No Observed Adverse Effects Level (NOAEL) Based Toxicity
 Reference Values (TRVs) Used in the Screening Level Ecological Risk Assessment
 Alcoa North Plant, East St. Louis, IL.

| Receptor | COPEC | Study Receptor | TRV (mg/kg/day) | Source |
|-----------------------|------------------------|----------------------|-----------------|--|
| Bird | Endosulfan sulfate | Gray Partridge | 10 | Sample et. al (1996); Value for endosulfan |
| Bird | Endrin | Mallard Duck | 0.01 | Sample et al. (1996) |
| Bird | Endrin aldehyde | Mallard Duck | 0.01 | Sample et al. (1996); Endrin used as a surrogate |
| Bird | Endrin ketone | Mallard Duck | 0.01 | Sample et al. (1996); Endrin used as a surrogate |
| Bird | Ethylbenzene | Bird | NV | No Value Available |
| Bird | Fluoranthene | Bobwhite Quail | 19.4 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | Fluorene | Bobwhite Quail | 19.4 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | gamma-BHC (Lindane) | Mallard Duck | 2 | Sample et al. (1996) |
| Bird | Gamma-Chlordane | Red-Winged Blackbird | 2.14 | Sample et al. (1996); Value for chlordane |
| Bird | Heptachlor | Bird | NA | No Value Available |
| Bird | Heptachlor epoxide | Bird | NA | No Value Available |
| Bird | Indeno(1,2,3-cd)pyrene | Bobwhite Quail | 19.4 | Not available. Benzo(a)pyrene used as a surrogate. |
| Bird | Methoxychlor | Bird | NA | No Value Available |
| Bird | Methylene chloride | Bird | NA | No Value Available |
| Bird | Napthalene | Bobwhite Quail | 1.94 | USEPA (1995) |
| Bird | Nitrobenzene | Bird | NA | No Value Available |
| Bird | Petachlorophenol | Bird | NA | No Value Available |
| Bird | Phenanthrene | Red-Winged Blackbird | 2.49 | Schafer et al. (1983) |
| Bird | Phenol | Bird | NA | No Value Available |
| Bird | Pyrene | Bobwhite Quail | 19.4 | HSDB (1998) |
| Bird | Styrene | Bird | NV | No Value Available |
| Bird | Tetrachloroethene | Bobwhite Quail | 1.4 | Sample et al. (1996) |
| Bird | Tetrachloroethene | Bird | NA | No Value Available |
| Bird | Toluene | Bird | NA | No Value Available |
| Bird | Toxaphene | Bird | NA | No Value Available |
| Bird | Xylene (total) | Bird | NA | No Value Available |
| Inorganic COIs | | | | |
| Mammal | Aluminum | Mouse | 34 | Ondreicka et al. 1966 |
| Mammal | Antimony | Mouse | 0.2 | Friberg et al. 1979 |
| Mammal | Arsenic | Mouse | 0.6 | Pershagen & Vahter 1979 |
| Mammal | Barium | Rat | 5.1 | Sample et. al (1996) |
| Mammal | Beryllium | Mouse | 4.3 | WHO 1990 |
| Mammal | Cadmium | Mouse | 2.5 | Wilson et al. 1941 |
| Mammal | Chromium | Mouse | 1.8 | NAS 1974 |
| Mammal | Cobalt | Mouse | 1.2 | Domingo 1994 |
| Mammal | Copper | Mink | 168 | Aulerich et al. 1982 |

Table 3-2
 No Observed Adverse Effects Level (NOAEL) Based Toxicity
 Reference Values (TRVs) Used in the Screening Level Ecological Risk Assessment
 Alcoa North Plant, East St. Louis, IL.

| Receptor | COPEC | Study Receptor | TRV (mg/kg/day) | Source |
|---------------------|---------------------|-----------------|-----------------|--|
| Mammal | Cyanide | Rat | 68.7 | Sample et. al (1996) |
| Mammal | Iron | Mouse | 260 | NAS 1974 |
| Mammal | Lead | Mouse | 80 | Stowe & Goyer 1971 |
| Mammal | Manganese | Rat | 200 | NTP 1993 |
| Mammal | Mercury | Mink | 13 | Aulerich et al. 1974 |
| Mammal | Nickel | Rat | 40 | Sample et al. (1996) |
| Mammal | Selenium | Rat | 0.03 | Rosenfeld and Beath 1954 |
| Mammal | Silver | Mouse | 65 | Walker 1971, Van Vleet 1976 |
| Mammal | Thallium | Rat | 0.3 | Roll & Matthiaschk 1981 |
| Mammal | Vanadium | Rat | 0.01 | Friberg et al. 1979 |
| Mammal | Zinc | Mink | 120 | Aulerich et al. 1991 |
| Organic COIs | | | | |
| Mammal | 2,4-Dinitrotoluene | Mouse | 13.4 | USBRLD (1989) |
| Mammal | 2,4-Dinitrotoluene | Mouse | 13.4 | Not available. Mammalian TRV used as a surrogate. |
| Mammal | 2-Methylnaphthalene | Mouse | 16.3 | RTECS (1995) |
| Mammal | 4-4'-DDD | Rat | 0.8 | DDT used as a surrogate |
| Mammal | 4-4'-DDE | Rat | 0.8 | DDT used as a surrogate |
| Mammal | 4-4'-DDT | Rat | 0.8 | Sample et. al (1996) |
| Mammal | Acenaphthene | Mouse | 1 | Not available. Benzo(a)pyrene used as a surrogate. |
| Mammal | Acenaphthylene | Mouse | 1 | Not available. Benzo(a)pyrene used as a surrogate. |
| Mammal | Acetone | Rat | 10 | Sample et. al (1996) |
| Mammal | Aldrin | Rat | 0.2 | Sample et. al (1996) |
| Mammal | Aldrin | Rat | 0.2 | Not available. Mammalian TRV used as a surrogate. |
| Mammal | Alpha-BHC | Mink | 0.014 | Sample et. al (1996) |
| Mammal | alpha-Chlordane | Mouse | 4.6 | Sample et. al (1996) |
| Mammal | Anthracene | Mouse | 1 | Not available. Benzo(a)pyrene used as a surrogate. |
| Mammal | Aroclor-1016 | Mink | 1.37 | Sample et. al (1996) |
| Mammal | Aroclor-1221 | Mink | 0.685 | Not available. Aroclor 1242 used as a surrogate. |
| Mammal | Aroclor-1232 | Mink | 0.685 | Not available. Aroclor 1242 used as a surrogate. |
| Mammal | Aroclor-1242 | Mink | 0.685 | Sample et. al (1996) |
| Mammal | Aroclor-1248 | Rhesus Monkey | 0.1 | Sample et. al (1996) |
| Mammal | Aroclor-1254 | Old-field Mouse | 0.14 | Sample et. al (1996) |
| Mammal | Aroclor-1260 | Old-field Mouse | 0.14 | Sample et. al (1996) |

Table 3-2
 No Observed Adverse Effects Level (NOAEL) Based Toxicity
 Reference Values (TRVs) Used in the Screening Level Ecological Risk Assessment
 Alcoa North Plant, East St. Louis, IL.

| Receptor | COPEC | Study Receptor | TRV (mg/kg/day) | Source |
|----------|----------------------------|----------------|-----------------|--|
| Mammal | Benzo(a)anthracene | Mouse | 1 | Not available. Benzo(a)pyrene used as a surrogate. |
| Mammal | Benzo(a)pyrene | Mouse | 1 | Sample et. al (1996) |
| Mammal | Benzo(b)fluoranthene | Mouse | 1 | Not available. Benzo(a)pyrene used as a surrogate. |
| Mammal | Benzo(g,h,i)perylene | Mouse | 1 | Not available. Benzo(a)pyrene used as a surrogate. |
| Mammal | Benzo(k)fluoranthene | Mouse | 1 | Not available. Benzo(a)pyrene used as a surrogate. |
| Mammal | beta-BHC | Rat | 1.6 | Sample et. al (1996) |
| Mammal | bis(2-ethylhexyl)phthalate | Mouse | 18.3 | Sample et. al (1996) |
| Mammal | Butylbenzylphthalate | Mouse | 159 | Lamb et al. (1987) |
| Mammal | Carbazole | Rat | 25 | RTECS (1997) |
| Mammal | Carbon Disulfide | Mammal | NV | No Value Available |
| Mammal | Chloromethane | Mammal | NV | No Value Available |
| Mammal | Chrysene | Mouse | 1 | Not available. Benzo(a)pyrene used as a surrogate. |
| Mammal | delta-BHC | Rat | 0.014 | Sample et. al (1996) |
| Mammal | Dibenz(a,h)anthracene | Mouse | 1 | Not available. Benzo(a)pyrene used as a surrogate. |
| Mammal | Dibenzofuran | Beagle Dog | 2 | Duphar (1985) |
| Mammal | Dieldrin | Rat | 0.02 | Sample et al. (1996) |
| Mammal | Diethylphthalate | Mouse | 3 | Lamb et al. (1987) |
| Mammal | Di-n-butylphthalate | Mouse | 550 | Sample et. al (1996) |
| Mammal | Di-n-octylphthalate | Mouse | 550 | Not available. DNBT used as a surrogate |
| Mammal | Endosulfan I | Rat | 0.15 | Sample et. al (1996); Value for endosulfan |
| Mammal | Endosulfan II | Rat | 0.15 | Sample et. al (1996); Value for endosulfan |
| Mammal | Endosulfan sulfate | Rat | 0.15 | Sample et. al (1996); Value for endosulfan |
| Mammal | Endrin | Mouse | 0.92 | Sample et al. (1996) |
| Mammal | Endrin aldehyde | Mouse | 0.92 | Sample et al. (1996); Endrin used as a surrogate |
| Mammal | Endrin ketone | Mouse | 0.92 | Sample et al. (1996); Endrin used as a surrogate |
| Mammal | Ethylbenzene | Mammal | NV | No Value Available |
| Mammal | Fluoranthene | Mouse | 12.5 | Sample et. al (1996) |
| Mammal | Fluorene | Mouse | 12.5 | Sample et. al (1996) |
| Mammal | gamma-BHC (Lindane) | Rat | 8 | Sample et al. (1996) |

Table 3-2
 No Observed Adverse Effects Level (NOAEL) Based Toxicity
 Reference Values (TRVs) Used in the Screening Level Ecological Risk Assessment
 Alcoa North Plant, East St. Louis, IL.

| Receptor | COPEC | Study Receptor | TRV (mg/kg/day) | Source |
|----------|------------------------|----------------|-----------------|---|
| Mammal | Gamma-Chlordane | Mouse | 4.6 | Sample et al. (1996); Value for chlordane |
| Mammal | Heptachlor | Mink | 0.1 | Sample et al. (1996) |
| Mammal | Heptachlor epoxide | Mink | 0.1 | Sample et al. (1996); Heptachlor used as a surrogate. |
| Mammal | Indeno(1,2,3-cd)pyrene | Mouse | 1 | Not available. Benzo(a)pyrene used as a surrogate. |
| Mammal | Methoxychlor | Rat | 4 | Sample et al. (1996) |
| Mammal | Methylene chloride | Rat | 5.85 | Sample et al. (1996) |
| Mammal | Napthalene | Mouse | 26.7 | USEPA (1990) |
| Mammal | Nitrobenzene | Mouse | 6.95 | USEPA (1999) |
| Mammal | Petachlorophenol | Rat | 0.24 | Sample et al. (1996) |
| Mammal | Phenanthrene | Rat | 7 | Eisler (1987) |
| Mammal | Phenol | Mouse | 60 | USEPA (1999) |
| Mammal | Pyrene | Mouse | 75 | USEPA (1989) |
| Mammal | Styrene | Mammal | NV | No Value Available |
| Mammal | Toluene | Mouse | 26 | Sample et al. (1996) |
| Mammal | Toxaphene | Rat | 8 | Sample et al. (1996) |
| Mammal | Xylene (total) | Mouse | 2.1 | Sample et al. (1996) |

Table 3-3
 Bioconcentration Factors Used to Estimate Prey Tissue Concentrations
 Alcoa North Plant, East St. Louis, IL

| Analyte | Bioconcentration Factor - Soil to | | | |
|----------------------------|-----------------------------------|---------------|---------------|------------|
| | Plants | Invertebrates | Small Mammals | Amphibians |
| Inorganic COIs | | | | |
| Aluminum | 0.0008 | 0.22 | 1 | 1 |
| Antimony | 1 | 0.22 | 0.00000144 | 1 |
| Arsenic | 0.047 | 0.236 | 0.038 | 0.21 |
| Barium | 1 | 0.22 | 0.0168 | 1 |
| Beryllium | 1 | 0.22 | 0.00000144 | 1 |
| Cadmium | 0.833 | 14.3 | 0.757 | 1 |
| Chromium | 1 | 0.161 | 0.061 | 1 |
| Cobalt | 1 | 1 | 0.1 | 1 |
| Copper | 0.2 | 0.636 | 0.6 | 1 |
| Cyanide | 1 | 1.12 | 1 | 1 |
| Lead | 0.117 | 0.225 | 0.1233 | 0.5 |
| Manganese | 1 | 0.061 | 1 | 1 |
| Mercury | 0.663 | 3.93 | 0.054 | 1 |
| Nickel | 0.0136 | 0.778 | 0.3524 | 1 |
| Selenium | 0.7 | 0.22 | 0.2107 | 1 |
| Silver | 1 | 0.22 | 0.00000432 | 1 |
| Thallium | 1 | 0.22 | 0.1124 | 1 |
| Vanadium | 1 | 0.35 | 1 | 1 |
| Zinc | 0.43 | 0.025 | 0.898 | 10.2 |
| Organic COIs | | | | |
| 2,4-Dinitrotoluene | 0.02 | 3.08 | 3.58E-09 | NA |
| 2-butanone (MEK) | 1 | 10 | 10 | 1 |
| 2-Methylnaphthalene | 0.02 | 10 | 10 | 1.2 |
| 4-4'-DDD | 0.00264 | 1.26 | 0.0000652 | NA |
| 4-4'-DDE | 0.00393 | 1.26 | 0.0000652 | NA |
| 4-4'-DDT | 0.00155 | 1.26 | 0.0000652 | NA |
| Acenaphthene | 0.02 | 0.375 | 0.0000199 | NA |
| Acenaphthylene | 0.02 | 0.25 | 0.0000199 | NA |
| Acetone | 0.02 | 10 | 2.17E-11 | NA |
| Aldrin | 0.007 | 4.178 | 10 | NA |
| Alpha-BHC | 0.02 | 2.6 | 10 | NA |
| alpha-Chlordane | 0.00513 | 1.6 | 10 | NA |
| Anthracene | 0.0187 | 0.4 | 0.0000199 | 1.7 |
| Aroclor-1016 | 0.01 | 10.7 | 0.00000914 | NA |
| Aroclor-1221 | 0.01 | 10.7 | 0.00000914 | NA |
| Aroclor-1232 | 0.01 | 10.7 | 0.00000914 | NA |
| Aroclor-1242 | 0.01 | 10.7 | 0.0000583 | NA |
| Aroclor-1248 | 0.01 | 10.7 | 0.0000583 | NA |
| Aroclor-1254 | 0.01 | 10.7 | 0.0000583 | NA |
| Aroclor-1260 | 0.01 | 10.7 | 0.0000583 | NA |
| Benzo(a)anthracene | 0.0202 | 0.03 | 0.0000173 | 8.8 |
| Benzo(a)pyrene | 0.0264 | 0.07 | 0.0000486 | 11.3 |
| Benzo(b)fluoranthene | 0.0101 | 0.07 | 0.0000575 | 8.84 |
| Benzo(g,h,i)perylene | 0.0119 | 0.188 | 0.0000573 | 14 |
| Benzo(k)fluoranthene | 0.0101 | 0.08 | 0.0000573 | 11.3 |
| beta-BHC | 0.253 | 1.95 | 10 | NA |
| bis(2-ethylhexyl)phthalate | 1 | 0.05 | 0.0000058 | 11.7 |
| Butylbenzylphthalate | 1 | 10 | 10 | 2.18 |

Table 3-3
Bioconcentration Factors Used to Estimate Prey Tissue Concentrations
Alcoa North Plant, East St. Louis, IL

| Analyte | Plants | Invertebrates | Small Mammals | Amphibians |
|------------------------|--------|---------------|---------------|------------|
| Carbazole | 1 | 0.05 | 10 | 1.13 |
| Carbon Disulfide | NA | NA | NA | 1 |
| Chloromethane | NA | NA | NA | 1 |
| Chrysene | 0.0187 | 0.04 | 0.0000199 | 8.8 |
| delta-BHC | 0.447 | 2.24 | 10 | NA |
| Dibenz(a,h)anthracene | 0.0064 | 0.07 | 0.000127 | NA |
| Dibenzofuran | 1 | 10 | 10 | NA |
| Dieldrin | 0.216 | 3.28 | 10 | NA |
| Diethylphthalate | 1 | 10 | 10 | NA |
| Di-n-butylphthalate | 1 | 10 | 10 | NA |
| Di-n-octylphthalate | 1 | 10 | 0.0772 | NA |
| Endosulfan I | 0.535 | 1.99 | 10 | NA |
| Endosulfan II | 0.535 | 1.99 | 10 | NA |
| Endosulfan sulfate | 0.535 | 1.99 | 10 | NA |
| Endrin | 0.242 | 3.11 | 10 | NA |
| Endrin aldehyde | 0.305 | 2.79 | 10 | NA |
| Endrin ketone | 0.305 | 2.79 | 10 | NA |
| Ethylbenzene | 1 | 10 | 10 | NA |
| Fluoranthene | 0.0187 | 0.463 | 0.0000199 | 4.2 |
| Fluorene | 0.0187 | 0.25 | 0.0000199 | NA |
| gamma-BHC (Lindane) | 1 | 2.6 | 10 | NA |
| Gamma-Chlordane | 0.011 | 3.9 | 10 | NA |
| Heptachlor | 0.144 | 1.4 | 0.00000374 | NA |
| Heptachlor epoxide | 0.275 | 1.4 | 0.00000374 | NA |
| Indeno(1,2,3-cd)pyrene | 0.0039 | 0.08 | 0.000298 | 12.2 |
| Methoxychlor | 0.26 | 20.4 | 10 | NA |
| Methylene chloride | 1 | 0.05 | 10 | 1 |
| Napthalene | 0.0187 | 0.263 | 0.0000199 | NA |
| Nitrobenzene | 1 | 2.26 | 2.46E-09 | NA |
| Petachlorophenol | 1 | 1034 | 0.00000434 | 3.64 |
| Phenanthrene | 1 | 0.35 | 0.00000199 | 1.77 |
| Phenol | 1 | 10 | 10 | 1 |
| Pyrene | 0.0187 | 0.488 | 0.0000199 | 2.78 |
| Styrene | 1 | 10 | 10 | NA |
| Tetrachloroethene | 1 | 10 | 10 | NA |
| Toluene | 1 | 10 | 10 | NA |
| Toxaphene | 1 | 10 | 10 | NA |
| Xylene (total) | 1 | 10 | 10 | NA |

NA - Not applicable. The COI was either not detected or no TRVs were available.

References:

Plants :

ORNL. 1998. Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants.

Bechtel Jacobs Company LLC, Oak Ridge, TN. BJC/OR-133

USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste

Combustion Facilities. Office of Solid Waste and Emergency Response. EPA530-D-99-001A. August 1999.

Travis, C.C., and A.D. Arms. 1988. "Bioconcentration of Organics in Beef, Milk, and Vegetation.

"Environmental Science and Technology. 22:271-274.

A default value of 1 was used where no data were available.

Table 3-3
Bioconcentration Factors Used to Estimate Prey Tissue Concentrations
Alcoa North Plant, East St. Louis, IL

| Analyte | Plants | Invertebrates | Small Mammals | Amphibians |
|---------|--------|---------------|---------------|------------|
|---------|--------|---------------|---------------|------------|

Invertebrates:

Sample, B. E., J. Beauchamp, R. Efroymson, G. W. II Suter, and T. L. Ashwood. 1998a. Development and Validation of Bioaccumulation Models for Earthworms. ES/ER/TM-220. Oak Ridge National Laboratory, Oak Ridge, TN, USA.

USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Office of Solid Waste and Emergency Response. EPA530-D-99-001A. August 1999.

A default equal to 1 was used for metals that are not known to bioaccumulate with no available BCFs

A default equal to 10 was used for organic COIs with no available BCFs

Small Mammals:

USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Office of Solid Waste and Emergency Response. EPA530-D-99-001A. August 1999.

Sample, B. E., J. Beauchamp, R. Efroymson, and G. W. II Suter 1998b. Development and Validation of Bioaccumulation Models for Small Mammals. ES/ER/TM-219. Oak Ridge National Laboratory, Oak Ridge, TN, USA.

A default equal to 1 was used for metals that are not known to bioaccumulate with no available BCFs

A default equal to 10 was used for organic COIs with no available BCFs

Amphibians:

CH2MHill. 2000. Baseline Ecological Risk Assessment for the Couer d'Alene River Basin.

A default equal to 1 was used for COIs with no available BCFs

Table 3-4
Receptor Specific Soil Screening Levels (SSLs)
Alcoa North Plant, East St. Louis, IL

| Analyte | American Robin | Coyote | Deer/Mouse | Red-Tailed Hawk | Whitetail Deer | Mallard | Muskrat | Night Heron |
|----------------------------|----------------|----------|------------|-----------------|----------------|----------|----------|-------------|
| Inorganic Cois | | | | | | | | |
| Aluminum | 7.90E+03 | 7.94E+02 | 1.24E+03 | 3.06E+03 | 1.91E+04 | 1.72E+05 | 9.92E+02 | 1.43E+04 |
| Antimony | NV | 2.38E+02 | 1.51E+00 | NV | 5.44E+00 | NV | NV | 1.64E+06 |
| Arsenic | 9.84E+01 | 2.46E+02 | 1.77E+01 | 6.63E+02 | 1.77E+02 | 2.14E+03 | 1.20E+01 | 8.98E+02 |
| Barium | 1.46E+02 | 3.30E+03 | 3.85E+01 | 9.68E+03 | 1.39E+02 | 3.17E+03 | 1.36E+01 | 3.18E+03 |
| Beryllium | 3.68E+01 | 5.12E+03 | 3.25E+01 | 3.27E+03 | 1.17E+02 | 8.01E+02 | 1.15E+01 | 8.05E+02 |
| Cadmium | 1.51E+00 | 7.66E+01 | 1.57E+00 | 7.02E+00 | 8.09E+01 | 3.28E+01 | 7.88E+00 | 1.07E+01 |
| Chromium | 9.77E-01 | 5.29E+02 | 1.43E+01 | 3.90E+01 | 4.90E+01 | 2.13E+01 | 4.81E+00 | 2.14E+01 |
| Cobalt | 1.88E+00 | 2.38E+02 | 5.60E+00 | 5.56E+01 | 3.27E+01 | 4.09E+01 | 3.21E+00 | 3.75E+01 |
| Copper | 7.71E+01 | 6.45E+03 | 1.83E+03 | 1.44E+02 | 1.92E+04 | 1.68E+03 | 1.65E+03 | 4.14E+02 |
| Cyanide | NV | 1.60E+03 | 3.03E+02 | NV | 1.87E+03 | NV | 1.84E+02 | NV |
| Lead | 1.52E+01 | 1.33E+04 | 1.99E+03 | 7.69E+01 | 1.37E+04 | 3.32E+02 | 1.08E+03 | 1.13E+02 |
| Manganese | 7.34E+02 | 4.67E+03 | 1.73E+03 | 3.10E+03 | 5.44E+03 | 1.60E+04 | 5.35E+02 | 1.47E+04 |
| Mercury | 5.42E-01 | 4.18E+03 | 2.67E+01 | 1.60E+01 | 5.21E+02 | 1.18E+01 | 5.01E+01 | 5.83E+00 |
| Nickel | 5.60E+02 | 2.56E+03 | 4.58E+02 | 6.38E+02 | 1.80E+04 | 1.22E+04 | 1.04E+03 | 1.15E+03 |
| Selenium | 3.10E-01 | 3.10E+00 | 2.98E-01 | 3.84E+00 | 1.14E+00 | 6.74E+00 | 1.10E-01 | 4.82E+00 |
| Silver | 6.76E+00 | 7.74E+04 | 4.91E+02 | 6.00E+02 | 1.77E+03 | 1.47E+02 | 1.74E+02 | 1.48E+02 |
| Thallium | 1.50E+00 | 5.39E+01 | 2.27E+00 | 4.11E-01 | 8.16E+00 | 3.27E+01 | 8.02E-01 | 3.25E+01 |
| Vanadium | 1.80E+00 | 2.33E-01 | 6.85E-02 | 7.62E+00 | 2.72E-01 | 3.92E+01 | 2.67E-02 | 3.51E+01 |
| Zinc | 1.56E+01 | 3.11E+03 | 2.31E+03 | 3.52E+01 | 7.14E+03 | 3.39E+02 | 6.66E+02 | 1.81E+01 |
| Organic Cois | | | | | | | | |
| 2,4-Dinitrotoluene | 9.23E+01 | 1.61E+04 | 4.09E+01 | 8.93E+02 | 5.51E+03 | 2.01E+03 | 3.31E+02 | 4.98E+02 |
| 2-butanone (MEK) | NV | NV | NV | NV | NV | NV | NV | NV |
| 2-Methylnaphthalene | NV | 3.87E+01 | 1.54E+01 | NV | 6.65E+03 | NV | NV | 8.07E+01 |
| 4-4'-DDD | 2.42E-02 | 9.49E+02 | 5.85E+00 | 2.00E-01 | 4.34E+02 | 5.26E-01 | 2.29E+01 | 2.01E-01 |
| 4-4'-DDE | 2.39E-02 | 9.49E+02 | 5.84E+00 | 2.00E-01 | 4.24E+02 | 5.19E-01 | 2.26E+01 | 2.01E-01 |
| 4-4'-DDT | 2.44E-02 | 9.49E+02 | 5.85E+00 | 2.00E-01 | 4.43E+02 | 5.31E-01 | 2.32E+01 | 2.01E-01 |
| Acenaphthene | 1.34E+02 | 1.19E+03 | 2.19E+01 | 1.29E+03 | 4.08E+02 | 2.91E+03 | 2.45E+01 | 2.14E+03 |
| Acenaphthylene | 1.34E+02 | 1.19E+03 | 3.07E+01 | 1.29E+03 | 4.08E+02 | 2.91E+03 | 2.45E+01 | 2.35E+03 |
| Acetone | 8.88E+03 | 1.19E+04 | 9.47E+00 | 8.60E+04 | 4.08E+03 | 1.83E+05 | 2.45E+02 | 1.78E+04 |
| Aldrin | 1.54E+00 | 4.75E-01 | 4.51E-01 | 6.63E-02 | 1.00E+02 | 3.36E+01 | 5.50E+00 | 2.00E+00 |
| Alpha-BHC | 2.75E+00 | 3.33E-02 | 5.01E-02 | 1.33E-01 | 5.71E+00 | 6.00E+01 | 3.43E-01 | 4.46E+00 |
| alpha-Chlordane | 1.68E+01 | 1.09E+01 | 2.86E+01 | 7.10E-01 | 2.38E+03 | 3.66E+02 | 1.29E+02 | 2.57E+01 |
| Anthracene | 1.35E+02 | 1.19E+03 | 2.08E+01 | 1.29E+03 | 4.16E+02 | 2.94E+03 | 2.48E+01 | 1.96E+02 |
| Aroclor-1018 | 3.08E+00 | 1.63E+03 | 1.21E+00 | 2.73E+01 | 6.52E+02 | 6.70E+01 | 3.66E+01 | 5.31E+00 |
| Aroclor-1221 | 3.08E+00 | 8.15E+02 | 6.07E-01 | 2.73E+01 | 3.26E+02 | 6.70E+01 | 1.83E+01 | 5.31E+00 |
| Aroclor-1232 | 3.08E+00 | 8.15E+02 | 6.07E-01 | 2.73E+01 | 3.26E+02 | 6.70E+01 | 1.83E+01 | 5.31E+00 |
| Aroclor-1242 | 3.08E+00 | 8.13E+02 | 6.07E-01 | 2.73E+01 | 3.26E+02 | 6.70E+01 | 1.83E+01 | 5.31E+00 |
| Aroclor-1248 | 1.35E+00 | 1.19E+02 | 8.86E-02 | 1.20E+01 | 4.76E+01 | 2.94E+01 | 2.67E+00 | 2.33E+00 |
| Aroclor-1254 | 1.35E+00 | 1.66E+02 | 1.24E-01 | 1.20E+01 | 6.67E+01 | 2.94E+01 | 3.74E+00 | 2.33E+00 |
| Aroclor-1260 | 1.35E+00 | 1.32E+02 | 9.83E-02 | 1.20E+01 | 5.29E+01 | 2.94E+01 | 2.97E+00 | 2.33E+00 |
| Benzo(a)anthracene | 1.33E+02 | 1.19E+03 | 1.06E+02 | 1.29E+03 | 4.07E+02 | 2.90E+03 | 2.45E+01 | 4.12E+01 |
| Benzo(a)pyrene | 1.27E+02 | 1.19E+03 | 6.98E+01 | 1.29E+03 | 3.74E+02 | 2.76E+03 | 2.33E+01 | 3.21E+01 |
| Benzo(b)fluoranthene | 1.46E+02 | 1.19E+03 | 7.93E+01 | 1.29E+03 | 4.75E+02 | 3.17E+03 | 2.67E+01 | 4.09E+01 |
| Benzo(g,h,i)perylene | 1.43E+02 | 1.19E+03 | 3.97E+01 | 1.29E+03 | 4.62E+02 | 3.12E+03 | 2.63E+01 | 2.60E+01 |
| Benzo(k)fluoranthene | 1.43E+02 | 1.19E+03 | 7.32E+01 | 1.27E+03 | 4.75E+02 | 3.10E+03 | 2.67E+01 | 3.15E+01 |
| beta-BHC | 9.36E-01 | 3.80E+00 | 6.79E+00 | 1.33E-01 | 1.51E+02 | 2.04E+01 | 1.33E+01 | 4.68E+00 |
| bis(2-ethylhexyl)phthalate | 8.26E-01 | 2.18E+04 | 1.60E+02 | 7.33E-01 | 4.98E+02 | 1.80E+01 | 4.89E+01 | 1.76E+00 |
| Butylbenzylphthalate | NV | 3.78E+02 | 1.37E+02 | NV | 4.33E+03 | NV | NV | 6.27E+02 |
| Carbazole | NV | 5.94E+01 | 2.18E+02 | NV | 6.80E+02 | NV | NV | 1.89E+02 |
| Carbon Disulfide | NV | NV | NV | NV | NV | NV | NV | NV |
| Chloromethane | NV | NV | NV | NV | NV | NV | NV | NV |
| Chrysene | 1.35E+02 | 1.19E+03 | 9.65E+01 | 1.29E+03 | 4.16E+02 | 2.94E+03 | 2.48E+01 | 4.11E+01 |
| delta-BHC | 6.04E-01 | 3.33E-02 | 4.89E-02 | 1.33E-01 | 8.05E-01 | 1.32E+01 | 7.53E-02 | 4.58E+00 |
| Dibenz(a,h)anthracene | 1.51E+02 | 1.18E+03 | 8.18E+01 | 1.29E+03 | 5.07E+02 | 3.28E+03 | 2.76E+01 | 2.75E+03 |
| Dibenzofuran | 4.75E+00 | 4.75E+00 | 1.73E+00 | 2.10E+00 | 5.44E+01 | 1.03E+02 | 5.35E+00 | 4.56E+01 |
| Dieldrin | 2.01E-01 | 4.75E-02 | 5.39E-02 | 2.55E-02 | 2.15E+00 | 4.38E+00 | 1.86E-01 | 8.17E-01 |
| Diethylphthalate | 8.34E-02 | 7.13E+00 | 2.59E+00 | 3.68E-02 | 8.16E+01 | 1.81E+00 | 8.02E+00 | 8.01E-01 |
| Di-n-butylphthalate | 8.26E-02 | 1.31E+03 | 4.74E+02 | 3.65E-02 | 1.50E+04 | 1.80E+00 | 1.47E+03 | 7.94E-01 |
| Di-n-octylphthalate | 8.26E-02 | 1.35E+05 | 4.74E+02 | 2.88E+00 | 1.50E+04 | 1.80E+00 | 1.47E+03 | 1.50E+00 |
| Endosulfan I | 1.30E+01 | 3.56E-01 | 5.57E-01 | 3.32E+00 | 7.33E+00 | 2.83E+02 | 6.95E-01 | 1.17E+02 |
| Endosulfan II | 1.30E+01 | 3.56E-01 | 5.57E-01 | 3.32E+00 | 7.33E+00 | 2.83E+02 | 6.95E-01 | 1.17E+02 |
| Endosulfan sulfate | 1.30E+01 | 3.56E-01 | 5.57E-01 | 3.32E+00 | 7.33E+00 | 2.83E+02 | 6.95E-01 | 1.17E+02 |
| Endrin | 2.42E-02 | 2.19E+00 | 2.58E+00 | 3.32E-03 | 9.00E+01 | 5.26E-01 | 7.91E+00 | 1.07E-01 |
| Endrin aldehyde | 2.04E-02 | 2.19E+00 | 2.79E+00 | 3.32E-03 | 7.40E+01 | 4.44E-01 | 6.68E+00 | 1.10E-01 |
| Endrin ketone | 2.04E-02 | 2.19E+00 | 2.79E+00 | 3.32E-03 | 7.40E+01 | 4.44E-01 | 6.68E+00 | 1.10E-01 |
| Ethylbenzene | NV | 2.38E+05 | 8.63E+04 | NV | 2.72E+06 | NV | 2.67E+05 | NV |
| Fluoranthene | 1.35E+02 | 1.49E+04 | 2.28E+02 | 1.29E+03 | 5.20E+03 | 2.94E+03 | 3.10E+02 | 8.38E+01 |
| Fluorene | 1.35E+02 | 1.49E+04 | 3.86E+02 | 1.29E+03 | 5.20E+03 | 2.94E+03 | 3.10E+02 | 2.35E+03 |
| gamma-BHC (Lindane) | 1.50E+00 | 1.90E+01 | 2.09E+01 | 6.63E-01 | 2.18E+02 | 3.27E+01 | 2.14E+01 | 2.23E+01 |
| Gamma-Chlordane | 1.59E+01 | 1.09E+01 | 1.11E+01 | 7.10E-01 | 2.15E+03 | 3.47E+02 | 1.22E+02 | 2.18E+01 |
| Heptachlor | NV | 1.19E+02 | 6.01E-01 | NV | 1.47E+01 | NV | NV | NV |
| Heptachlor epoxide | NV | 1.19E+02 | 5.55E-01 | NV | 8.79E+00 | NV | NV | NV |

Table 3-4
Receptor Specific Soil Screening Levels (SSLs)
Alcoa North Plant, East St. Louis, IL

| Analyte | American Robin | Coyote | Deer/Mouse | Red-Tailed Hawk | Whitetail Deer | Mallard | Muskrat | Night Heron |
|------------------------|----------------|----------|------------|-----------------|----------------|----------|----------|-------------|
| Indeno(1,2,3-cd)pyrene | 1.54E+02 | 1.17E+03 | 7.69E+01 | 1.29E+03 | 5.30E+02 | 3.36E+03 | 2.83E+01 | 2.98E+01 |
| Methoxychlor | NV | 9.50E+00 | 1.84E+00 | NV | 3.69E+02 | NV | NV | NV |
| Methylene chloride | NV | 1.39E+01 | 5.11E+01 | NV | 1.59E+02 | NV | NV | NV |
| Napthalene | 1.35E+01 | 3.18E+04 | 7.90E+02 | 1.29E+02 | 1.11E+04 | 2.94E+02 | 6.62E+02 | 2.33E+02 |
| Nitrobenzene | NV | 8.27E+03 | 2.01E+01 | NV | 1.89E+02 | NV | NV | NV |
| Petachlorophenol | NV | 2.86E+02 | 2.21E+03 | NV | 6.53E+00 | NV | NV | NV |
| Phenanthrene | 1.87E+00 | 8.33E+03 | 4.80E+01 | 1.66E+02 | 1.90E+02 | 4.07E+01 | 1.87E+01 | 2.43E+01 |
| Phenol | NV | 1.43E+02 | 5.18E+01 | NV | 1.63E+03 | NV | NV | NV |
| Pyrene | 1.35E+02 | 8.92E+04 | 1.31E+03 | 1.29E+03 | 3.12E+04 | 2.94E+03 | 1.86E+03 | 1.24E+02 |
| Styrene | NV | NV | NV | NV | NV | NV | NV | NV |
| Tetrachloroethene | NV | 3.33E+00 | 1.21E+00 | NV | 3.81E+01 | NV | 1.01E+01 | NV |
| Toluene | NV | 6.18E+01 | 2.24E+01 | NV | 7.07E+02 | NV | 1.88E+02 | NV |
| Toxaphene | NV | 1.90E+01 | 6.90E+00 | NV | 2.18E+02 | NV | 5.77E+01 | NV |
| Xylene (total) | NV | 4.99E+00 | 1.81E+00 | NV | 5.71E+01 | NV | 1.52E+01 | NV |

Table 3-5
Maximum Detections of COIs in Surface Soils
Alcoa North Plant, East St. Louis, IL

| COPEC | Type | Units | Media | Brown Mud RDA | Brick Works | Redevelopment Area | Red Mud RDA |
|---------------------|-----------|-------|-------|---------------|-------------|--------------------|-------------|
| Aluminum | Metal | mg/Kg | Soil | 46000 | 60400 | 73800 | 59800 |
| Antimony | Metal | mg/Kg | Soil | 11.1 | 19.9 | 120 | 6.3 |
| Arsenic | Metal | mg/Kg | Soil | 34.6 | 624 | 226 | 18.3 |
| Barium | Metal | mg/Kg | Soil | 80.5 | 377 | 361 | 64.6 |
| Beryllium | Metal | mg/Kg | Soil | ND | 0.9 | 2 | ND |
| Cadmium | Metal | mg/Kg | Soil | ND | 447 | 24.8 | 2.5 |
| Calcium | Metal | mg/Kg | Soil | 256000 | 95900 | 255000 | 73000 |
| Chromium | Metal | mg/Kg | Soil | 2540 | 141 | 1130 | 1020 |
| Cobalt | Metal | mg/Kg | Soil | 5.9 | 96 | 117 | 5.4 |
| Copper | Metal | mg/Kg | Soil | 85.2 | 43300 | 592 | 5.9 |
| Cyanide | Metal | mg/Kg | Soil | 0.58 | 1 | 24.9 | ND |
| Cyanide, Reactive | Metal | mg/kg | Soil | ND | ND | ND | 0.36 |
| Cyanide, Total | Metal | mg/kg | Soil | ND | ND | ND | 0.71 |
| Iron | Metal | mg/Kg | Soil | 305000 | 49300 | 115000 | 182000 |
| Lead | Metal | mg/Kg | Soil | 291 | 5500 | 38200 | 81.6 |
| Magnesium | Metal | mg/Kg | Soil | 385 | 11600 | 25100 | 1730 |
| Manganese | Metal | mg/Kg | Soil | 115 | 1260 | 1010 | 183 |
| Mercury | Metal | mg/Kg | Soil | 0.32 | 0.8 | 4.3 | 1.1 |
| Nickel | Metal | mg/Kg | Soil | 7.3 | 321 | 212 | 6.2 |
| Potassium | Metal | mg/Kg | Soil | 226 | 3830 | 3060 | 127 |
| Selenium | Metal | mg/Kg | Soil | ND | 14 | 3.2 | 3.6 |
| Silver | Metal | mg/Kg | Soil | ND | 108 | 28.2 | 11.2 |
| Sodium | Metal | mg/Kg | Soil | 947 | 3470 | 23500 | 29900 |
| Thallium | Metal | mg/Kg | Soil | ND | 3.4 | 1.9 | ND |
| Vanadium | Metal | mg/Kg | Soil | 1820 | 73 | 682 | 795 |
| Zinc | Metal | mg/Kg | Soil | 283 | 51800 | 1430 | 40 |
| Aroclor-1016 | PCB | mg/kg | Soil | ND | 0.046 | 0.5 | ND |
| Aroclor-1221 | PCB | mg/kg | Soil | ND | 0.094 | ND | ND |
| Aroclor-1232 | PCB | mg/kg | Soil | ND | 0.046 | ND | ND |
| Aroclor-1242 | PCB | mg/kg | Soil | ND | 0.046 | ND | ND |
| Aroclor-1248 | PCB | mg/kg | Soil | ND | 0.046 | ND | ND |
| Aroclor-1254 | PCB | mg/kg | Soil | ND | 0.046 | 0.26 | ND |
| Aroclor-1260 | PCB | mg/kg | Soil | ND | 3.5 | 0.13 | ND |
| 4,4'-DDD | Pesticide | mg/kg | Soil | ND | 0.015 | 0.014 | ND |
| 4,4'-DDE | Pesticide | mg/kg | Soil | ND | 0.074 | 0.014 | 0.0005 |
| 4,4'-DDT | Pesticide | mg/kg | Soil | ND | 0.15 | 0.037 | ND |
| Aldrin | Pesticide | mg/kg | Soil | ND | 0.004 | 0.016 | ND |
| alpha-BHC | Pesticide | mg/kg | Soil | ND | 0.00047 | 0.0066 | ND |
| alpha-Chlordane | Pesticide | mg/kg | Soil | ND | 0.089 | 0.12 | ND |
| beta-BHC | Pesticide | mg/kg | Soil | ND | 0.0057 | 0.00078 | ND |
| delta-BHC | Pesticide | mg/kg | Soil | ND | 0.0054 | 0.019 | 0.00056 |
| Dieldrin | Pesticide | mg/kg | Soil | ND | 0.068 | 0.0077 | ND |
| Endosulfan sulfate | Pesticide | mg/kg | Soil | ND | 0.0079 | ND | ND |
| Endosulfan I | Pesticide | mg/kg | Soil | ND | 0.04 | 0.0077 | 0.00053 |
| Endosulfan II | Pesticide | mg/kg | Soil | ND | 0.0089 | 0.014 | ND |
| Endosulfan sulfate | Pesticide | mg/kg | Soil | ND | 0.0046 | 0.0035 | ND |
| Endrin | Pesticide | mg/kg | Soil | ND | 0.033 | 0.0083 | ND |
| Endrin aldehyde | Pesticide | mg/kg | Soil | ND | 0.011 | 0.0084 | ND |
| Endrin Ketone | Pesticide | mg/kg | Soil | ND | 0.019 | 0.016 | ND |
| gamma-BHC (Lindane) | Pesticide | mg/kg | Soil | ND | 0.003 | 0.0046 | ND |

Table 3-5
Maximum Detections of COIs in Surface Soils
Alcoa North Plant, East St. Louis, IL

| COPEC | Type | Units | Media | Brown Mud/RDA | Brick Works | Redevelopment Area | Red Mud RD |
|----------------------------|-----------|-------|-------|---------------|-------------|--------------------|------------|
| Gamma-Chlordane | Pesticide | mg/kg | Soil | ND | 0.03 | 0.025 | ND |
| Heptachlor | Pesticide | mg/kg | Soil | ND | 0.0026 | 0.0021 | ND |
| Heptachlor epoxide | Pesticide | mg/kg | Soil | ND | 0.0028 | 0.016 | 0.00075 |
| Methoxychlor | Pesticide | mg/kg | Soil | ND | 0.09 | 0.067 | 0.021 |
| Toxaphene | Pesticide | mg/kg | Soil | ND | 0.15 | 0.9 | ND |
| 2,4-Dinitrotoluene | Semi-Vol | mg/kg | Soil | ND | ND | 0.14 | ND |
| 2-Methylnapthalene | Semi-Vol | mg/kg | Soil | ND | 0.51 | 1 | ND |
| 4-Methyphenol | Semi-Vol | mg/kg | Soil | ND | ND | 0.12 | ND |
| Acenapnhtylene | Semi-Vol | mg/kg | Soil | ND | 0.51 | 0.26 | ND |
| Acenapthene | Semi-Vol | mg/kg | Soil | ND | 0.54 | ND | ND |
| Anthracene | Semi-Vol | mg/kg | Soil | ND | 1.4 | 0.2 | ND |
| Benzo(a)anthracene | Semi-Vol | mg/kg | Soil | ND | 5.5 | 2.7 | ND |
| Benzo(a)pyrene | Semi-Vol | mg/kg | Soil | ND | 5.4 | 3.2 | ND |
| Benzo(b)fluoranthene | Semi-Vol | mg/kg | Soil | ND | 7.5 | 7.9 | ND |
| Benzo(g,h,i)perylene | Semi-Vol | mg/kg | Soil | ND | 4.1 | 0.93 | ND |
| Benzo(k)fluoranthene | Semi-Vol | mg/kg | Soil | ND | 2.3 | 8.3 | ND |
| bis(2-Ethylhexyl)phthalate | Semi-Vol | mg/kg | Soil | ND | 89 | 6.9 | ND |
| Butylbenzylphthalate | Semi-Vol | mg/kg | Soil | ND | 0.72 | 2.8 | ND |
| Butylbenzylphthalate | Semi-Vol | mg/kg | Soil | ND | 0.42 | ND | ND |
| Carbazole | Semi-Vol | mg/kg | Soil | ND | 0.74 | ND | ND |
| Chlorobenzene | Semi-Vol | mg/kg | Soil | ND | 0.015 | ND | ND |
| Chrysene | Semi-Vol | mg/kg | Soil | ND | 5.4 | 3 | ND |
| Dibenz(a,h)anthracene | Semi-Vol | mg/kg | Soil | ND | 2 | ND | ND |
| Dibenzofuran | Semi-Vol | mg/kg | Soil | ND | 0.51 | 0.41 | ND |
| Diethylphthalate | Semi-Vol | mg/kg | Soil | ND | 0.022 | 0.051 | ND |
| Di-n-Butylphthalate | Semi-Vol | mg/kg | Soil | ND | 2 | 1.2 | ND |
| Di-n-octylphthalate | Semi-Vol | mg/kg | Soil | ND | 18 | 1.5 | ND |
| Fluoranthene | Semi-Vol | mg/kg | Soil | ND | 8.2 | 4.2 | ND |
| Fluorene | Semi-Vol | mg/kg | Soil | ND | 0.51 | ND | ND |
| Indeno(1,2,3-cd)pyrene | Semi-Vol | mg/kg | Soil | ND | 4.5 | 1.3 | ND |
| Napthalene | Semi-Vol | mg/kg | Soil | ND | 0.44 | 0.38 | ND |
| Pentachlorophenol | Semi-Vol | mg/kg | Soil | ND | 1.1 | ND | ND |
| Phenanthrene | Semi-Vol | mg/kg | Soil | ND | 5.1 | 0.89 | ND |
| Phenol | Semi-Vol | mg/kg | Soil | ND | ND | 0.092 | ND |
| Pyrene | Semi-Vol | mg/kg | Soil | ND | 8.2 | 3.3 | ND |
| Acetone | Volatile | mg/kg | Soil | 0.023 | 0.015 | 0.15 | 0.008 |
| Ethylbenzene | Volatile | mg/kg | Soil | ND | 0.015 | ND | ND |
| Methylene Chloride | Volatile | mg/kg | Soil | 0.022 | 0.054 | 0.1 | 0.01 |
| Nitrobenzene | Volatile | mg/kg | Soil | ND | ND | 0.061 | ND |
| Styrene | Volatile | mg/kg | Soil | ND | 0.015 | ND | ND |
| Tetrachloroethene | Volatile | mg/kg | Soil | ND | 0.015 | ND | ND |
| Toluene | Volatile | mg/kg | Soil | ND | 0.013 | ND | ND |
| Xylene (total) | Volatile | mg/kg | Soil | ND | 0.014 | ND | ND |

Table 3-6
Maximum Detections of COIs in Sediments
Alcoa North Plant, East St. Louis, IL

| Analyte | Type | Units | North Wet Area | Triangle Wet Area |
|----------------------------|-----------|-------|----------------|-------------------|
| Aluminum | Metal | mg/kg | 5.35E+04 | 4.00E+04 |
| Antimony | Metal | mg/kg | 4.80E+00 | 1.40E+00 |
| Arsenic | Metal | mg/kg | 3.45E+01 | 8.00E+01 |
| Barium | Metal | mg/kg | 1.88E+02 | 6.48E+01 |
| Beryllium | Metal | mg/kg | 8.00E-01 | ND |
| Cadmium | Metal | mg/kg | 3.20E+00 | 3.20E+00 |
| Calcium | Metal | mg/kg | 1.30E+05 | 2.23E+05 |
| Chromium | Metal | mg/kg | 3.80E+01 | 9.30E+00 |
| Cobalt | Metal | mg/kg | 6.20E+00 | 1.60E+00 |
| Copper | Metal | mg/kg | 7.44E+01 | 1.85E+01 |
| Cyanide | Metal | mg/kg | 6.00E-01 | 9.40E+00 |
| Iron | Metal | mg/kg | 1.11E+05 | 5.13E+03 |
| Lead | Metal | mg/kg | 3.68E+02 | 2.42E+03 |
| Magnesium | Metal | mg/kg | 8.06E+03 | 6.71E+02 |
| Manganese | Metal | mg/kg | 1.26E+03 | 7.73E+01 |
| Mercury | Metal | mg/kg | 7.00E-01 | 3.00E-01 |
| Nickel | Metal | mg/kg | 2.03E+01 | 7.60E+00 |
| Potassium | Metal | mg/kg | 2.43E+03 | 3.36E+02 |
| Selenium | Metal | mg/kg | 8.90E+00 | 2.90E+00 |
| Silver | Metal | mg/kg | 7.00E-01 | 5.00E-01 |
| Sodium | Metal | mg/kg | 3.01E+04 | 5.20E+03 |
| Thallium | Metal | mg/kg | 9.90E+00 | 1.50E+00 |
| Vanadium | Metal | mg/kg | 2.02E+02 | 7.66E+01 |
| Zinc | Metal | mg/kg | 5.09E+02 | 2.84E+02 |
| delta-BHC | Pesticide | mg/kg | 7.70E-03 | ND |
| Dieldrin | Pesticide | mg/kg | 4.20E-02 | ND |
| Gamma-Chlordane | Pesticide | mg/kg | 5.70E-03 | ND |
| 2-Butanone (MEK) | Semi-Vol | mg/kg | 8.80E-02 | ND |
| 2-Methylnapthalene | Semi-Vol | mg/kg | 9.60E-02 | ND |
| Anthracene | Semi-Vol | mg/kg | 6.50E-02 | ND |
| Benzo(a)anthracene | Semi-Vol | mg/kg | 2.80E-01 | 8.70E-02 |
| Benzo(a)pyrene | Semi-Vol | mg/kg | 2.70E-01 | ND |
| Benzo(b)fluoranthene | Semi-Vol | mg/kg | 4.50E-01 | 1.40E-01 |
| Benzo(g,h,i)perylene | Semi-Vol | mg/kg | 2.20E-01 | ND |
| Benzo(k)fluoranthene | Semi-Vol | mg/kg | 1.80E-01 | ND |
| bis(2-Ethylhexyl)phthalate | Semi-Vol | mg/kg | 1.70E+00 | ND |
| Butylbenzylphthalate | Semi-Vol | mg/kg | 1.70E-01 | ND |
| Carbazole | Semi-Vol | mg/kg | 1.20E-01 | ND |
| Carbon Disulfide | Semi-Vol | mg/kg | 8.00E-03 | 5.00E-03 |
| Chloromethane | Semi-Vol | mg/kg | 7.00E-03 | ND |
| Chrysene | Semi-Vol | mg/kg | 3.60E-01 | 1.20E-01 |
| Fluoranthene | Semi-Vol | mg/kg | 4.20E-01 | 2.40E-01 |
| Indeno(1,2,3-cd)pyrene | Semi-Vol | mg/kg | 1.70E-01 | ND |
| Pentachlorophenol | Semi-Vol | mg/kg | 1.10E+00 | ND |
| Phenanthrene | Semi-Vol | mg/kg | 3.10E-01 | 2.50E-01 |
| Phenol | Semi-Vol | mg/kg | 4.90E-02 | ND |
| Pyrene | Semi-Vol | mg/kg | 5.50E-01 | 2.00E-01 |
| Acetone | Volatile | mg/kg | 2.80E-01 | 8.80E-02 |
| Methylene Chloride | Volatile | mg/kg | 6.20E-02 | 6.80E-02 |

Table 3-7
Screening Level Hazard Quotients in Surface Soils
Alcoa North Plant, East St. Louis, IL

| COPEC | Maximum Detection (mg/kg) | American Robin | Coyle | Deer Mouse | Red-Tailed Hawk | Whitetail Deer |
|----------------------------|---------------------------------|-------------------|----------|---------------|--------------------|-------------------|
| Brick Works | | | | | | |
| Inorganic COIs | | | | | | |
| Aluminum | 60400 | 7.65E+00 | 7.61E+01 | 4.86E+01 | 1.98E+01 | 3.16E+00 |
| Antimony | 19.9 | NA | 8.36E-02 | 1.32E+01 | NA | 3.66E+00 |
| Arsenic | 624 | 6.34E+00 | 2.53E+00 | 3.53E+01 | 9.41E-01 | 3.53E+00 |
| Barium | 377 | 2.59E+00 | 1.14E-01 | 9.78E+00 | 3.89E-02 | 2.72E+00 |
| Beryllium | 0.9 | 2.44E-02 | 1.76E-04 | 2.77E-02 | 2.76E-04 | 7.69E-03 |
| Cadmium | 447 | 2.97E+02 | 5.83E+00 | 2.85E+02 | 6.37E+01 | 5.53E+00 |
| Chromium | 141 | 1.44E+02 | 2.66E-01 | 9.88E+00 | 3.61E+00 | 2.88E+00 |
| Cobalt | 96 | 5.11E+01 | 4.03E-01 | 1.71E+01 | 1.73E+00 | 2.94E+00 |
| Copper | 43300 | 5.61E+02 | 6.71E+00 | 2.37E+01 | 3.02E+02 | 2.26E+00 |
| Cyanide | 1 | NA | 6.24E-04 | 3.30E-03 | NA | 5.35E-04 |
| Lead | 5500 | 3.61E+02 | 4.14E-01 | 2.76E+00 | 7.15E+01 | 4.02E-01 |
| Manganese | 1260 | 1.72E+00 | 2.70E-01 | 7.28E-01 | 4.06E-01 | 2.32E-01 |
| Mercury | 0.8 | 1.48E+00 | 1.91E-04 | 2.99E-02 | 4.99E-02 | 1.54E-03 |
| Nickel | 321 | 5.73E-01 | 1.26E-01 | 7.01E-01 | 5.03E-01 | 1.79E-02 |
| Selenium | 14 | 4.52E+01 | 4.52E+00 | 4.70E+01 | 3.65E+00 | 1.23E+01 |
| Silver | 108 | 1.60E+01 | 1.40E-03 | 2.20E-01 | 1.80E-01 | 6.11E-02 |
| Thallium | 3.4 | 2.26E+00 | 6.30E-02 | 1.50E+00 | 8.28E-02 | 4.17E-01 |
| Vanadium | 73 | 4.05E+01 | 3.13E+02 | 1.07E+03 | 9.58E+00 | 2.68E+02 |
| Zinc | 51800 | 3.32E+03 | 1.66E+01 | 2.24E+01 | 1.47E+03 | 7.25E+00 |
| Organic COIs | | | | | | |
| Acenaphthylene | 0.51 | 3.82E-03 | 4.29E-04 | 1.66E-02 | 3.94E-04 | 1.25E-03 |
| Acetone | 0.015 | 1.69E-06 | 1.26E-06 | 1.58E-03 | 1.74E-07 | 3.68E-06 |
| Aldrin | 0.004 | 2.59E-03 | 8.42E-03 | 8.87E-03 | 6.03E-02 | 3.99E-05 |
| alpha-BHC | 0.00047 | 1.71E-04 | 1.41E-02 | 9.38E-03 | 3.54E-03 | 8.23E-05 |
| alpha-Chlordane | 0.089 | 5.29E-03 | 8.14E-03 | 3.34E-03 | 1.25E-01 | 3.73E-05 |
| Anthracene | 1.4 | 1.04E-02 | 1.18E-03 | 6.74E-02 | 1.08E-03 | 3.37E-03 |
| Aroclor-1016 | 0.046 | 1.49E-02 | 2.82E-05 | 3.79E-02 | 1.68E-03 | 7.05E-05 |
| Aroclor-1221 | 0.094 | 3.05E-02 | 1.15E-04 | 1.55E-01 | 3.44E-03 | 2.88E-04 |
| Aroclor-1232 | 0.046 | 1.49E-02 | 5.64E-05 | 7.58E-02 | 1.68E-03 | 1.41E-04 |
| Aroclor-1242 | 0.046 | 1.49E-02 | 5.66E-05 | 7.58E-02 | 1.68E-03 | 1.41E-04 |
| Aroclor-1248 | 0.046 | 3.40E-02 | 3.88E-04 | 5.19E-01 | 3.84E-03 | 9.66E-04 |
| Aroclor-1254 | 0.046 | 3.40E-02 | 2.77E-04 | 3.71E-01 | 3.84E-03 | 6.90E-04 |
| Aroclor-1260 | 3.5 | 2.59E+00 | 2.66E-02 | 3.56E+01 | 2.92E-01 | 6.62E-02 |
| Benzo(a)anthracene | 5.5 | 4.12E-02 | 4.62E-03 | 5.21E-02 | 4.25E-03 | 1.35E-02 |
| Benzo(a)pyrene | 5.4 | 4.26E-02 | 4.55E-03 | 7.73E-02 | 4.18E-03 | 1.44E-02 |
| Benzo(b)fluoranthene | 7.5 | 5.15E-02 | 6.32E-03 | 9.46E-02 | 5.81E-03 | 1.58E-02 |
| Benzo(g,h,i)perylene | 4.1 | 2.86E-02 | 3.45E-03 | 1.03E-01 | 3.17E-03 | 8.88E-03 |
| Benzo(k)fluoranthene | 2.3 | 1.61E-02 | 1.94E-03 | 3.14E-02 | 1.82E-03 | 4.84E-03 |
| beta-BHC | 0.0057 | 6.09E-03 | 1.50E-03 | 8.39E-04 | 4.30E-02 | 3.78E-05 |
| bis(2-Ethylhexyl)phthalate | 89 | 1.08E+02 | 4.09E-03 | 5.57E-01 | 1.21E+00 | 1.79E-01 |
| Butylbenzylphthalate | 0.42 | NA | 1.11E-03 | 3.06E-03 | NA | 9.71E-05 |
| Carbazole | 0.74 | NA | 1.25E-02 | 3.39E-03 | NA | 1.09E-03 |
| Chrysene | 5.4 | 4.00E-02 | 4.54E-03 | 5.60E-02 | 4.18E-03 | 1.30E-02 |
| delta-BHC | 0.0054 | 8.94E-03 | 1.62E-01 | 1.10E-01 | 4.07E-02 | 6.71E-03 |
| Dibenz(a,h)anthracene | 2 | 1.33E-02 | 1.69E-03 | 2.44E-02 | 1.55E-03 | 3.95E-03 |
| Dibenzofuran | 0.51 | 1.07E-01 | 1.07E-01 | 2.96E-01 | 2.43E-01 | 9.37E-03 |

Table 3-7
Screening Level Hazard Quotients in Surface Soils
Alcoa North Plant, East St. Louis, IL

| COPEC | Maximum Detection (mg/kg) | American Robin | Coyote | Deer Mouse | Red-Tailed Hawk | Whitetail Deer |
|---------------------------|---------------------------------|-------------------|----------|---------------|--------------------|-------------------|
| Dieldrin | 0.068 | 3.38E-01 | 1.43E+00 | 1.26E+00 | 2.66E+00 | 3.17E-02 |
| Diethylphthalate | 0.022 | 2.64E-01 | 3.09E-03 | 8.50E-03 | 5.98E-01 | 2.70E-04 |
| Di-n-Butylphthalate | 2 | 2.42E+01 | 1.53E-03 | 4.22E-03 | 5.48E+01 | 1.34E-04 |
| Di-n-octylphthalate | 18 | 2.18E+02 | 1.34E-04 | 3.79E-02 | 6.24E+00 | 1.20E-03 |
| Endosulfan I | 0.04 | 3.07E-03 | 1.12E-01 | 7.18E-02 | 1.21E-02 | 5.46E-03 |
| Endosulfan II | 0.0089 | 6.84E-04 | 2.50E-02 | 1.60E-02 | 2.68E-03 | 1.21E-03 |
| Endosulfan sulfate | 0.0046 | 3.53E-04 | 1.29E-02 | 8.26E-03 | 1.39E-03 | 6.28E-04 |
| Endrin | 0.033 | 1.37E+00 | 1.51E-02 | 1.28E-02 | 9.95E+00 | 3.67E-04 |
| Endrin aldehyde | 0.011 | 5.39E-01 | 5.03E-03 | 3.94E-03 | 3.32E+00 | 1.49E-04 |
| Endrin Ketone | 0.019 | 9.31E-01 | 8.69E-03 | 6.80E-03 | 5.73E+00 | 2.57E-04 |
| Ethylbenzene | 0.015 | NA | 6.31E-08 | 1.74E-07 | NA | 5.51E-09 |
| Fluoranthene | 8.2 | 6.07E-02 | 5.52E-04 | 3.59E-02 | 6.34E-03 | 1.58E-03 |
| Fluorene | 0.51 | 3.78E-03 | 3.43E-05 | 1.32E-03 | 3.94E-04 | 9.81E-05 |
| gamma-BHC (Lindane) | 0.003 | 2.00E-03 | 1.58E-04 | 1.43E-04 | 4.52E-03 | 1.38E-05 |
| Gamma-Chlordane | 0.03 | 1.88E-03 | 2.74E-03 | 2.71E-03 | 4.23E-02 | 1.39E-05 |
| Heptachlor | 0.0026 | NA | 2.18E-05 | 4.32E-03 | NA | 1.77E-04 |
| Heptachlor epoxide | 0.0028 | NA | 2.35E-05 | 5.04E-03 | NA | 3.19E-04 |
| Indeno(1,2,3-cd)pyrene | 4.5 | 2.92E-02 | 3.84E-03 | 5.85E-02 | 3.50E-03 | 8.49E-03 |
| Methoxychlor | 0.09 | NA | 9.47E-03 | 4.89E-02 | NA | 2.44E-04 |
| Methylene Chloride | 0.054 | NA | 3.88E-03 | 1.06E-03 | NA | 3.39E-04 |
| Napthalene | 0.44 | 3.26E-02 | 1.39E-05 | 5.57E-04 | 3.40E-03 | 3.96E-05 |
| Phenanthrene | 5.1 | 2.73E+00 | 6.12E-04 | 1.06E-01 | 3.07E-02 | 2.68E-02 |
| Pyrene | 8.2 | 6.07E-02 | 9.19E-05 | 6.28E-03 | 6.34E-03 | 2.63E-04 |
| Styrene | 0.015 | NA | 6.31E-08 | 1.74E-07 | NA | 5.51E-09 |
| Tetrachloroethene | 0.015 | NA | 4.51E-03 | 1.24E-02 | NA | 3.94E-04 |
| Toluene | 0.013 | NA | 2.10E-04 | 5.80E-04 | NA | 1.84E-05 |
| Toxaphene | 0.15 | NA | 7.89E-03 | 2.17E-02 | NA | 6.89E-04 |
| Xylene (total) | 0.014 | NA | 2.81E-03 | 7.73E-03 | NA | 2.45E-04 |
| Redevelopment Area | | | | | | |
| Inorganic COIs | | | | | | |
| Aluminum | 73800 | 9.35E+00 | 9.30E+01 | 5.94E+01 | 2.41E+01 | 3.86E+00 |
| Antimony | 120 | NA | 5.04E-01 | 7.94E+01 | NA | 2.21E+01 |
| Arsenic | 226 | 2.30E+00 | 9.18E-01 | 1.28E+01 | 3.41E-01 | 1.28E+00 |
| Barium | 361 | 2.48E+00 | 1.09E-01 | 9.36E+00 | 3.73E-02 | 2.60E+00 |
| Beryllium | 2 | 5.43E-02 | 3.91E-04 | 6.15E-02 | 6.12E-04 | 1.71E-02 |
| Cadmium | 24.8 | 1.65E+01 | 3.24E-01 | 1.58E+01 | 3.53E+00 | 3.07E-01 |
| Chromium | 1130 | 1.16E+03 | 2.14E+00 | 7.92E+01 | 2.89E+01 | 2.31E+01 |
| Cobalt | 117 | 6.23E+01 | 4.91E-01 | 2.09E+01 | 2.11E+00 | 3.58E+00 |
| Copper | 592 | 7.67E+00 | 9.18E-02 | 3.24E-01 | 4.12E+00 | 3.08E-02 |
| Cyanide | 24.9 | NA | 1.55E-02 | 8.22E-02 | NA | 1.33E-02 |
| Lead | 38200 | 2.51E+03 | 2.87E+00 | 1.92E+01 | 4.97E+02 | 2.79E+00 |
| Manganese | 1010 | 1.38E+00 | 2.16E-01 | 5.84E-01 | 3.26E-01 | 1.86E-01 |
| Mercury | 4.3 | 7.94E+00 | 1.03E-03 | 1.61E-01 | 2.68E-01 | 8.25E-03 |
| Nickel | 212 | 3.78E-01 | 8.29E-02 | 4.63E-01 | 3.32E-01 | 1.18E-02 |
| Selenium | 3.2 | 1.03E+01 | 1.03E+00 | 1.08E+01 | 8.34E-01 | 2.80E+00 |
| Silver | 28.2 | 4.17E+00 | 3.65E-04 | 5.74E-02 | 4.70E-02 | 1.59E-02 |
| Thallium | 1.9 | 1.26E+00 | 3.52E-02 | 8.38E-01 | 4.63E-02 | 2.33E-01 |
| Vanadium | 682 | 3.78E+02 | 2.92E+03 | 9.95E+03 | 8.95E+01 | 2.51E+03 |

Table 3-7
Screening Level Hazard Quotients in Surface Soils
Alcoa North Plant, East St. Louis, IL

| COPEC | Maximum Detection (mg/kg) | American Robin | Goyote | Deer Mouse | Red-Tailed Hawk | Whitetail Deer |
|----------------------------|---------------------------|----------------|----------|------------|-----------------|----------------|
| Zinc | 1430 | 9.17E+01 | 4.59E-01 | 6.19E-01 | 4.07E+01 | 2.00E-01 |
| Organic COIs | | | | | | |
| 2,4-Dinitrotoluene | 0.14 | 1.52E-03 | 8.71E-06 | 3.42E-03 | 1.57E-04 | 2.54E-05 |
| Acenaphthylene | 0.26 | 1.95E-03 | 2.19E-04 | 8.46E-03 | 2.01E-04 | 6.37E-04 |
| Acetone | 0.15 | 1.69E-05 | 1.26E-05 | 1.58E-02 | 1.74E-06 | 3.68E-05 |
| Aldrin | 0.016 | 1.04E-02 | 3.37E-02 | 3.55E-02 | 2.41E-01 | 1.60E-04 |
| alpha-BHC | 0.0066 | 2.40E-03 | 1.98E-01 | 1.32E-01 | 4.97E-02 | 1.16E-03 |
| alpha-Chlordane | 0.12 | 7.13E-03 | 1.10E-02 | 4.51E-03 | 1.69E-01 | 5.03E-05 |
| Anthracene | 0.2 | 1.48E-03 | 1.68E-04 | 9.63E-03 | 1.55E-04 | 4.81E-04 |
| Aroclor-1016 | 0.5 | 1.62E-01 | 3.07E-04 | 4.12E-01 | 1.83E-02 | 7.66E-04 |
| Aroclor-1254 | 0.26 | 1.92E-01 | 1.56E-03 | 2.10E+00 | 2.17E-02 | 3.90E-03 |
| Aroclor-1260 | 0.13 | 9.61E-02 | 9.87E-04 | 1.32E+00 | 1.08E-02 | 2.46E-03 |
| Benzo(a)anthracene | 2.7 | 2.02E-02 | 2.27E-03 | 2.56E-02 | 2.09E-03 | 6.63E-03 |
| Benzo(a)pyrene | 3.2 | 2.52E-02 | 2.69E-03 | 4.58E-02 | 2.48E-03 | 8.56E-03 |
| Benzo(b)fluoranthene | 7.9 | 5.42E-02 | 6.66E-03 | 9.96E-02 | 6.12E-03 | 1.66E-02 |
| Benzo(g,h,i)perylene | 0.93 | 6.49E-03 | 7.83E-04 | 2.34E-02 | 7.20E-04 | 2.01E-03 |
| Benzo(k)fluoranthene | 8.3 | 5.82E-02 | 6.99E-03 | 1.13E-01 | 6.56E-03 | 1.75E-02 |
| beta-BHC | 0.00078 | 8.33E-04 | 2.05E-04 | 1.15E-04 | 5.88E-03 | 5.17E-06 |
| bis(2-Ethylhexyl)phthalate | 6.9 | 8.35E+00 | 3.17E-04 | 4.32E-02 | 9.41E-02 | 1.39E-02 |
| Chrysene | 3 | 2.22E-02 | 2.52E-03 | 3.11E-02 | 2.32E-03 | 7.21E-03 |
| delta-BHC | 0.019 | 3.14E-02 | 5.71E-01 | 3.89E-01 | 1.43E-01 | 2.36E-02 |
| Dibenzofuran | 0.41 | 8.63E-02 | 8.63E-02 | 2.38E-01 | 1.96E-01 | 7.53E-03 |
| Dieldrin | 0.0077 | 3.82E-02 | 1.62E-01 | 1.43E-01 | 3.02E-01 | 3.58E-03 |
| Diethylphthalate | 0.051 | 6.12E-01 | 7.15E-03 | 1.97E-02 | 1.39E+00 | 6.25E-04 |
| Di-n-Butylphthalate | 1.2 | 1.45E+01 | 9.18E-04 | 2.53E-03 | 3.29E+01 | 8.02E-05 |
| Di-n-octylphthalate | 1.5 | 1.82E+01 | 1.11E-05 | 3.16E-03 | 5.20E-01 | 1.00E-04 |
| Endosulfan I | 0.0077 | 5.92E-04 | 2.16E-02 | 1.38E-02 | 2.32E-03 | 1.05E-03 |
| Endosulfan II | 0.014 | 1.08E-03 | 3.93E-02 | 2.51E-02 | 4.22E-03 | 1.91E-03 |
| Endosulfan sulfate | 0.0035 | 2.69E-04 | 9.82E-03 | 6.28E-03 | 1.06E-03 | 4.78E-04 |
| Endrin | 0.0083 | 3.43E-01 | 3.80E-03 | 3.21E-03 | 2.50E+00 | 9.22E-05 |
| Endrin aldehyde | 0.0084 | 4.12E-01 | 3.84E-03 | 3.01E-03 | 2.53E+00 | 1.13E-04 |
| Endrin Ketone | 0.016 | 7.84E-01 | 7.32E-03 | 5.72E-03 | 4.82E+00 | 2.16E-04 |
| Fluoranthene | 4.2 | 3.11E-02 | 2.83E-04 | 1.84E-02 | 3.25E-03 | 8.08E-04 |
| gamma-BHC (Lindane) | 0.0046 | 3.06E-03 | 2.42E-04 | 2.20E-04 | 6.93E-03 | 2.11E-05 |
| Gamma-Chlordane | 0.025 | 1.57E-03 | 2.29E-03 | 2.25E-03 | 3.52E-02 | 1.16E-05 |
| Heptachlor | 0.0021 | NA | 1.76E-05 | 3.49E-03 | NA | 1.43E-04 |
| Heptachlor epoxide | 0.016 | NA | 1.34E-04 | 2.88E-02 | NA | 1.82E-03 |
| Indeno(1,2,3-cd)pyrene | 1.3 | 8.42E-03 | 1.11E-03 | 1.69E-02 | 1.01E-03 | 2.45E-03 |
| Methoxychlor | 0.067 | NA | 7.05E-03 | 3.64E-02 | NA | 1.82E-04 |
| Methylene Chloride | 0.1 | NA | 7.19E-03 | 1.96E-03 | NA | 6.28E-04 |
| Napthalene | 0.38 | 2.81E-02 | 1.20E-05 | 4.81E-04 | 2.94E-03 | 3.42E-05 |
| Nitrobenzene | 0.061 | NA | 7.37E-06 | 3.04E-03 | NA | 3.23E-04 |
| Phenanthrene | 0.89 | 4.76E-01 | 1.07E-04 | 1.86E-02 | 5.36E-03 | 4.67E-03 |
| Phenol | 0.092 | NA | 6.45E-04 | 1.78E-03 | NA | 5.64E-05 |
| Pyrene | 3.3 | 2.44E-02 | 3.70E-05 | 2.53E-03 | 2.55E-03 | 1.06E-04 |
| Toxaphene | 0.9 | NA | 4.73E-02 | 1.30E-01 | NA | 4.13E-03 |
| Brown Mud RDA | | | | | | |
| Inorganic COIs | | | | | | |

Table 3-7
Screening Level Hazard Quotients in Surface Soils
Alcoa North Plant, East St. Louis, IL

| COPEC | Maximum Detection (mg/kg) | American Robin | Coyote | Deer Mouse | Red-Tailed Hawk | Whitetail Deer |
|-----------------------|---------------------------|----------------|----------|------------|-----------------|----------------|
| Aluminum | 46000 | 5.83E+00 | 5.80E+01 | 3.70E+01 | 1.50E+01 | 2.41E+00 |
| Antimony | 11.1 | NA | 4.66E-02 | 7.34E+00 | NA | 2.04E+00 |
| Arsenic | 34.6 | 3.52E-01 | 1.40E-01 | 1.96E+00 | 5.22E-02 | 1.96E-01 |
| Barium | 80.5 | 5.52E-01 | 2.44E-02 | 2.09E+00 | 8.32E-03 | 5.80E-01 |
| Chromium | 2540 | 2.60E+03 | 4.80E+00 | 1.78E+02 | 6.51E+01 | 5.19E+01 |
| Cobalt | 5.9 | 3.14E+00 | 2.48E-02 | 1.05E+00 | 1.06E-01 | 1.81E-01 |
| Copper | 85.2 | 1.10E+00 | 1.32E-02 | 4.66E-02 | 5.93E-01 | 4.44E-03 |
| Cyanide | 0.58 | NA | 3.62E-04 | 1.91E-03 | NA | 3.10E-04 |
| Lead | 291 | 1.91E+01 | 2.19E-02 | 1.46E-01 | 3.78E+00 | 2.13E-02 |
| Manganese | 115 | 1.57E-01 | 2.46E-02 | 6.65E-02 | 3.71E-02 | 2.11E-02 |
| Mercury | 0.32 | 5.91E-01 | 7.65E-05 | 1.20E-02 | 2.00E-02 | 6.14E-04 |
| Nickel | 7.3 | 1.30E-02 | 2.85E-03 | 1.59E-02 | 1.14E-02 | 4.06E-04 |
| Vanadium | 1820 | 1.01E+03 | 7.80E+03 | 2.66E+04 | 2.39E+02 | 6.69E+03 |
| Zinc | 283 | 1.81E+01 | 9.09E-02 | 1.23E-01 | 8.05E+00 | 3.96E-02 |
| Organic COIs | | | | | | |
| Acetone | 0.023 | 1.30E-06 | 9.70E-07 | 2.40E-03 | 1.30E-07 | 2.80E-06 |
| Methylene Chloride | 0.022 | NA | 7.90E-04 | 4.30E-04 | NA | 6.90E-05 |
| Red Mud RDA | | | | | | |
| Inorganic COIs | | | | | | |
| Aluminum | 59800 | 7.57E+00 | 7.53E+01 | 4.82E+01 | 1.96E+01 | 3.13E+00 |
| Antimony | 6.3 | NA | 2.65E-02 | 4.17E+00 | NA | 1.16E+00 |
| Arsenic | 18.3 | 1.86E-01 | 7.43E-02 | 1.03E+00 | 2.76E-02 | 1.04E-01 |
| Barium | 64.6 | 4.43E-01 | 1.96E-02 | 1.68E+00 | 6.67E-03 | 4.66E-01 |
| Cadmium | 2.5 | 1.66E+00 | 3.26E-02 | 1.59E+00 | 3.56E-01 | 3.09E-02 |
| Chromium | 1020 | 1.04E+03 | 1.93E+00 | 7.15E+01 | 2.61E+01 | 2.08E+01 |
| Cobalt | 5.4 | 2.87E+00 | 2.27E-02 | 9.64E-01 | 9.72E-02 | 1.65E-01 |
| Copper | 5.9 | 7.65E-02 | 9.15E-04 | 3.23E-03 | 4.11E-02 | 3.07E-04 |
| Lead | 81.6 | 5.36E+00 | 6.14E-03 | 4.09E-02 | 1.06E+00 | 5.96E-03 |
| Manganese | 183 | 2.49E-01 | 3.92E-02 | 1.06E-01 | 5.90E-02 | 3.36E-02 |
| Mercury | 1.1 | 2.03E+00 | 2.63E-04 | 4.12E-02 | 6.86E-02 | 2.11E-03 |
| Nickel | 6.2 | 1.11E-02 | 2.42E-03 | 1.35E-02 | 9.72E-03 | 3.45E-04 |
| Selenium | 3.6 | 1.16E+01 | 1.16E+00 | 1.21E+01 | 9.39E-01 | 3.15E+00 |
| Silver | 11.2 | 1.66E+00 | 1.45E-04 | 2.28E-02 | 1.87E-02 | 6.33E-03 |
| Vanadium | 795 | 4.41E+02 | 3.41E+03 | 1.16E+04 | 1.04E+02 | 2.92E+03 |
| Zinc | 40 | 2.57E+00 | 1.29E-02 | 1.73E-02 | 1.14E+00 | 5.60E-03 |
| Organic COIs | | | | | | |
| Acetone | 0.008 | 9.00E-07 | 6.72E-07 | 8.45E-04 | 9.30E-08 | 1.96E-06 |
| delta-BHC | 0.00056 | 9.27E-04 | 1.68E-02 | 1.15E-02 | 4.22E-03 | 6.96E-04 |
| Endosulfan I | 0.00053 | 4.07E-05 | 1.49E-03 | 9.52E-04 | 1.60E-04 | 7.23E-05 |
| Heptachlor epoxide | 0.00075 | NA | 6.30E-06 | 1.35E-03 | NA | 8.53E-05 |
| Methoxychlor | 0.021 | NA | 2.21E-03 | 1.14E-02 | NA | 5.70E-05 |
| Methylene Chloride | 0.01 | NA | 7.19E-04 | 1.96E-04 | NA | 6.28E-05 |

Table 3-8
 Screening Hazard Quotients in Sediment
 Alcoa North Plant, East St. Louis, IL

| Analyte | Maximum GOPEC Detection (mg/kg) | Mallard | Muskrat | Night Heron |
|----------------------------|--|----------|----------|----------------|
| North Wet Area | | | | |
| Inorganic COIs | | | | |
| Aluminum | 53500 | 3.11E-01 | 5.39E+01 | 3.75E+00 |
| Antimony | 4.8 | NA | 8.98E+00 | NA |
| Arsenic | 34.5 | 1.61E-02 | 2.87E+00 | 3.84E-02 |
| Barium | 188 | 5.93E-02 | 1.38E+01 | 5.91E-02 |
| Beryllium | 0.8 | 9.99E-04 | 6.96E-02 | 9.94E-04 |
| Cadmium | 3.2 | 9.76E-02 | 4.06E-01 | 2.99E-01 |
| Chromium | 38 | 1.79E+00 | 7.90E+00 | 1.78E+00 |
| Cobalt | 6.2 | 1.52E-01 | 1.93E+00 | 1.65E-01 |
| Copper | 74.4 | 4.43E-02 | 4.52E-02 | 1.80E-01 |
| Cyanide | 0.6 | NA | 3.27E-03 | NA |
| Lead | 368 | 1.11E+00 | 3.39E-01 | 3.25E+00 |
| Manganese | 1260 | 7.89E-02 | 2.36E+00 | 8.56E-02 |
| Mercury | 0.7 | 5.94E-02 | 1.40E-02 | 1.20E-01 |
| Nickel | 20.3 | 1.67E-03 | 1.96E-02 | 1.76E-02 |
| Selenium | 8.9 | 1.32E+00 | 8.07E+01 | 1.85E+00 |
| Silver | 0.7 | 4.76E-03 | 4.03E-03 | 4.73E-03 |
| Thallium | 9.9 | 3.03E-01 | 1.23E+01 | 3.05E-01 |
| Vanadium | 202 | 5.15E+00 | 7.55E+03 | 5.75E+00 |
| Zinc | 509 | 1.50E+00 | 7.64E-01 | 2.81E+01 |
| Organic COIs | | | | |
| 2-Butanone (MEK) | 0.088 | NA | 1.69E-06 | NA |
| Acetone | 0.28 | 1.45E-06 | 1.14E-03 | 1.58E-05 |
| Anthracene | 0.065 | 2.21E-05 | 2.62E-03 | 3.32E-04 |
| Benzo(a)anthracene | 0.28 | 9.65E-05 | 1.14E-02 | 6.80E-03 |
| Benzo(a)pyrene | 0.27 | 9.78E-05 | 1.16E-02 | 8.40E-03 |
| Benzo(b)fluoranthene | 0.45 | 1.42E-04 | 1.68E-02 | 1.10E-02 |
| Benzo(g,h,i)perylene | 0.22 | 7.06E-05 | 8.37E-03 | 8.47E-03 |
| Benzo(k)fluoranthene | 0.18 | 5.80E-05 | 6.74E-03 | 5.72E-03 |
| bis(2-Ethylhexyl)phthalate | 1.7 | 9.45E-02 | 3.47E-02 | 9.65E-01 |
| Butylbenzylphthalate | 0.17 | NA | 4.00E-04 | NA |
| Carbazole | 0.12 | NA | 1.80E-03 | NA |
| Carbon Disulfide | 0.008 | NA | 2.72E-09 | NA |
| Chrysene | 0.36 | 1.22E-04 | 1.45E-02 | 8.75E-03 |
| delta-BHC | 0.0077 | 5.85E-04 | 1.02E-01 | 1.68E-03 |
| Dieldrin | 0.042 | 9.58E-03 | 2.26E-01 | 5.14E-02 |
| Fluoranthene | 0.42 | 1.43E-04 | 1.36E-03 | 5.01E-03 |
| Gamma-Chlordane | 0.0057 | 1.64E-05 | 4.68E-05 | 2.62E-04 |
| Indeno(1,2,3-cd)pyrene | 0.17 | 5.06E-05 | 6.01E-03 | 5.71E-03 |
| Methylene Chloride | 0.062 | NA | 3.96E-03 | NA |
| Phenanthrene | 0.31 | 7.61E-03 | 1.66E-02 | 1.27E-02 |
| Phenol | 0.049 | NA | 3.05E-04 | NA |
| Pyrene | 0.55 | 1.87E-04 | 2.96E-04 | 4.44E-03 |

Table 3-8
 Screening Hazard Quotients in Sediment
 Alcoa North Plant, East St. Louis, IL

| Analyte | Maximum COPEC Detection (mg/kg) | Mallard | Muskrat | Night Heron |
|--------------------------|--|----------|----------|----------------|
| Triangle Wet Area | | | | |
| Inorganic COIs | | | | |
| Aluminum | 40000 | 2.33E-01 | 4.03E+01 | 2.80E+00 |
| Antimony | 1.4 | NA | 2.62E+00 | NA |
| Arsenic | 80 | 3.74E-02 | 6.66E+00 | 8.91E-02 |
| Barium | 64.8 | 2.04E-02 | 4.75E+00 | 2.04E-02 |
| Cadmium | 3.2 | 9.76E-02 | 4.06E-01 | 2.99E-01 |
| Chromium | 9.3 | 4.38E-01 | 1.93E+00 | 4.35E-01 |
| Cobalt | 1.6 | 3.91E-02 | 4.99E-01 | 4.27E-02 |
| Copper | 18.5 | 1.10E-02 | 1.12E-02 | 4.46E-02 |
| Cyanide | 9.4 | NA | 5.12E-02 | NA |
| Lead | 2420 | 7.30E+00 | 2.23E+00 | 2.14E+01 |
| Manganese | 77.3 | 4.84E-03 | 1.45E-01 | 5.25E-03 |
| Mercury | 0.3 | 2.55E-02 | 5.99E-03 | 5.14E-02 |
| Nickel | 7.6 | 6.23E-04 | 7.34E-03 | 6.60E-03 |
| Selenium | 2.9 | 4.30E-01 | 2.63E+01 | 6.02E-01 |
| Silver | 0.5 | 3.40E-03 | 2.88E-03 | 3.38E-03 |
| Thallium | 1.5 | 4.59E-02 | 1.87E+00 | 4.62E-02 |
| Vanadium | 76.6 | 1.95E+00 | 2.86E+03 | 2.18E+00 |
| Zinc | 284 | 8.37E-01 | 4.26E-01 | 1.57E+01 |
| Organic COIs | | | | |
| Acetone | 0.088 | 4.55E-07 | 3.59E-04 | 4.95E-06 |
| Benzo(a)anthracene | 0.087 | 3.00E-05 | 3.56E-03 | 2.11E-03 |
| Benzo(b)fluoranthene | 0.14 | 4.42E-05 | 5.24E-03 | 3.42E-03 |
| Carbon Disulfide | 0.005 | NA | 1.70E-09 | NA |
| Chrysene | 0.12 | 4.08E-05 | 4.84E-03 | 2.92E-03 |
| Fluoranthene | 0.24 | 8.16E-05 | 7.75E-04 | 2.86E-03 |
| Methylene Chloride | 0.068 | NA | 4.35E-03 | NA |
| Phenanthrene | 0.25 | 6.14E-03 | 1.34E-02 | 1.03E-02 |
| Pyrene | 0.2 | 6.80E-05 | 1.08E-04 | 1.61E-03 |

Table
Summary of Endpoints for Wildlife Receptors
Alcoa North Plant, East St. Louis, IL.

Management Goal:

Prevent or eliminate the potential for adverse effects on local communities of ecological receptors due to exposure to elevated concentrations of COPECs in on-site abiotic and biotic media.

| Assessment Endpoint | Risk Hypotheses or Question | Measures |
|----------------------------------|--|--|
| <p>1 Omnivorous Birds</p> | <p style="text-align: center;"><u>Exposure Assessment</u></p> <p>1. COPEC exposures do not exceed TRVs (estimate by habitat type and location on site)</p> <p>2. COPEC in exposure media do not exceed reference levels</p> <p>3. What soil concentrations are associated with exposures that exceed TRVs?</p> <p style="text-align: center;"><u>Effects Assessment</u></p> <p>4. What portion of the Site with COPECs in soils exceed risk-based criterion?</p> | <p>COPEC concentrations in soils, vegetation, invertebrates; TRVs for small omnivorous birds; Intake calculations</p> <p>COPEC concentrations in soils, vegetation, and invertebrates from reference areas</p> <p>Correlation between COPEC concentrations in soils and either (a) concentrations in forage or prey or (b) bioconcentration factors</p> <p>Spatial distribution of elevated metal concentrations in soils.</p> |
| <p>2 Raptors</p> | <p style="text-align: center;"><u>Exposure Assessment</u></p> <p>1. COPEC exposure do not exceed TRVs (estimate by habitat type and location on site)</p> <p>2. COPEC in exposure media do not exceed reference levels</p> <p>3. What soil concentrations are associated with exposures that exceed TRVs?</p> <p style="text-align: center;"><u>Effects Assessment</u></p> <p>4. What portion of the Site with COPECs in soils and vegetation exceed risk-based criterion?</p> | <p>COPEC concentrations in soils and small mammals TRVs for raptors; Intake calculations</p> <p>COPEC concentrations in soils, prey</p> <p>Correlation between COPEC concentrations in soils and either (a) concentrations in forage or prey or (b) bioconcentration factors</p> <p>Spatial distribution of elevated COPEC concentrations in soils and prey</p> |

Table 1
Summary of Endpoints for Wildlife Receptors
Alcoa North Plant, East St. Louis, IL.

Management Goal:

Prevent or eliminate the potential for adverse effects on local communities of ecological receptors due to exposure to elevated concentrations of COPECs in on-site abiotic and biotic media.

| Assessment Endpoint | Risk Hypotheses or Question | Measures |
|--|--|--|
| 3 Omnivorous Small Mammals | <u>Exposure Assessment</u> | |
| | 1. COPEC exposure do not exceed TRVs (estimate by habitat type and location on site) | COPEC concentrations in soils, vegetation and invertebrates; TRVs for small omnivorous mammals; Intake calculations |
| | 2. COPEC in exposure media do not exceed reference levels | COPEC concentrations in soils, vegetation and invertebrates in the reference area |
| | 3. What soil concentrations are associated with exposures that exceed TRVs? | Correlation between COPEC concentrations in soils and either (a) concentrations in forage or prey or (b) bioaccumulation factors |
| 4 Ruminant Wildlife | <u>Effects Assessment</u> | |
| | 4. What portion of the Site with COPECs in soils exceed risk-based criterion? | Spatial distribution of elevated COPEC concentrations in soils, vegetation, and invertebrates |
| | <u>Exposure Assessment</u> | |
| | 1. COPEC exposures do not exceed TRVs (estimated by habitat type and location on site) | COPEC concentrations in soils and vegetation; TRVs for ruminants; Intake calculations |
| 4 Ruminant Wildlife | 2. COPEC in exposure media do not exceed reference levels | COPEC concentrations in soils and vegetation from reference area |
| | 3. What soil concentrations are associated with exposures that exceed TRVs? | Correlation between COPEC concentrations in soils and either (a) concentrations in forage (b) bioaccumulation factors for uptake soil-forage |
| | <u>Effects Assessment</u> | |
| 4. What portion of Site with COPECs in soils and vegetation exceed risk-based criterion? | Spatial distribution of elevated metal concentrations in soils and vegetation | |

Table 1
Summary of Endpoints for Wildlife Receptors
Alcoa North Plant, East St. Louis, IL.

Management Goal:

Prevent or eliminate the potential for adverse effects on local communities of ecological receptors due to exposure to elevated concentrations of COPECs in on-site abiotic and biotic media.

| Assessment Endpoint | Risk Hypotheses or Question | Measures |
|---|--|--|
| 5 Mammalian Predators | <u>Exposure Assessment</u> | |
| | 1. COPEC exposures do not exceed TRVs (estimated by habitat type and location on site) | COPEC concentrations in soils and small mammals; TRVs for mammals; Intake calculations |
| | 2. COPECs in exposure media do not exceed reference levels | COPEC concentrations in soils and small mammals from reference area |
| | 3. What soil concentrations are associated with exposures that exceed TRVs? | Correlation between COPEC concentrations in soils and either (a) concentrations in prey (b) bioaccumulation factors for uptake soil-forage |
| <u>Effects Assessment</u> | | |
| | 4. What portion of the Site with COPECs in soils and prey exceed risk-based criterion? | Spatial distribution of elevated COPEC concentrations in soils and prey |
| 5 Semi-Aquatic Mammalian Herbivore | <u>Exposure Assessment</u> | |
| | 1. COPEC exposures do not exceed TRVs (estimated by habitat type and location on site) | COPEC concentrations in sediments and aquatic plants; TRVs for mammals; Intake calculations |
| | 2. COPECs in exposure media do not exceed reference levels | COPEC concentrations in sediments and aquatic plants from reference area |
| | 3. What soil concentrations are associated with exposures that exceed TRVs? | Correlation between COPEC concentrations in sediments and either (a) concentrations in prey (b) bioaccumulation factors for uptake soil-forage |
| <u>Effects Assessment</u> | | |
| | 4. What portion of the Site with COPECs in sediments and prey exceed risk-based criterion? | Spatial distribution of elevated COPEC concentrations in sediments and prey |

Table 1
Summary of Endpoints for Wildlife Receptors
Alcoa North Plant, East St. Louis, IL.

Management Goal:

Prevent or eliminate the potential for adverse effects on local communities of ecological receptors due to exposure to elevated concentrations of COPECs in on-site abiotic and biotic media.

| Assessment Endpoint | Risk Hypotheses or Question | Measures |
|--------------------------------|--|--|
| 5 Semi-Aquatic Avian Herbivore | <u>Exposure Assessment</u> | |
| | 1. COPEC exposures do not exceed TRVs (estimated by habitat type and location on site) | COPEC concentrations in sediments and aquatic plants; TRVs for birds; Intake calculations |
| | 2. COPECs in exposure media do not exceed reference levels | COPEC concentrations in sediments and aquatic plants from reference area |
| | 3. What soil concentrations are associated with exposures that exceed TRVs? | Correlation between COPEC concentrations in sediments and either (a) concentrations in prey (b) bioaccumulation factors for uptake soil-forage |
| <u>Effects Assessment</u> | | |
| | 4. What portion of the Site with COPECs in sediments and prey exceed risk-based criterion? | Spatial distribution of elevated COPEC concentrations in sediments and prey |
| 5 Semi-aquatic Avian Predators | <u>Exposure Assessment</u> | |
| | 1. COPEC exposures do not exceed TRVs (estimated by habitat type and location on site) | COPEC concentrations in sediments, small mammals and amphibians; TRVs for birds; Intake calculations |
| | 2. COPECs in exposure media do not exceed reference levels | COPEC concentrations in sediments, small mammals, and amphibians from reference area |
| | 3. What soil concentrations are associated with exposures that exceed TRVs? | Correlation between COPEC concentrations in sediment and either (a) concentrations in prey (b) bioaccumulation factors for uptake soil-forage |
| <u>Effects Assessment</u> | | |
| | 4. What portion of the Site with COPECs in sediments and prey exceed risk-based criterion? | Spatial distribution of elevated COPEC concentrations in sediments and prey |

FIGURES



EXPLANATION

- Site Boundary
 - Mud Lakes
 - Railroads
 - Roads
 - Parks
- HABITAT**
- Open Water
 - Open Wet Area
 - Vegetated Wet Area
 - Grassy Area
 - Industrial
 - Open
 - Recreational
 - Successional Forest

Source: MFG, 2003. Habitat digitized from USGS DOQs - NE portion of Cahokia DOQ (June 28, 2001) and NW portion of French Village DOQ (December 30, 1999).



NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

FIGURE D2-1
PRELIMINARY HABITAT MAP

| | |
|-------------------|------------------------|
| PROJECT: 020209.1 | DATE: JUL 15, 2003 |
| REV: 0 | BY: PJM CHECKED: MCP |

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EXPLANATION

Site Boundary

Mud Lakes

Railroads

Roads

Parks

SLERA Data Source

ESL-0017

ESL-0049

ESL-0074

ESL-0080

HABITAT

Open Water

Open Wet Area

Vegetated Wet Area

Grassy Area

Industrial

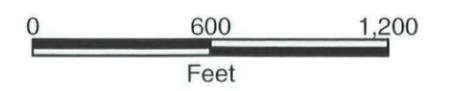
Open

Recreational

Successional Forest

Source: MFG, 2003. Habitat digitized from USGS DOQs - NE portion of Cahokia DOQ (June 28, 2001) and NW portion of French Village DOQ (December 30, 1999).

N



NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

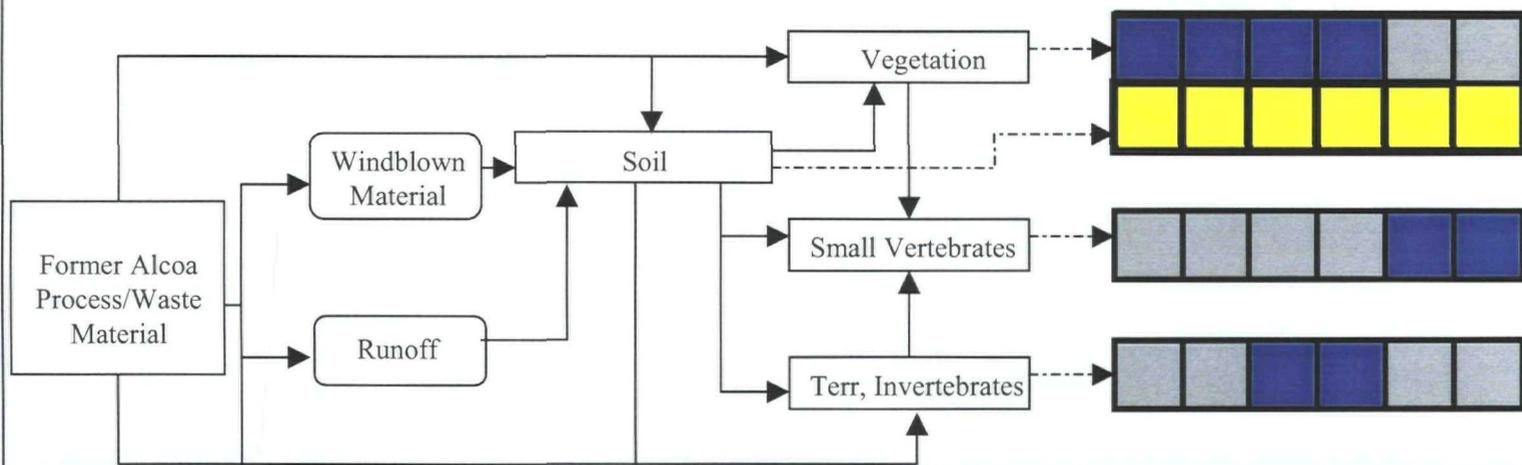
FIGURE D2-2
MAP OF DATA SOURCES
USED IN THE
SCREENING LEVEL RISK ASSESSMENT

| | |
|-------------------|----------------------|
| PROJECT: 020209.1 | DATE: JUL 15, 2003 |
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| PRIMARY SOURCE(S) | PRIMARY RELEASE MECHANISM | SECONDARY SOURCE(S) | TERTIARY SOURCE(S) | RECEPTORS | | | | | | NOTES |
|-------------------|---------------------------|---------------------|--------------------|-------------------|------------------|-----------------|------------------|-----------------|------------------|-------|
| | | | | Herbivore; Mammal | Herbivore; Avian | Omnivore; Avian | Omnivore; Mammal | Predator; Avian | Predator; Mammal | |

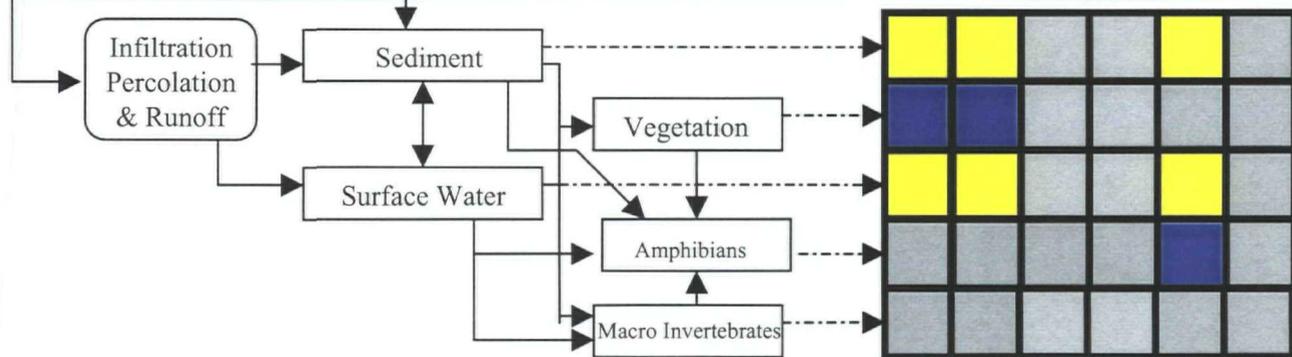
UPLAND HABITATS



Model assumes limited transfer of COPCs in the foodweb.

Receptors included in the upland portions of the Site:
 Deer Mouse
 American Robin
 Red-tailed Hawk
 Coyote
 Whitetail Deer

WETLAND HABITATS



Key:
 [Grey Box] Incomplete Pathway
 [Blue Box] Oral Ingestion Only
 [Yellow Box] Oral Ingestion and Direct Contact

Receptors included in the wetland portions of the Site:
 Mallard
 Muskrat
 Black-Crowned Night Heron

Figure D2-3

Conceptual Site Model for Exposure of Ecological Receptors

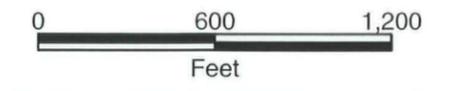
East St. Louis – Alcoa N. Plant





EXPLANATION

- Site Boundary
- Railroads
- Roads
- Investigative Blocks



| Investigative Block | Description |
|---------------------|-----------------------------|
| 1a | RDA 1 |
| 1b | RDA 2 |
| 1c | RDA 3 |
| 2 | Gypsum Dike Areas |
| 3a | Brick Works/Childs Property |
| 3b | Redevelopment Area |
| 3c | SPL Stockpile Area |
| 4a | North Wet Area |
| 4b | Triangle Wet Area |
| 4c | Ball Fields |
| 4d | Berm Wet Area |
| 4e | Active Commercial Area |

NORTH ALCOA SITE
 EAST ST. LOUIS, ILLINOIS
 FIGURE D2-4
 INVESTIGATIVE BLOCKS

| | |
|-------------------|----------------------|
| PROJECT: 020209.1 | DATE: JUL 15, 2003 |
| REV: 0 | BY: CRL CHECKED: PJM |

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APPENDIX E
EXISTING DATA

July 24, 2003

APPENDIX F
HEALTH AND SAFETY PLAN

**SITE SAFETY PLAN
 FOR
 NORTH ALCOA SITE
 EAST ST. LOUIS
 3600 MISSOURI AVENUE
 EAST ST. LOUIS, ILLINOIS 62207**

**MFG, INC.
 PROJECT NO. 020209**

| PREPARED BY: | | | |
|---|-----------------------|-------------|-----------------|
| TITLE | NAME | SIGNATURE | DATE |
| Site Health and Safety Officer | James Ferguson | | 07/24/03 |
| REVIEWED BY: | | | |
| TITLE | NAME | SIGNATURE | DATE |
| Project Manager | Bryan McCulley | | 07/24/03 |
| Corporate Health and Safety Director | Tory Fravel | | 07/24/03 |
| REVISIONS | | | |
| DATE | NAME | APPROVED BY | DATE |
| | | | |
| | | | |

1.0 PROJECT BACKGROUND AND SITE CHARACTERIZATION

(PORTIONS OF CFR 29 PART 1910 120 (c) AND CCR TITLE 8 SECTION 5192(c))

| | |
|--|--|
| Site Name: East St. Louis Site Location/Address: 3600 Missouri Avenue East St. Louis, Illinois 62207 | |
| Client Contact(s): Ron Weddell | |
| Alcoa Alumina & Chemicals, LLC Point Comfort Operations State Highway 35 Point Comfort Operations Point Comfort, Texas 77978 | Phone: 361-987-6445 Fax: 361-987-6804 |
| Owner/Operator Contact(s): City of East St. Louis | |
| Mike Wagner Attorney for City of East St. Louis Hinshaw Law Firm PO Box 509 521 W. Main Street Belleville, IL 62222 City Manager City of East St. Louis 301 River Park Drive East St. Louis, IL 62222 | Phone: 618-277-2400 Fax: 618-277-1144 |
| Regulatory Agency/Contact(s): United States Environmental Protection Agency (US EPA) | |
| Dion Novak US EPA, Region 5 Superfund Division, Mail Code SR-6J 77 W. Jackson Boulevard Chicago, IL 60604 | Phone: 312-886-4737 Fax: |
| Regulatory Agency/Contact(s): Illinois Environmental Protection Agency (Illinois EPA) | |
| Rick Lanham Illinois EPA PO Box 19276 Springfield, IL 62794 Tom Miller Illinois EPA 209 Mall Street Collinsville, IL 62234 | Phone: Fax: |

1.1 GENERAL PROJECT OBJECTIVE

The project objective is the collection of field data in preparation of a Remedial Investigation and Feasibility Study (RI/FS) at the North Alcoa Site in East St. Louis, Illinois. The Site to be evaluated in the RI is defined in the Administrative Order of Consent as: the property located north of Missouri Avenue, which is approximately bounded by 29th Street to the west, Alton Southern Railroad to the east, and Lake Drive to the north; and (2) areas located north of Missouri Avenue where hazardous substances have or may have come to be located from former Alcoa operations. The RI shall evaluate the nature and extent of contamination at and from the Site and also assess the risk from these contaminations on human health and the environment.

1.2 SITE SAFETY PLAN SCOPE/APPLICABILITY

This Site Safety Plan applies to MFG employees undertaking the tasks described herein. Non-MFG employees are responsible for adherence to their employer's own health and safety program(s) for work undertaken at the site. MFG may share the contents of this plan and the results of environmental monitoring or observation with other parties at the site for informational purposes. MFG may also comment on the conformance of subcontractor practices with project requirements, including contract documents. Information provided by MFG to non-MFG employees at the site shall not constitute control over the means, methods and safety practices used by those parties to complete their work.

SITE DESCRIPTION

The site primarily consists of three Bauxite residue disposal areas (RDA) of approximately 40 acres each. The RDAs are all adjacent to one another and form a rough triangular shape of 120 acres with the 3 RDAs forming the apexes of the triangle (RDA 1 is the northwest apex; RDA 3 is the northeast apex; and RDA 2 is the south apex).

In addition to the three named bauxite residue disposal areas, bauxite residue may have been disposed of over a broader area of the North Alcoa Site. The three RDA sites are surrounded by gypsum berms and are elevated in comparison to the surrounding landscape. Over time the three RDAs have developed wetland/marsh areas. RDA-1 contains more upland vegetation and unvegetated areas than RDAs-2 and 3. To the north of the RDAs lies a rectangular area that contains seasonal marsh areas and upland vegetation. A triangular wetland is located to the northeast of RDA-3, and is contained by gypsum berms on the northern and southwestern sides and a road and railroad on the northeast. The sampling zone to the southwest of the RDAs contains upland vegetated and unvegetated areas with seasonal wetlands interspersed.

A Site Map is included in Attachment A.

1.4 COMMENTS/ADDITIONAL SITE DESCRIPTION AND BACKGROUND

Alcoa's former East St. Louis Works (ESLW) was constructed primarily for the purpose of refining bauxite ore into alumina. In addition, the former East St. Louis Works also engaged in the production of fluoride, as well as bauxite and fluoride-based chemicals, including cryolite, aluminum fluorides, and sodium acid fluoride. The former ESLW began operations in or about 1903 and ceased bauxite refining in or about 1957. The material remaining after aluminum is extracted during bauxite refining is known as "red mud" or bauxite residue. The red mud was placed initially at the edge of the former Pittsburgh Lake, and in three impoundments (with gypsum berms).

The site is located in a broad alluvial valley that was a former plain of the Mississippi River known as the American Bottoms. Much of the soils on-site consist of fill material containing clay, sand, gravel cinders, limestone fragments, cloth remains and organic material; and two types of materials at the surface as a result of the former Alcoa process, bauxite residue and gypsum. There is also a small area of spent potlining (SPL) at the surface. In general, the bauxite residue was deposited into the three mud lakes (RDAs), which was stabilized and contained by the gypsum berms. The SPL was deposited in a small area of the Site.

WARNING: THIS SITE MAY CONTAIN CHEMICALS THAT ARE KNOWN TO CAUSE MEDICAL PROBLEMS. CONCENTRATIONS FOR CHEMICALS THAT WILL PROTECT 100 PERCENT OF THE POPULATION HAVE NOT BEEN ESTABLISHED. THEREFORE, IT IS ENCUMBERT UPON EVERY PERSON WORKING AT THE SITE TO MINIMIZE THEIR EXPOSURE TO THESE CHEMICALS.

2.0 PROJECT ORGANIZATION
(PORTIONS OF CFR 29 PART 1910 120 (b)(2) AND CCR TITLE 8 SECTION 5192(b)(2))

| PERSONNEL | NAME | AFFILIATION | PHONE (Work) | PHONE (Other) |
|-------------------------|-------------------------|-------------------------------|---------------------|----------------------|
| Project Manager: | Bryan McCulley | MFG | 303-517-1143 | |
| Site Safety Officer: | Jim Ferguson | MFG-Pittsburgh | 412-321-2278 | |
| Office H&S Coordinator: | Amy Longfield | MFG- Port Lavaca | 361-552-8839 | 361-652-8986 |
| Corp H&S Director: | Tory Fravel | MFG-Fort Collins | 970-223-9600 | 970-266-9409 |
| Field Project Staff: | Sean Covington | MFG-Austin | 512-338-1667 | |
| | Peter McAlenney | MFG-Boulder | 303-447-1823 | |
| | To Be Determined | | | |
| | | | | |
| MFG Subcontractors: | Jon Bruner | Terracon, Inc. | 314-692-8811 | |
| | Ronald Schonegg | 3Di Technologies, Inc. | 317-244-1800 | |
| Others: | | | | |
| | | | | |
| | | | | |

3.0 PROJECT WORK PLAN/TASK HAZARD ANALYSIS

(CFR 29 PART 1910 120(b)(4)(u)(A), CCR TITLE 8 SECTION 5192(4)(B)(1))

3.1 PROJECT OBJECTIVES

Is this project being performed at the request, or due to involvement of, a regulatory agency? Yes No

| | |
|---|--|
| List all involved agencies: | United States Environmental Protection Agency, Illinois Environmental Protection Agency |
| Briefly state the objectives of the project: | |
| <p>The objectives of the project are to:</p> <ul style="list-style-type: none"> • Evaluate the nature and extent of contamination at and from the site • Assess the risk to human health and the environment from the contamination at and from the Site • Develop remedial alternatives. | |

3.2 WORK TASKS

| TASK - TITLE | TASK DESCRIPTION |
|---|---|
| Well installation and sampling; Soil and groundwater sampling | Install monitoring well; collection of soil samples during well construction; purging and collection of groundwater sample from monitoring well using bailer. |
| Shallow soil sampling | Soil sampling using a spade, post hole digger, or hand auger to recover sample at different intervals. |
| Subsurface soil sampling | Soil sampling using a hollow stem auger to recover sample at different intervals. |
| Surface water sampling | Sample surface water utilizing a grab sampler or a peristaltic pump, possibly using a small boat to reach sampling locations. |
| Sediment sampling | Sediment sampling utilizing a core sampler, possibly using a small boat to reach sampling locations. |
| Waste Handling | Placement of solid waste (e.g., soil, liners, PPE equipment) and liquid wastes (e.g., development water, purged groundwater, and decontamination rinse water) into properly labeled and stored DOT-approved polyethylene 55-gallon drums. |

3.3 SITE SPECIFIC CHEMICAL HAZARDS (Chemicals known or suspected to be on-site)

| GENERAL PROPERTIES | | | | |
|---------------------------|--------------------------------|---|---|--|
| CONSTITUENT | HAZARD CLASS | PHYSICAL STATE | POTENTIAL EXPOSURE ROUTES | TASKS INVOLVING POTENTIAL EXPOSURE. |
| Aluminum | Corrosive | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Antimony | Poison | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Arsenic | Combustible, Carcinogen | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Cadmium | Carcinogen, Flammable | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Chromium | Combustible | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Copper | Combustible | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Cyanide | Poison | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Fluoride | Uknown | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Lead | Toxic | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |

| CONSTITUENT | HAZARD CLASS | PHYSICAL STATE | POTENTIAL EXPOSURE ROUTES | TASKS INVOLVING POTENTIAL EXPOSURE |
|--------------------------|------------------------|--|--|------------------------------------|
| Vanadium | Explosive | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Zinc | Combustible, Flammable | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Benz (a) anthracene | Combustible | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Benzo (a) pyrene | Carcinogen | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Benzo (b) fluoranthene | Combustible | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Dibenz (a, h) anthracene | Carcinogen | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |
| Indeno (1,2,3-cd) pyrene | Not available | Adsorbed in soil; dissolved in groundwater; vapor off-gassing from soils and groundwater | Inhalation, Absorption through skin, and Ingestion | All tasks |

| EXPOSURE LIMITS | | | | |
|-----------------|-------------------------|----------------------------------|----------------------|---------------|
| CONSTITUENT | PEL/TLV or REL* | STEL | IDLH | LEL |
| Aluminum | 10 mg/m ³ | Not available | Not available | Not available |
| Antimony | 0.5 mg/m ³ | Not available | 50 mg/m ³ | Not available |
| Arsenic | 0.010 mg/m ³ | Ceiling: 0.002 mg/m ³ | Not available | Not available |
| Cadmium | 0.005 mg/m ³ | Not available | 9 mg/m ³ | Not available |
| Chromium | 0.5 mg/m ³ | Not available | Not available | Not available |
| Copper | 0.2 mg/m ³ | Not available | Not available | Not available |
| Cyanide | 5 mg/m ³ | Not available | Not available | Not available |

| CONSTITUENT | PEL/TLV or REL* | STEL | IDLH | LEL |
|--------------------------|---|---------------|-----------------------|---------------|
| Fluoride | Not available | Not available | Not available | Not available |
| Lead | 0.100 mg/m ³ | Not available | 100 mg/m ³ | Not available |
| Vanadium | 1 mg/m ³ | Not available | 25 mg/m ³ | Not available |
| Zinc | 1 mg/m ³ Short Term: 3 mg/m ³ | Not available | 500 mg/m ³ | 1.3 % |
| Benz (a) anthracene | 0.2 mg/m ³ | Not available | Not available | Not available |
| Benzo(a)pyrene | Not available | Not available | Not available | Not available |
| Benzo (b) fluoranthene | Not available | Not available | Not available | Not available |
| Dibenz (a,h) anthracene | Not available | Not available | Not available | Not available |
| Indeno (1,2,3-cd) pyrene | Not available | Not available | Not available | Not available |

Notes:

* TLV or REL listed when they are lower than the PEL. PEL = Permissible Exposure Limit (OSHA); TLV = Threshold Limit Value (ACGIH); REL = Recommended Exposure Limit (NIOSH); STEL = Short Term Exposure Limit (OSHA); IDLH = Immediately Dangerous to Life and Health; LEL = Lower Explosive Limit. ppm = parts per million; mg/m³ = milligrams per cubic meter.

WARNING PROPERTIES/EXPOSURE SYMPTOMS

| CONSTITUENT | WARNING PROPERTIES | EXPOSURE SYMPTOMS |
|-------------|---|---|
| Aluminum | Silvery white malleable ductile odorless metal | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage |
| Antimony | Silvery, white, lustrous, hard, and brittle solid | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage |
| Arsenic | Metal, silver-gray or tan-white, brittle, odorless solid | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage (carc) |
| Cadmium | Metal: Silver-white, blue tinged, lustrous, odorless solid | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage (carc) |
| Chromium | Steel gray lustrous metal | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage |
| Copper | Red powder, turns green on exposure to moist air | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage |
| Cyanide | Bitter almond odor, White deliquescent granular solid | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; loss of consciousness |
| Fluoride | Unknown | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage |
| Lead | A heavy, ductile, soft gray solid | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage |
| Vanadium | Yellow orange powder or dark gray, odorless flakes, disperse in air | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage |

| CONSTITUENT | WARNING PROPERTIES | EXPOSURE SYMPTOMS |
|--------------------------|--|---|
| Zinc | Not available | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage |
| Benz (a) anthracene | Colorless to yellow brown fluorescent flakes or powder | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage |
| Benzo (a) pyrene | Slightly brown solid with a faint aromatic odor | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage (carc) |
| Benzo (b) fluoranthene | Colorless to yellow crystals | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage |
| Dibenz (a,h) anthracene | Solid | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage (carc) |
| Indeno (1,2,3-cd) pyrene | Not available | Eyes, nose, throat, skin irritation; dizziness; nausea; headache; liver damage |

| CONCENTRATIONS DETECTED OR SUSPECTED TO BE PRESENT | | | | |
|--|--------------|--------------------|------------|------------------------|
| CONSTITUENT | SOIL (mg/kg) | GROUNDWATER (ug/L) | AIR (ppmv) | FREE PRODUCT? (yes/no) |
| Aluminum | Unknown | Unknown | Unknown | No |
| Antimony | Unknown | Unknown | Unknown | No |
| Arsenic | Unknown | Unknown | Unknown | No |
| Cadmium | Unknown | Unknown | Unknown | No |
| Chromium | Unknown | Unknown | Unknown | No |
| Copper | Unknown | Unknown | Unknown | No |
| Cyanide | Unknown | Unknown | Unknown | No |
| Fluoride | Unknown | Unknown | Unknown | No |
| Lead | Unknown | Unknown | Unknown | No |
| Titanium | Unknown | Unknown | Unknown | No |
| Vanadium | Unknown | Unknown | Unknown | No |
| Zinc | Unknown | Unknown | Unknown | No |
| Benz (a) anthracene | Unknown | Unknown | Unknown | No |
| Benzo (a) pyrene | Unknown | Unknown | Unknown | No |
| Benzo (b) fluoranthene | Unknown | Unknown | Unknown | No |
| Dibenz (a,h) anthracene | Unknown | Unknown | Unknown | No |
| Indeno (1,2,3-cd) pyrene | Unknown | Unknown | Unknown | No |

4 CHEMICALS USED TO PERFORM ON-SITE TASKS

| TASK | CHEMICAL | HAZARD CLASS | PHYSICAL STATE | PEL/TLV/REL |
|---|-----------------------------------|----------------------|------------------|--|
| Decontamination/ cleaning of sampling equipment | Liqui-Nox Alconox | Irritant Irritant | Liquid Powder | Not Established Not Established |
| Preservative in sample containers | Hydrochloric Acid Nitric Acid | Toxic, Corrosive | Liquid | HCL: 7 mg/m ³ HNO ₃ : 2 mg/m ³ |
| Calibration of PID for air monitoring | Isobutylene, 100 ppmv standard | Compressed gas | Compressed gas | Not Established |
| | | | | |

Notes:
 Abbreviations: PEL = Permissible Exposure Limit (OSHA); TLV = Threshold Limit Value (ACGIH); REL = Recommended Exposure Limit (NIOSH); mg/m³ = milligrams per cubic meter

Material Safety Data Sheets for chemicals used to perform on-site tasks are available in a notebook in the field vehicle.

3.5 NON-CHEMICAL HAZARDS

| TASK/HAZARD | NON-CHEMICAL HAZARDS (List all that apply from list below, expand as needed) |
|-----------------------------------|--|
| Working in Protective Gear | Possible heat exposure, heat stress, dehydration, or sunstroke. Symptoms include heat rash, heat cramps, heat exhaustion, dizziness, nausea, faintness, and elevated body temperature. Personnel exhibiting symptoms of heat stress must stop work immediately and go and sit in the shade and rest for at least 15 minutes, and drink cool fluids or water. |
| Sunburn | Over-exposure to the sun can be prevented. Personnel will bring sunscreen with an SPF of least 30 with them to the field and apply it several times a day. |
| Inclement Weather | Cold exposure and hypothermia can result during wet or cold weather conditions. Symptoms of hypothermia include numb body parts (fingers, toes, ears, nose), uncontrollable shaking, slurred speech, impaired judgment and poor coordination. Personnel with any cold exposure symptoms must stop work immediately and get warmed. |
| Drowning | Field sampling activities along surface waters pose a potential drowning hazard. This hazard is addressed in US Coast Guard Regulation 29 CFR 1926.106: "Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jackets or buoyant work vests." Workers working over or in water greater than 3 feet deep will be required to don a life vest. Workers working near water (i.e., along the shore) will not be required to wear life vests; however, life vests will be available within 50 feet of the work activity. A rescue line must also be available. |
| Stream Work | Sampling activities will take place in or adjacent to streams and rivers. Hazards include slips, trips and falls resulting from underestimating the power of currents, stepping on slippery or potentially unstable rocks or logs, or slipping on steep banks and drop offs. Drowning could result from unconsciousness after a fall, being swept away by currents, becoming trapped under obstacles in deep, rapidly moving water, being pulled under if waders fill with water, or an inability to swim. Workers working over or in water greater than 3 feet deep will be required to don a life vest. Workers working near water (i.e., along the shore) will not be required to wear life vests; however, life vests will be available within 50 feet of the work activity. A rescue line must also be available. |
| Poisonous Plants | Poisonous plants, such as poison ivy, may be present on site. Reactions to poisonous plant exposure vary depending on the individual and the severity of the exposure, and can range from minor skin irritation to severe allergic reactions (oozing rashes and swelling) that require medical attention. Skin protection such as Ivy Block is available in the field kit. |
| Biting/Stinging Insects | Wasps, bees, spiders, centipedes and other insects may be found on site. Wear insect repellent. Bites and stings from insects may be painful but generally are not dangerous, unless the individual bitten/stung is severely allergic. Some spiders such as the Black Widow and Brown Recluse can inflict a serious bite that should be evaluated by a medical professional. |
| Ticks | Ticks are small (2mm to 7mm), blood-eating parasites related to spiders that may reside in brushy or grassy areas. When an animal or person passes, the tick will jump onto the passing host and crawl around looking for a place to attach itself and begin feeding. Tick bites can result in transmission of Lyme Disease, Rocky Mountain Spotted Tick Fever and other diseases, and may become infected. Lyme Disease can be a debilitating, long-term illness. All tick bites must be evaluated by a medical professional. |
| Small Animals | Never approach animals, including dogs and cats. Many serious diseases can be transmitted from animals such as rabies, Hantavirus and Cat Scratch Fever. All animal bites must be evaluated by a medical professional. |
| Snakes | Snake bites can occur when snakes are inadvertently disturbed when stepping on or near them, or placing hands in crevices. Never handle a snake. Assume all snakes are poisonous. All snake bites must be immediately evaluated by a medical professional. |
| Working Hours | Normal working hours in the field are from 7am to 5pm. Personnel needing to work outside these normal working hours must first get permission from the Project Manager. Tasks involving extended work hours (i.e., after 5 pm) require the buddy system – at least 2 people must be present for nighttime work. Personnel may not work alone after dark. |
| Overhead Lines | Locations of overhead lines are not known at this time. Before any drilling work takes place the position of overhead lines will be noted and work will be conducted to avoid the lines. Table 1 provides the requirements for equipment operation near powerlines. |

| | |
|------------------------------|--|
| Underground Utilities | Locations of underground utility lines are not available at this time. Before any drilling work will take place the underground utility locator company will be notified to determine the locations of any underground pipelines. |
|------------------------------|--|

| | | | | |
|---|--------------------|----------------------|-----------------------------|--------------------------|
| Partial list of examples of non-chemical hazards: | | | | |
| Electrical Overhead Lines | Drill Rig | Low Light | Stick/Puncture/Pinch | Dangerous Animals |
| Underground Utilities | Backhoe/Excavator | Noise | Slip/Trip/Fall | Snakes |
| Trenches | Welding | Traffic | High Crime | Drowning |
| Excavations | Lifting | Heat Stress | Insects | Dust |
| | Hot Surfaces/Burns | Cold Exposure | Poisonous Plants | Inclement Weather |
| List all construction/heavy equipment | | Drill rig. | | |

3.6 WORKPLACE SAFETY SURVEYS

The Field Supervisor will survey the Site for potential work hazards at the beginning of the project. Additional site safety surveys or safety audits will be performed (1) in the event of an accident, injury, or illness related to the site; (2) whenever a new substance, process or equipment is introduced that was not contemplated in this Site Safety Plan; (3) whenever a safety deficiency is noted; (4) when a new hazard is recognized and needs to be evaluated; or (5) periodically as needed.

4.0 PERSONNEL TRAINING

(CFR 29 PART 1910 120(b)(4)(u)(B), CCR TITLE 8 SECTION 5192(b)(4)(B)(2))

All MFG personnel engaged in work involving potential exposure to hazardous chemicals at the Site have completed training in accordance with OSHA Standard 29 CFR 1910.120 (e). Records for personnel training are kept in accordance with 29 CFR 1910.120 and copies are available from the Office Health and Safety Coordinator. At a minimum, all personnel shall have completed a 40 Hour OSHA HAZWOPER training course and have had 24 hours of supervised field training. The Field Supervisor shall have completed an additional 8 Hour OSHA Supervisor training course. The Site Safety Officer shall hold a current certificate for first aid/CPR training.

4.1 TAILGATE SAFETY MEETINGS

Tailgate safety meetings (TSMs) will be conducted to discuss Site activities and task-specific hazards. Forms documenting the TSMs are included in Attachment C. TSMs will be conducted according to the following schedule:

- Every day before work begins which involves more than one person.
- Every time a new individual enters the Work Area that did not attend the morning TSM.

4.2 SITE SAFETY PLAN

The following personnel are required to review this Site Safety Plan and acknowledge by signature that they have read it and agree to abide by its requirements. Safety Compliance Agreement Forms are included in Attachment C. (Check all that apply.)

- MFG personnel
- MFG subcontractors
- All other personnel engaged in the project at the Site
- All personnel entering the Work Area

4.3 ADDITIONAL TRAINING REQUIREMENTS

1. Any personnel that will engage in activities requiring the use of respiratory protection must have an annual respirator fit test and be using the respirator brand and size indicated on the certificate.
2. All MFG personnel will be familiar with the written MFG Standard Operation Procedures (SOPs) relating to the work.
3. All MFG personnel and contractors must check in with site personnel for a briefing on the site-specific health and safety requirements prior to commencing with work.

5.0 ENGINEERING CONTROLS, WORK PRACTICES AND PERSONAL PROTECTIVE EQUIPMENT

(CFR 29 PART 1910 120(b)(4)(a)(C), CCR TITLE 8 SECTION 5192(b)(4)(B)(3))

5.1 ENGINEERING CONTROLS

Describe engineering controls that may be used to control worker exposure and/or migration of contaminants:

Investigation derived waste from RDAs 1,2 or 3 will be disposed of at the location where it was derived. Wastes derived in other locations will be disposed of using DOT-approved polyethylene 55-gallon drums for temporary storage of soil and purge water from sampling activities and decontamination water. Cover all drums when not in use. Place waste materials into containers as quickly as practicable.

Partial list of commonly used engineering controls:

| | | | | | |
|---------------------|-----------|-------------|------------------|------------------|----------------|
| Fans | Blowers | Water Truck | Sprinklers | Hoses | Dry Ice |
| Foam | Berms | Liners | Covers | Sediment Fence | Inert Gas |
| Sedimentation Basin | Hay Bails | Wind Screen | Pressurized Cabs | Remote Equipment | Plastic Sheets |

5.2 SAFE WORK PRACTICES

The following work practices will be instituted in order to limit worker exposure to contaminants and other hazards.

authorized persons will not be allowed in the work areas. Non-essential personnel will maintain an appropriate distance from rig, boring holes, monitoring well and potentially contaminated media. No eating, drinking, chewing gum or using tobacco products will be permitted in the work areas. All personnel shall wash their hands and face prior to eating or leaving the Site.

GENERAL SAFE WORK PRACTICES

1. Employees must be physically fit and properly trained prior to performing any field activities.
2. Employees must inspect the job site for safety hazards prior to beginning any field activities. The Field Supervisor will inform all employees of the potential hazards of the job during the initial tailgate meeting.
3. All field personnel shall:
 - A. Read the Site Health & Safety Plan prior to beginning any field work;
 - B. Dress appropriately for weather conditions;
 - C. Wear safety glasses at all times while in work areas;
 - D. Wear protective clothing as required by the Site Health & Safety Plan; and
 - E. Immediately report any accident or injury to the Field Supervisor. This includes minor or slight injuries and near-miss events.
4. Employees are required to keep their work environment clean and orderly.
5. Do not eat, drink, smoke, chew gum or use tobacco products in the active work areas.
6. Changes in work practices or work rules that involve deviations from the Site Health and Safety Plan, or that introduce new hazards, will be implemented only after approval by: (1) the Project Manager; (2) the Site HSO; and the Office Health and Safety Coordinator (OHSC).
7. Follow all emergency procedures explicitly.

8. Be aware of site conditions, and especially any changes in conditions. If an unsafe condition is encountered, rectify and/or report it immediately.
9. If other people are present or working nearby, always check in with the area supervisor or other appropriate personnel to coordinate your activities and request their cooperation.
10. Employees shall wash their hands and face prior to eating, smoking or leaving the Site. Water for hand washing will be made available in the field. Employees will scrub soil from their boots using a stiff brush prior to leaving the Site.
11. Employees shall follow all client-designated safety procedures.

USE OF PROTECTIVE EQUIPMENT

1. Inspect, clean and maintain the protective equipment issued to you on a daily basis when in use. Report any defects in the equipment immediately to the Site HSO.
2. Anticipate local weather conditions. Wear appropriate clothing and bring extra clothing/rain gear.
3. Beards or long sideburns will not be allowed on sites where respiratory protection may be required, since they interfere with respiratory protection. Trimmed sideburns and mustaches are acceptable, provided they do not interfere with respiratory protection. Report to work clean-shaven when there is a potential need for the use of respiratory protection.
4. Use only the equipment for which you are trained and qualified.

STINGING/BITING INSECTS, POISONOUS PLANTS AND ANIMALS

1. Determine if any field personnel are known to be allergic to bee stings or other insect bites/stings. If such persons are identified, an appropriate adrenaline injection kit should be carried into the field and other personnel should be made aware of its location and how to use it. Avoid wearing perfume or after shave lotion.
2. Learn to recognize common poisonous plants ("leaves of three, leave them be") and avoid areas where they grow.
3. If possible, avoid traversing areas of brush or tall grass where ticks might occur. The use of commercially available tick repellent is recommended when working in such areas.
4. Avoid putting your hands where you can not see them. Wear leather work gloves to avoid being stung or bitten by small insects/animals.

GROUNDWATER SAMPLING

1. Wear the appropriate protective gear for the operation.
2. Be careful when opening wells, pipes, or valves that may have become pressurized. Vent off the pressure if possible, or provide shielding to avoid splashing of materials. Keep face away from well heads. Be careful when opening well covers. Watch for spiders, wasps and other insects.
3. Exercise caution when opening or handling sampling containers containing acid (hydrochloric, nitric, sulfuric) preservatives. Do not allow sampling containers containing acid to sit in the sun. Warmed acids may fume when the containers are opened causing irritation to the eyes, nose and throat.

SOIL SAMPLING

1. Wear the appropriate protective gear for the operation.
2. Make sure others on site (especially equipment operators) know where you are and that you maintain line-of-sight contact.
4. During geoprobe drilling operations, stand upwind of the active area of soil movement as far away as is practical. During collection of soil samples, minimize contact with soil with your clothing and body.

DRILLING OPERATIONS

1. All the safety provisions of normal site operations will be followed.
2. Use all of the following means to locate underground utilities prior to any drilling: (1) Underground Service Alert (USA); (2) site maps and drawings (when available); (3) private utility locators (unless utility location services are provided by others); (4) site markings and conditions; (5) hand-probing or excavating to a depth of at least 4 feet; and (6) site personnel familiar with the history of site usage (when available). Be especially wary of electrical, natural gas, and product lines. **NEVER rely solely on site drawings or site personnel to determine the exact location of buried utilities.**
3. Observe safe distances from overhead utilities of at least 10 feet. In accordance with OSHA requirements, greater distances are required for overhead lines carrying greater than 50,000 volts. Greater distance should also be maintained if there is a risk that stray or broken (snapped) cables could come into contact with electrical lines.
4. At sites where non-project personnel may be present, properly demarcate the area to be excavated with barricades, fencing, and/or flagging. When appropriate, post warning and "No Smoking" signs conspicuously, and enforce them.
5. Fire extinguishers (at least one, 10-lb. ABC) must be on site and readily accessible at all times.
6. All drilling locations should be verified and marked by an authorized person.
7. When drilling at active facilities, contact the area supervisor in advance to advise him/her of the activities.
8. Locate emergency shut-off valves and switches, and (if present) confirm that the drilling crew knows where they are and how to use them.
9. When drilling near tanks, determine tank location, depth and product levels, and continue monitoring product levels during drilling activities. The minimum distance to drill between or adjacent to tanks is 18 inches. Eight-inch augers should be the maximum size for initial drilling. Hand excavation should be done to the tank-top depth (but in no case less than 4 feet).
10. Drill rig must be properly grounded at all times.
11. Drilling in or near streets should be performed according to city or state provisions.
12. Drilling should stop if any of the following conditions are encountered: (1) levels of contamination that are significantly higher than those contemplated in the Site Health and Safety Plan; (2) unknown substances that are not contemplated in the Site Health and Safety Plan; (3) explosive atmospheres (exceeding 10% of the lower explosive limit); or (4) utility lines. In such instances, all operations will stop until the situation is evaluated with the Site HSO, and the Project HSO or Office Health and Safety Coordinator (OHSC) have been notified. All drilling and sampling equipment should be left in the ground, equipment should be turned off, and cuttings and samples should be containerized, if necessary.

13. Cuttings should be containerized and covered whenever feasible, and especially at the end of each workday. Drums should be labeled and placed in a secured area.
14. Drilling materials, equipment and supplies should be stored in a secure area.
15. The field vehicle should be parked, and the logging table/station should be set up, beside (not behind) the drill rig. A safe distance of at least 15 feet should be maintained.
16. Hard hats, safety glasses, steel-toe boots and hearing protection should be worn near the drill rig. Do not approach the drill rig during changing of equipment (e.g., augers, samplers, bits/tools, or drill rods), or during use of the hoist(s). Stand clear and let the drillers do their job. When approaching the drill rig, make sure you make line-of-sight contact with the driller. Watch for overhead equipment.
17. **NEVER** put your hands near moving equipment (e.g. cables, pulleys, hammers, or augers).
18. If airborne contaminants are emanating from the borehole or cuttings, keep your face as far as possible from the hole and soil cuttings, and maintain an upwind position whenever feasible.
19. Steam-cleaning or pressure-washing of equipment should be performed wearing the appropriate protective equipment, which should always include eye and face protection. Never attempt to clean any body parts with pressure washers or steam cleaners.

WORK AT ISOLATED OR REMOTE SITES

1. Workers at isolated sites must use the “buddy system” and may not work alone. Try and maintain line of sight with other field personnel, or at a minimum, stay in frequent communication/contact. Work will only be conducted during daylight hours.
2. A check in/check out system will be established by the MFG office conducting the work. A designated contact person will be identified and informed of all planned field activities. Prior to departure, field personnel will inform the contact person of the following:
 - Name(s) of persons in the field crew;
 - Date and time of departure;
 - Estimated time of return; and
 - Location and nature of work to be conducted.

The field crew will notify the designated contact person at the actual time of return by either telephone contact or voice mail message.

3. Field personnel will familiarize themselves with the work area by reviewing the site map and other available information prior to beginning field work. Maps, compasses and other navigational equipment will be carried by field personnel to the field as appropriate.
4. Work may require walking through densely vegetated terrain to access remote work areas. Roads, trails and landmarks for navigation may not be available and persons unfamiliar with the Site could get lost. Do not allow yourself to become unaware of your location and route back to the field vehicle. When traveling to remote locations on foot, be sure to pack along ample food, water, a first aid kit and other emergency supplies. Always use the buddy system for remote work.
5. Standard communication equipment should include the following: walkie-talkies, cell phones, whistles, and flashlights.
6. Be aware of local hunting seasons and practices. If the area you are working in may have active hunting activity, wear an orange safety vest at all times.

7. Off-road vehicle travel is not permitted except as approved on a case-by-case basis by the Project Manager.

WORK IN STREAMS OR RIVERS

1. Walk slowly and try to anticipate your footing and subsurface conditions.
2. Personnel working in streams will wear footwear with cork or felt soles.
3. Life jackets will be worn by personnel working in water that is more than knee deep, or if working in a rapidly moving stream. All personnel will don a life jacket when in a boat. The need for life jackets under other circumstances will be evaluated by the Project Manager and Site Safety Officer.
4. If using waders, waist belts shall be worn to slow the inflow of water in the event of submergence. If submerged, avoid panic and extricate yourself from the waders as quickly as possible. Note that in still water, you will remain buoyant even with waders on.
5. If wading through streams of significant depth, never wade directly upstream but angle across the stream. If you fall backwards while facing directly upstream you may not be able to get up again due to the current.
6. Use of a walking stick/wading rod will often provide additional stability for in-stream work and should be considered.
7. Each field crew performing work in streams or lakes shall carry a 50-foot rescue line to be used in the event that rescue becomes necessary.
8. Work in or near streams should be avoided during inclement weather, if possible. If such work must be conducted during inclement weather, the Project Manager must be contacted and specific additional safety measures must be established in advance.
9. If working downstream of a power plant or dam, all work shall be coordinated with the plant/dam operator and a lookout shall be posted at the plant's/dam's control center to ensure that there are no releases while personnel are in the stream.

5.3 PERSONAL PROTECTIVE EQUIPMENT

| PPE LEVEL SELECTION | | | | | | | | | |
|--|---------|--|---------|---|---------|---|------------------|---|---------|
| Work will be performed using what level PPE: | | | | | | | | | |
| | Level A | | Level B | | Level C | | Modified Level D | X | Level D |
| PPE may be upgraded to: | | | | | | | | | |
| | Level A | | Level B | X | Level C | X | Modified Level D | | Level D |
| Current respirator fit testing documentation is required for Level C PPE attire. | | | | | | | | | |

PPE UTILIZATION CHART

| PPE | UTILIZATION REQUIREMENTS |
|--|--|
| Hard Hat (ANSI Z 89.1) | At all times |
| Steel-toe boots (ANSI Z 41.1) | At all times |
| Safety Glasses/Goggles (ANSI Z 87.1) | At all times |
| Hearing Protection | At all times near operating machinery (use arms length rule); when noise level exceeds 85 dB |
| Chemical Resistant Gloves (Nitrile) | At all times when handling potentially impacted media; during decon |
| Cotton or Leather Work Gloves | When using hand tools (i.e., when opening wells and using samplers); when handling or moving drums |
| Rain gear; cold weather gear | As necessary |
| Bright-colored Orange Traffic Safety Vest | Optional |
| Half-Face Respirator | Level C upgrade when organic vapors concentrations are ≥ 5 ppmv sustained |
| Full Face Respirator | Optional |
| Other: Construction attire | 100% cotton clothing; blue jeans; shirts with minimum 4" sleeves; long hair must be restrained; no dangling jewelry |
| List types of respirator cartridges that will be available on-site: Organic vapor | |
| Specify how often respirator cartridges will be changed: DAILY when used | |

6.0 MEDICAL SURVEILLANCE

(CFR 29 PART 1910.120(b)(4)(u)(D), CCR TITLE 8 SECTION 5192(b)(4)(B)(4))

All MFG personnel engaged in work involving potential exposure to hazardous substances are enrolled in a medical surveillance program to comply with the requirements of 29 CFR 1910.120 (f). Records for respective medical surveillance programs are kept in compliance with 29 CFR 1910.120. Medical and respirator clearance records are available from the Office Health and Safety Coordinator.

Describe any additional, site-specific, medical monitoring below.

None.

7.0 EXPOSURE MONITORING

(CFR 29 PART 1910 120(b)(4)(u)(E), CCR TITLE 8 SECTION 5192(b)(4)(B)(5))

7.1 MONITORING INSTRUMENTS (Check all that apply)

| | | | | | | | | | |
|--|------------------------|--------------------------|-----|--------------------------|------------------|-------------------------------------|------|--------------------------|------------------|
| <input checked="" type="checkbox"/> | HNu - PID | <input type="checkbox"/> | FID | <input type="checkbox"/> | LEL/Oxygen (CGI) | <input checked="" type="checkbox"/> | PM10 | <input type="checkbox"/> | Hydrogen Sulfide |
| Sorbent Tubes (List): | | | | | | | | | |
| <input checked="" type="checkbox"/> | Other (List): pH meter | | | | | | | | |
| Calibration procedures will be performed in accordance with the manufacturer's written instructions | | | | | | | | | |
| Additional comments: Exposure monitoring will be conducted during the first day to obtain representative exposure data for the work. Exposures are expected to be well below PELs and action levels described in this HASP. pH, temperature, redox potential measurements will be taken during the sampling of the well. | | | | | | | | | |
| Calibrate PID at least daily to 100 ppmv isobutylene. <u>Calibration must be documented in the field log.</u> Set R.F.=1.0 (isobutylene). Monitor in the breathing zone and downwind of work area. | | | | | | | | | |

7.2 CONTAMINANTS AND ACTION LEVELS

| CONSTITUENT | ACTION LEVEL | MEDIUM | REQUIRED ACTION |
|---|--|----------------------|--|
| Total Hydrocarbon Vapors as Isobutylene | 5 ppmv sustained for 5 minutes; or ≥ 20 ppmv instantaneously | Air (breathing zone) | Stop working and allow vapors to dissipate. If necessary, don respirators. Consult Project Manager before resuming work. |
| | | | |

8.0 SITE CONTROLS

(CFR 29 PART 1910 120(b)(4)(u)(F), CCR TITLE 8 SECTION 5192(b)(4)(B)(6))

| | | | | | | | | | |
|--|---------------|--------------------------|------------|--------------------------|--------------|--------------------------|-------|--------------------------|-------|
| Is the Site securely fenced? Yes. | | | | | | | | | |
| What types of people routinely have access to the site (List): MFG personnel and contractors have access to the Site. | | | | | | | | | |
| The Work Area will be marked with (check any that apply): | | | | | | | | | |
| <input checked="" type="checkbox"/> | Traffic cones | <input type="checkbox"/> | Barricades | <input type="checkbox"/> | Caution tape | <input type="checkbox"/> | Signs | <input type="checkbox"/> | Fence |
| Other: | | | | | | | | | |
| Briefly describe the location of the work area: Hazard areas will be barricaded off with caution tape to maintain a safe distance during work activities. Work areas are within approximately 10 feet of any drilling activity or well being installed/sampled. | | | | | | | | | |
| Briefly describe the location of the contamination reduction zone: The CRZ will be established by the Field Supervisor/Site HSO upon beginning work. CRZ area will be discussed during the tailgate safety meeting and documented on the Daily Field Record. | | | | | | | | | |
| Briefly describe the location of the support zone: he support zone will be established by the Field Supervisor/Site HSO upon beginning work. The zone will be discussed during the tailgate safety meeting and documented on the Daily Field Record. The MFG field vehicle containing the first aid kit, drinking water, wipes and fire extinguisher will be parked in the support zone. | | | | | | | | | |

9.0 DECONTAMINATION

(CFR 29 PART 1910 120(b)(4)(u)(G), CCR TITLE 8 SECTION 5192(b)(4)(B)(7))

| EQUIPMENT | DECONTAMINATION PROCEDURE |
|--------------------------------|--|
| Sampling/Development Equipment | <ul style="list-style-type: none">• Potable water rinse;• Alconox detergent wash;• DI water rinse;• 10 % Nitric acid wash; and• DI water rinse (3 times). |
| Monitoring Equipment | Rinse pH meter with distilled water until readout is near neutral. |
| PPE | Wash with Liqui-Nox/water or Alconox/water solution, rinse with tap water. Dispose of PPE in the trash if clean or drum with solid waste. |
| Other: | Containerize all decontamination wash water as specified in Section 10. |
| | Wash hands and face prior to eating or leaving the Site. |
| | Clean dirt from boots before leaving the Site. |

10.0 HANDLING AND STORAGE OF INVESTIGATION DERIVED WASTES:

| | | | | | | | | | |
|---|---|-------------------------------------|----------------------------|-------------------------------------|--------------------|-------------------------------------|-----|-------------------------------------|------------------|
| The following investigation-derived wastes are expected to be generated (check all that apply): | | | | | | | | | |
| <input checked="" type="checkbox"/> | Soil cuttings | <input checked="" type="checkbox"/> | Decontamination wash water | <input checked="" type="checkbox"/> | Purged groundwater | <input checked="" type="checkbox"/> | PPE | <input checked="" type="checkbox"/> | Plastic sheeting |
| <input checked="" type="checkbox"/> | Equipment (describe): disposable tools used for soil sampling | | | | | | | | |
| | Other (describe): | | | | | | | | |
| Describe the method of waste storage: | | | | | | | | | |
| <p>Investigation derived waste from RDAs 1,2 or 3 will be disposed of at the location where it was derived. Decontamination wash water and purged groundwater will be placed into labeled polyethylene 55-gallon drum containers. Solid wastes will be drummed and stored separately from liquid wastes. Drums will be stored on-site pending proper disposal by the client.</p> | | | | | | | | | |

11.0 EMERGENCY RESPONSE PLAN
(CFR 29 PART 1910 120(b)(4)(w)(H), CCR TITLE 8 SECTION 5192(b)(4)(B)(8))

| CONTACT | PHONE NUMBER |
|---|---------------------|
| Fire/Rescue: Alorton Fire Department (618) 874-7084 | 911 |
| Ambulance: Simmons (618) 274-2550 | 911 |
| Police: Alorton Police Department (618) 874-7084 | 911 |
| Nearest Hospital: St. Mary's Hospital | 618-875-6636 |
| Centers for Disease Control: | 404-639-3311 |
| Utility Locator Company: | |
| Hazardous Materials Spill Response Units: | |
| EPA Hotline (24 Hours): | 800-621-3191 |
| CHEMTREC (24 Hours) | 800-424-9300 |
| National Response Center (24 Hours) | 800-424-8802 |

In case of injury, administer first aid immediately and if necessary transport to nearest medical facility as soon as possible or call an ambulance.

Advise MFG Project Manager, Field Supervisor and Office Health and Safety Coordinator (OHSC) as soon as possible of any injury, accident, property damage or near-miss event.

In the event evacuation is necessary, first shut off all operating equipment, if possible. Proceed in a quick and orderly manner to the Support Zone.

Emergency equipment is located as follows:

| | |
|--------------------------|------------------------------|
| First Aid Kit | In MFG field vehicle. |
| Fire Extinguisher | In MFG field vehicle. |
| Cellular Phone | In MFG field vehicle. |
| Spill Kit | NA |
| Eye Wash | NA |
| Wipes for face and hands | In MFG field vehicle. |
| Other: | |

12.0 CONFINED SPACE ENTRY

(CFR 29 PART 1910 120(b)(4)(u)(i), CCR TITLE 8 SECTION 5192(b)(4)(B)(9))

CONFINED SPACE ENTRY IS NOT PERMITTED UNDER THIS HEALTH AND SAFETY PLAN UNDER ANY CIRCUMSTANCES. IF ENTRY INTO CONFINED SPACES IS NECESSARY A CONFINED SPACE ENTRY PLAN AND PERMIT SYSTEM MUST FIRST BE PREPARED AND APPROVED BY THE PROJECT MANAGER AND THE CORPORATE HEALTH AND SAFETY DIRECTOR.

Examples of potential confined spaces include the following:

- Manholes and utility access points
- Containment pits and sumps
- Aboveground storage tanks

13.0 SPILL CONTAINMENT

(CFR 29 PART 1910.120(b)(4)(ii)(J), CCR TITLE 8 SECTION 5192(b)(4)(B)(10))

If contaminated materials will possibly be spilled during site operations, describe the methods for spill containment below. If major spills may occur, please attach a Spill Containment Plan meeting the requirements of 29 CFR 1910.120 (j).

Perform all decontamination in paved areas of the site. Do not handle potentially hazardous or contaminated materials near storm drains or surface water bodies/drainage ditches. Do not attempt to move full drums without drum dolly or appropriate jig and rigging. Verify that drums are securely sealed prior to moving. If liquid spills occur, contain/absorb with absorbent. Use soil as absorbent or to construct temporary berms if needed in emergency. Spills of contaminated soil should be cleaned up as soon as possible. Report all spills to the Project Manager.

14.0 FALL PROTECTION

WORK ON LADDERS OR ELEVATED STRUCTURES MORE THAN 6 FEET HIGH IS NOT PERMITTED UNDER THIS HEALTH AND SAFETY PLAN. IF SUCH WORK IS ANTICIPATED, A FALL PROTECTION PLAN COMPLYING WITH CLIENT AND OSHA STANDARDS MUST FIRST BE PREPARED AND APPROVED BY THE PROJECT MANAGER AND CORPORATE HEALTH AND SAFETY DIRECTOR.

Examples of fall hazards for which fall protection would be required include the following:

- Work near ramps, containments or sumps more than 6 feet high, if not provided with adequate railing
- Work on ladders, scaffolds or elevated platforms
- Climbing on tanks or treatment vessels

LIST OF ATTACHMENTS

Table 1 Requirements for Equipment Operation Near Powerlines

- | | |
|---|---|
| A | Site Map |
| B | Site Vicinity Map Showing Route to Medical Facility |
| C | Tailgate Safety Meeting Form Safety Compliance Agreement Forms |
| D | Material Safety Data Sheets |

TABLE 1
REQUIREMENTS FOR EQUIPMENT OPERATION NEAR POWER LINES

Table 1
Requirements for Equipment Operation Near Power Lines
(29 CFR 1926.550)

| ACTIVITY | LINE RATING | MINIMUM CLEARANCE |
|--|----------------------------|---|
| Equipment Operation | ≤ 50 kV | 10 feet |
| | > 50 kV | 10 feet + 0.4 inches per each kV over 50 kV, or 2 times the length of the line insulator (minimum of 10 feet) |
| In transit with no load and beam lowered | ≤ 50 kV | 4 feet |
| | > 50 kV to ≤ 345 kV | 10 feet |
| | 345 kV to ≤ 750 kV | 16 feet |

Note: kV = kilovolt

**ATTACHMENT A
SITE MAP**



EXPLANATION

-  Site Boundary
-  Mud Lakes
-  Railroads



AERIAL PHOTOGRAPHY: SEPTEMBER 1, 2000



NORTH ALCOA SITE
EAST ST. LOUIS, ILLINOIS

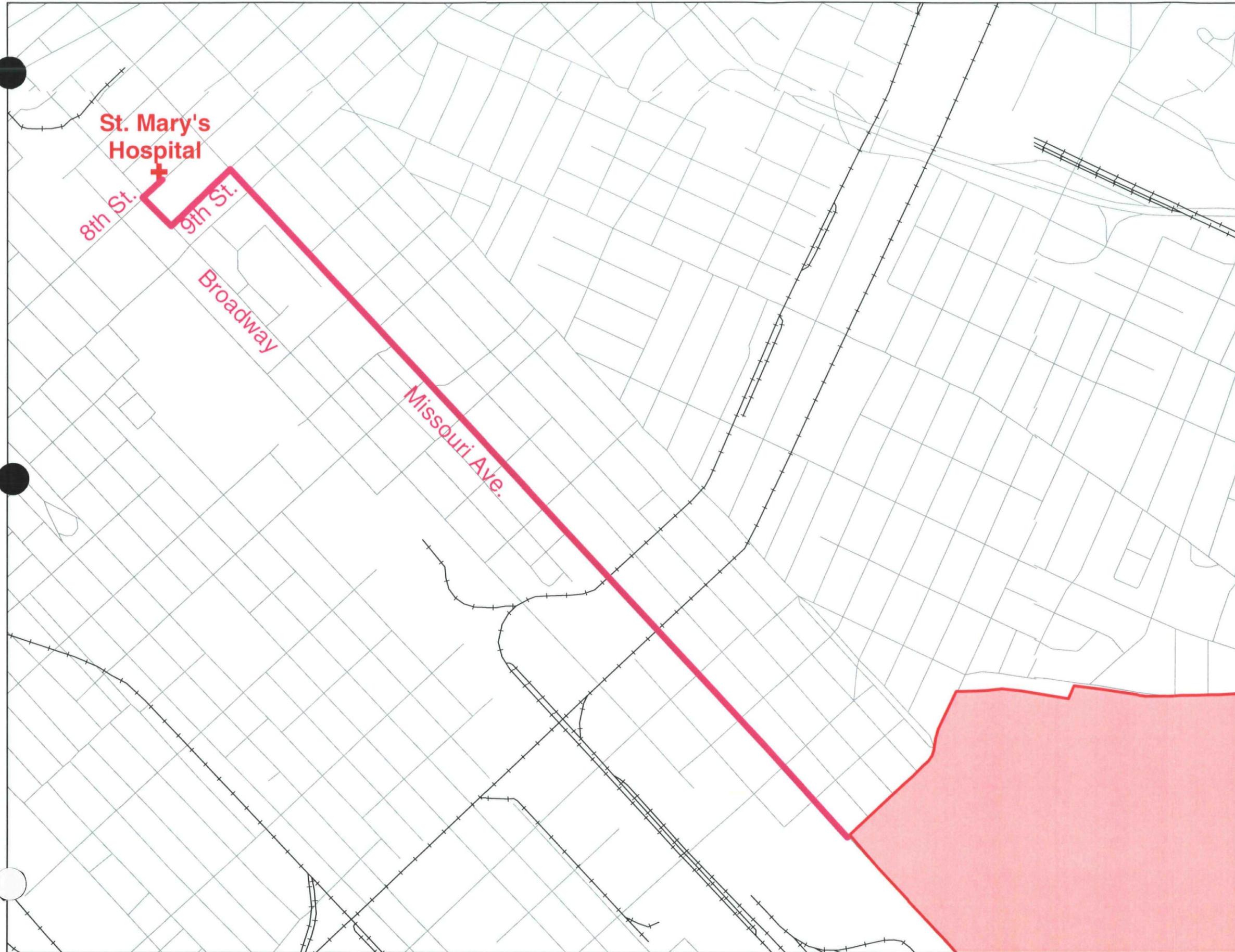
FIGURE F-1

SITE MAP

| | |
|--------------------|------------------------|
| PROJECT: 020209.1A | DATE: JUL 15, 2003 |
| REV: 0 | BY: MCP CHECKED: BLM |

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ATTACHMENT B
SITE VICINITY MAP SHOWING ROUTE TO MEDICAL FACILITY



EXPLANATION

- Site Boundary
- Railroads
- Roads

Winkler, Cathy - St Marys Hospital
 129 N 8th St # 240
 East Saint Louis, IL 62201
 (618) 274-1900



AERIAL PHOTOGRAPHY: SEPTEMBER 1, 2000



0 1,000 2,000
 Feet

NORTH ALCOA SITE
 EAST ST. LOUIS, ILLINOIS

FIGURE F-2
 SITE MAP WITH ROUTE
 TO HOSPITAL

| | |
|--------------------|------------------------|
| PROJECT: 020209.1A | DATE: JUL 15, 2003 |
| REV: 0 | BY: MCP CHECKED: BLM |

MFG, Inc.
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Hospitals

1. **St. Mary's Hospital**
129 North 8th Street #240
East St. Louis, IL 62201
618-875-6636
2. **Touchette Regional Hospital**
5900 Bond Avenue
East St. Louis, IL 62207
618-332-3060

Fire Departments

1. **Alorton Fire Department**
4821 Bond Avenue
Alorton, IL 62207
618-874-7084
2. **East St. Louis Fire Department**
1700 Central Avenue
East St. Louis, IL 62207
618-482-6877

Police Departments

1. **Alorton Police Department**
4821 Bond Avenue
Alorton, IL 62207
618-874-7084
2. **East St. Louis Police Department**
301 River Park Drive
East St. Louis, IL 62201
618-482-6767

EMS

1. **Simmons**
129 8th Street
East St. Louis, IL 62201
618-274-2550

ATTACHMENT C

TAILGATE SAFETY MEETING FORM
SAFETY COMPLIANCE AGREEMENT FORMS

DAILY SAFETY MEETING ATTENDANCE FORM

MFG, Inc.

Project Name: _____
 Project Number: _____

Date: _____ Time: _____
 Presented by: _____

Check the Topics/Information Reviewed:

- | | | |
|--|--|---|
| <input type="checkbox"/> safety glasses, hard hat, safety boots <input type="checkbox"/> site safety plan review and location <input type="checkbox"/> equipment and machinery familiarization <input type="checkbox"/> employee Right-To-Know/MSDS location <input type="checkbox"/> open pits, excavations, and site hazards <input type="checkbox"/> vehicle safety and driving/road conditions <input type="checkbox"/> portable tool safety and awareness <input type="checkbox"/> overhead utility locations and clearance <input type="checkbox"/> first aid, safety, and PPE location <input type="checkbox"/> sharp object, rebar, and scrap metal hazards <input type="checkbox"/> safety is everyone's responsibility <input type="checkbox"/> inner gloves/outer gloves <input type="checkbox"/> excavation/trenching inspections/documentation <input type="checkbox"/> full face respirators with proper cartridges <input type="checkbox"/> location and operation of kill switch <input type="checkbox"/> upgrade to level C at: PID (___ eV) > ___ ppm <input type="checkbox"/> work stoppage at: PID (___ eV) > ___ ppm, % LEL > 10% | <input type="checkbox"/> slips, trips, and falls <input type="checkbox"/> directions to hospital/first aid <input type="checkbox"/> anticipated visitors <input type="checkbox"/> electrical ground fault <input type="checkbox"/> public safety and fences <input type="checkbox"/> excavator swing and loading <input type="checkbox"/> orderly site and housekeeping <input type="checkbox"/> smoking in designated areas <input type="checkbox"/> leather gloves for protection <input type="checkbox"/> effects of the night before <input type="checkbox"/> vibration related injuries <input type="checkbox"/> fire extinguisher locations <input type="checkbox"/> eye wash station locations <input type="checkbox"/> decontamination procedures | <input type="checkbox"/> daily work scope <input type="checkbox"/> emergency protocol <input type="checkbox"/> parking and lay down <input type="checkbox"/> hot work permits <input type="checkbox"/> strains and sprains <input type="checkbox"/> noise hazards <input type="checkbox"/> no horseplay <input type="checkbox"/> heat and cold stress <input type="checkbox"/> backing up hazards <input type="checkbox"/> accidents are costly <input type="checkbox"/> dust and vapor control <input type="checkbox"/> refueling procedures <input type="checkbox"/> confined space entry <input type="checkbox"/> Safety Is No Accident |
|--|--|---|

Discussion/Comments/Follow-up Actions: _____

| NAME | SIGNATURE | COMPANY |
|------|-----------|---------|
| | | |
| | | |
| | | |
| | | |

- Instructions:**
- Conduct a daily safety meeting prior to beginning each day's site activities.
 - Complete form, obtain signatures, and file with the Daily Summary.
 - Follow-up on any noted items and document resolution of any action items.

SAFETY COMPLIANCE AGREEMENT FORM

MFG, Inc.
Personnel Form

PROJECT TITLE: _____

PROJECT NUMBER: _____

PROJECT TASK: _____

I have received a copy of the Site Health and Safety Plan (the "HASP") for the above referenced project. I have read the HASP and agree to comply with all the health and safety requirements contained therein. I understand that I may be prohibited from working on the project for violating any of the HASP requirements. My signature below indicates that I understand the procedures and restrictions of this plan and agree to abide by them.

PRINT NAME: _____

SIGNATURE: _____ DATE: _____

NOTE: This form must be submitted to the Project Manager prior to beginning site activities and filed in the project files.

SAFETY COMPLIANCE AGREEMENT FORM

MFG, Inc.
Subcontractor Form

PROJECT TITLE: _____

PROJECT NUMBER: _____

PROJECT TASK: _____

The MFG Site Health and Safety Plan (the "HASP") provides guidance for site-specific safety requirements. It is not intended to replace any general or specific requirements of a contractor's safety program. MFG personnel will, to the best of their ability, inform contractors of any potential hazard(s) that has been identified during the field investigations. However, contractors will bear the ultimate responsibility for all matters dealing with health and safety in the performance of their appointed work. This responsibility will include, at a minimum, ensuring that their equipment is in proper working order and that their employee's and/or authorized representatives are trained and medically fit in accordance with OSHA Standards 29 CFR 1910 and 29 CFR 1926, as appropriate. The contractor is also responsible for informing its' subcontractors of these requirements.

I have received a copy of the HASP for the above referenced project. I have read the HASP and agree to comply with all the health and safety requirements contained therein. I understand that I may be prohibited from working on the project for violating any of the HASP requirements. My signature below indicates that I understand the procedures and restrictions of this plan and agree to abide by them.

PRINT NAME: _____

SIGNATURE: _____ DATE: _____

AFFILIATION: _____

NOTE: This form must be submitted to the Project Manager prior to beginning site activities and filed in the project files.

ATTACHMENT D
MATERIAL SAFETY DATA SHEETS

MSDS Number: A2702 * * * * * Effective Date: 06/26/00 * * * * * Supercedes: 09/08/97



Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response In Canada
CANUTEC: 613-998-8868

Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTICE: CHEMTREC is a national emergency response center. It is not a government agency. It is a private, non-profit organization. It is not a law enforcement agency. It is not a fire department. It is not a police department. It is not a health department. It is not a hospital. It is not a laboratory. It is not a research center. It is not a government agency. It is not a law enforcement agency. It is not a fire department. It is not a police department. It is not a health department. It is not a hospital. It is not a laboratory. It is not a research center.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

Aluminum, 1000 ug/mL (0.10% w/v)

1. Product Identification

Synonyms: None
CAS No.: Not applicable to mixtures.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Al and HCl in H₂O
Product Codes: 6917

2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|-------------------|-----------|---------|-----------|
| Aluminum Metal | 7429-90-5 | < 1% | No |
| Hydrogen Chloride | 7647-01-0 | 1 - 2% | Yes |
| Water | 7732-18-5 | > 97% | No |

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. VAPOR IRRITATING TO EYES AND RESPIRATORY TRACT. INHALATION MAY CAUSE LUNG DAMAGE.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)

Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;
PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Health hazards given on this data sheet apply to concentrated solutions of hydrochloric acid. Hazards of dilute solutions may be reduced, depending upon the concentration. Degree of hazard for these reduced concentrations is not currently addressed in the available literature.

Inhalation:

Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.

Ingestion:

Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea, and in severe cases, death.

Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.

Eye Contact:

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard. Extreme heat or contact with metals can release flammable hydrogen gas.

Explosion:

Contact of concentrated solutions with most metals causes formation of flammable and explosive hydrogen gas.

Fire Extinguishing Media:

Water or water spray. Neutralize with soda ash or slaked lime.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For Hydrochloric acid:

- OSHA Permissible Exposure Limit (PEL):

5 ppm (Ceiling)

- ACGIH Threshold Limit Value (TLV):

5 ppm (STEL/Ceiling)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Contains mostly water.

Appearance:

Clear, colorless liquid.

Odor:

Slight odor of hydrochloric acid.

Solubility:

Complete (100%)

Specific Gravity:

ca. 1

pH:

1.0 (0.1M HCl)

% Volatiles by volume @ 21C (70F):

Not applicable.

Boiling Point:

ca. 100C (ca. 212F)

Melting Point:

ca. 0C (ca. 32F)

Vapor Density (Air=1):

Not applicable.

Vapor Pressure (mm Hg):

Essentially the same as water.

Evaporation Rate (BuAc=1):

Essentially the same as water.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:

When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces toxic chlorine fumes and explosive hydrogen gas.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A strong mineral acid, concentrated hydrochloric acid is incompatible with many substances and highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde. For Aluminum metal: Mercury, halocarbons, halogens, water (with bulk aluminum powder) strong oxidizing agents, some acids, bases and many other materials.

Conditions to Avoid:

Heat, direct sunlight, incompatibles.

11. Toxicological Information

Hydrochloric acid: Inhalation rat LC50: 3124 ppm/1H; Oral rabbit LD50: 900 mg/kg.

Investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----

| Ingredient | ---NTP Carcinogen--- | | IARC Category |
|-------------------------------|----------------------|-------------|---------------|
| | Known | Anticipated | |
| Aluminum Metal (7429-90-5) | No | No | None |
| Hydrogen Chloride (7647-01-0) | No | No | 3 |
| Water (7732-18-5) | No | No | None |

12. Ecological Information

Environmental Fate:

For Hydrochloric Acid (Concentrated Solutions):

When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.

Environmental Toxicity:

For Hydrochloric Acid (Concentrated Solutions):

This material may be toxic to aquatic life. LC50 Shrimp: 100-300 ppm/48-hr/salt water;

LC100 trout: 10 mg/l/24-hr; TLm mosquito fish: 282 ppm/96-hr.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
(HYDROGEN CHLORIDE)

Hazard Class: 8

UN/NA: UN3264

Packing Group: III

Information reported for product/size: 500ML

International (Water, I.M.O.)

Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
(HYDROGEN CHLORIDE)

Hazard Class: 8

UN/NA: UN3264

Packing Group: III

Information reported for product/size: 500ML

International (Air, I.C.A.O.)

Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
(HYDROGEN CHLORIDE)

Hazard Class: 8
 UN/NA: UN3264
 Packing Group: III
 Information reported for product/size: 500ML

15. Regulatory Information

| -----\Chemical Inventory Status - Part 1\----- | | | | |
|--|------|-----|-------|-----------|
| Ingredient | TSCA | EC | Japan | Australia |
| Aluminum Metal (7429-90-5) | Yes | Yes | No | Yes |
| Hydrogen Chloride (7647-01-0) | Yes | Yes | Yes | Yes |
| Water (7732-18-5) | Yes | Yes | Yes | Yes |

| -----\Chemical Inventory Status - Part 2\----- | | | | |
|--|-------|------------|------|-------|
| Ingredient | Korea | --Canada-- | | Phil. |
| | | DSL | NDSL | |
| Aluminum Metal (7429-90-5) | Yes | Yes | No | Yes |
| Hydrogen Chloride (7647-01-0) | Yes | Yes | No | Yes |
| Water (7732-18-5) | Yes | Yes | No | Yes |

| -----\Federal, State & International Regulations - Part 1\----- | | | | |
|---|------------|------|------------|----------------|
| Ingredient | -SARA 302- | | -SARA 313- | |
| | RQ | TPQ | List | Chemical Catg. |
| Aluminum Metal (7429-90-5) | No | No | Yes | No |
| Hydrogen Chloride (7647-01-0) | 5000 | 500* | Yes | No |
| Water (7732-18-5) | No | No | No | No |

| -----\Federal, State & International Regulations - Part 2\----- | | | |
|---|--------|--------|--------|
| Ingredient | CERCLA | -RCRA- | -TSCA- |
| | | 261.33 | 8(d) |
| Aluminum Metal (7429-90-5) | No | No | No |
| Hydrogen Chloride (7647-01-0) | 5000 | No | No |
| Water (7732-18-5) | No | No | No |

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: None allocated.

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 1

Label Hazard Warning:

DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. VAPOR IRRITATING TO EYES AND RESPIRATORY TRACT. INHALATION MAY CAUSE LUNG DAMAGE.

Label Precautions:

- Do not get in eyes, on skin, or on clothing.
- Do not breathe vapor or mist.
- Use only with adequate ventilation.
- Keep container closed.
- Wash thoroughly after handling.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 2, 3, 14.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: A7152 * * * * * Effective Date: 08/02/00 * * * * * Supercedes: 09/08/97



Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08855



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response In Canada
CANUTEC: 613-996-8668

Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Centers are available 24 hours a day, 7 days a week. For more information on chemical emergencies, contact your local fire department or the National Fire Protection Association (NFPA) at 1-800-354-3434.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

Antimony

1. Product Identification

Synonyms: Stibium, C.I. 77050
CAS No.: 7440-36-0
Molecular Weight: 121.75
Chemical Formula: Sb
Product Codes: 0848

2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|------------|-----------|-----------|-----------|
| Antimony | 7440-36-0 | 90 - 100% | Yes |

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF INHALED. CAUSES IRRITATION.
TARGET ORGAN(S): Respiratory system, cardiovascular system, eyes, skin.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 1 - Slight

Reactivity Rating: 2 - Moderate

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:

Is harmful may be fatal.

Ingestion:

None identified.

Skin Contact:

Prolonged contact may cause dermatitis.

Eye Contact:

None identified.

Chronic Exposure:

Kidney damage, liver damage.

Aggravation of Pre-existing Conditions:

No information found.

4. First Aid Measures

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Prompt action is essential.

Ingestion:

If large amounts were swallowed, give water to drink and get medical advice.

Skin Contact:

In case of contact, flush skin with water.

Eye Contact:

In case of eye contact, immediately flush with plenty of water for at least 15 minutes.

5. Fire Fighting Measures

Fire:

Not expected to be a fire hazard.

Explosion:

Can be an explosion hazard, especially when heated.

Fire Extinguishing Media:

Use extinguishing media appropriate for surrounding fire.

Special Information:

No information found.

6. Accidental Release Measures

Wear self-contained breathing apparatus and full protective clothing. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

7. Handling and Storage

Keep container tightly closed. Store in secure poison area. Keep product out of light. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):

0.5 mg/m³ (TWA)

-ACGIH Threshold Limit Value (TLV):

0.5 mg/m³ (TWA)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

For conditions of use where exposure to the substance is apparent, consult an industrial hygienist. For emergencies, or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Silvery-white metal.

Odor:

No information found.

Solubility:

Negligible (< 0.1%)

Specific Gravity:

6.68

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

1635C (2975F)

Melting Point:

630C (1166F)

Vapor Density (Air=1):

4.2

Vapor Pressure (mm Hg):

Not applicable.

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

No information found.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong oxidizing agents, strong acids, halogen acids, chlorine, fluorine.

Conditions to Avoid:

Heat, Light.

11. Toxicological Information

| -----\Cancer Lists\----- Ingredient | ---NTP Carcinogen--- | | IARC Category |
|--|----------------------|-------------|---------------|
| | Known | Anticipated | |
| ----- | ----- | ----- | ----- |

Antimony (7440-36-0)

No

No

None

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

| -----\Chemical Inventory Status - Part 1\----- | | | | |
|--|------|-----|-------|-----------|
| Ingredient | TSCA | EC | Japan | Australia |
| Antimony (7440-36-0) | Yes | Yes | No | Yes |

| -----\Chemical Inventory Status - Part 2\----- | | | | |
|--|-------|-----|----------------------|-------|
| Ingredient | Korea | DSL | ---Canada--- NDSL | Phil. |
| Antimony (7440-36-0) | Yes | Yes | No | Yes |

| -----\Federal, State & International Regulations - Part 1\----- | | | | |
|---|------------------|-----|----------------------------|----------------|
| Ingredient | -SARA 302- RQ | TPQ | -----SARA 313----- List | Chemical Catg. |
| Antimony (7440-36-0) | No | No | Yes | Antimony com |

| -----\Federal, State & International Regulations - Part 2\----- | | | |
|---|--------|------------------|----------------|
| Ingredient | CERCLA | -RCRA- 261.33 | -TSCA- 8(d) |
| | | | |

Antimony (7440-36-0)

5000

No

No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: None allocated.

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

Label Hazard Warning:

POISON! DANGER! MAY BE FATAL IF INHALED. CAUSES IRRITATION. TARGET ORGAN(S): Respiratory system, cardiovascular system, eyes, skin.

Label Precautions:

Avoid contact with eyes, skin, clothing.

Do not breathe dust. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.

Label First Aid:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Prompt action is essential. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse.

Product Use:

Laboratory Reagent.

Revision Information:

No changes.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

International Chemical Safety Cards

ARSENIC

ICSC: 0013

ARSENIC
 Grey arsenic
 Metallic arsenic
 As
 Atomic mass: 74.9

CAS # 7440-38-2
 RTECS # CG0525000
 ICSC # 0013
 UN # 1558
 EC # 033-001-00-X

| TYPES OF HAZARD/ EXPOSURE | ACUTE HAZARDS/ SYMPTOMS | PREVENTION | FIRST AID/ FIRE FIGHTING |
|--|--|---|---|
| FIRE | Combustible. Gives off irritating or toxic fumes (or gases) in a fire. | NO open flames. NO contact with strong oxidizers. NO contact with hot surfaces. | Powder, water spray, foam, carbon dioxide. |
| EXPLOSION | Risk of fire and explosion is slight if in the form of fine powder or dust when exposed to hot surfaces or flames. | Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting. | |
| EXPOSURE | | AVOID ALL CONTACT! | IN ALL CASES CONSULT A DOCTOR! |
| • INHALATION | Cough. Diarrhoea. Shortness of breath. Sore throat. Vomiting. Weakness. Grey skin. | Closed system and ventilation. | Fresh air, rest. Artificial respiration if indicated. Refer for medical attention. |
| • SKIN | Redness. | Protective gloves. Protective clothing. | Remove contaminated clothes. Rinse skin with plenty of water or shower. |
| • EYES | Redness. | or eye protection in combination with breathing protection if powder. | First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor. |
| • INGESTION | Diarrhoea. Nausea. Sore throat. Unconsciousness. Vomiting (further see Inhalation). | Do not eat, drink, or smoke during work. Wash hands before eating. | Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention. |
| SPILLAGE DISPOSAL | | STORAGE | PACKAGING & LABELLING |
| Evacuate danger area! Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: complete protective clothing including self-contained breathing apparatus). | | Provision to contain effluent from fire extinguishing. Separated from strong oxidants, acids, halogens, food and feedstuffs. Well closed. Keep in a well-ventilated room. | Do not transport with food and feedstuffs. T symbol R: 23/25 S: (1/2-)20/21-28-45 UN Hazard Class: 6.1 UN Packing Group: II Marine pollutant. |

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0013

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International Chemical Safety Cards

ARSENIC

ICSC: 0013

| | | | |
|--|---|---|---------------------------|
| I M P O R T A N T A R T I C L E | PHYSICAL STATE; APPEARANCE: ODOURLESS, BRITTLE, GREY, METALLIC-LOOKING CRYSTALS. | ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion. | |
| | PHYSICAL DANGERS: | INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. | |
| | CHEMICAL DANGERS: Upon heating, toxic fumes are formed. Reacts violently with strong oxidants and halogens causing fire and explosion hazard. Reacts with nitric acid, hot sulfuric acid. Toxic arsine gas may be formed in contact with acid or acidic substances and certain metals, such as galvanized or light metals. | EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes, the skin and the respiratory tract. The substance may cause effects on the circulatory system, nervous system, kidneys and gastrointestinal tract, resulting in convulsions, kidney impairment, severe hemorrhage, losses of fluids, and electrolytes, shock and death. Exposure may result in death. The effects may be delayed. Medical observation is indicated. | |
| | OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV: ppm; 0.01 mg/m ³ (as TWA) A1 (ACGIH 1994-1995). | EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis. Repeated or prolonged contact may cause skin sensitization. The substance may have effects on the mucous membranes, skin, kidneys, liver, resulting in neuropathy, pigmentation disorders, perforation of nasal septum and tissue lesions. This substance is carcinogenic to humans. | |
| | PHYSICAL PROPERTIES | Sublimation point: 613°C Relative density (water = 1): 5.7 | Solubility in water: none |
| | ENVIRONMENTAL DATA | The substance is toxic to aquatic organisms. It is strongly advised not to let the chemical enter into the environment because it persists in the environment. | |
| | NOTES | | |
| | The substance is combustible but no flash point is available in literature. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific arsenic compounds, e.g., Arsenic pentoxide (ICSC # 0377), Arsenic trichloride (ICSC # 0221), Arsenic trioxide (ICSC # 0378), Arsine (ICSC # 0222). | | |
| | ADDITIONAL INFORMATION | | |
| | ICSC: 0013 | | ARSENIC |

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UNITED MINERAL & CHEMICAL CORP -- ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GR

=====
*SDS Safety Information
=====

FSC: 6810
MSDS Date: 08/01/1997
MSDS Num: CJLPK
LIIN: 00N092040
Product ID: ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE
MFN: 01
Responsible Party
Cage: 87730
Name: UNITED MINERAL & CHEMICAL CORP
Address: 1100 VALLEYBROOK AVE
City: LYNDHURST NJ 07071
Info Phone Number: 201-507-3300
Emergency Phone Number: (800)424-9300
Chemtrec IND/Phone: (800)424-9300
Review Ind: Y
Published: Y

=====
Contractor Summary
=====

Cage: 87730
Name: UNITED MINERAL & CHEMICAL CORP
Address: 1100 VALLEYBROOK AVE
City: LYNDHURST NJ 07071
Phone: 201-507-3300

=====
Item Description Information
=====

=====
Ingredients
=====

Cas: 7440-38-2
RTECS #: CG0525000
Name: ARSENIC; (ARSENIC METAL)
Percent by Wt: 100.
ACGIH TLV: 0.01 MG/M3
ACGIH STEL: NOT ESTABLISHED
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB

=====
Health Hazards Data
=====

LD50 LC50 Mixture: LD50: (ORAL, RAT) 763 MG/M3
Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: YES
IARC: YES
OSHA: YES
Effects of Exposure: ARSENIC METAL IS NOT AS READILY AVAIL IN THE BODY AS
ARSENIC IN THE FORM OF DUST OR VAP OR WHEN PROCESSED INTO ARSENIC CMPDS
(ARSENICALS). INORGANIC ARSENICALS ARE MORE TOXIC THAN ORGANIC ARSENICALS.
ACUTE EFTS: ARSENIC IS POISON BY SUBCUTANEOUS, INTRAMUSCULAR &
INTRAPERITONEAL ROUTES. ACUTE ARSENIC POISONING FROM INGEST RSLTS IN MARKED
IRRIT OF STOMACH & INTESTINES W/NAUS, VOMIT & DIARR. IN SEV C ASES
STOOLS & VOMIT ARE BLOODY & PATIENT MAY GO INTO COLLAPSE & SHOCK
W/WEAK, RAPID PULSE, COLD SWEATS, COMA & DEATH. INHAL MAY CAUSE

ULCERATION OF NASAL SEPTUM, RESP IRRIT. SKIN/EYE CNTCT MAY CAUSE DERM, SKIN & EYE (EFTS OF OVEREXP)

Explanation Of Carcinogenicity: ARSENIC: IARC MONOGRAPHS, SUPPLEMENT, VOL 7, PG 100, 1987: GROUP 1. NTP 8TH ANNUAL REPORT ON CARCINOGENS, 1998: KNOWN TO BE CARCINOGEN. OSHA REGULATED: CFR 29 1910.1018.

Signs And Symptions Of Overexposure: HLTH HAZS: IRRIT. CHRONIC EFTS: ARSENIC IS CONFIRMED HUMAN CARCIN PRODUCING LIVER TUMORS & AN EXPERIMENTAL TERATOGEN (MAY CAUSE DMG TO DEVELOPING FETUS). CHRONIC ARSENIC POISONING MAY INCL ANY/ALL OF FOLLOWING: DIGEST SYS DISTURBS, LOSS OF APPETITE, CRAMPS, NAUS, CONSTIP, DIARR; LIVER DMG WHICH MAY RSLT IN JAUN; DISTURBS OF BLOOD, KIDNEYS & NERVOUS SYS; SKIN ABNORMS INCL ITCHING, PIGMENTATION & POS S CANCEROUS CHGS. TARGET ORGANS FOR INORGANIC CMPDS AS AS): LIVER, KIDNEYS, SKIN, LUNGS, LYMPHATIC SYS. TLV: 0.01 MG/M3 TWA ARSENIC, ELEMENTAL & INORGANIC CMPDS (EXCEPT ARSINE), AS AS. OSHA PEL: (SUPD AT)

Medical Cond Aggravated By Exposure: KNOWN EFFECTS ON OTHER ILLNESSES: GASTROINTESTINAL. NERVOUS SYSTEM. SKIN. LIVER & KIDNEY PROBLEMS. AFTER EXPOSURE HAVE URINE TEST.

First Aid: SKIN: FLUSH WITH SOAP AND WATER. AVOID RUBBING INTO SKIN. CONTACT MD IMMEDIATELY. EYES: FLUSH WITH WATER FOR AT LEAST 15 MINUTES. CONTACT PHYSICIAN IMMEDIATELY. INHALATION: REMOVE TO FRESH AIR. PROVIDE OXYGEN IF NECESSARY. CONTACT PHYSICIAN IMMEDIATELY. INGESTION: TREATMENT WITH BAS (DIMERCAPTOL) IS OF QUESTIONABLE EFFECTIVENESS IN TRIVALENT ARSENIC COMPOUNDS. INDUCE VOMITING AND DO GASTRIC LAVAGE. GET PERSONNEL TO HOSPITAL IMMEDIATELY. A PHYSICIAN CAN INITIATE AN EXCHANGE TRANSFUSION AND DIALYSIS. ALSO ABSORPTION AND REMOVAL WITH ANIMAL BONE COAL OR $Fe(OH)_2$ SHOULD BE DONE.

Handling and Disposal

Spill Release Procedures: RESTRICT PERSONS NOT WEARING PROTECTIVE EQUIPMENT FROM AREA UNTIL CLEANUP IS COMPLETE. WEARING NIOSH APPROVED RESPIRATOR, GLOVES, GOGGLES, LAB COAT, GATHER UP CHUNKS, RODS OR GRANULES WITH VACUUM OR U TENSILS RESERVED FOR POISONOUS SOLIDS. AVOID RAISING DUST. VENTILATE THE AREA AFTER CLEANUP IS COMPLETE.

Waste Disposal Methods: SOLID WASTES SHOULD BE VITRIFIED, PLACED IN LABELED CNTNR & BURIED IN EPA SUPERVISED FACILITY. ETCHING SOLNS & CUTTING WASTES SHOULD BE PRECIPITATED, CEMENTED/VITRIFIED & PLACED IN METAL/PLASTIC LABEL ED CNTNRS & BURIED IN EPA SUPERVISED FACILITY. PASS GAS THRU POTASSIUM PERMANGANATE, PRECIPITATE & TREAT AS ABOVE. WASTE MAY BE CONSIDERED (SUPDAT)

Handling And Storage Precautions: FOR INDUSTRIAL USE ONLY. PRIOR TO WORKING WITH ARSENIC, PERSONNEL SHOULD BE TRAINED IN PROPER HANDLING AND STORAGE. STORE IN ORIGINAL PACKAGING IN COOL, DRY AREA. WHEN HANDLING, PLACE INTO INERT ATMOSPHERE IMMEDIATELY. WEAR NIOSH APPROVED RESPIRATORY PROTECTION, GLOVES AND EYE PROTECTION.

Other Precautions: MINIMUM - HAVE QUARTERLY MEDICAL CHECKS INCLUDING URINE TESTS OF PERSONNEL WORKING WITH ARSENIC OR ARSENIC COMPOUNDS. DO NOT SMOKE OR EAT IN WORK AREA.

Fire and Explosion Hazard Information

Flash Point Text: NONE

Extinguishing Media: FOAM, CARBON DIOXIDE, DRY CHEMICAL.

Fire Fighting Procedures: USE NIOSH APPROVED SCBA & FULL PROT EQUIP (FP N). RESTRICT PERS NOT WEARING PROT EQUIP FROM AREA. TRY TO SNUFF FIRE W/SAND, DRY MEDIA, FOAM OR CO_2 . IF NO OTHER OPTIONS AVAILABLE, USE WATER & ALWAYS WEAR NIOSH APPROVED SCBA OR NIOSH TOXIC VAPOR RESP. POISONOUS GASES ARE PRODUCED IN FIRE, INCLUDING ARSENIC OXIDES.

Unusual Fire/Explosion Hazard: ARSENIC, WHEN HEATED OR IN CONTACT W/ACID OR ACID FUMES, CAN PRODUCE HIGHLY TOXIC FUMES. ARSENIC REACTS VIGOROUSLY W/OXIDIZING MATLS. ARSENIC IS FLAMMABLE IN FORM OF DUST WHEN EXPOSED TO HEAT

OR FLAME OR BY CHEMICAL RXN W/POWERFUL OXIDIZERS. SLIGHT EXPLOSION HAZ
EXISTS IN FORM OF DUST WHEN EXPOSED TO (ECOLOGICAL INFO)

Control Measures

Respiratory Protection: NIOSH APPROVED, AIR PURIFYING, TOXIC VAPOR RESPIRATOR
TO PARTICULATE AND FUME AIR LEVEL. FOR INORGANIC ARSENIC APPLICATIONS, SEE 29
CFR 1910.1018 FOR PROPER RESPIRATOR SELECTION.

Ventilation: LOC EXHST/MECH (GEN) SCRUBBER OR TRAP IF POSS TO MAINTAIN EXPOS TO
LESS THAN PERMISSIBLE LIMITS FOR ELEMENTAL ARSENIC & ANY CMPDS BEING
GENERATED.

Protective Gloves: NEOPRENE OR PLASTIC.

Eye Protection: ANSI APPROVED CHEMICAL WORKERS GOGGLES (FP N).

Other Protective Equipment: ANSI APPROVED EYE WASH AND DELUGE SHOWER (FP N).
LAB COAT.

Supplemental Safety and Health: EFTS OF OVEREXP: 0.01 MG/M3 AS AS &
INORGANIC CMPDS; 0.5 AS AS ORGANIC CMPDS. ACGIH TLV: 0.01 MG/M3 TWA ARSENIC,
ELEMENTAL & INORGANIC CMPDS (EXCEPT ARSINE), AS AS. ALSO SEE
TOXICOLOGICAL INFO. WASTE DISP METH: HAZ DEPENDING ON LEVEL OF TOX CHARACT
OF ARSENIC. SEE 40 CFR 261.24 FOR DETERMINATION. (OTHER INFO)

Physical/Chemical Properties

Boiling Point: =612.C, 1133.6F

B.P. Text: SUBLIMES

Melt/Freeze Pt: =814.C, #####F

M.P/F.P Text: @ 36 ATM. FP:N/A

Vapor Pres: 1 MMHG @ 372C

Spec Gravity: 5.727

Sol: NONE-0% IN H₂O

Solubility in Water: INSOLUBLE

Appearance and Odor: SILVER GRAY CRYSTALLINE CHUNKS, RODS OR GRANULES; NO ODOR
AS (ECOLOGICAL INFO)

Percent Volatiles by Volume: N/A (BY WT)

Reactivity Data

Stability Indicator: YES TES, (ECOLOGICAL INFO)

Stability Condition To Avoid: AVOID OPEN CONTAINERS AND CONTACT WITH
INCOMPATIBLE MATERIALS.

Materials To Avoid: INCOMPATIBLE W/BROMINE AZIDE, DIRUBIDIUM ACETYLIDE,
HALOGENS, PALLADIUM ZINC, PLATINUM, NCL*3, AGNO*3, CRO*3, NA*2O*2,
HEXAFLUOROISOPROPYLIDENEAMINO LITHIUM. CAN REACT W/ACIDS OR ACID FUMES &
POWERFUL OXIDIZERS SUCH AS BROM

Hazardous Decomposition Products: ARSENIC FUMES, ARSINE, OTHER ARSENIC
COMPOUNDS.

Hazardous Polymerization Indicator: NO

Toxicological Information

Toxicological Information: LD50: TDLO 605 ?G/KG. ORAL-MAN TDLO 7857 MG/KG/55Y
SKIN. DERMAL IRRITATION-RABBIT: UNKNOWN; SUBCUTANEOUS IMPLANT RABBIT LTLO 75
MG/KG. EYE IRRITATION-RABBIT: UNKNOWN.

Ecological Information

Ecological: N/P. EXPLO HAZ: FLAME. IN EVENT OF A FIRE OR SPILL CONTACT THE
STATE DEPARTMENT OF THE ENVIRONMENT & YOUR REGIONAL OFFICE OF THE FEDERAL
EPA. PHYSICAL DATA - APPEAR/ODOR: METAL AS COMPOUND, ASH*3, HAS GARLIC ODOR.
ODOR THRESHOLD: N/A. MATLS TO AVOID: CHLORATES, IODATES, PEROXIDES, LITHIUM,

NACL*3, KMNO*3, RB*2C*2, AGNO*4, NOCL, IF*5, CRO*3, CLF*3, CLO, BRF*3, BRF*5, BRN*3, RBC*3BCH, CSC*3BCH.

MSDS Transport Information

Transport Information: DOT REGULATED: YES. RQ: (NA - PIECES ARE LARGER THAN 100 MICROMETERS IN DIAMETER). IF REGULATED, PROPER SHIPPING NAME: ARSENIC. HAZARD CLASS: (6.1). IDENTIFICATION NO: (UN1558). PACKING GROUP: (III). LABEL REQUIRED: (POISON). INLAND B/L: ARSENIC, 6.1, UN1558, PACKING GROUP II, POISON. EMERGENCY RESPONSE GUIDE NO: (152).

Regulatory Information

Sara Title III Information: SARA TITLE III, SECT 313: LISTED.
Federal Regulatory Information: TSCA: WE CERTIFY THAT ALL COMPONENTS OF THIS PRODUCT ARE REGISTERED UNDER THE REGULATIONS OF THE TOXIC SUBSTANCES CONTROL ACT. : HEALTH (4); FLAMMABILITY (0); REACTIVITY (1).

Other Information

Other Information: WASTE DISP METH; HAZARDOUS DEPENDING ON LEVEL OF TOXICITY CHARACTERISTIC OF ARSENIC. SEE 40 CFR 261.24 FOR DETERMINATION. RCRA HAZARDOUS WASTE: YES RCRA @: D004; IF TESTED POSITIVE AS CHARACT OF TOXIC ITY FOR ARSENIC.

CERCLA: YES. RQ (1 LB RQ IS APPLICABLE ONLY IF DIAMETER OF PIECES OF SOLID METAL RELEASED IS LESS THAN 100 MICROMETERS OR 0.004 INCH. THIS PROD FORM IS LARGER THAN 100 MICROMETERS & H AS NO RQ IN ITS CURRENT FORM. IF AS HAZ WASTE CHARACT OF ARSENIC, THEN RQ=1LB. FOLLOW ALL LOCAL, STATE AND FEDERAL INFO & REGULATIONS.

HAZCOM Label

Product ID: ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Cage: 87730

Company Name: UNITED MINERAL & CHEMICAL CORP.

Street: 1100 VALLEYBROOK AVE

City: LYNDHURST NJ

Zipcode: 07071

Health Emergency Phone: (800)424-9300

Label Required IND: Y

Date Of Label Review: 09/01/1999

Status Code: A

Origination Code: F

Chronic Hazard IND: Y

Eye Protection IND: YES

Skin Protection IND: YES

Signal Word: DANGER

Respiratory Protection IND: YES

Health Hazard: Severe

Contact Hazard: Severe

Fire Hazard: None

Reactivity Hazard: Slight

Hazard And Precautions: DECOMP PRODS MAY BE HAZ. ACUTE: ARSENIC POISONING FROM INGEST RSLTS IN MARKED IRRIT OF STOMACH & INTESTINES W/NAUS, VOMIT & DIARR. IN SEV CASES STOOLS & VOMIT ARE BLOODY & PATIENT MAY GO INTO COLLAPSE & SHOCK W/WEAK, RAPID PULSE, COLD SWEATS, COMA & DEATH. INHAL MAY CAUSE ULCERS OF NASAL SEPTUM, RESP IRRIT. SKIN/EYE: MAY CAUSE DERM, SKIN & EYE IRRIT. CHRONIC: CANCER HAZ. CONTAINS ARSENIC WHICH IS LISTED AS A HUMAN LIVER CARCINOGEN (FP N). EXPERIMENTAL TERATOGEN (DMG TO DEVELOPING FETUS). ARSENIC POISONING W/DIGEST SYS DISTURBS, LOSS APPETITE,

CRAMPS, NAUS, CONSTIP, DIARR, LIVER DMG, JAUND ICE, & BLOOD, KIDNEY & NERV SYS EFTS. SKIN ABNORM.

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International Chemical Safety Cards

CADMIUM

ICSC: 0020

CADMIUM
(powder)
Cd
Molecular mass: 112.4

CAS # 7440-43-9
RTECS # EU9800000
ICSC # 0020
UN # 2570 (cadmium compounds)

| TYPES OF HAZARD/ EXPOSURE | ACUTE HAZARDS/ SYMPTOMS | PREVENTION | FIRST AID/ FIRE FIGHTING |
|---------------------------|---|--|---|
| FIRE | Flammable in powder form. Gives off irritating or toxic fumes (or gases) in a fire. | NO open flames, NO sparks, and NO smoking. NO contact with heat or acids. | Dry sand. Special powder. No other agents. |
| EXPLOSION | Finely dispersed particles form explosive mixtures in air. | Prevent deposition of dust; closed system; dust explosion-proof electrical equipment and lighting. | |
| EXPOSURE | | PREVENT DISPERSION OF DUST! STRICT HYGIENE! | IN ALL CASES CONSULT A DOCTOR! |
| • INHALATION | Cough. Headache. Symptoms may be delayed (see Notes). | Local exhaust or breathing protection. | Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention. |
| • SKIN | | Protective gloves. | Remove contaminated clothes. Rinse and then wash skin with water and soap. |
| • EYES | Redness. Pain. | Face shield or eye protection in combination with breathing protection. | First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor. |
| • INGESTION | Abdominal pain. Diarrhoea. Headache. Nausea. Vomiting. | Do not eat, drink, or smoke during work. | Rest. Refer for medical attention. |

| SPILLAGE DISPOSAL | STORAGE | PACKAGING & LABELLING |
|---|---|--|
| Evacuate danger area! Extinguish ignition sources. Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter respirator for toxic particles). | Fireproof. Separated from strong oxidants, strong acids, food and feedstuffs. | Airtight. Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. UN Hazard Class: 6.1 |

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0020

Prepared in the context of cooperation between the International Programme on Chemical Safety & the

International Chemical Safety Cards

CADMIUM

ICSC: 0020

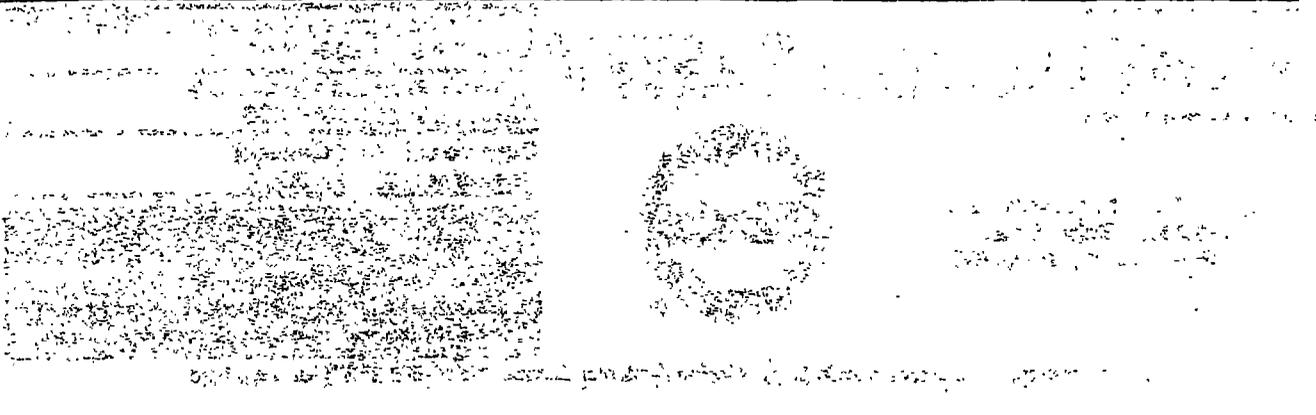
| | | |
|---|--|---|
| <p>I M P O R T A N T D A T A</p> | <p>PHYSICAL STATE; APPEARANCE: SOFT BLUE-WHITE METAL LUMPS OR GREY POWDER. MALLEABLE. TURNS BRITTLE ON EXPOSURE TO 80°C AND TARNISHES ON EXPOSURE TO MOIST AIR.</p> <p>PHYSICAL DANGERS: Dust explosion possible if in powder or granular form, mixed with air.</p> <p>CHEMICAL DANGERS: Reacts with acids giving off flammable hydrogen gas. Dust reacts with oxidants, hydrogen azide, zinc, selenium or tellurium, causing fire and explosion hazard.</p> <p>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV (as dust): ppm; 0.05 mg/m³ as TWA (ACGIH 1991-1992).</p> | <p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.</p> <p>INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes and the respiratory tract. Inhalation of fume may cause lung oedema (see Notes). Inhalation of fume may cause metal fever. The effects may be delayed. Medical observation is indicated.</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Lungs may be affected by repeated or prolonged exposure to dust particles. The substance may have effects on the kidneys, resulting in proteinuria and kidney dysfunction. This substance is probably carcinogenic to humans.</p> |
| <p>PHYSICAL PROPERTIES</p> | <p>Boiling point: 765°C Melting point: 321°C Relative density (water = 1): 8.6</p> | <p>Solubility in water: none Auto-ignition temperature: 250°C (cadmium metal dust)°C</p> |
| <p>ENVIRONMENTAL DATA</p> | | |
| <p>NOTES</p> | | |
| <p>Reacts violently with fire extinguishing agents such as water, foam, carbon dioxide and halons. Depending on the degree of exposure, periodic medical examination is indicated. The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential. Do NOT take working clothes home.</p> | | |
| <p>ADDITIONAL INFORMATION</p> | | |
| | | |
| <p>ICSC: 0020</p> | <p>© IPCS, CEC, 1993</p> | <p>CADMIUM</p> |

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From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08855



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response In Canada
CANUTEC: 613-996-6666

Outside U.S. And Canada
Chemtrec: 703-527-3887

For more information on our products and services, please contact our Customer Service Department at 1-800-582-2537. We are also available on the Internet at www.jtbaker.com.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

CADMIUM, 1000 ug/mL (0.10% w/v)

1. Product Identification

Synonyms: Atomic Absorption Standard
CAS No.: Not applicable to mixtures.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Cd and HNO₃ in H₂O
Product Codes: 6924

2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|-------------|-----------|----------|-----------|
| Cadmium | 7440-43-9 | < 1% | Yes |
| Nitric Acid | 7697-37-2 | 1 - 2% | Yes |
| Water | 7732-18-5 | 97 - 98% | No |

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. VAPOR IRRITATING TO EYES AND RESPIRATORY TRACT, INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE. MAY AFFECT RESPIRATORY SYSTEM, KIDNEYS, PROSTATE, AND BLOOD. CANCER HAZARD. CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)

Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES;

Storage Color Code: White (Corrosive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. The following hazards are for concentrated solutions. Hazards of less concentrated solutions may be reduced. Degree of hazard for reduced concentrations is not currently addressed in the available literature.

Inhalation:

Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.

Ingestion:

Corrosive! Swallowing can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea, and in severe cases, death.

Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.

Eye Contact:

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid. Chronic exposure to cadmium, even at relatively low concentrations, may result in permanent damage to the kidney and lung, may damage the liver, may cause anemia, loss of smell, and increase risk of cancer of the lung and of the prostate.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders, or eye or cardiopulmonary diseases may be more susceptible to the effects of this substance.

4. First Aid Measures

Immediate first-aid treatment reduces the health effects of this substance.

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not combustible, but concentrated material is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition.

Explosion:

Concentrated material reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

- OSHA Permissible Exposure Limit (PEL) -

For nitric acid:

2 ppm (TWA).

For cadmium, elemental and compounds:

0.005 mg/m³ (TWA); 0.0025 mg/m³ (Action Level); OSHA Cancer Hazard.

- ACGIH Threshold Limit Value (TLV) -

For nitric acid:

2 ppm (TWA); 4 ppm (STEL).

For cadmium, elemental and compounds (inhalable particulate):

0.01 mg/m³ (TWA), A2 - Suspected human carcinogen.

For cadmium, elemental and compounds (respirable fraction):

0.002 mg/m³ (TWA), A2 - Suspected human carcinogen.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airtight hood, or full-facepiece self-contained breathing

apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). Canister-type respirators using sorbents are ineffective. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

Skin Protection:

Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:

Eating, drinking, and smoking should not be permitted in areas where solids or liquids containing cadmium compounds are handled, processed, or stored. See OSHA substance-specific standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1027).

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Odorless.

Solubility:

Soluble in water.

Specific Gravity:

No information found.

pH:

1.0 (0.1M HNO₃)

% Volatiles by volume @ 21C (70F):

ca. 99

Boiling Point:

No information found.

Melting Point:

No information found.

Vapor Density (Air=1):

Not applicable.

Vapor Pressure (mm Hg):

Not applicable.

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:

Nitric acid: Investigated as a mutagen and reproductive effector. Cadmium: Oral rat LD50 2330 mg/kg; Inhalation rat LC50 25 mg/m³/30M; Investigated as a tumorigen, mutagen and reproductive effector.

Reproductive Toxicity:

For cadmium: May damage the reproductive system.

Carcinogenicity:

For cadmium:

EPA / IRIS classification: Group B1 - Probable human carcinogen, limited human evidence.

Regulated by OSHA as a carcinogen.

-----\Cancer Lists\-----

| Ingredient | ---NTP Carcinogen--- | | IARC Category |
|-------------------------|----------------------|-------------|---------------|
| | Known | Anticipated | |
| Cadmium (7440-43-9) | Yes | No | 1 |
| Nitric Acid (7697-37-2) | No | No | None |
| Water (7732-18-5) | No | No | None |

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
(NITRIC ACID)

Hazard Class: 8

UN/NA: UN3264

Packing Group: III

Information reported for product/size: 500ML

International (Water, I.M.O.)

Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
(NITRIC ACID)

Hazard Class: 8

UN/NA: UN3264

Packing Group: III

Information reported for product/size: 500ML

International (Air, I.C.A.O.)

Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
(NITRIC ACID)

Hazard Class: 8

UN/NA: UN3264

Packing Group: III

Information reported for product/size: 500ML

15. Regulatory Information

| Ingredient | TSCA | EC | Japan | Australia |
|-------------------------|------|-----|-------|-----------|
| Cadmium (7440-43-9) | Yes | Yes | No | Yes |
| Nitric Acid (7697-37-2) | Yes | Yes | Yes | Yes |
| Water (7732-18-5) | Yes | Yes | Yes | Yes |

-----\Chemical Inventory Status - Part 2\-----

| Ingredient | ---Canada--- | | | |
|-------------------------|--------------|-----|------|------|
| | Korea | DSL | NDSL | Phil |
| Cadmium (7440-43-9) | Yes | Yes | No | Yes |
| Nitric Acid (7697-37-2) | Yes | Yes | No | Yes |
| Water (7732-18-5) | Yes | Yes | No | Yes |

-----\Federal, State & International Regulations - Part 1\-----

| Ingredient | -SARA 302- | | -SARA 313- | |
|-------------------------|------------|------|------------|----------------|
| | RO | TPQ | List | Chemical Catg. |
| Cadmium (7440-43-9) | No | No | Yes | No |
| Nitric Acid (7697-37-2) | 1000 | 1000 | Yes | No |
| Water (7732-18-5) | No | No | No | No |

-----\Federal, State & International Regulations - Part 2\-----

| Ingredient | CERCLA | -RCRA- | | -TSCA- | |
|-------------------------|--------|--------|------|--------|------|
| | | 261.33 | 8(d) | 8(d) | 8(d) |
| Cadmium (7440-43-9) | 10 | No | No | No | No |
| Nitric Acid (7697-37-2) | 1000 | No | No | No | No |
| Water (7732-18-5) | No | No | No | No | No |

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: No (Mixture / Liquid)

WARNING:

THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: None allocated.

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0

Label Hazard Warning:

DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. VAPOR IRRITATING TO EYES AND RESPIRATORY TRACT. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE. MAY AFFECT RESPIRATORY SYSTEM, KIDNEYS, PROSTATE, AND BLOOD. CANCER HAZARD. CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep container closed.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8, 11.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

International Chemical Safety Cards

CHROMIUM

ICSC: 0029

| CHROMIUM Chrome (powder) Cr (metal) Atomic mass: 52.0 CAS # 7440-47-3 RTECS # GB4200000 ICSC # 0029 | | | |
|--|---|--|---|
| TYPES OF HAZARD/ EXPOSURE | ACUTE HAZARDS/ SYMPTOMS | PREVENTION | FIRST AID/ FIRE FIGHTING |
| FIRE | Combustible if in very fine powder. Gives off irritating or toxic fumes (or gases) in a fire. | No open flames if in powder form. | In case of fire in the surroundings: all extinguishing agents allowed. |
| EXPLOSION | Finely dispersed particles form explosive mixtures in air. | Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting. | |
| EXPOSURE | | PREVENT DISPERSION OF DUST! STRICT HYGIENE! | |
| • INHALATION | Cough. | Local exhaust or breathing protection. | Fresh air, rest. |
| • SKIN | Redness. | Protective gloves. | Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention. |
| • EYES | Redness. | Face shield. | First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor. |
| • INGESTION | | Do not eat, drink, or smoke during work. | Rinse mouth. |
| SPILLAGE DISPOSAL | STORAGE | PACKAGING & LABELLING | |
| Vacuum spilled material. Carefully collect remainder, then remove to safe place (extra personal protection: P2 filter respirator for harmful particles). | Fireproof. Separated from strong oxidants. | | |
| SEE IMPORTANT INFORMATION ON BACK | | | |
| ICSC: 0029 | | Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993 | |

International Chemical Safety Cards

CHROMIUM

ICSC: 0029

| | | |
|--|--|--|
| <p>I M P O R T A N T D A T A</p> | <p>PHYSICAL STATE; APPEARANCE: STEEL GREY LUTROUS METAL.</p> <p>PHYSICAL DANGERS: Dust explosion possible if in powder or granular form, mixed with air.</p> <p>CHEMICAL DANGERS: Reacts violently with strong oxidants such as hydrogen peroxide, causing fire and explosion hazard. Reacts with diluted hydrochloric and sulfuric acids. Incompatible with alkalis and alkali carbonates.</p> <p>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV: ppm; 0.5 mg/m³ (as TWA) (ACGIH 1994-1995).</p> | <p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.</p> <p>INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE:</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact may cause skin sensitization.</p> |
| <p>PHYSICAL PROPERTIES</p> | <p>Boiling point: 2642°C Melting point: 1900°C</p> | <p>Relative density (water = 1): 7.14 Solubility in water: none</p> |
| <p>ENVIRONMENTAL DATA</p> | | |
| <p style="text-align: center;">NOTES</p> | | |
| <p>Explosive limits are unknown in literature. Depending on the degree of exposure, periodic medical examination is indicated.</p> | | |
| <p style="text-align: center;">ADDITIONAL INFORMATION</p> | | |
| | | |
| <p>ICSC: 0029</p> | <p style="text-align: right;">CHROMIUM</p> <p style="text-align: center;">© IPCS, CEC, 1993</p> | |
| <p>IMPORTANT LEGAL NOTICE:</p> | <p>Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.</p> | |

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Chromium

Catalog Numbers:

S79965-1, S79965, S79965-2, S799651, S799652

Synonyms:

Chrome

Company Identification: Fisher Scientific

1 Reagent Lane

Fairlawn, NJ 07410

For information, call: 201-796-7100

Emergency Number: 201-796-7100

For CHEMTREC assistance, call: 800-424-9300

For International CHEMTREC assistance, call: 703-527-3887

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

| CAS# | Chemical Name | % | EINECS# |
|-----------|---------------|-------|-----------|
| 7440-47-3 | CHROMIUM | >=99% | 231-157-5 |

Hazard Symbols: XN

Risk Phrases: 40

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: silver-gray.

Warning! May cause allergic skin reaction. Causes digestive tract irritation. May cause liver damage. May cause kidney damage. May cause lung damage. Causes eye and skin irritation. Causes severe respiratory tract irritation.

Target Organs: Liver.

Potential Health Effects

Eye:

Causes eye irritation. May cause conjunctivitis.

Skin:

Causes skin irritation. Prolonged and/or repeated contact may cause irritation and/or dermatitis. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material.

Ingestion:

May cause irritation of the digestive tract. May cause liver damage.

Inhalation:

Causes respiratory tract irritation. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. May cause asthma and shortness of breath. May cause headache, coughing, fever, weight loss, and pneumoconiosis.

Chronic:

Prolonged inhalation may cause respiratory tract inflammation and lung damage.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin:

Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.

Ingestion:

Do NOT induce vomitings. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation:

Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid. Do NOT use mouth-to-mouth resuscitation.

Notes to Physician:

Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

Evacuate area and fight fire from a safe distance. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. May burn with invisible flame. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Dust can be an explosion hazard when exposed to heat or flame.

Extinguishing Media:

Use dry sand or earth to smother fire. Use dry chemical to fight fire. Contact professional fire-fighters immediately.

Autoignition Temperature: Not available.

Flash Point: Not available.

Explosion Limits, lower: .0230oz/ft³

Explosion Limits, upper: Not available.

NEPA Ratings: (estimated) Health: 2; Flammability: 1; Reactivity: 1

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up or absorb material, then place into a suitable clean, dry, closed container for disposal. Avoid generating dusty conditions. Remove all sources of ignition. Isolate area and deny entry. Place under an inert atmosphere. Do not use combustible materials such as paper towels to clean up spill.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Use spark-proof tools and explosion proof equipment. Avoid contact with skin and eyes. Keep container tightly closed. Avoid contact with heat, sparks and flame. Avoid ingestion and inhalation. Handle under an inert atmosphere.

Storage:

Keep away from heat, sparks, and flame. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away from acids. Keep containers tightly closed. Do not expose to air. Store under an inert atmosphere.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---------------|-----------------------|---|-------------------------|
| CHROMIUM | 0.5 mg/m ³ | as Cr: 0.5 mg/m ³ TWA; see Appendix C for supplementary exposure limits as Cr: 250 mg/m ³ IDLH | 1 mg/m ³ TWA |

OSHA Vacated PELs:

CHROMIUM:

(as Cr): 1 mg/m³ TWA

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

Wear appropriate gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State: Solid
 Appearance: silver-gray
 Odor: odorless
 pH: Not available.
 Vapor Pressure: Not applicable.
 Vapor Density: Not available.
 Evaporation Rate: Not applicable.

Viscosity: Not applicable.
Boiling Point: 4784 deg F
Freezing/Melting Point: 3375 deg F
Decomposition Temperature: Not available.
Solubility in water: Insoluble in water.
Specific Gravity/Density: 7.2 @28C
Molecular Formula: Cr
Molecular Weight: 51.996

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability: Stable under normal temperatures and pressures. Powder or liquid is pyrophoric.
Conditions to Avoid: Incompatible materials, ignition sources, dust generation, exposure to air, acids, strong oxidants.
Incompatibilities with Other Materials: Ammonium nitrate, hydrogen peroxide, lithium, nitric oxide, potassium chlorate, sulfur dioxide, strong oxidizers, hydrochloric acid, sulfuric acid, nitrogen oxide,
Hazardous Decomposition Products: Toxic chromium oxide fumes.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 7440-47-3: GB4200000
LD50/LC50:
Not available.
Carcinogenicity:
CHROMIUM -
ACGIH: A4 - Not Classifiable as a Human Carcinogen
IARC: Group 3 carcinogen

Epidemiology:
Certain hexavalent chromium compounds have been demonstrated to be carcinogenic on the basis of epidemiologic investigations on workers and experimental studies in animals. Increased incidences of respiratory cancer has been found in chromium (VI) workers. There is an increased incidence of lung cancer in industrial workers exposed to chromium (VI) compounds. Please refer to IARC volume 23 for a more detailed discussion.

Teratogenicity:
No information found.

Reproductive Effects:
No information found.

Neurotoxicity:
No information found.

Mutagenicity:
No information found.

Other Studies:
See actual entry in RTECS for complete information.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste.

US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste-generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT

No information available

Canadian TDG

No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA

CAS# 7440-47-3 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)

CAS# 7440-47-3: final RQ = 5000 pounds (2270-kg) (no reporting of rele

Section 302 (TPQ)

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 7440-47-3: acute, chronic, flammable.

Section 313

This material contains CHROMIUM (CAS# 7440-47-3, 99%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.

Clean Air Act:

CAS# 7440-47-3 listed as ** no name ** is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 7440-47-3 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 7440-47-3 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CHROMIUM can be found on the following state right to know lists:

California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California No Significant Risk Level:

None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN

Risk Phrases:

R 40 Possible risks of irreversible effects.

Safety Phrases:

WGK (Water Danger/Protection)

CAS# 7440-47-3: No information available.

United Kingdom Occupational Exposure Limits

CAS# 7440-47-3: OES-United Kingdom, TWA 0.5 mg/m3 TWA

Canada

CAS# 7440-47-3 is listed on Canada's DSL List.

This product has a WHMIS classification of D2A, D2B.

CAS# 7440-47-3 is listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 7440-47-3: OEL-ARAB Republic of Egypt:TWA 0.05 mg/m3

OEL-AUSTRALIA:TWA 0.05 mg/m3

OEL-BELGIUM:TWA 0.5 mg/m3

OEL-DENMARK:TWA 0.5 mg/m3

OEL-FINLAND:TWA 0.01 mg/m3

OEL-FRANCE:TWA 0.5 mg/m3

OEL-JAPAN:TWA 0.5 mg/m3

OEL-THE NETHERLANDS:TWA 0.5 mg/m3

OEL-THE PHILIPPINES:TWA 1 mg/m3

OEL-SWEDEN:TWA 0.5 mg/m3

OEL-UNITED KINGDOM:TWA 0.5 mg/m3

OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV

OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 3/01/1999 Revision #4 Date: 8/02/2000

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International Chemical Safety Cards

COPPER

ICSC: 0240

| |
|---|
| <p>COPPER (powder) Cu Atomic mass: 63.5</p> <p>CAS # 7440-50-8 RTECS # GL5325000 ICSC # 0240</p> |
|---|

| TYPES OF HAZARD/ EXPOSURE | ACUTE HAZARDS/ SYMPTOMS | PREVENTION | FIRST AID/ FIRE FIGHTING |
|---------------------------|--|--|---|
| FIRE | Combustible. | NO open flames. | Special powder, dry sand, NO other agents. |
| EXPLOSION | | | |
| EXPOSURE | | PREVENT DISPERSION OF DUST! | |
| • INHALATION | Cough. Headache. Shortness of breath. Sore throat. | Local exhaust or breathing protection. | Fresh air, rest. Refer for medical attention. |
| • SKIN | Redness. | Protective gloves. | Remove contaminated clothes. Rinse and then wash skin with water and soap. |
| • EYES | Redness. Pain. | Safety goggles. | First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor. |
| • INGESTION | Abdominal pain. Nausea. Vomiting. | Do not eat, drink, or smoke during work. | Rinse mouth. Refer for medical attention. |

| SPILLAGE DISPOSAL | STORAGE | PACKAGING & LABELLING |
|--|---------------------------------------|-----------------------|
| Sweep spilled substance into containers. Carefully collect remainder. Then remove to safe place (extra personal protection: P2 filter respirator for harmful particles). | Separated from: see Chemical Dangers. | |

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0240

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

COPPER

ICSC: 0240

| | |
|-----------------------------|---------------------|
| PHYSICAL STATE; APPEARANCE: | ROUTES OF EXPOSURE: |
|-----------------------------|---------------------|

| | | |
|---|---|--|
| <p style="text-align: center;">I M P O R T A N T D A T A</p> | <p>RED POWDER, TURNS GREEN ON EXPOSURE TO MOIST AIR.</p> <p>PHYSICAL DANGERS:</p> <p>CHEMICAL DANGERS: Shock-sensitive compounds are formed with acetylenic compounds, ethylene oxides and azides. Reacts with strong oxidants like chlorates, bromates and iodates, causing explosion hazard.</p> <p>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV: ppm; 0.2 mg/m³ fume (ACGIH 1992-1993). TLV (as Cu, dusts & mists): ppm; 1 mg/m³ (ACGIH 1992-1993).</p> | <p>The substance can be absorbed into the body by inhalation and by ingestion.</p> <p>INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE: Inhalation of fume may cause metal fever (see Notes).</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact may cause skin sensitization.</p> |
| <p>PHYSICAL PROPERTIES</p> | <p>Boiling point: 2595°C Melting point: 1083°C</p> | <p>Relative density (water = 1): 8.9 Solubility in water: none</p> |
| <p>ENVIRONMENTAL DATA</p> | | |
| <p>NOTES</p> | | |
| <p>The symptoms of metal fume fever do not become manifest until several hours.</p> | | |
| <p>ADDITIONAL INFORMATION</p> | | |
| | | |
| <p>ICSC: 0240</p> | <p>COPPER</p> <p style="text-align: center;">© IPCS, CEC, 1993</p> | |
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MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08855

**Mallinckrodt
CHEMICALS**



24 Hour Emergency Telephone: 908-959-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-956-6666

Outside U.S. and Canada
Chemtrec: 704-527-5887

NOTE: CHEMTREC, CANUTEC and National
Response Center emergency numbers to be
used only in the event of chemical emergencies
involving a spill, leak, fire, exposure or accident
involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-522-2537) for assistance.

COPPER METAL

1. Product Identification

Synonyms: C.I. 77400; Arwood Copper

CAS No.: 7440-50-8

Molecular Weight: 63.546

Chemical Formula: Cu

Product Codes:

J.T. Baker: 1714, 1720, 1732, 1736

Mallinckrodt: 1733, 4649

2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|------------|-----------|-----------|-----------|
| Copper | 7440-50-8 | 90 - 100% | Yes |

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE LIVER AND KIDNEYS. CHRONIC EXPOSURE MAY CAUSE TISSUE DAMAGE.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 0 - None

Flammability Rating: 0 - None

Reactivity Rating: 0 - None

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT

Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
Inhalation of dusts and fumes of metallic copper causes irritation of the upper respiratory tract, congestion of nasal mucous membranes, ulceration and perforation of the nasal septum, and pharyngeal congestion. Inhalation of copper fumes may give rise to metal fume fever (high temperature, metallic taste, nausea, coughing, general weakness, muscle aches, and exhaustion).

Ingestion:
Copper ingestion causes nausea, vomiting, abdominal pain, metallic taste, and diarrhea. Ingestion of large doses may cause stomach and intestine ulceration, jaundice, and kidney and liver damage.

Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain. Exposure to copper dust may cause a greenish-black skin discoloration.

Eye Contact:
Small copper particles in the eyes may cause irritation, discoloration, and damage.

Chronic Exposure:
Prolonged or repeated exposure to copper can discolor skin and hair and irritate the skin; may cause mild dermatitis, runny nose, and irritation of the mucous membranes. Repeated ingestion may damage the liver and kidneys. Repeated inhalation can cause chronic respiratory disease.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or impaired liver, kidney, or pulmonary function or pre-existing Wilson's disease may be more susceptible to the effects of this material.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by

mouth to an unconscious person.

Skin Contact:

Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard since the bulk solid does not burn, but very finely divided particles (ultra-fine powder) may burn in air.

Explosion:

Not considered to be an explosion hazard. Reactions with incompatibles may pose an explosion hazard. Liquid copper explodes on contact with water. High concentrations of finely divided copper particles in the air may present an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Avoid exposure to air and moisture. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

Copper Dust and Mists, as Cu:

- OSHA Permissible Exposure Limit (PEL) -

1 mg/m³ (TWA)

- ACGIH Threshold Limit Value (TLV) -

1 mg/m³ (TWA)

Copper Fume:

- OSHA Permissible Exposure Limit (PEL) -

0.1 mg/m³ (TWA)

- ACGIH Threshold Limit Value (TLV) -

0.2 mg/m³ (TWA)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a full facepiece respirator with dust/mist filter may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Reddish, metallic solid.

Odor:

Odorless.

Solubility:

Insoluble in water.

Density:

8.94

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

2595C (4703F)

Melting Point:

1083C (1981F)

Vapor Density (Air=1):

Not applicable.

Vapor Pressure (mm Hg):

1 @ 1628C (2962F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Copper becomes dull when exposed to air; on exposure to moist air it gradually converts to the carbonate. On long standing, a white, highly explosive peroxide deposit may form.

Hazardous Decomposition Products:

No information found.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Copper is incompatible with oxidizers, alkalis, acetylene, chlorine plus oxygen difluoride, phosphorus, nitric acid, potassium peroxide, 1-bromo-2-propyne, sulfur plus chlorates. Reacts violently with ammonium nitrate, bromates, iodates, chlorates, ethylene oxide, hydrozoic acid, potassium oxide, dimethyl sulfoxide plus trichloroacetic acid, hydrogen peroxide, sodium peroxide, sodium azide, sulfuric acid, hydrogen sulfide plus air, and lead azide. A potentially explosive reaction occurs with acetylenic compounds. Copper ignites on contact with chlorine, fluorine (above 121C), chlorine trifluoride, and hydrazinum nitrate (above 70C). An incandescent reaction occurs with potassium dioxide.

Conditions to Avoid:

Incompatibles and prolonged exposure to air and moisture.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

Investigated as a tumorigen and a reproductive effector.

-----\Cancer Lists\-----

| Ingredient | ---NTP Carcinogen--- | | IARC Category |
|--------------------|----------------------|-------------|---------------|
| | Known | Anticipated | |
| Copper (7440-50-8) | No | No | None |

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\

Ingredient TSCA EC Japan Australia

Copper (7440-50-8) Yes Yes No Yes

-----\Chemical Inventory Status - Part 2\

Ingredient Korea --Canada-- DSL NDSL Phil.

Copper (7440-50-8) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\

Ingredient -SARA 302- -SARA 313-
RQ TPQ List Chemical Catg.

Copper (7440-50-8) No No Yes No

-----\Federal, State & International Regulations - Part 2\

Ingredient -RCRA- -TSCA-
CERCLA 261.33 8(d)

Copper (7440-50-8) 5000 No No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No

SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: None allocated.

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 0 Reactivity: 0

Label Hazard Warning:

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE LIVER AND KIDNEYS. CHRONIC EXPOSURE MAY CAUSE TISSUE DAMAGE.

Label Precautions:

Avoid contact with eyes, skin and clothing.

Wash thoroughly after handling.

Avoid breathing dust or vapors.

Keep container closed.

Use only with adequate ventilation.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

No changes.

Disclaimer:

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COPIER METAL

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FROM USE OF OR RELIANCE UPON THIS INFORMATION.**

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Safety Information

FSC: 6550
MSDS Date: 05/07/1993
MSDS Num: BTZDG
LIIN: 00N049220
Product ID: CYANIDE
MFN: 01
Responsible Party
Cage: 07987
Name: SPEX INDUSTRIES, INC
Address: 3880 PARK AVE
City: EDISON NJ 08820
Info Phone Number: 908-549-7144
Emergency Phone Number: 800-424-9300 (CHEMTREC)
Published: Y

Contractor Summary

Cage: 07977
Name: SPEX CERTIPREP INC
Address: 203 NORCROSS AVE
City: METUCHEN NJ 08840
Phone: 732-549-7144
Cage: 07987
Name: SPEX INDUSTRIES, INC
Address: 3880 PARK AVE
City: EDISON NJ 08820
Phone: (201) 549-7144

Ingredients

Cas: 151-50-8
RTECS #: TS8750000
Name: POTASSIUM CYANIDE
% Wt: 0.0063
OSHA PEL: 5 MG/M3 (CN)
ACGIH TLV: 5 MG/M3, C
EPA Rpt Qty: 10 LBS
DOT Rpt Qty: 10 LBS

Health Hazards Data

LD50 LC50 Mixture: LD50: (ORAL, RAT) 10 MG/KG
Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: CONC KCN IS A RAPIDLY FATAL POISON WHEN TAKEN INTO
DIGESTIVE SYS. TOX SYMPS MAY ALSO OCCUR WHEN INHALED. PRLNGD SKIN CONT WILL
CAUSE IRRIT & POSS POISONING COULD OCCUR IF SKIN IS BROKEN. BUT SOLN CNTN
S A VERY SM AMT (0.0063%) OF POTASSIUM CYANIDE. A STUDY BY AN INDEPENDENT LAB
HAS SHOWN THAT THIS SOLN (EFTS OF OVEREXP)
Explanation Of Carcinogenicity: NOT RELEVANT
Signs And Symptions Of Overexposure: HLTH HAZ: DID NOT INDUCE ANY MORTALITY IN
LAB ANIMALS FOLLOWNG ORAL ADMIN @ 0.5 G/KG & WAS CONSIDERED TO HAVE AN

ACUTE ORAL LD50 VALUE OF 0.5 G/KG. ALL ANIMALS APPEARED NORM THROUGHOUT 14-DAY OBSERVATION PERIOD & NO ABNORM WERE NOTED @ NECROPSY ON DAY 14 OF STUDY.

Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.

First Aid: EYES: FLUSH WITH WATER FOR AT LEAST 15 MINUTES OCCAS LIFTING LIDS.
SKIN: REMOVE CONTAMD CLTHG, THEN FLUSH W/WATER FOR @-LST 15 MIN. WASH CLOTHING BEFORE REUSE. INHAL: MOVE TO FRESH AIR. INGEST: GET IM MED MED HELP. IF IRRIT CONTINUES, GET MED ATTN IMMED.

Handling and Disposal

Spill Release Procedures: VENT AREA. WIPE UP AND PLACE IN SEALED CONTAINER FOR PROPER DISPOSAL. WASH SPILL SITE W/WATER AFTER MATERIAL HAS BEEN PICKED UP COMPLETEY. WEAR CHEM RESIST GLASSES, GLOVES & CLTHG. WEAR NIOSH/MSHA APPROV RVD RESPIRATOR.

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods: CONTACT LOCAL HAZARDOUS OR CHEMICAL WASTE DISPOSAL AGENCY FOR REGULATIONS. DISPOSE OF I/A/W FEDERAL, STATE AND LOCAL REGULATIONS (FP N).

Handling And Storage Precautions: KEEP STORED IN TIGHTLY CLOSED CONTR IN A DRY AREA. KEEP @ ROOM TEMP. HARMFUL/FATAL IF SWALLOWED.

Other Precautions: AVOID INHAL, INGEST & CONTACT W/EYES & SKIN.

Fire and Explosion Hazard Information

Extinguishing Media: APPROPRIATE TO SURROUNDING FIRE CONDITIONS.

Fire Fighting Procedures: WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N).

Unusual Fire/Explosion Hazard: POTASSIUM CYANIDE IS IN VERY DILUTE CONC IN SOLN. CONC KCN MAY RELEASE HCN GAS.

Control Measures

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR.

Ventilation: CHEMICAL FUME HOOD.

Protective Gloves: CHEMICAL RESISTANT GLOVES.

Eye Protection: CHEMICAL RESISTANT GLASSES.

Other Protective Equipment: CHEMICAL RESISTANT CLOTHES.

Work Hygienic Practices: WASH CAREFULLY AFTER USE.

Supplemental Safety and Health: NONE SPECIFIED BY MANUFACTURER.

Physical/Chemical Properties

Spec Gravity: 1

PH: 8.4

Solubility in Water: SOLUBLE

Appearance and Odor: TRANSPARENT SOLUTION

Reactivity Data

Stability Indicator: YES

Stability Condition To Avoid: NONE SPECIFIED BY MANUFACTURER.

Materials To Avoid: AVOID CONTACT W/ACID AND STRONG OXIDIZING AGENTS.

Hazardous Decomposition Products: CONC KCN WILL REL TOX HYDROGEN CYANIDE & NITROGEN OXIDES IN ADDN TO CARBON MONOXIDE & CARBON DIOXIDE.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: NOT RELEVANT

Toxicological Information

Ecological Information

MSDS Transport Information

Regulatory Information

Other Information

HAZCOM Label

Product ID: CYANIDE
Cage: 07987
Company Name: SPEX INDUSTRIES, INC.
Street: 3880 PARK AVE
City: EDISON NJ
Zipcode: 08820
Health Emergency Phone: 800-424-9300 (CHEMTREC)
Label Required IND: Y
Date Of Label Review: 03/01/1994
Status Code: C
Label Date: 03/01/1994
Origination Code: G
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES
Health Hazard: Severe
Contact Hazard: Severe
Fire Hazard: None
Reactivity Hazard: None

Hazard And Precautions: POISON. AVOID ALL CONTACT, INHALATION AND INGESTION.
ACUTE: ALTHOUGH POTASSIUM CYANIDE IS VERY MUCH IN DILUTION IN THIS AMPULE,
HEALTH HAZARDS FOR CONCENTRATED POTASSIUM CYANIDE (KCN) ARE GIVEN. CONCE
NTRATED KCN IS FATAL POISON IF INGESTED. TOXIC SYMPTOMS MAY ALSO OCCUR IF
INHALED. PROLONGED SKIN CONTACT WILL CAUSE IRRITATION AND POSSIBLE POISONING
COULD OCCUR OF SKIN IS BROKEN. CHRONIC: NONE LISTED BY MANUFACTURER.

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MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 900-659-2151
CHEMTREC: 1-800-424-9500

National Response in Canada
CANUTEC: 619-896-6666

Outside U.S. and Canada
Chemtrec: 708-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-522-2537) for assistance.

POTASSIUM CYANIDE

1. Product Identification

Synonyms: Potassium cyanide, solid; hydrocyanic acid, potassium salt

CAS No.: 151-50-8

Molecular Weight: 65.12

Chemical Formula: KCN

Product Codes:

J.T. Baker: 3080

Mallinckrodt: 6881

2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|-------------------|----------|-----------|-----------|
| Potassium Cyanide | 151-50-8 | 96 - 100% | Yes |

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR

ABSORBED THROUGH SKIN. CONTACT WITH ACIDS LIBERATES POISONOUS GAS. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. AFFECTS BLOOD, CARDIOVASCULAR SYSTEM, CENTRAL NERVOUS SYSTEM AND THYROID.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 2 - Moderate

Contact Rating: 3 - Severe (Life)

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

Potential Health Effects

In most cases, cyanide poisoning causes a deceptively healthy pink to red skin color. However, if a physical injury or lack of oxygen is involved, the skin color may be bluish. Reddening of the eyes and pupil dilation are symptoms of cyanide poisoning. Cyanosis (blue discoloration of the skin) tends to be associated with severe cyanide poisonings.

Inhalation:

Corrosive to the respiratory tract. The substance inhibits cellular respiration and may cause blood, central nervous system, and thyroid changes. May cause headache, weakness, dizziness, labored breathing nausea and vomiting, which can be followed by weak and irregular heart beat, unconsciousness, convulsions, coma and death.

Ingestion:

Highly Toxic! Corrosive to the gastro-intestinal tract with burning in the mouth and esophagus, and abdominal pain. Larger doses may produce sudden loss of consciousness and prompt death from respiratory arrest. Smaller but still lethal doses may prolong the illness for one or more hours. Bitter almonds odor may be noted on the breath or vomitus. Other symptoms may be similar to those noted for inhalation exposure.

Skin Contact:

Corrosive. May cause severe pain and skin burns. Solutions are corrosive to the skin and eyes, and may cause deep ulcers which heal slowly. May be absorbed through the skin, with symptoms similar to those noted for inhalation.

Eye Contact:

Corrosive. Symptoms may include redness, pain, blurred vision, and eye damage.

Chronic Exposure:

Prolonged or repeated skin exposure may cause a "cyanide" rash and nasal sores.

Aggravation of Pre-existing Conditions:

Workers using cyanides should have a preplacement and periodic medical exam. Those with history of central nervous system, thyroid, skin, heart or lung diseases may be more susceptible to the effects of this substance.

4. First Aid Measures

IN CASE OF CYANIDE POISONING, start first aid treatment immediately, then get medical attention. A cyanide antidote kit (amyl nitrite, sodium nitrite and sodium thiosulfate) should be available in any cyanide work area. Actions to be taken in case of cyanide poisoning should be planned and practiced before beginning work with cyanides. Oxygen and amyl nitrite can be given by a first responder before medical help arrives. Allow victim to inhale amyl nitrite for 15-30 seconds per minute until sodium nitrite and sodium thiosulfate can be administered intravenously (see Note to Physician). A new amyl nitrite ampule should be used every 3 minutes. If conscious but symptoms (nausea, difficult breathing, dizziness, etc.) are evident, give oxygen. If consciousness is impaired (non-responsiveness, slurred speech, confusion, drowsiness) or the patient is unconscious but breathing, give oxygen and amyl nitrite by means of a respirator. If not breathing, give oxygen and amyl nitrite immediately by means of a positive pressure respirator (artificial respiration).

Inhalation:

If inhaled, remove to fresh air. Administer antidote kit and oxygen per pre-planned instructions if symptoms occur. Keep patient warm and at rest. Do not give mouth to mouth resuscitation.

Ingestion:

If ingested, antidote kit and oxygen should be administered per above. If the patient is conscious, immediately give the patient activated charcoal slurry. Never give anything by mouth to an unconscious person. Do not induce vomiting as it could interfere with resuscitator use.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse. Administer antidote kit and oxygen per preplanned instructions if symptoms occur.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:

If patient does not respond to amyl nitrite, inject intravenously with 10mL of a 3% solution of sodium nitrite at a rate of not more than 2.5 to 5 mL per minute. Once nitrite administration is complete, follow directly with 50 mL of a 25% solution of sodium thiosulfate at the same rate by the same route. Give victim oxygen and keep under observation. If exposure was severe, watch victim for 24-48 hours. If signs of cyanide poisoning persist or reappear, repeat nitrite and thiosulfate injections 1 hour later in 1/2 the original doses. Cyanocobalamin (B12), 1 mg intramuscularly, may speed recovery. Moderate cyanide exposures need be treated only by supportive measures such as bed rest and oxygen.

5. Fire Fighting Measures

Fire:

Not combustible, but upon decomposition or contact with acids, this material releases highly flammable and toxic hydrogen cyanide gas.

Explosion:

Not considered an explosion hazard, but upon heating with chlorates or nitrites to 450C (842F) may cause an explosion. Violent explosion occurs if melted with nitrite salt. Sealed containers may rupture when heated.

Fire Extinguishing Media:

Do Not use carbon dioxide. Carbon dioxide can react with this material in the presence of moisture to produce hydrogen cyanide. Water may be used on nearby fires not involving this material. Use alkali dry chemical. Water spray may be used to keep fire exposed containers cool. Reacts slowly with water to form hydrogen cyanide. Use any means suitable for extinguishing surrounding fire.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Spills: Ventilate area of leak or spill. Allow only qualified personnel to handle spill. Clean-up personnel require protective clothing and respiratory protection from vapors. Collect material and place in a closed container for recovery or disposal. Do not flush to sewer! Decontaminate liquid or solid residues in spill area with sodium or calcium hypochlorite solution.

US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Separate from incompatibles. Workers must carefully follow good hygienic practices, including no eating, drinking, or smoking in workplace. Proper use and maintenance of protective equipment is essential. Workers using cyanide need preplacement and annual medical exams. Special training should be given to workers using cyanide. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product. Do not store near combustibles or flammables because subsequent fire fighting with water could lead to cyanide solution runoff. Do not store under sprinkler systems. All persons with the potential for cyanide poisoning should be trained to provide immediate First Aid using oxygen and amyl nitrite. A cyanide antidote kit (amyl nitrite, sodium nitrite, and sodium thiosulfate) should be readily available in cyanide

workplaces. The antidotes should be checked annually to ensure they are still within their shelf-lives. Identification of community hospital resources and emergency medical squads in order to equip and train them on handling cyanide emergencies is essential.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):

5 mg/m³ skin (TWA) (as CN)

-ACGIH Threshold Limit Value (TLV):

5 mg/m³ (STEL) Ceiling, skin, as CN

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airtight hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has poor warning properties.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

White deliquescent granular solid.

Odor:

Bitter almonds.

Solubility:

Very soluble in water.

Specific Gravity:

1.55 @ 20C/4C

pH:

11 (0.1 N aqueous solution)

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

1625C (2957F)

Melting Point:

634C (1173F)

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

No information found.

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Very stable when dry. Moisture will cause slow decomposition, releasing poisonous hydrogen cyanide gas.

Hazardous Decomposition Products:

Emits toxic fumes of cyanide and oxides of nitrogen when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong acids and strong oxidizers. Reacts with acids to liberate toxic and flammable hydrogen cyanide gas. Water or weak alkaline solutions can produce dangerous amounts of hydrogen cyanide in confined areas. Can react with carbon dioxide in ordinary air to form hydrogen cyanide gas.

Conditions to Avoid:

Heat, moisture, incompatibles.

11. Toxicological Information

Oral rat LD50: 5 mg/kg. Investigated as a mutagen, reproductive effector.

| Ingredient | ---NTP Carcinogen--- | | IARC Category |
|------------------------------|----------------------|-------------|---------------|
| | Known | Anticipated | |
| Potassium Cyanide (151-50-8) | No | No | None |

12. Ecological Information

Environmental Fate:

This material has an estimated bioconcentration factor (BCF) of less than 100. This

material is not expected to significantly bioaccumulate.

Environmental Toxicity:

This material is expected to be very toxic to aquatic life. This material is expected to be very toxic to terrestrial life.

13. Disposal Considerations

Cyanides must be oxidized to harmless waste before disposal. An alkaline solution (pH about 10) is treated with chlorine or commercial bleach in excess to decompose cyanide. When cyanide-free, it can be neutralized. Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: RQ, POTASSIUM CYANIDE

Hazard Class: 6.1

UN/NA: UN1680

Packing Group: I

Information reported for product/size: 100LB

International (Water, I.M.O.)

Proper Shipping Name: POTASSIUM CYANIDE, SOLID

Hazard Class: 6.1

UN/NA: UN1680

Packing Group: I

Information reported for product/size: 100LB

International (Air, I.C.A.O.)

Proper Shipping Name: POTASSIUM CYANIDE, SOLID

Hazard Class: 6.1

UN/NA: UN1680

Packing Group: I

Information reported for product/size: 100LB

15. Regulatory Information

| -----\Chemical Inventory Status - Part 1\----- | | | | |
|--|------|-----|-------|-----------|
| Ingredient | TSCA | EC | Japan | Australia |
| Potassium Cyanide (151-50-8) | Yes | Yes | Yes | Yes |

| -----\Chemical Inventory Status - Part 2\----- | | | | |
|--|-------|-----|--------------------|-------|
| Ingredient | Korea | DSL | --Canada-- NDSL | Phil. |
| Potassium Cyanide (151-50-8) | Yes | Yes | No | Yes |

| -----\Federal, State & International Regulations - Part 1\----- | | | | |
|---|------------|-----|------------|----------------|
| Ingredient | -SARA 302- | | -SARA 313- | |
| | RQ | TPQ | List | Chemical Catg. |
| Potassium Cyanide (151-50-8) | 10 | 100 | No | Cyanide comp |

| -----\Federal, State & International Regulations - Part 2\----- | | | |
|---|--------|--------|--------|
| Ingredient | CERCLA | -RCRA- | -TSCA- |
| | | 261.33 | 8(d) |
| Potassium Cyanide (151-50-8) | 10 | P098 | No |

Chemical Weapons Convention: Yes TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: No (Pure / Solid)

Australian Hazchem Code: 4X

Poison Schedule: S7

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0

Label Hazard Warning:

POISON! DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CONTACT WITH ACIDS LIBERATES POISONOUS GAS. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. AFFECTS BLOOD, CARDIOVASCULAR SYSTEM, CENTRAL NERVOUS SYSTEM AND THYROID.

Label Precautions:

- Do not breathe dust.
- Do not get in eyes, on skin, or on clothing.
- Keep container closed.
- Use only with adequate ventilation.
- Wash thoroughly after handling.

Label First Aid:

IN ALL CASES, GET MEDICAL ATTENTION IMMEDIATELY. KEEP A CYANIDE ANTIDOTE KIT (amyl nitrite, sodium nitrite and sodium thiosulfate) in area of product use or storage. First-aiders must take precautions to avoid contact with cyanide substance. If ingested, administer antidote kit and oxygen per pre-planned instructions. If the patient is conscious, immediately give the patient activated charcoal slurry. Never give anything by mouth to an unconscious person. Do not induce vomiting as it could interfere with resuscitator use. If inhaled, remove to fresh air. Administer antidote kit and oxygen per pre-planned instructions if symptoms occur. Keep patient warm and at rest. Do not give mouth to mouth resuscitation. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Administer antidote kit and oxygen per preplanned instructions if symptoms occur.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

International Chemical Safety Cards

LEAD

ICSC: 0052

| |
|---|
| <p>LEAD Lead metal Plumbum (powder) Pb Atomic mass: 207.2</p> <p>CAS # 7439-92-1 RTECS # OF7525000 ICSC # 0052</p> |
|---|

| TYPES OF HAZARD/ EXPOSURE | ACUTE HAZARDS/ SYMPTOMS | PREVENTION | FIRST AID/ FIRE FIGHTING |
|--|---|---|---|
| FIRE | Not combustible. Finely divided lead powder is flammable. Gives off irritating or toxic fumes (or gases) in a fire. | NO open flames, NO sparks, and NO smoking (if in powder form). | In case of fire in the surroundings: all extinguishing agents allowed. |
| EXPLOSION | Finely dispersed particles form explosive mixtures in air. | Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting. | |
| EXPOSURE | | PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN! | IN ALL CASES CONSULT A DOCTOR! |
| • INHALATION | Abdominal cramps. Drowsiness. Headache. Nausea. Vomiting. Weakness. Wheezing. Pallor. Hemoglobinuria. Collapse. | Ventilation (not if powder). Avoid inhalation of fine dust and mist. Local exhaust or breathing protection. | Fresh air, rest. Refer for medical attention. |
| • SKIN | | | |
| • EYES | | | |
| • INGESTION | Abdominal cramps (further see Inhalation). | Do not eat, drink, or smoke during work. Wash hands before eating. | Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention. |
| SPILLAGE DISPOSAL | | STORAGE | PACKAGING & LABELLING |
| Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect | | Separated from strong oxidants, strong bases, strong acids, food and feedstuffs. | |

remainder, then remove to safe place.
Do NOT let this chemical enter the environment (extra personal protection: P2 filter respirator for harmful particles).

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0052

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

LEAD

ICSC: 0052

| | | |
|---|---|---|
| I M P O R T A N T I N F O R M A T I O N | <p>PHYSICAL STATE; APPEARANCE: BLUISH-WHITE OR SILVERY-GREY SOLID IN VARIOUS FORMS. TURNS TARNISHED ON EXPOSURE TO AIR.</p> | <p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.</p> |
| | <p>PHYSICAL DANGERS: Dust explosion possible if in powder or granular form, mixed with air.</p> | <p>INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.</p> |
| | <p>CHEMICAL DANGERS: Upon heating, toxic fumes are formed. Reacts with hot concentrated nitric acid, boiling concentrated hydrochloric and sulfuric acids. Attacked by pure water and by weak organic acids in the presence of oxygen.</p> | <p>EFFECTS OF SHORT-TERM EXPOSURE: The substance may cause effects on the gastrointestinal tract, blood, central nervous system and kidneys, resulting in colics, shock, anemia, kidney damage and encephalopathy. Exposure may result in death. The effects may be delayed. Medical observation is indicated.</p> |
| | <p>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV: ppm; 0.15 mg/m³ (as TWA) (ACGIH 1993-1994).</p> | <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: The substance may have effects on the gastrointestinal tract, nervous system, blood, kidneys and immune system, resulting in severe lead colics, paralysis of muscle groups of the upper extremities (forearm, wrist and fingers), anemia, mood and personality changes, retarded mental development, and irreversible nephropathy. May cause retarded development of the new-born. Danger of cumulative effect.</p> |
| <p>PHYSICAL PROPERTIES</p> | <p>Boiling point: 1740°C Melting point: 327.5°C</p> | <p>Relative density (water = 1): 11.34 Solubility in water: none</p> |
| <p>ENVIRONMENTAL DATA</p> | <p>This substance may be hazardous to the environment; special attention should be given to air and water. In the food chain important to humans, bioaccumulation takes place, specifically in plants and water organisms, especially shellfish.</p> | |
| <p>NOTES</p> | | |
| <p>Explosive limits are unknown in literature. Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific lead compounds, e.g., lead chromate (ICSC # 0003), lead(II) oxide (ICSC # 0288).</p> <p style="text-align: right;">Transport Emergency Card: TEC (R)-61G12b</p> | | |
| <p>ADDITIONAL INFORMATION</p> | | |

ICSC: 0052

LEAD

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**IMPORTANT
LEGAL
NOTICE:**

Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Lead

Catalog Numbers:

L18 500, L18-500, L18500, L246 500, L246-500, L246500, L27 1LB, L27-1LB,
L271LB, S719571, NC9657609, XXL24625KG

Synonyms:

Lead Metal

Company Identification: Biochemical Sciences, Inc.

200 Commodore Drive

Swedesboro, NJ 08085

For information, call: 800-524-0294

Emergency Number: 800-524-0294

For CHEMTREC assistance, call: 800-424-9300

For International CHEMTREC assistance, call: 703-527-3887

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

| CAS# | Chemical Name | % | EINECS# |
|-----------|---------------|------|-----------|
| 7439-92-1 | LEAD | 99.8 | 231-100-4 |

Hazard Symbols: T

Risk Phrases: 20/22 33 61 62

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Harmful by inhalation and if swallowed. Danger of cumulative effects. May cause harm to the unborn child. Possible risk of impaired fertility. Dangerous to the environment.

Potential Health Effects

Eye:

Causes eye irritation.

Skin:

Causes skin irritation. May be absorbed through the skin.

Ingestion:

Causes gastrointestinal irritation with nausea, vomiting and diarrhea. Ingestion of lead compounds can cause toxic effects in the blood-forming organs, kidneys and central nervous system. Symptoms of lead poisoning or plumbism include weakness, weight loss, lassitude, insomnia, and hypotension. It also includes constipation, anorexia, abdominal discomfort and colic.

Inhalation:

May cause respiratory tract irritation. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. May cause effects similar to those described for ingestion.

Chronic:

Chronic exposure may cause reproductive disorders and teratogenic effects. Chronic exposure to lead may result in plumbism which is characterized by lead line in gum, headache, muscle weakness, mental changes.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin:

Get medical aid. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Discard contaminated clothing in a manner which limits further exposure.

Ingestion:

Get medical aid immediately. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

Inhalation:

Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:**Antidote:**

The use of Dimercaprol or BAL (British Anti-Lewisite) as a chelating agent should be determined by qualified medical personnel. The use of d-Penicillamine as a chelating agent should be determined by qualified medical personnel. The use of Calcium disodium EDTA as a chelating agent should be determined by qualified medical personnel.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use extinguishing media appropriate to the surrounding fire. Substance is noncombustible. Dust can be an explosion hazard when exposed to heat or flame.

Extinguishing Media:

For small fires, use water spray, dry chemical, carbon dioxide or chemical foam. Substance is noncombustible; use agent most appropriate to extinguish surrounding fire.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Avoid generating dusty conditions. Provide ventilation.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash thoroughly after handling. Wash hands before eating. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation. Wash clothing before reuse.

Storage:

Store in a cool, dry place. Keep from contact with oxidizing materials. Keep containers tightly closed.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

Wear appropriate protective gloves and clothing to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

| | |
|----------------------------|----------------------------|
| Physical State: | Solid |
| Appearance: | bluish white, silvery gray |
| Odor: | none reported |
| pH: | Not applicable. |
| Vapor Pressure: | 1.3 mm Hg @ 970C |
| Vapor Density: | Not available. |
| Evaporation Rate: | Not applicable. |
| Viscosity: | Not applicable. |
| Boiling Point: | 1740 deg C |
| Freezing/Melting Point: | 327.4 deg C |
| Autoignition Temperature: | Not available. |
| Flash Point: | Not available. |
| Explosion Limits, lower: | Not available. |
| Explosion Limits, upper: | Not available. |
| Decomposition Temperature: | Not available. |
| Solubility: | Insoluble in water. |
| Specific Gravity/Density: | 11.3 |
| Molecular Formula: | Pb |
| Molecular Weight: | 207.2 |

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

Dust generation, excess heat, strong oxidants.

Incompatibilities with Other Materials:

Strong oxidizing agents.
 Hazardous Decomposition Products:
 Lead/lead oxides.
 Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:

CAS# 7439-92-1: OF7525000

LD50/LC50:

Not available.

Carcinogenicity:

LEAD -

ACGIH: A3 - animal carcinogen

California: carcinogen; initial date 10/1/92

OSHA: Possible Select Carcinogen

IARC: Group 2B carcinogen

Epidemiology:

There are several reports that certain lead compounds administered to animals in high doses are carcinogenic, primarily producing renal tumors. Salts demonstrating carcinogenicity in animals are usually soluble salts. Epidemiological studies have not shown a relationship between lead exposure and the incidence of cancer in lead workers. However, one study of lead-exposed workers demonstrated a statistically significant elevation in the standardized mortality ratio for gastric and lung cancer in battery plant workers only.

Teratogenicity:

Lead penetrates the placental barrier and has caused fetal abnormalities in animals. Excessive exposure to lead during pregnancy has caused neurological disorders in infants.

Reproductive Effects:

Reproductive effects from lead have been documented in animals and human beings of both sexes. In battery workmen with a mean exposure of 8.5 years to lead, there was an increased frequency of sperm abnormalities as compared with a control group.

Neurotoxicity:

Subtle neurologic effects have been demonstrated with relatively low blood levels of lead. The performance of lead workers on various neurophysiological tests was mildly reduced when compared with a control group. Anxiety, depression, poor concentration, forgetfulness, mild reductions in motor and sensory nerve conduction velocities have been documented in lead-exposed workers.

Mutagenicity:

No data available.

Other Studies:

No data available.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:

LC50 Japanese quail (*Coturnix japonica*), males or females, 14 days old, oral (5-day ad libitum in diet) >5,000 ppm; at 1000, 2236 & 5000 onset of toxic signs began at 7, 7 & 7 days and remitted at 11, 11 & 12 days, respectively, no mortality was observed; control references were dieldrin & dicrotophos; corn oil diluent was added to diet at ratio of 2:98 by wt; (extreme concentrations: 1,000-5,000 ppm) /Lead metal, 100%.

Other

For more information, see "HANDBOOK OF ENVIRONMENTAL FATE AND

EXPOSURE DATA."

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT

Shipping Name: RQ, ENVIRONMENTALLY HAZARDOUS SUBSTANCE,
SOLID, N.O.S. (CONTAINS LEAD SHOT)

Hazard Class: 9

UN Number: UN3077

Packing Group: III

Canadian TDG

No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA

CAS# 7439-92-1 is listed on the TSCA inventory.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 7439-92-1 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 7439-92-1 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

LEAD can be found on the following state right to know lists:

California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains LEAD, a chemical known to the state of California to cause cancer.

WARNING: This product contains LEAD, a chemical known to the state of California to cause birth defects or other reproductive harm.

California No Significant Risk Level:

CAS# 7439-92-1: NOEL = 0.5 ug/day

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T

Risk Phrases:

R 20/22 Harmful by inhalation and if swallowed.

R 33 Danger of cumulative effects.

R 61 May cause harm to the unborn child.

R 62 Possible risk of impaired fertility.

Safety Phrases:

WGK (Water Danger/Protection)

CAS# 7439-92-1: No information available.

United Kingdom Occupational Exposure Limits

Canada

CAS# 7439-92-1 is listed on Canada's DSL List.

CAS# 7439-92-1 is listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 7439-92-1: OEL-FRANCE:TWA 150 mg/m3

OEL-GERMANY:TWA 0.1 mg/m3

OEL-POLAND:TWA 0.05 mg/m3

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 4/29/1999 Revision #2 Date: 8/02/2000

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

Product Name: Vanadium, Powder, -325 Mesh, 99.5%

Product Catalog Numbers:

AC318010000, AC318010100

Synonyms:

None.

Company Identification (Europe): Acros Organics BVBA
Janssen Pharmaceuticaaan 3a
2440 Geel, Belgium

Company Identification (USA): Acros Organics
One Reagent Lane
Fairlawn, NJ 07410

For information in North America, call: 800-ACROS-01

For information in Europe, call: 0032(0) 14575211

For emergencies in the US, call CHEMTREC: 800-424-9300

For emergencies in Europe, call: 0032(0) 14575299

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

| CAS# | Chemical Name | % | EINECS# |
|-----------|---------------|------|-----------|
| 7440-62-2 | Vanadium | 99.5 | 231-171-1 |

Hazard Symbols: XI

Risk Phrases: 36/37/38

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: light gray-white.

Warning! Causes respiratory tract irritation. May cause digestive tract irritation. The toxicological properties of this material have not been fully investigated. Causes eye and skin irritation.

Target Organs: None known.

Potential Health Effects

Eye:

Causes severe eye irritation.

Skin:

Causes skin irritation.

Ingestion:

May cause gastrointestinal irritation with nausea, vomiting and diarrhea. The toxicological properties of this substance have not been fully investigated.

Inhalation:

The toxicological properties of this substance have not been fully investigated. Causes severe respiratory tract irritation.

Chronic:

No information found.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:

Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin:

Get medical aid. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion:

Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

Inhalation:

Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Treat symptomatically and supportively. Green coloration of the tongue, resulting from the deposition of vanadium salts is an indicator of exposure; however, may be absent even in prolonged exposure..

Antidote:

None reported.

****** SECTION 5 - FIRE FIGHTING MEASURES ******

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Flammable in dust form from heat, flame or sparks.

Extinguishing Media:

Use agent most appropriate to extinguish fire. Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Autoignition Temperature: Not applicable.

Flash Point: Not applicable.

Explosion Limits, lower: Not available.

Explosion Limits, upper: Not available.

NFPA Rating: (estimated) Health: 2; Flammability: 1; Reactivity: 0

****** SECTION 6 - ACCIDENTAL RELEASE MEASURES ******

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

****** SECTION 7 - HANDLING and STORAGE ******

Handling:

Wash thoroughly after handling. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation. Use with adequate ventilation. Wash clothing before reuse.

Storage:

Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

****** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ******

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---------------|-------------|-------------|-------------------|
| Vanadium | none listed | none listed | none listed |

OSHA Vacated PELs:

Vanadium:

No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State: Lusturous powder
Appearance: light gray-white
Odor: Not available.
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 3380 deg C
Freezing/Melting Point: 1917 deg C
Decomposition Temperature:
Solubility in water: Insoluble.
Specific Gravity/Density: 6.11 @ 18.7C
Molecular Formula: V
Molecular Weight: 50.94

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:

Stable at room temperature in closed containers under normal storage and handling conditions. Oxidizes readily above 600°C.

Conditions to Avoid:

Incompatible materials, dust generation, excess heat.
Incompatibilities with Other Materials:

Violent reaction with BrF₃, Cl₂, lithium, nitryl fluoride, oxidants..
Hazardous Decomposition Products:

Irritating and toxic fumes and gases, vanadium oxide (VO_x) gases.
Hazardous Polymerization: Has not been reported

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:

CAS# 7440-62-2: YW1355000

LD50/LC50:

Not available.

Carcinogenicity:

Vanadium -

Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.

Epidemiology:

No information available.

Teratogenicity:

No information available.

Reproductive Effects:

No information available.

Neurotoxicity:

No information available.

Mutagenicity:

No information available.

Other Studies:

See actual entry in RTECS for complete information.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste.

US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT

No information available

Canadian TDG

No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA

CAS# 7440-62-2 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)

None of the chemicals in this material have an RQ.

Section 302 (TPQ)

None of the chemicals in this product have a TPQ.

Section 313

This material contains Vanadium (CAS# 7440-62-2, 99.5%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class-1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

Vanadium can be found on the following state right to know lists:

California, New Jersey, Pennsylvania, Massachusetts.

California No Significant Risk Level:

None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XI

Risk Phrases:

R 36/37/38 Irritating to eyes, respiratory system and skin.

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.

S 28A After contact with skin, wash immediately with plenty of water.

S 37 Wear suitable gloves.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)

CAS# 7440-62-2: No information available.

United Kingdom Occupational Exposure Limits

Canada

CAS# 7440-62-2 is listed on Canada's DSL List.

This product has a WHMIS classification of D2B.

CAS# 7440-62-2 is listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 7440-62-2: OEL-CZECHOSLOVAKIA:TWA 0.5 mg/m3;STEL 1.5 mg/m3

**** SECTION 16 - ADDITIONAL INFORMATION ****

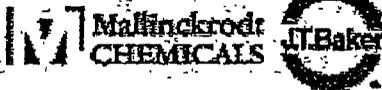
MSDS Creation Date: 5/05/1999 Revision #2 Date: 8/02/2000

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MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08855



24 Hour Emergency Telephone: 906-459-2151
CHEMTREC: 1-800-424-9300

NATIONAL Response in Canada
CANUTEC: 610-961-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-552-2537) for assistance.

ZINC METAL POWDER

1. Product Identification

Synonyms: Powdered zinc; blue powder; CI77945; CI Pigment Black 16
CAS No.: 7440-66-6
Molecular Weight: 65.37
Chemical Formula: Zn
Product Codes:
J.T. Baker: 4282
Mallinckrodt: 8681

2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|------------|-----------|----------|-----------|
| Zinc | 7440-66-6 | 96 - 97% | Yes |
| Zinc Oxide | 1314-13-2 | 0 - 3% | Yes |
| Lead | 7439-92-1 | 0 - 0.3% | Yes |

Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO SKIN, EYES, AND RESPIRATORY TRACT. MAY FORM COMBUSTIBLE DUST CONCENTRATIONS IN AIR. WATER REACTIVE. MAY AFFECT THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM (lead component).

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight

Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 2 - Moderate

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; CLASS D EXTINGUISHER

Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:

No adverse effects expected but dust may cause mechanical irritation. The effects may be expected to resemble those of inhaling an inert dust; possible difficulty in breathing, sneezing, coughing. When heated, the fumes are highly toxic and may cause fume fever.

Ingestion:

Extremely large oral dosages may produce gastrointestinal disturbances, due both to mechanical effects and the possibility of reaction with gastric juice to produce zinc chloride. Pain, stomach cramps and nausea could occur in aggravated cases.

Skin Contact:

May cause irritation.

Eye Contact:

May cause irritation.

Chronic Exposure:

No adverse health effects expected.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. Get medical attention for any breathing difficulty.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

Skin Contact:

Wipe off excess material from skin then immediately flush skin with plenty of water for at

least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention if irritation persists.

5. Fire Fighting Measures

Fire:

Autoignition temperature: ca. 460C (ca. 860F)

The listed autoignition temperature is for Zinc powder (layer); dust cloud is ca. 680C (1255F). Zinc powder is not pyrophoric but will burn in air at elevated temperatures. Bulk dust in damp state may heat spontaneously and ignite on exposure to air. Releases flammable hydrogen gas upon contact with acids or alkali hydroxides. Contact with strong oxidizers may cause fire.

Explosion:

Fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

Fire Extinguishing Media:

Smother with a suitable dry powder (sodium chloride, magnesium oxide, Met-L-X).

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Remove all sources of ignition and provide mild ventilation in area of spill. Substance may be pyrophoric and self-ignite. Clean-up personnel require protective clothing, goggles and dust/mist respirators. Sweep or vacuum up the spill in a manner that does not disperse zinc powder in the air and place the zinc in a closed container for recovery or disposal.

US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

None for Zinc metal.

-OSHA Permissible Exposure Limit (PEL):

10 mg/m³ (TWA), for zinc oxide fume

-ACGIH Threshold Limit Value (TLV):

5 mg/m³ (TWA), 10 mg/m³ (STEL) for zinc oxide fume.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece particulate respirator (NIOSH type N100 filters) may be worn for up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear protective gloves and clean body-covering clothing.

Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Gray or bluish-gray powder.

Odor:

Odorless.

Solubility:

Insoluble in water.

Density:

7.14

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

907C (1665F)

Melting Point:
419C (786F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
1 @ 487C (909F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Moist zinc dust can react exothermically and ignite spontaneously in air.

Hazardous Decomposition Products:

Hydrogen in moist air, zinc oxide with oxygen at high temperature. Zinc metal, when melted, produces zinc vapor which oxidizes and condenses in air to form zinc fume.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Zinc powder can react violently with water, sulfur and halogens. Dangerous or potentially dangerous with strong oxidizing agents, lower molecular weight chlorinated hydrocarbons, strong acids and alkalis.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Zinc: Irritation skin, human: 300 ug/3D-I mild; investigated as a mutagen.

| Ingredient | ---NTP Carcinogen--- | | IARC Category |
|------------------------|----------------------|-------------|---------------|
| | Known | Anticipated | |
| Zinc (7440-66-6) | No | No | None |
| Zinc Oxide (1314-13-2) | No | No | None |
| Lead (7439-92-1) | No | No | 2B |

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

International (Water, I.M.O.)

Proper Shipping Name: ZINC POWDER, NON-PYROPHORIC

Hazard Class: 4.3, 4.2

UN/NA: UN1436

Packing Group: II

Information reported for product/size: 100LB

International (Air, I.C.A.O.)

Proper Shipping Name: ZINC POWDER, NON-PYROPHORIC

Hazard Class: 4.3, 4.2

UN/NA: UN1436

Packing Group: II

Information reported for product/size: 100LB

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----

| Ingredient | TSCA | EC | Japan | Australia |
|------------------------|------|-----|-------|-----------|
| Zinc (7440-66-6) | Yes | Yes | No | Yes |
| Zinc Oxide (1314-13-2) | Yes | Yes | Yes | Yes |
| Lead (7439-92-1) | Yes | Yes | Yes | Yes |

-----\Chemical Inventory Status - Part 2\-----

| Ingredient | Korea | --Canada-- | | |
|------------------------|-------|------------|------|-------|
| | | DSL | NDSL | Phil. |
| Zinc (7440-66-6) | Yes | Yes | No | Yes |
| Zinc Oxide (1314-13-2) | Yes | Yes | No | Yes |
| Lead (7439-92-1) | Yes | Yes | No | Yes |

| -----\Federal, State & International Regulations - Part 1\----- | | | | |
|---|------------|-----|--------------------|----------------|
| Ingredient | -SARA 302- | | -----SARA 313----- | |
| | RQ | TPQ | List | Chemical Catg. |
| inc (7440-66-6) | No | No | Yes | No |
| Zinc Oxide (1314-13-2) | No | No | No | Zinc compoun |
| Lead (7439-92-1) | No | No | Yes | No |

| -----\Federal, State & International Regulations - Part 2\----- | | | |
|---|--------|--------|--------|
| Ingredient | CERCLA | -RCRA- | -TSCA- |
| | | 261.33 | 8 (d) |
| Zinc (7440-66-6) | 1000 | No | No |
| Zinc Oxide (1314-13-2) | No | No | No |
| Lead (7439-92-1) | 10 | No | No |

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: No Fire: Yes Pressure: No
Reactivity: Yes (Mixture / Solid)

WARNING:

THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 4Y

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 1 Flammability: 1 Reactivity: 1 Other: Water reactive

Label Hazard Warning:

WARNING! HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO SKIN, EYES, AND RESPIRATORY TRACT. MAY FORM COMBUSTIBLE DUST CONCENTRATIONS IN AIR. WATER REACTIVE. MAY AFFECT THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM (lead component).

Label Precautions:

- Avoid breathing dust.
- Avoid contact with eyes, skin and clothing.
- Keep away from heat and flame.
- Keep container closed.
- Use with adequate ventilation.
- Wash thoroughly after handling.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. Get medical

attention for any breathing difficulty. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

BENZ(a)ANTHRACENE

1,2-Benzoanthracene

Benzo(a)anthracene

2,3-Benzphenanthrene

Naphthanthracene

C₁₈H₁₂

Molecular mass: 228.3

CAS # 56-55-3

RTECS # CV9275000

ICSC # 0385

EC # 601-033-00-9

| TYPES OF HAZARD/ EXPOSURE | ACUTE HAZARDS/ SYMPTOMS | PREVENTION | FIRST AID/ FIRE FIGHTING |
|--|--|--|---|
| FIRE | Combustible. | | Water spray, powder. In case of fire in the surroundings: all extinguishing agents allowed. |
| EXPLOSION | Finely dispersed particles form explosive mixtures in air. | Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting. | |
| EXPOSURE | | AVOID ALL CONTACT! | |
| • INHALATION | | Local exhaust or breathing protection. | Fresh air, rest. |
| • SKIN | | Protective gloves. Protective clothing. | Remove contaminated clothes. Rinse and then wash skin with water and soap. |
| • EYES | | Safety goggles, face shield, or eye protection in combination with breathing protection. | First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor. |
| • INGESTION | | Do not eat, drink, or smoke during work. Wash hands before eating. | Rinse mouth. |
| SPILLAGE DISPOSAL | | STORAGE | PACKAGING & LABELLING |
| Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus). | | Well closed. | T symbol R: 45 S: 53-45 |

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0385

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

| | | |
|---|--|--|
| I M P O R T A N T D A T A | PHYSICAL STATE; APPEARANCE: COLOURLESS TO YELLOW-BROWN FLUORESCENT FLAKES OR POWDER. PHYSICAL DANGERS: Dust explosion possible if in powder or granular form, mixed with air. CHEMICAL DANGERS: OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established. | ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation, through the skin and by ingestion. INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. EFFECTS OF SHORT-TERM EXPOSURE: EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: This substance is probably carcinogenic to humans. |
| PHYSICAL PROPERTIES | Sublimation point: 435°C Melting point: 162°C Relative density (water = 1): 1.274 | Solubility in water: none Vapour pressure, Pa at 20°C: 292 Octanol/water partition coefficient as log Pow: 5.61 |
| ENVIRONMENTAL DATA | In the food chain important to humans, bioaccumulation takes place, specifically in seafood. | |
| NOTES | | |
| This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetrathene is a common name. | | |
| ADDITIONAL INFORMATION | | |
| | | |
| ICSC: 0385 | BENZ(a)ANTHRACENE | |
| © IPCS, CEC, 1993 | | |

| | |
|--|--|
| IMPORTANT LEGAL NOTICE: | Neither the CEC or the IPSC nor any person acting on behalf of the CEC or the IPSC is responsible for the use which might be made of this information. This card contains the collective views of the IPSC Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. |
|--|--|

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Benzo(a)pyrene, 98%

Catalog Numbers:

AC105600000, AC105600010, AC105601000

Synonyms:

3,4-Benzopyrene; 3,4-Benzpyrene.

Company Identification (Europe): Acros Organics BVBA
 Janssen Pharmaceuticaaan 3a
 2440 Geel, Belgium

Company Identification (USA): Acros Organics
 One Reagent Lane
 Fairlawn, NJ 07410

For information in North America, call: 800-ACROS-01

For information in Europe, call: 0032(0) 14575211

For emergencies in the US, call CHEMTREC: 800-424-9300

For emergencies in Europe, call: 0032(0) 14575299

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

| CAS# | Chemical Name | % | EINECS# |
|---------|----------------|------|-----------|
| 50-32-8 | Benzo[a]pyrene | 98.0 | 200-028-5 |

Hazard Symbols: T

Risk Phrases: 45 46 60 61

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: slightly brown.

Caution! Cancer suspect agent. The toxicological properties of this material have not been fully investigated. May cause eye and skin irritation. May cause respiratory and digestive tract irritation. Possible risk of harm to the unborn child.

Target Organs: None.

Potential Health Effects

Eye:

May cause eye irritation.

Skin:

May cause skin irritation.

Ingestion:

May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated.

Inhalation:

May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated.

Chronic:

May cause cancer in humans.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally

lifting the upper and lower eyelids. Get medical aid.

Skin:

Get medical aid. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion:

Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

Inhalation:

Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:

In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam. Use agent most appropriate to extinguish fire. Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Autoignition Temperature: Not available.

Flash Point: Not available.

Explosion Limits, lower: Not available.

Explosion Limits, upper: Not available.

NFPA Rating:

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage:

Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:

Facilities storing or utilizing this material should be equipped

with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|----------------|---|-------------|--|
| Benzo[a]pyrene | 0.2 mg/m ³ (as benzene solubles) (listed under ** no name **). | none listed | benzene soluble fraction: 0.2 mg/m ³ TWA (includes anthracene, BaP, phenanthrene, acridine, chrysene, and pyrene) (listed under ** no name **). |

OSHA Vacated PELs:

Benzo[a]pyrene:

benzene soluble fraction: 0.2 mg/m³ TWA (anthracene, BaP, phenanthrene, acridine, (listed under ** no name **))

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

A respiratory protection program that meets OSHA's 29 CFR :1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use. Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State: Solid
 Appearance: slightly brown
 Odor: faint aromatic odor
 pH: Not available.
 Vapor Pressure: Not available.
 Vapor Density: Not available.
 Evaporation Rate: Not available.
 Viscosity: Not available.

Boiling Point: 495 deg C @ 760.00mm Hg
Freezing/Melting Point: 175 - 177 deg C
Decomposition Temperature:
Solubility in water: 1.60x10⁻³ mg/l @25°C
Specific Gravity/Density:
Molecular Formula: C20H12
Molecular Weight: 252.31

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

Incompatible materials, dust generation.

Incompatibilities with Other Materials:

Strong oxidizing agents.

Hazardous Decomposition Products:

Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide, acrid smoke and fumes.

Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:

CAS# 50-32-8: DJ3675000

LD50/LC50:

Not available.

Carcinogenicity:

Benzo[a]pyrene

ACGIH: A2 - Suspected Human Carcinogen

California: carcinogen; initial date 7/1/87

NIOSH: occupational carcinogen (listed as ** undefined **)

NTP: Suspect carcinogen

OSHA: Possible Select carcinogen

IARC: Group 2A carcinogen

Epidemiology:

No information available.

Teratogenicity:

No information available.

Reproductive Effects:

No information available.

Neurotoxicity:

No information available.

Mutagenicity:

No information available.

Other Studies:

No data available.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Other

No information available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste.

US EPA guidelines for the classification determination are listed in

40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: CAS# 50-32-8; waste number U022.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT

Shipping Name: TOXIC SOLID, ORGANIC, N.O.S.*

Hazard Class: 6.1

UN Number: 2811

Packing Group: I

Canadian TDG

No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA

CAS# 50-32-8 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA:

Section 302 (RQ)

CAS# 50-32-8: final RQ = 1 pound (0.454 kg)

Section 302 (TPQ)

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 50-32-8: acute, chronic.

Section 313

This chemical is not at a high enough concentration to be reportable under Section 313.

No chemicals are reportable under Section 313.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

Benzo[a]pyrene can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

The following statement(s) is(are) made in order to comply with

the California Safe Drinking Water Act:

WARNING: This product contains Benzo[a]pyrene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level:

CAS# 50-32-8: no significant risk level = 0.06 ug/day

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T

Risk Phrases:

- R 45 May cause cancer.
- R 46 May cause heritable genetic damage.
- R 60 May impair fertility.
- R 61 May cause harm to the unborn child.

Safety Phrases:

- S 53 Avoid exposure - obtain special instructions before use.
- S 28A After contact with skin, wash immediately with plenty of water.
- S 37 Wear suitable gloves.
- S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)

CAS# 50-32-8: No information available.

United Kingdom Occupational Exposure Limits

Canada

CAS# 50-32-8 is listed on Canada's DSL List.

This product has a WHMIS classification of D2A.

CAS# 50-32-8 is listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 50-32-8: OEL-AUSTRALIA; Carcinogen

OEL-BELGIUM; Carcinogen

OEL-FINLAND: TWA 0.01 mg/m³; Skin; Carcinogen

OEL-FRANCE; Carcinogen

OEL-GERMANY; Carcinogen

OEL-RUSSIA: STEL 0.00015 mg/m³; Carcinogen

OEL-SWEDEN: TWA 0.005 mg/m³; STEL 0.03 mg/m³; Skin

OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV

OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 9/02/1997 Revision #4 Date: 8/02/2000

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

BENZO(B)FLUORANTHENE

Benzo(e)acephenanthrylene

2,3-Benzofluoranthene

C₂₀H₁₂

Molecular mass: 252.3

CAS # 205-99-2

RTECS # CU1400000

ICSC # 0720

| TYPES OF HAZARD/ EXPOSURE | ACUTE HAZARDS/ SYMPTOMS | PREVENTION | FIRST AID/ FIRE FIGHTING |
|--|--|---|--|
| FIRE | Combustible. | NO open flames. | Water spray, powder. |
| EXPLOSION | | | |
| EXPOSURE | | PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT! | IN ALL CASES CONSULT A DOCTOR! |
| • INHALATION | | Local exhaust or breathing protection. | Fresh air, rest. |
| • SKIN | MAY BE ABSORBED! | Protective gloves. Protective clothing. | Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid. |
| • EYES | | Safety goggles or eye protection in combination with breathing protection. | First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor. |
| • INGESTION | | Do not eat, drink, or smoke during work. | Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention. |
| SPILLAGE DISPOSAL | STORAGE | PACKAGING & LABELLING | |
| Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment. | Provision to contain effluent from fire extinguishing. Tightly closed. | Unbreakable packaging; put breakable packaging into closed unbreakable container. | |
| SEE IMPORTANT INFORMATION ON BACK | | | |
| ICSC: 0720 | Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993 | | |

International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

| | | | | |
|---|--|---|--|--|
| I M P O R T A N T D A T A | PHYSICAL STATE; APPEARANCE: COLOURLESS TO YELLOW CRYSTALS. | ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol and through the skin. | | |
| | PHYSICAL DANGERS: | INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. | | |
| | CHEMICAL DANGERS: Upon heating, toxic fumes are formed. | EFFECTS OF SHORT-TERM EXPOSURE: | | |
| | OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established. | EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: This substance is possibly carcinogenic to humans. | | |
| PHYSICAL PROPERTIES | Melting point: 168°C Solubility in water: none | Vapour pressure, Pa at 20°C: <10 Octanol/water partition coefficient as log Pow: 6.04 | | |
| ENVIRONMENTAL DATA | This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats. | | | |
| NOTES | | | | |
| Depending on the degree of exposure, periodic medical examination is indicated. Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. | | | | |
| ADDITIONAL INFORMATION | | | | |
| <table border="1" style="width: 100%; height: 20px;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> </table> | | | | |
| | | | | |
| ICSC: 0720 | | BENZO(B)FLUORANTHENE | | |
| © IPCS, CEC, 1993 | | | | |

| | |
|--------------------------------|--|
| IMPORTANT LEGAL NOTICE: | Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. |
|--------------------------------|--|

Product Number: 33530
 Product Name: Dibenz[a,h]anthracene

Description / Pricing

Valid 08/2002 - 10/2002

Cert. of Analysis

Fluka Chemie AG

MSDS

Postfach 260

CH-9471 Buchs

Switzerland

Print Preview

Tel: 081 755 25 11 Fax: 081 756 54 49

Bulk Quote

Night: 071 228 3600

Ask A Scientist

M A T E R I A L S A F E T Y D A T A S H E E T

SECTION 1. - - - - - CHEMICAL IDENTIFICATION - - - - -

CATALOG #: 33530

NAME: DIBENZ (A,H) ANTHRACENE

SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - -

CAS #: 53-70-3

MP: C22H14

EC NO: 200-181-8

SYNONYMS

1,2:5,6-BENZANTHRACENE * DB(A,H)A * 1,2,5,6-DBA * 1,2,5,6-

DIBENZANTHRACENE (DUTCH) * 1,2:5,6-DIBENZANTHRACENE * 1,2:5,6-

DIBENZ (A) ANTHRACENE * DIBENZO (A,H) ANTHRACENE * 1,2:5,6-

DIBENZANTHRACENE * RCRA WASTE NUMBER U063

SECTION 3. - - - - - HAZARDS IDENTIFICATION - - - - -

LABEL PRECAUTIONARY STATEMENTS

TOXIC

MAY CAUSE CANCER.

MAY CAUSE HERITABLE GENETIC DAMAGE.

HARMFUL BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.

TARGET ORGAN(S):

LIVER

LUNGS

IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).

WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.

DO NOT BREATHE DUST.

SECTION 4. - - - - - FIRST-AID MEASURES - - - - -

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL

RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.

CALL A PHYSICIAN.

DISCARD CONTAMINATED CLOTHING AND SHOES.

SECTION 5. - - - - - FIRE FIGHTING MEASURES - - - - -

EXTINGUISHING MEDIA

WATER SPRAY.

CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.

SPECIAL FIREFIGHTING PROCEDURES

WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.

SECTION 6. - - - - - ACCIDENTAL RELEASE MEASURES - - - - -

EVACUATE AREA.

WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.

WEAR DISPOSABLE COVERALLS AND DISCARD THEM AFTER USE.

SWEEP UP, PLACE IN A BAG AND HOLD FOR WASTE DISPOSAL.

VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

SECTION 7. - - - - - HANDLING AND STORAGE - - - - -

REFER TO SECTION 8.

SECTION 8. - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION - - - - -

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.

SAFETY SHOWER AND EYE BATH.

USE ONLY IN A CHEMICAL FUME HOOD.

DO NOT BREATHE DUST.

AVOID ALL CONTACT.

WASH THOROUGHLY AFTER HANDLING.

CARCINOGEN.

MUTAGEN.

HARMFUL SOLID.

KEEP TIGHTLY CLOSED.

STORE IN A COOL DRY PLACE.

SECTION 9. - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - -
 APPEARANCE AND ODOR
 SOLID.
 PHYSICAL PROPERTIES
 MELTING POINT: 262 TO 265C

SECTION 10. - - - - - STABILITY AND REACTIVITY - - - - -
 INCOMPATIBILITIES
 STRONG OXIDIZING AGENTS
 HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
 TOXIC FUMES OF:
 CARBON MONOXIDE, CARBON DIOXIDE

SECTION 11. - - - - - TOXICOLOGICAL INFORMATION - - - - -
 ACUTE EFFECTS
 HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN.
 MAY CAUSE IRRITATION.
 CHRONIC EFFECTS
 CARCINOGEN.
 MUTAGEN.
 TARGET ORGAN(S):
 LIVER
 LUNGS
 TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND
 TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
 RTECS #: HN2625000
 DIBENZ(A,H) ANTHRACENE
 TARGET ORGAN DATA
 LUNGS, THORAX OR RESPIRATION (TUMORS)
 LUNGS, THORAX OR RESPIRATION (BRONCHOGENIC CARCINOMA)
 LIVER (TUMORS)
 KIDNEY, URETER, BLADDER (BLADDER TUMORS)
 KIDNEY, URETER, BLADDER (KIDNEY TUMORS)
 SKIN AND APPENDAGES (TUMORS)
 TUMORIGENIC (CARCINOGENIC BY RTECS CRITERIA)
 TUMORIGENIC (NEOPLASTIC BY RTECS CRITERIA)
 TUMORIGENIC (EQUIVOCAL TUMORIGENIC AGENT BY RTECS CRITERIA)
 TUMORIGENIC (TUMORS AT SITE OF APPLICATION)
 ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES
 (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR
 COMPLETE INFORMATION.

SECTION 12. - - - - - ECOLOGICAL INFORMATION - - - - -
 DATA NOT YET AVAILABLE.

SECTION 13. - - - - - DISPOSAL CONSIDERATIONS - - - - -
 DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A
 CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.
 OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION 14. - - - - - TRANSPORT INFORMATION - - - - -
 CONTACT FLUKA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.

SECTION 15. - - - - - REGULATORY INFORMATION - - - - -
 EUROPEAN INFORMATION
 EC INDEX NO: 601-041-00-2
 TOXIC
 R 45
 MAY CAUSE CANCER.
 S 53
 AVOID EXPOSURE - OBTAIN SPECIAL INSTRUCTIONS BEFORE USE.
 S 45
 IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE
 IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
 REVIEWS, STANDARDS, AND REGULATIONS
 OEL=MAK
 IARC CANCER REVIEW: ANIMAL SUFFICIENT EVIDENCE IMEMDT 3,178,1973
 IARC CANCER REVIEW: ANIMAL SUFFICIENT EVIDENCE IMEMDT 32,299,1983
 IARC CANCER REVIEW: HUMAN NO ADEQUATE DATA IMEMDT 32,299,1983
 IARC CANCER REVIEW: GROUP 2A IMSDDL 7,56,1987
 OEL-FRANCE: CARCINOGEN, JAN1993
 OEL-GERMANY: CARCINOGEN, JAN1999
 OEL-NORWAY: TWA 0.04 MG/M3, JAN1999
 OEL-POLAND: TWA 0.004 MG/M3, JAN1999
 EPA GENETOX PROGRAM 1988, POSITIVE: CARCINOGENICITY-MOUSE/RAT; CELL
 TRANSFORM.-SA7/F344 RAT
 EPA GENETOX PROGRAM 1988, POSITIVE: CELL TRANSFORM.-BALB/C-3T3;
 SHE-FOCUS ASSAY
 EPA GENETOX PROGRAM 1988, POSITIVE: CELL TRANSFORM.-C3H/10T1/2; CELL
 TRANSFORM.-MOUSE EMBRYO
 EPA GENETOX PROGRAM 1988, POSITIVE: CELL TRANSFORM.-RLV F344 RAT EMBRYO
 EPA GENETOX PROGRAM 1988, POSITIVE: CELL TRANSFORM.-SA7/SHE; N
 CRASSA-FORWARD MUTATION
 EPA GENETOX PROGRAM 1988, POSITIVE: HISTIDINE REVERSION-AMES TEST
 EPA GENETOX PROGRAM 1988, POSITIVE: D MELANOGASTER SEX-LINKED LETHAL

EPA GENETOX PROGRAM 1988, POSITIVE: V79 CELL CULTURE-GENE MUTATION
EPA GENETOX PROGRAM 1988, POSITIVE/DOSE RESPONSE: SHE-CLONAL ASSAY
EPA GENETOX PROGRAM 1988, INCONCLUSIVE: CELL TRANSFORM.-MOUSE PROSTATE;
IN VIVO SCE-NONHUMAN
EPA GENETOX PROGRAM 1988, INCONCLUSIVE: IN VITRO-UDS-HUMAN FIBROBLAST
EPA TSCA SECTION 8(B) CHEMICAL INVENTORY
EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES
ON EPA IRIS DATABASE
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JANUARY 2001
NIOSH ANALYTICAL METHOD, 1994: POLYNUCLEAR AROMATIC HYDROCARBONS BY
EPLC, 5506; BY GC, 5515
NTP 9TH REPORT ON CARCINOGENS, 2000: REASONABLY ANTICIPATED TO BE HUMAN
CARCINOGEN

U.S. INFORMATION

THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.

CALIFORNIA PROPOSITION 65:

THIS PRODUCT IS OR CONTAINS CHEMICAL(S) KNOWN TO THE STATE OF
CALIFORNIA TO CAUSE CANCER.

SECTION 16. OTHER INFORMATION:

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO
BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA, ALDRICH,
FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING
OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR
PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.
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NIOSH Pocket Guide to Chemical Hazards

| | | | |
|--|--|---|-------------------|
| Nitric acid | | CAS 7697-37-2 | |
| HNO₃ | | RTECS QU5775000 | |
| Synonyms & Trade Names: Aqua fortis, Engravers acid, Hydrogen nitrate, Red fuming nitric acid (RFNA), White fuming nitric acid (WFNA) | | DOT ID & Guide 1760 154 (<=40% acid) 2031 157 (>40% acid) 2032 157 (fuming) | |
| Exposure Limits | NIOSH REL: TWA 2 ppm (5 mg/m ³) ST 4 ppm (10 mg/m ³) | | |
| | OSHA PEL: TWA 2 ppm (5 mg/m ³) | | |
| IDLH 25 ppm See: 7697372 | | Conversion: 1 ppm = 2.58 mg/m ³ | |
| Physical Description Colorless, yellow, or red, fuming liquid with an acid, suffocating odor. [Note: Often used in an aqueous solution. Fuming nitric acid is concentrated nitric acid that contains dissolved nitrogen dioxide.] | | | |
| MW: 63.0 | BP: 181°F | FRZ: -44°F | Sol: Miscible |
| VP: 48 mmHg | IP: 11.95 eV | | Sp.Gr(77°F): 1.50 |
| Fl.P: NA | UEL: NA | LEL: NA | |
| Noncombustible Liquid, but increases the flammability of combustible materials. | | | |
| Incompatibilities & Reactivities Combustible materials, metallic powders, hydrogen sulfide, carbides, alcohols [Note: Reacts with water to produce heat. Corrosive to metals.] | | | |
| Measurement Methods NIOSH 7903; OSHA ID165SG See: NMAM or OSHA Methods | | | |
| Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: No recommendation Provide: Eyewash (pH<2.5), Quick drench (pH<2.5) | | First Aid (See procedures) Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately | |
| Important additional information about respirator selection Respirator Recommendations NIOSH/OSHA Up to 25 ppm: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*/(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern*/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern*/(APF = 50) Any self-contained breathing apparatus with a full facepiece/ (APF = 50) Any supplied-air respirator with a full facepiece Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode*/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern*/Any appropriate escape-type, self-contained breathing apparatus | | | |
| Exposure Routes inhalation, ingestion, skin and/or eye contact | | | |
| Symptoms Irritation eyes, skin, mucous membrane; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion | | | |
| Target Organs Eyes, skin, respiratory system, teeth | | | |

See also: INTRODUCTION See ICSC CARD: 0183 See MEDICAL TESTS: 0158

[NIOSH Home](#) | [NIOSH Search](#) | [Site Index](#) | [Topic List](#) | [Contact Us](#)

AMOCO OIL -- REGULAR LEAD FREE GASOLINE - GASOLINE,AUTOMOTIVE
SERIAL SAFETY DATA SHEET
: 9130001487102
Manufacturer's CAGE: 15958
Part No. Indicator: A
Part Number/Trade Name: REGULAR LEAD FREE GASOLINE

General Information

Item Name: GASOLINE,AUTOMOTIVE
Company's Name: AMOCO OIL COMPANY
Company's Street: 200 EAST RANDOLPH DRIVE MC 1408
Company's City: CHICAGO
Company's State: IL
Company's Country: US
Company's Zip Code: 60601-6401
Company's Emerg Ph #: 800-447-8735 800-424-9300
Company's Info Ph #: 312-856-3931
Record No. For Safety Entry: 020
Tot Safety Entries This Stk#: 052
Status: SE
Date MSDS Prepared: 14JAN91
Safety Data Review Date: 23JUL93
Supply Item Manager: KY
MSDS Preparer's Name: R.G. FARMER
MSDS Serial Number: BRFLJ
Specification Number: VV-G-1690
Spec Type, Grade, Class: CL A,B,C,D,E, GR SPL
Hazard Characteristic Code: F2
Unit Of Issue: GL
Of Issue Container Qty: BULK
Of Container: BULK
Unit Weight: UNKNOWN
NRC/State License Number: NONE
Net Propellant Weight-Ammo: NONE

Ingredients/Identity Information

Proprietary: NO
Ingredient: GASOLINE
Ingredient Sequence Number: 01
Percent: UNKNOWN
NIOSH (RTECS) Number: LX3300000
CAS Number: 8006-61-9
OSHA PEL: 300 PPM/500 STEL
ACGIH TLV: 300 PPM/500STEL;9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: BENZENE (SARA III)
Ingredient Sequence Number: 02
Percent: 4.0
NIOSH (RTECS) Number: CY1400000
CAS Number: 71-43-2
OSHA PEL: 1PPM/5STEL;1910.1028
ACGIH TLV: 10 PPM; A2; 9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: ETHYL BENZENE (SARA III)
Ingredient Sequence Number: 03
Percent: 2.0
NIOSH (RTECS) Number: DA0700000

CAS Number: 100-41-4
OSHA PEL: 100 PPM/125 STEL
ACGIH TLV: 100 PPM/125 STEL 9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: TOLUENE (SARA III)
Ingredient Sequence Number: 04
Percent: 22.0
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM/150 STEL
ACGIH TLV: 50 PPM; 9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: XYLENES (O-,M-,P- ISOMERS) (SARA III)
Ingredient Sequence Number: 05
Percent: 10.0
NIOSH (RTECS) Number: ZE2100000
CAS Number: 1330-20-7
OSHA PEL: 100 PPM/150 STEL
ACGIH TLV: 100 PPM/150 STEL; 9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: CYCLOHEXANE (SARA III)
Ingredient Sequence Number: 06
Percent: 5.0
NIOSH (RTECS) Number: GU6300000
CAS Number: 110-82-7
OSHA PEL: 300 PPM
ACGIH TLV: 300 PPM, 9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: METHYL TERT-BUTYL ETHER (SARA III)
Ingredient Sequence Number: 07
Percent: 15
NIOSH (RTECS) Number: KN5250000
CAS Number: 1634-04-4
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

=====

Physical/Chemical Characteristics

=====

Appearance And Odor: LIQUID; COLOR NOT REPORTED; GASOLINE ODOR
Boiling Point: 80F-430F
Vapor Pressure (MM Hg/70 F): 7-15LB RVP
Vapor Density (Air=1): 3-4
Specific Gravity: 0.75
Solubility In Water: NEGLIGIBLE (<0.1%)

=====

Fire and Explosion Hazard Data

=====

Flash Point: -45F, -43C
Lower Explosive Limit: 1.3
Upper Explosive Limit: 7.6
Extinguishing Media: AGENTS FOR CLASS B FIRE (EG. DRY CHEMICAL, CARBON DIOXIDE, HALOGENATED AGENTS, FOAM, STEAM), WATER FOG.
Special Fire Fighting Proc: HMIS SUGGESTS TO USE A SELF-CONTAINED BREATHING APPARATUS WHENEVER FIGHTING A CHEMICAL FIRE.
Unusual Fire And Expl Hazrds: FLASHBACK HAZARD-VAPORS ARE HEAVIER THAN AIR

AND TRAVEL ALONG THE GROUND; FLOWING GASOLINE GENERATES STATIC ELECTRICITY.

Reactivity Data

Stability: YES

Cond To Avoid (Stability): HIGH HEAT AND SOURCES OF IGNITION.

Materials To Avoid: CHLORINE, FLUORINE AND OTHER STRONG OXIDIZERS.

Hazardous Decomp Products: CARBON DIOXIDE, CARBON MONOXIDE.

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NONE

Health Hazard Data

LD50-LC50 Mixture: TLV(GASOLINE)=300PPM

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: YES

Route Of Entry - Ingestion: NO

Health Haz Acute And Chronic: EYES:MAY CAUSE DISCOMFORT. SKIN:THE DEFATTING

PROPERTY OF THIS ITEM MAY CAUSE IRRITATION OR DERMATITIS. INHAL:VAPORS ARE

HARMFUL. INGEST:CAN CAUSE LUNG DAMAGE IF VOMITTED AFTER SWALLOWING.

Carcinogenicity - NTP: YES

Carcinogenicity - IARC: YES

Carcinogenicity - OSHA: YES

Explanation Carcinogenicity: CONTAINS Benzene [71-43-2] WHICH IS LISTED BY

NTP AND IARC AND REGULATED BY OSHA AS A CARCINOGEN.

Signs/Symptoms Of Overexp: INHAL:HEADACHE, DIZZINESS, DROWSINESS AND NAUSEA.

Med Cond Aggravated By Exp: NOT REPORTED.

Emergency/First Aid Proc: EYES:FLUSH WITH WATER;GET MEDICAL ATTENTION IF

IRRITATION PERSISTS. SKIN:REMOVE CONTAMINATED CLOTHING;WASH WITH SOAP AND

WATER;CALL PHYSICIAN IF IRRITATION PERSISTS. INHAL:REMOVE FROM EXPOSURE. GIVE

ARTIFICIAL RESPIRATION IF NEEDED. CALL PHYSICIAN. INGEST:DO NOT INDUCE

ING. GET VICTIM TO LAY ON LEFT SIDE WITH HEAD DOWN IF VOMITING OCCURS.

PROMPT QUALIFIED MEDICAL ATTENTION.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: REMOVE SOURCES OF IGNITION. VENTILATE; USE

WATER SPRAY TO DISPERSE VAPORS. ADSORB ON A NON-FLAMMABLE MATERIEL (EG.

DIATOMACEOUS EARTH, CLAY); PLACE IN AN APPROPRIATE CONTAINER FOR DISPOSAL.

Neutralizing Agent: NONE

Waste Disposal Method: WASTE IS RCRA HAZARD (IGNITABLE AND TOXIC). DISPOSE

OF IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.

Precautions-Handling/Storing: STORE IN FLAMMABLE LIQUID STORAGE AREA. KEEP

CONTAINER CLOSED.

Other Precautions: KEEP OUT OF SEWERS AND WATERWAYS. USE ONLY AS A MOTOR

FUEL.

Control Measures

Respiratory Protection: USE A SELF-CONTAINED BREATHING APPARATUS OR NIOSH

ORGANIC MIST RESPIRATOR IN THE LACK OF ENVIROMENTAL CONTROLS OR IN ENCLOSED

SPACES (ONLY USE SCBA).

Ventilation: ENVIRONMENTAL CONTROLS TO MAINTAIN EXPOSURE OF GASOLINE BELOW

300PPM.

Protective Gloves: NITRILE, VITON.

Eye Protection: SPLASH-PROOF TYPE.

Other Protective Equipment: CLOTHING TO PROTECT SKIN FROM LIQUID CONTACT.

Work Hygienic Practices: WASH HANDS. SEPERATE WORK CLOTHES FROM STREET

CLOTHES. LAUNDRER WORK CLOTHES BEFORE REUSE. KEEP FOOD OUT OF THE WORK AREA.

Safety & Health Data: NONE

Transportation Data

Trans Data Review Date: 93204

DOT PSN Code: GTN
DOT Proper Shipping Name: GASOLINE
Class: 3
ID Number: UN1203
DOT Pack Group: II
DOT Label: FLAMMABLE LIQUID
IMO PSN Code: HRV
IMO Proper Shipping Name: GASOLINE
IMO Regulations Page Number: 3141
IMO UN Number: 1203
IMO UN Class: 3.1
IMO Subsidiary Risk Label: -
IATA PSN Code: RMF
IATA UN ID Number: 1203
IATA Proper Shipping Name: MOTOR SPIRIT
IATA UN Class: 3
IATA Label: FLAMMABLE LIQUID
AFI PSN Code: MUC
AFI Prop. Shipping Name: GASOLINE
AFI Class: 3
AFI ID Number: UN1203
AFI Pack Group: II
AFI Basic Pac Ref: 7-7
Additional Trans Data: NONE

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 23JUL93
Label Number: UNKNOWN
Label Status: F
Common Name: REGULAR LEAD FREE GASOLINE
Signal Word: DANGER!
Acute Health Hazard-Moderate: X
Contact Hazard-Moderate: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: EYES:MAY CAUSE DISCOMFORT.SKIN:THE DEFATTING
PROPERTY OF THIS ITEM MAY CAUSE IRRITATION OR DERMATITIS.INHAL:VAPORS ARE
HARMFUL.INGEST:CAN CAUSE LUNG DAMAGE IF VOMITTED AFTER SWALLOWING. STORE IN
FLAMMABLE LIQUID STORAGE AREA.KEEP CONTAINER CLOSED. FIRST AID: EYES:FLUSH
WITH WATER;GET MEDICAL ATTENTION IF IRRITATION PERSISTS.SKIN:REMOVE
CONTAMINATED CLOTHING;WASH WITH SOAP AND WATER;CALL PHYSICIAN IF IRRITATION
PERSISTS.INHAL:REMOVE FROM EXPOSURE.GIVE ARTIFICIAL RESPIRATION IF NEEDED.
CALL PHYSICIAN.INGEST:DO NOT INDUCE VOMITING.GET VICTIM TO LAY ON LEFT SIDE
WITH HEAD DOWN IF VOMITING OCCURS.GET PROMPT QUALIFIED MEDICAL ATTENTION.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: AMOCO OIL COMPANY
Label Street: 200 EAST RANDOLPH DRIVE MC 1408
Label City: CHICAGO
Label State: IL
Label Zip Code: 60601-6401
Label Country: US
Label Emergency Number: 800-447-8735 800-424-9300

AMOCO OIL -- AMOCO NO. 1 DIESEL FUEL - DIESEL FUEL
SERIAL SAFETY DATA SHEET
9140002865286

Manufacturer's CAGE: 15958
Part No. Indicator: A
Part Number/Trade Name: AMOCO NO. 1 DIESEL FUEL

General Information

Item Name: DIESEL FUEL
Company's Name: AMOCO OIL CO
Company's Street: 200 E RANDOLPH DR MC 1408
Company's City: CHICAGO
Company's State: IL
Company's Country: US
Company's Zip Code: 60601-6401
Company's Emerg Ph #: 800-424-9300 SPL, 800-447-8735 HEAL
Company's Info Ph #: 312-856-5111
Record No. For Safety Entry: 015
Tot Safety Entries This Stk#: 048
Status: SE
Date MSDS Prepared: 24JUL89
Safety Data Review Date: 27SEP91
Supply Item Manager: KY
MSDS Preparer's Name: R. G. FARMER
MSDS Serial Number: BKSMV
Specification Number: VV-F-800
Spec Type, Grade, Class: DF-1 GRADE
Hazard Characteristic Code: F4
Unit Of Issue: GL
Type of Container: BULK

Ingredients/Identity Information

Proprietary: NO
Ingredient: PETROLEUM DISTILLATES
Ingredient Sequence Number: 01
Percent: UNKNOWN
NIOSH (RTECS) Number: 1001292PD
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: NAPHTHALENE (SARA III)
Ingredient Sequence Number: 02
Percent: UNKNOWN
NIOSH (RTECS) Number: QJ0525000
CAS Number: 91-20-3
OSHA PEL: 10 PPM/15 STEL
ACGIH TLV: 10 PPM/15 STEL; 9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: XYLENES (O-,M-,P- ISOMERS) (SARA III)
Ingredient Sequence Number: 03
Percent: UNKNOWN
NIOSH (RTECS) Number: ZE2100000
CAS Number: 1330-20-7
OSHA PEL: 100 PPM/150 STEL
ACGIH TLV: 100 PPM/150 STEL; 9192
Other Recommended Limit: NONE SPECIFIED

 Physical/Chemical Characteristics

Appearance And Odor: CLEAR, BRIGHT LIQUID.
 Boiling Point: 3F, -16C
 Specific Gravity: 0.81-0.85
 Decomposition Temperature: UNKNOWN
 Solubility In Water: NEGLIGIBLE BELOW .1%
 Viscosity: 1.4-2.2
 Corrosion Rate (IPY): -UNKNOWN -

 Fire and Explosion Hazard Data

Flash Point: 110F, 43C
 Flash Point Method: TCC
 Lower Explosive Limit: 6
 Upper Explosive Limit: 1.3
 Extinguishing Media: AGENTS APPROVED FOR CLASS B HAZARDS (CARBON DIOXIDE, FOAM, OR DRY CHEMICAL, HALOGENATED AGENTS, STEAM) OR WATER FOG.
 Special Fire Fighting Proc: NONE SPECIFIED BY MANUFACTURER.
 Unusual Fire And Expl Hazrds: COMBUSTIBLE LIQUID.

 Reactivity Data

Stability: YES
 Cond To Avoid (Stability): HIGH HEAT, OPEN FLAMES AND OTHER SOURCES OF IGNITION.
 Materials To Avoid: STRONG OXIDIZING AGENTS.
 Hazardous Decomp Products: NONE SPECIFIED BY MANUFACTURER.
 Hazardous Poly Occur: NO
 Conditions To Avoid (Poly): NONE SPECIFIED BY MANUFACTURER.

 Health Hazard Data

LD50-LC50 Mixture: LD50 (ORAL RAT) IS >5 G/KG
 Route Of Entry - Inhalation: YES
 Route Of Entry - Skin: YES
 Route Of Entry - Ingestion: YES
 Health Haz Acute And Chronic: EYE-NO SIGNIFICANT IRRITATION EXPECTED. SKIN-CAUSE SKIN IRRITATION ON PROLONGED/REPEATED CONTACT. INHALE-NO SIGNIFICANT HEALTH HAZARD IDENTIFIED FOR THE LIQUID FUEL. INGEST-LOW VISCOSITY PRODUCT. HARMFUL OR FATAL IF ASPIRATED INTO LUNGS.
 Carcinogenicity - NTP: NO
 Carcinogenicity - IARC: NO
 Carcinogenicity - OSHA: NO
 Explanation Carcinogenicity: THIS COMPOUND CONTAINS NO INGREDIENTS AT CONCENTRATIONS OF 0.1% OR GREATER THAT ARE CARCINOGENS OR SUSPECT CARCINOGENS.
 Signs/Symptoms Of Overexp: MAY CAUSE SKIN IRRITATION. INHALATION OF MIST OR HIGH CONCENTRATIONS OF VAPORS CAN PRODUCE HEADACHE, DIZZINESS AND NAUSEA AND POSSIBLY IRRITATION OF THE EYE, NOSE AND THROAT. ASPIRATION OF THIS PRODUCT INTO THE LUNGS CAN CAUSE CHEMICAL PNEUMONIA & CAN BE FATAL.
 Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
 Emergency/First Aid Proc: EYES-FLUSH EYES WITH PLENTY OF WATER. SKIN- WASH EXPOSED SKIN WITH SOAP AND WATER. REMOVE CONTAMINATED CLOTHING INCLUDING SHOES. CLEAN BEFORE REUSING. INHALATION-IF ADVERSE EFFECTS OCCUR, REMOVE TO UNCONTAMINATED AREA. INGESTION-DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL ATTENTION.

 Precautions for Safe Handling and Use

Steps If Matl Released/Spill: REMOVE OR SHUT OFF ALL IGNITION SOURCES. USE WATER SPRAY TO DISPERSE VAPORS. TREAT AS AN OIL SPILL. CONTAIN AND REMOVE BY MECHANICAL MEANS.
 Neutralizing Agent: NOT APPLICABLE

Waste Disposal Method: DISPOSAL MUST BE MADE IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS. ENCLOSED-CONTROLLED INCINERATION IS RECOMMENDED UNLESS DIRECTED OTHERWISE BY APPLICABLE ORDINANCES.

Precautions-Handling/Storing: STORE IN COMPATIBLE LIQUID STORAGE AREA.

Other Precautions: KEEP AWAY FROM IGNITION SOURCES (E.G., HEAT AND OPEN FLAMES). AVOID STRONG OXIDIZERS.

Control Measures

Respiratory Protection: USE WITH ADEQUATE VENTILATION.
Ventilation: LOCAL AND MECHANICAL (GENERAL) EXHAUST TO PROVIDE ADEQUATE VENTILATION.
Protective Gloves: WEAR PROTECTIVE GLOVES. E RUBBER GLOVES
Eye Protection: NONE REQUIRED.
Other Protective Equipment: WEAR PROTECTIVE CLOTHING. HAVE EMERGENCY EYE WASH AND SAFETY SHOWER AVAILABLE.
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING AND BEFORE EATING, DRINKING OR SMOKING. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.
Suppl. Safety & Health Data: AVOID PROLONGED OR REPEATED EXPOSURE. DO NOT GET ON SKIN OR IN EYES. THE USE OF EYE PROTECTION IS A GOOD INDUSTRIAL PRACTICE.

Transportation Data

Trans Data Review Date: 91270
DOT PSN Code: GTF
DOT Proper Shipping Name: GAS OIL OR DIESEL FUEL OR HEATING OIL, LIGHT
DOT Class: 3
DOT ID Number: UN1202
DOT Pack Group: III
DOT Label: FLAMMABLE LIQUID
SN Code: HNZ
Proper Shipping Name: FUEL OIL NO. 1
IMO Regulations Page Number: SEE 3375
IMO UN Number: 1223
IMO UN Class: 3.3
IMO Subsidiary Risk Label: -
IATA PSN Code: MTX
IATA UN ID Number: 1202
IATA Proper Shipping Name: GAS OIL
IATA UN Class: 3
IATA Label: FLAMMABLE LIQUID
AFI PSN Code: MTX
AFI Prop. Shipping Name: GAS OIL OR DIESEL FUEL OR HEATING OIL, LIGHT
AFI Class: 3
AFI ID Number: UN1202
AFI Pack Group: III
AFI Basic Pac Ref: 7-7
MMAC Code: NR
N.O.S. Shipping Name: FUEL OIL NO. 1
Additional Trans Data: COMBUSTIBLE LIQUID

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 27SEP91
IATA Status: G
Proper Shipping Name: AMOCO NO. 1 DIESEL FUEL
Signal Word: DANGER!
Acute Health Hazard-Severe: X
Contact Hazard-Moderate: X

Fire Hazard-Moderate: X

Reactivity Hazard-None: X

Special Hazard Precautions: REMOVE OR SHUT OFF ALL IGNITION SOURCES. USE WATER SPRAY TO DISPERSE VAPORS. TREAT AS AN OIL SPILL. CONTAIN AND REMOVE EYES-FLUSH EYES WITH PLENTY OF WATER. SKIN-WASH EXPOSED SKIN WITH SOAP AND WATER. REMOVE CONTAMINATED CLOTHING INCLUDING SHOES. CLEAN BEFORE REUSING. INHALATION-IF ADVERSE EFFECTS OCCUR, REMOVE TO UNCONTAMINATED AREA. INGESTION-DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL ATTENTION.

Protect Eye: Y

Protect Skin: Y

Protect Respiratory: Y

Label Name: AMOCO OIL CO

Label Street: 200 E RANDOLPH DR MC 1408

Label City: CHICAGO

Label State: IL

Label Zip Code: 60601-6401

Label Country: US

Label Emergency Number: 800-424-9300 SPL, 800-447-8735 HEAL



J. T. Baker Chemical Co.

222 Red School Lane, Phillipsburg, N.J. 08865
24-Hour Emergency Telephone -- (201) 859-2151

Chemrec # (800) 424-5300
National Response Center # (800) 424-8802

**MATERIAL
SAFETY DATA
SHEET**

H3880 -01
Effective: 10/08/85

Hydrochloric Acid

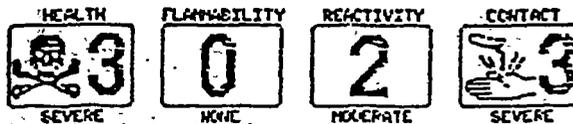
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SECTION I - PRODUCT IDENTIFICATION

Product Name: Hydrochloric Acid
Formula: HCl
Formula Wt: 36.46
CAS No.: 07647-01-0
NIOSH/RTECS No.: HW4025000
Common Synonyms: Muriatic Acid; Chlorohydric Acid; Hydrochloride
Product Codes: 9543, 9539, 9535, 5367, 9534, 9544, 9529, 9542, 4800, 9549, 9530, 9548, 9540, 9547, 9546, 9537

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System



Laboratory Protective Equipment



Precautionary Label Statements

**POISON! DANGER!
CAUSES SEVERE BURNS
MAY BE FATAL IF SWALLOWED**

Do not get in eyes, on skin, on clothing.
Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.

SECTION II - HAZARDOUS COMPONENTS

| Component | 3 | CAS No. |
|-------------------|-------|-----------|
| Hydrochloric Acid | 35-40 | 7647-01-0 |

SECTION III - PHYSICAL DATA

Boiling Point: 110°C (230°F) Vapor Pressure(mmHg): 212
Melting Point: N/A Vapor Density(air=1): 1.3

Continued on Page: 2



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Hydrochloric Acid

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 SECTION III - PHYSICAL DATA (Continued)

Specific Gravity: 1.19
 (H₂O=1)

Evaporation Rate: N/A
 (Butyl Acetate=1)

Solubility(H₂O): Complete (in all proportions) & Volatiles by Volume: 100

Appearance & Odor: Clear, colorless or slightly yellow fuming liquid.

 SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A NFPA 704M Rating: 3-0-0

Fire Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained (positive pressure if available) breathing apparatus with full facepiece. Move exposed containers from fire area, if it can be done without risk. Use water to keep fire exposed containers cool; do not get water inside containers.

Toxic Gases Produced

hydrogen chloride

 SECTION V - HEALTH HAZARD DATA

Toxicity: LC₅₀ (inhl-rat-1H) (ppm) - 3124
 LD₅₀ (ipr-mouse)(mg/kg) - 40
 LD₅₀ (oral-rabbit)(mg/kg) - 900

Effects of Overexposure

Liquid may cause severe burns to skin and eyes.
 Inhalation of vapors may cause severe irritation of the respiratory system.
 Inhalation of vapors may cause coughing and difficult breathing.

Emergency and First Aid Procedures

If swallowed, do NOT induce vomiting. Give water, milk, or milk of magnesia.
 In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
 Wash clothing before re-use.

Continued on Page: 3



J. T. Baker Chemical Co.

222 Red School Lane Pl Millipsum, N.J. 08865
24-Hour Emergency Telephone - (201) 859-2151

Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

**MATERIAL
SAFETY DATA
SHEET**

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Hydrochloric Acid

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SECTION VI - REACTIVITY DATA

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, moisture

Incompatibles: most common metals, water, strong bases, amines,
carbonates, metal oxide

Decomposition Products: hydrogen chloride

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing. Stop leak if you can do so without risk. Ventilate area. Neutralize spill with soda ash or lime. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

J. T. Baker Neutrasorb[®] or Neutrasol[®] "Low Na" acid neutralizers
are recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D002 (Corrosive Waste)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use adequate general or local exhaust ventilation to keep vapor and mist levels as low as possible.

Respiratory Protection: None required where adequate ventilation conditions exist. If airborne concentration is high, a chemical cartridge respirator with acid cartridge is recommended. If concentration exceeds capacity of cartridge respirator, a self-contained breathing apparatus is advised.

Eye/Skin Protection: Safety goggles and face shield, uniform, protective suit, acid-resistant gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA[™] Storage Color Code: White

Special Precautions

Keep container tightly closed. Store in corrosion-proof area.

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H3880 -01

Hydrochloric Acid

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Effective: 10/08/85

Issued: 10/09

SECTION IX - STORAGE AND HANDLING PRECAUTIONS (Continued)

Do not store near oxidizing materials.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

| | |
|----------------------|-----------------------------|
| Proper Shipping Name | Hydrochloric acid |
| Hazard Class | Corrosive material (liquid) |
| UN/NA | UN1789 |
| Labels | CORROSIVE |
| Reportable Quantity | 5000 LBS. |

INTERNATIONAL (I.M.O.)

| | |
|----------------------|-----------------------------|
| Proper Shipping Name | Hydrochloric acid, solution |
| Hazard Class | 8 |
| UN/NA | UN1789 |
| Labels | CORROSIVE |

N/A - Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

MATERIAL SAFETY DATA SHEET

BUFFER SOLUTION, pH 4.0

page 1 of 2

SECTION I

Field Environment Instrument
90 Miller Avenue
Braddock, PA 15104

revised: 2/15/00
contact: Bruce Ibe
phone: 800-393-4009

SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

NAME: BUFFER SOLUTION, pH 4.0

COMPONENTS:

- (1) potassium hydrogen phthalate (1%)
- (2) formaldehyde (0.04%)
- (3) water- balance

CAS:
877-24-7
50-00-0
7732-18-5

FORMULA/F.WT:
HOCOC6H4COOK / 204.23
CH2O / 30.03
H2O / 18.00

NFPA RATING (D-4): Health-0 Fire-0 Reactivity-0

SECTION III - PHYSICAL AND CHEMICAL CHARACTERISTICS

Boiling pt: >100C Melting pt: <0C Sp. gravity: 1.0 Evaporation rate: >1 TTE (ether=1) Vapor press: 14mmHg @ 20C Vapor density: 0.7 (water) pH: sl. acidic

Appearance/Odor: clear colorless solution - may be color coded (dye) according to pH.

Solubility: water - completely soluble.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash pt: n/a Explosion level-lower(LEL): n/a -upper(UEL): n/a Autoignition: n/a

Extinguishing Media: dry chemical, carbon dioxide, water spray or foam.

Firefighting: aqueous solution, negligible fire and explosion hazard when exposed to heat or flame. Move container if possible, avoid breathing vapors or dusts. No acute hazard.

SECTION V - REACTIVITY DATA

Stability: stable under normal temperatures and pressures up to boiling point (100C).

Condition to Avoid: incompatible with water reactive substances (oleum, sodium, etc.).

Hazardous Decomposition/Byproducts: boiling to dryness may release a trace of formaldehyde.

Hazardous Polymerization: not known to occur.

SECTION VI - HEALTH HAZARD DATA

Toxicity: potassium hydrogen phthalate is an eye, skin, and mucous membrane irritant.

Carcinogenicity: none classified by OSHA, IARC, NTP.

Exposure Limits: (NONE AFFECTING ACCEPTED LABORATORY USE OF STANDARD SOLUTIONS)

OSHA-PEL: ACGIH-TWA: -STEL: TLV CEILING: IDLH: OTHER:

Acute Health Hazards: potassium hydrogen phthalate may cause irritation of the eye, skin and respiratory tract. Redness and pain to the eye can occur. Ingestion can result in nausea, vomiting, and diarrhea.

Chronic Health Hazards: potassium hydrogen phthalate may cause respiratory irritation, dermatitis, conjunctivitis of the eye.

First Aid:

Inhalation: move victim to fresh air, give artificial respiration if necessary. Keep victim warm, at rest. Get medical aid.

Skin: remove contaminated clothing, wash area with soap and water, flush with large amounts of water (15-20min.) until no trace of the chemical remains. Get medical aid.

Eyes: flush eyes with large amounts of water, lifting upper/lower lids occasionally (15-20min.) until chemical is gone. Get medical aid.

Ingestion: give conscious victim 2 to 4 glasses of water, induce vomiting (touch finger to back of throat). Get medical aid immediately.

SECTION VII - PRECAUTION FOR SAFE HANDLING AND USE

Spills or Leaks: absorb with suitable material (vermiculite, diatomaceous earth, etc.), place in suitable container and label for disposal. Keep out of sewer and water sources.

Disposal: dispose in accordance with Federal, State, and local regulations.

Storage and handling: store at room temperature, keep tightly capped and away from water reactive materials.

SECTION VIII - CONTROL MEASURES

Respiratory Protection: provide general dilution ventilation. Respirators: none required.

Protective Clothing and Equipment: protective clothing and gloves required only as necessary to prevent prolonged contact with solution. Wear safety goggles, do not wear contact lenses when working with chemicals. An eye wash fountain should be available in the immediate work area.

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[Note: n/a means "not applicable" or data "not available".]

MATERIAL SAFETY DATA SHEET

BUFFER SOLUTION pH 7.0

page 1 of 2

SECTION I

Field Environmental Instrument
90 Miller Avenue
Braddock, PA 15104

revised: 2/15/00
contact: Bruce Ibe
phone: 800-393-4009

SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

NAME: BUFFER SOLUTION, pH 7.0

COMPONENTS:

| COMPONENTS: | CAS: | FORMULA/F.WT. |
|---|-----------|---|
| (1) sodium phosphate, dibasic, <1% | 7558-79-4 | Na ₂ HPO ₄ / 141.96 |
| (2) potassium phosphate, monobasic, <1% | 7778-77-0 | KH ₂ PO ₄ / 136.09 |
| (3) sodium hydroxide, <1% | 1310-73-2 | NaOH / 40.00 |
| (4) water, balance | 7732-18-5 | H ₂ O / 18.00 |

NFPA RATING (0-4): Health- n/a Fire- n/a Reactivity- n/a

SECTION III - PHYSICAL AND CHEMICAL CHARACTERISTICS

| | | | | | | |
|-------------|-------------|--------------|-------------------|---------------------------------|------------------------|-----|
| Boiling pt: | Melting pt: | Sp. gravity: | Evaporation rate: | Vapor press: | Vapor density: | pH: |
| >100C | <0C | 1.0 | >1 (ether=1) | 14mmHg @ 20C (H ₂ O) | 0.7 (H ₂ O) | 7 |

Appearance/Odor: clear colorless liquid (may be color coded for identification)/odorless. Solubility: soluble in water.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash pt: non-flammable Explosion level-lower(LEL): n/a Upper(UEL): n/a Autoignition: n/a

Extinguishing Media: dry chemical, carbon dioxide, water spray or foam.

Firefighting: negligible fire and explosion hazard when exposed to heat or flame. No acute hazards. Move container to safe area if possible. Avoid breathing vapors or dusts.

SECTION V - REACTIVITY DATA

Stability: stable under normal temperatures and pressures.

Condition to Avoid: incompatibilities - sodium phosphate dibasic may be corrosive to metals.

Hazardous Decomposition/Byproducts: thermal decomposition products may include toxic oxides of phosphorus, sodium and potassium.

Hazardous Polymerization: not known to occur.

SECTION VI - HEALTH HAZARD DATA

Toxicity: solutions containing sodium phosphate dibasic and potassium phosphate mono and dibasic are skin, eye, and mucous membrane irritants. Sodium phosphate, dibasic LD₅₀: 100mg/Kg IP-rat; 1000mg/Kg SubC-rat; 1000mg/Kg IM rat; 298mg/Kg IV-dog; 1075mg/Kg IV-rabbit.

Carcinogenicity: none classified by OSHA, IARC, NTP.

Exposure Limits: exposure limits have not been established by OSHA, NIOSH, ACGIH.

OSHA-PEL: ACGIH-TWA: -STEL: TLV CEILING: IDLH: OTHER:

Acute Health Hazards: inhalation of vapors may cause respiratory tract irritation and coughing. Contact with skin may result in irritation (sodium phosphate dibasic can cause erythema, pain, blisters). Eye irritation and possible corneal damage from sodium phosphate dibasic can occur. Ingestion can result in abdominal pain, vomiting, diarrhea, shock, coma, and death.

Chronic Health Hazards: repeated or prolonged contact may result in dermatitis, conjunctivitis, respiratory tract irritation. Chronic intoxication from sodium/potassium phosphates has not been reported in humans.

First Aid:

Inhalation: move victim to fresh air, give artificial respiration if necessary. Maintain airway; blood pressure - give oxygen if available. Keep victim warm, at rest. Get medical aid at once.

Skin: remove contaminated clothing, wash area with soap and water, flush with large amounts of water (15-20min.) until chemical is gone. Get medical aid at once.

Eyes: flush eyes with large amounts of water, lifting upper/lower lids occasionally (15-20min.) to remove all traces of chemical. Get medical aid at once.

Ingestion: give conscious victim water or milk to dilute alkali, allow vomiting to occur. Do not use gastric lavage or emesis. Medical personnel should examine for corrosive injury to mouth or throat. Irrigate affected areas with 1% acetic acid to neutralize the alkali. Get medical aid at once. No specific antidote, treat symptomatically and supportively.

SECTION VII - PRECAUTION FOR SAFE HANDLING AND USE

Spills or Leaks: no special precautions indicated. Small spills may be diluted with water and flushed away. Larger spills should be absorbed and placed in a marked container for disposal.

Disposal: dispose in accordance with Federal, State, and local regulations.

Storage and handling: store at room temperature, keep capped. Keep away from water reactive materials.

SECTION VIII - CONTROL MEASURES

Respiratory Protection: provide general dilution ventilation. Respirators: none required.

Protective Clothing and Equipment: wear protective clothing, gloves, splash-proof goggles to prevent contact. Provide an eye-wash fountain in the immediate work area. Do not wear contact lenses when working with chemicals.

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[Note: n/a means "not applicable" or data "not available".]

MATERIAL SAFETY DATA SHEET
BUFFER SOLUTION, pH 10.0

SECTION I

Field Environmental Instrument
90 Miller Avenue
Braddock, PA 15104

revised: 2/15/00
contact: Bruce Ibe
phone: 800-393-4009

SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

NAME: BUFFER SOLUTION, pH 10.0

COMPONENTS:

- (1) sodium tetraborate, 0.48%
- (2) sodium hydroxide, <1%
- (3) water, balance

CAS:

- 1303-98-4
- 1310-73-2
- 7732-18-5

FORMULA/F.WT.

- Na₂B₄O₇/381.37
- NaOH/40.00
- H₂O/18.00

NFPA RATING (0-4): Health- n/a Fire- n/a Reactivity- n/a

SECTION III - PHYSICAL AND CHEMICAL CHARACTERISTICS

Boiling pt: >100C Melting pt: <0C Sp. gravity: 1.0 Evaporation rate: n/a Vapor press: n/a Vapor density: n/a pH: 10

Appearance/Odor: clear, colorless solution (may be color coded for identification)/odorless.

Solubility: soluble in water.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash pt: non-flammable Explosion level-lower(LEL): n/a upper(UEL): n/a Autoignition: n/a

Extinguishing Media: dry chemical, carbon dioxide, water spray or foam.

Firefighting: Negligible fire and explosion hazard when exposed to heat or flame. Move container from fire area if possible. Avoid breathing vapors or dust. May produce toxic vapors of sodium oxide.

SECTION V - REACTIVITY DATA

Stability: stable under normal temperatures and pressures.

Condition to Avoid: Incompatible with water reactive materials (oleum, sodium), acids.

Hazardous Decomposition/Byproducts: thermal decomposition may produce toxic fumes of sodium oxide.

Hazardous Polymerization: not known to occur.

SECTION VI - HEALTH HAZARD DATA

Toxicity: Sodium Borate-- 1000mg/Kg Oral-infant LDLO; 709mg/Kg Oral man; 2660mg/Kg Oral-rat LD50; 2000mg/Kg Oral-mouse. Sodium hydroxide-- 40mg/Kg Intraperitoneal-mouse LD50; mutagenic data (RTECS).

Carcinogenicity: none classified by OSHA, IARC, NTP.

Exposure Limits:

| | OSHA-PEL: | ACGIH-TWA: | -STEL: | TLV CEILING: | IDLH: | NIOSH: |
|-----|-----------|------------|--------|--------------|-------|---------------|
| (1) | 10mg/M3 | 5mg/M3 | n/a | n/a | n/a | n/a |
| (2) | 2mg/M3 | 2mg/M3 | n/a | n/a | n/a | 2mg/M3/15min. |

Acute Health Hazards: sodium borate-inhalation may cause irritation to mucous membranes. May cause irritation to eyes and skin. Ingestion may cause irritation to gastrointestinal tract, nausea, vomiting, diarrhea, weakness, convulsions, and death. Sodium hydroxide-inhalation- 200mg/M3 is immediately dangerous to life and health. May cause irritation to respiratory tract, May cause irritation and burns to eyes and skin. Ingestion may cause severe abdominal pain, vomiting, irritation and burns to gastrointestinal tract.

Chronic Health Hazards: sodium borate-prolonged inhalation may cause bronchitis, laryngitis. Repeated skin may cause dermatitis. Repeated eye contact may cause conjunctivitis. Repeated ingestion may cause anorexia, irritation to gastrointestinal tract, nausea, vomiting, diarrhea, skin rashes. Sodium hydroxide-prolonged inhalation may cause bronchial irritation, coughing, bronchial pneumonia. Repeated skin contact may cause dermatitis. Repeated eye contact may cause conjunctivitis.

First Aid:

Inhalation: move victim to fresh air, give artificial respiration if necessary. Keep victim warm, at rest. Qualified medical personnel may administer oxygen. Get medical aid at once.

Skin: remove contaminated clothing, wash area with soap and water, flush with large amounts of water (15-20min.) until chemical is gone. Get medical aid at once.

Eyes: flush eyes with large amounts of water, lifting upper/lower lids occasionally (15-20min.) to remove all traces of the chemical. Get medical aid at once.

Ingestion: give conscious victim large quantities of water. Do not induce vomiting. Get medical aid at once.

SECTION VII - PRECAUTION FOR SAFE HANDLING AND USE

Spills or Leaks: absorb small spills with vermiculite, diatomaceous earth, or suitable absorbent. Scoop into container, label for disposal.

Disposal: dispose in accordance with Federal, State, and local regulations.

Storage and handling: store at room temperature, keep capped. Keep away from water reactive materials.

SECTION VIII - CONTROL MEASURES

Respiratory Protection: provide general dilution ventilation.

Respirators: use mist respirator, routine levels. Self-contained breathing apparatus with full facepiece (SCBAF).

Firefighting: any self-contained breathing apparatus with full facepiece operated in pressure-demand mode.

Protective Clothing and Equipment: protective clothing, gloves (neoprene, nitrile, PVC plastic), splash-proof goggles recommended. Do not wear contact lenses when working with chemicals.

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[Note: n/a means "not applicable" or data "not available".]

MATERIAL SAFETY DATA SHEET
CONDUCTIVITY STANDARDS

page 1 of 2

SECTION I

Field Environmental Instrument
90 Miller Avenue
Braddock, PA 15104

revised: 2/15/00
contact: Bruce Ibe
phone: 800-393-4009

SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

NAME: CONDUCTIVITY STANDARDS

| COMPONENTS: | CAS: | FORMULA/F.WT. |
|-----------------------------|-----------|---------------|
| (1) potassium chloride, <1% | 7447-40-7 | KCl / 74.56 |
| (2) water, balance | 7732-18-5 | H2O / 18.00 |

NFPA RATING (0-4): Health- n/a Fire- n/a Reactivity- n/a

SECTION III - PHYSICAL AND CHEMICAL CHARACTERISTICS

| | | | | | | |
|-------------|-------------|--------------|-------------------|--------------|----------------|---------|
| Boiling pt: | Melting pt: | Sp. gravity: | Evaporation rate: | Vapor press: | Vapor density: | pH: |
| >100C | <0C | >1.0 | < ether | 14mmHg @ 20C | 0.7 (water) | neutral |

Appearance/Odor: clear colorless solution/odorless.

Solubility: water - completely soluble

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash pt: non-flammable - Explosion level-lower(LEL): n/a -upper(UEL): n/a Autoignition: n/a

Extinguishing Media: dry chemical, carbon dioxide, water spray or foam.

Firefighting: avoid breathing vapors or dusts.

SECTION V - REACTIVITY DATA

Stability: stable at normal temperatures and pressures.

Condition to Avoid: Incompatibilities - none known.

Hazardous Decomposition/Byproducts: n/a

Hazardous Polymerization: not known to occur.

SECTION VI - HEALTH HAZARD DATA

Toxicity: potassium chloride solutions of less than 1% have not been investigated for toxicity.

Carcinogenicity: not classified by OSHA, IARC, NTP.

Exposure Limits: (none established)

OSHA-PEL: ACGIH-TWA: -STEL: TLV CEILING: IDLH: OTHER:

Acute Health Hazards: no toxic effects reported from inhalation or skin exposure. May be an eye, skin and gastrointestinal tract irritant.

Chronic Health Hazards: no effects reported.

First Aid:

Inhalation: maintain respiration, get medical aid if necessary. Keep victim warm, at rest.

Skin: wash area with soap and water after removing contaminated clothing. Get medical aid if necessary.

Eyes: immediately flush with water, lifting upper/lower lids occasionally until chemical is gone (15-20min.). Get medical aid.

Ingestion: do not induce vomiting. Get medical aid at once.

SECTION VII - PRECAUTION FOR SAFE HANDLING AND USE

Spills or Leaks: no special precautions required. Small spills may be washed down or absorbed with an inert absorbent (vermiculite, diatomaceous earth) and scoop into container for later disposal.

Disposal: dispose in accordance with Federal, State, and local regulations.

Storage and handling: store capped at room temperature, protect from water reactive materials (oleum, sodium).

SECTION VIII - CONTROL MEASURES

Respiratory Protection: none required for normal laboratory use. General dilution or local exhaust ventilation are adequate. Respirators are not required for laboratory use of this material.

Protective Clothing and Equipment: gloves, splash-proof goggles recommended. Do not wear contact lenses when working with chemicals. An eye-wash fountain should be in the immediate work area.

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[Note: n/a means "not applicable" or data "not available".]

Alconox, Inc. - Alconox Material Safety Data Sheet

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THE LEADER IN CRITICAL-CLEANING DETERGENTS

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Alconox® Material Safety Data Sheet

Alconox, Inc.
30 Glenn Street, Suite 309
White Plains, NY 10603

24 Hour Emergency Number - Chem-Tel (800) 255-3924

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I. Identification

| | |
|--------------------------------|------------------------------------|
| Product Name (shown on label): | ALCONOX |
| CAS Registry Number: | Not Applicable |
| Effective Date: | January 1, 2001 |
| Chemical Family: | Amionic Powdered Detergent |
| Mfr. Catalog #s for Sizes: | 1104, 1125, 1150, 1101, 1103, 1112 |

National Fire Protection Association 704 Labeling:



MJTSRN: 1100

II. Hazardous Ingredients/Identify Information

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. Physical/Chemical Characteristics

| | |
|-------------------------------------|--|
| Boiling Point (F): | Not Applicable |
| Vapor Pressure (mm Hg): | Not Applicable |
| Vapor Density (AIR=1): | Not Applicable |
| Specific Gravity (Water=1): | Not Applicable |
| Evaporation Rate (Butyl Acetate=1): | Not Applicable |
| Melting Point: | Not Applicable |
| Solubility in Water: | Appreciable-Soluble to 10% at ambient conditions |
| Appearance: | White powder interspersed with cream colored flakes. |
| pH: | 9.5 (1%) |

IV. Fire and Explosion Data

Alconox, Inc. - Alconox Material Safety Data Sheet

| | |
|--|--|
| Waste Disposal Method: | Biodegradable. Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products. |
| Precautions to be Taken in Storing and Handling: | Material should be stored in a dry area to prevent caking. |
| Other Precautions: | No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical. |

VII. Control Measures

| | |
|---|---|
| Respiratory Protection (Specify Type): | Dust mask - Recommended |
| Ventilation: | Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required |
| Protective Gloves: | Impervious gloves are useful but not required. |
| Eye Protection: | Goggles are recommended when handling solutions. |
| Other Protective Clothing or Equipment: | None |
| Work/Hygienic Practices: | No special practices required |

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INTERMOUNTAIN SPECIALTY GASES

206-05 E. 37th St., Boise, Idaho 83714 • 208-344-7336

Page 1

MATERIAL SAFETY DATA SHEET

Issue Date: 7/28/95

Chemtrec 1-800-424-9300

I. PRODUCT IDENTIFICATION

PRODUCT: Isobutylene
CHEMICAL NAME: 2-Methylpropene
FORMULA: C₄H₈
SYNONYMS: Isobutene, Methylpropene
CHEMICAL FAMILY: Alkene
MOLECULAR WEIGHT: 56.11
TRADE NAME: Isobutylene

II. HAZARDOUS INGREDIENTS

MATERIAL (CAS NO.): 2-Methylpropene (115-11-7)
VOL (%): 100
1990-1991 ACGIH TLV-TWA (OSHA-PEL): None currently established

III. PHYSICAL DATA

BOILING POINT, 760 MM. HG: -6.9°C (-19.6°F)
SPECIFIC GRAVITY (H₂O=1): 0.6002 @ 20°C
VAPOR DENSITY (AIR=1): 1.997 @ 21°C
PERCENT VOLATILES BY VOLUME: 100
FREEZING POINT: -140.34°C (-220.6°F)
VAPOR PRESSURE AT 20°C: 24.3 psig
SOLUBILITY IN WATER, % BY WT: Negligible
EVAPORATION RATE: (BUTYL ACETATE=1): High
APPEARANCE AND ODOR: Colorless gas at normal temperature and pressure; odor of coal gas, mild sweetish odor.

IV. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: See Section II
EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:
Swallowing: An unlikely route of exposure. This product is a gas at normal temperature and pressure but frostbite of the lips and mouth may result from contact with the liquid.
Skin Absorption: No evidence of adverse effects from available information.
Inhalation: May be mildly irritating to mucous membranes. At high concentrations, may cause drowsiness. At very high concentrations, may act as an asphyxiant and cause headache, drowsiness, dizziness, excitation, excess salivation, vomiting and unconsciousness. Lack of oxygen can cause frostbite.
Skin Contact: Exposure to liquid may cause frostbite.
Eye Contact: Exposure to liquid may cause frostbite.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE:

Repeated or prolonged exposure may cause dermatitis
OTHER EFFECTS OF OVEREXPOSURE: None currently known.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:

The defatting properties of the material may aggravate dermatitis.

EMERGENCY AND FIRST AID PROCEDURES:

Swallowing: This product is a gas at normal temperature and pressure.

Skin Contact: For exposure to liquid, immediately warm frostbite area with warm water (not to exceed 105°F). In case of massive exposure, remove clothing while showering in warm water. Call a physician.

Eye Contact: For contact with the liquid, immediately flush eyes thoroughly with water for at least 15 minutes. See a physician, preferably an ophthalmologist, immediately.

V. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (TEST METHOD): -76°C (-105°F) T.C.C.

AUTOIGNITION TEMPERATURE: 465°C (869°F)

FLAMMABLE LIMITS IN AIR, % BY VOLUME

LOWER: 1.8%

UPPER: 9.6%

EXTINGUISHING MEDIA: CO₂, dry chemical, water spray or fog.

SPECIAL FIRE FIGHTING PROCEDURES: Evacuate all personnel from danger area. Immediately cool containers with water spray from maximum distance taking care not to extinguish flames. Remove ignition sources if without risk. If flames are accidentally extinguished, explosive re-ignition may occur; therefore, appropriate measures should be taken: e.g. total evacuation. Reapproach with extreme caution. Use self-contained breathing apparatus. Stop flow of gas if without risk while continuing cooling water spray. Remove all containers from area of fire if without risk. Allow fire to burn out. On site fire brigades must comply with A 29 CFR 1910.156

UNUSUAL FIRE AND EXPLOSION HAZARDS: Flammable gas. Forms explosive mixtures with air and oxidizing agents. Container may rupture due to heat of fire. Do not extinguish flame due to possibility of explosive re-ignition. Vapors formed from this product may travel or be moved by air currents and ignited by pilot lights, or other flames, smoking, sparks, heaters, electrical equipment, static discharges or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with approved device. No part of a container should be subjected to a temperature higher than 52°C (approximately 125°F). Most containers are provided with a pressure-relief device designed to vent contents when they are exposed to elevated temperatures.

VI. REACTIVITY DATA

STABILITY: Stable

CONDITIONS TO AVOID: See Section IX.

INCOMPATIBILITY (Materials to avoid): Oxidizing agents, halogens, acids.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition or burning may produce CO/CO₂.

HAZARDOUS POLYMERIZATION: May occur.

CONDITIONS TO AVOID: Elevated temperatures and pressures and/or the presence of a catalyst.

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER: Forms explosive mixtures with air (See Section IX). Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if without risk. Reduce vapors with fog or fine water spray. Shut off leak if without risk. Ventilate area of leak or move leaking container to well-ventilated area. Flammable vapors may spread from spill. Before entering area, especially confined areas, check atmosphere with appropriate device.

WASTE DISPOSAL METHOD: See Section V - "Unusual Fire and Explosion Hazards." Prevent waste from contaminating surrounding area. Keep personnel away. Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with Federal, state and local regulations.

VIII. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE): Select in accordance with OSHA 29 CFR 1910.134. Respirators shall be acceptable to MSHA and NIOSH.

VENTILATION:

LOCAL EXHAUST: Explosion proof system is acceptable.

MECHANICAL (general): Inadequate, See "Special".

SPECIAL: Use only in a closed system.

OTHER: N/A, see "Special".

PROTECTIVE GLOVES: Neoprene.

EYE PROTECTION: Select in accordance with OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Protective clothing where needed.

Select in accordance with OSHA 29 CFR, 1910.132 and 1910.133.

IX. SPECIAL PRECAUTIONS

DANGER: Flammable, liquefied gas under pressure. Use piping and equipment adequately designed to withstand pressures to be encountered. May form explosive mixtures with air. Ground all equipment. Only use spark proof tools and explosion proof equipment. Keep away from heat, sparks, and open flame. Store and use with adequate ventilation at all times. Use only in a closed system. Close valve when not in use and empty. Keep away from oxidizing agents.

Page 4

MIXTURES: When two or more gases, or liquified gases are mixed, their hazardous properties may combine additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygenist, or other trained person when you make your safety evaluation of the product. Remember, gases and liquids have properties which can cause serious injury or death.

Be sure to read and understand all labels and other instructions supplied with all containers of this product.

MATERIAL SAFETY DATA SHEET



NO. 314

Original: August 30, 1982 Supersedes: July 9, 1997 Revised: January 22, 1998Product Name: **SPENT POTLINING**

Aluminum Company of America, 425 Sixth Avenue Alcoa Building, Pittsburgh, PA 15219-1850 USA

Emergency Phone: 1-412-553-4001

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Chemical Formula: Carbon cathode and insulation lining removed from aluminum smelting electrolytic cells

Other Designation: Potlining (Dug, Spent, Used), Potliner (Dug, Spent, Used), Spent Cathodes, SPL

Product Use: Waste

Manufacturer: Alcoa, various locations

USA Phones: Chemtrec: 1-800-424-9300; Health & Safety: 1-412-553-4649

2. COMPOSITION/INFORMATION ON INGREDIENTS

| Component | CAS No. | % by Weight | Form | EXPOSURE LIMITS (TWA in mg/m ³) | |
|---------------------------------|------------|-------------|--------------------------|---|----------------------------|
| | | | | ACGIH TLV | OSHA PEL |
| Carbon | 7440-44-0 | 40 | — | — | — |
| Tri-sodium hexafluoro aluminate | 13775-53-6 | 26 | Fluoride as F | 2.5 | 2.5 |
| Sodium aluminate | 1302-42-7 | 12 | — | — | — |
| Aluminum oxide (non-fibrous) | 1344-28-1 | 9 | Total dust Respirable | 10 — | 15 5 |
| Silica (amorphous) | 7631-86-9 | 2-7 | — | 10 | 80 ÷ [% SiO ₂] |
| Calcium fluoride | 7789-75-5 | 5 | Fluoride as F | 2.5 | 2.5 |
| Iron Sulfide | 1317-37-9 | 1 | — | — | — |
| Cyanide | — | 0.2 | Soluble cyanide salts | 5 (ceiling) | 5 |

Compounds that are generated by spent potlining on contact with water or acids are listed in Section 8.

3. HAZARDS INFORMATION

EMERGENCY OVERVIEW

Solid; gray to black colored variable sized lumps. Non-flammable.

Contact with water can generate irritating, toxic and/or flammable gases (e.g., ammonia, phosphine, methane and hydrogen). Contact with acids can generate additional toxic gases of hydrogen cyanide and hydrogen sulfide.

Can cause severe irritation to the eyes and skin, especially when wet. Can cause respiratory tract irritation.

POTENTIAL HEALTH EFFECTS (If dusts or fumes are generated by processing):

EYES: Can cause severe irritation, especially when wet.

SKIN: Can cause severe irritation, especially when wet.

INHALATION: Can cause respiratory tract irritation and fluid in the lungs (pulmonary edema). Inhalation of gases generated on reaction with water or acids can cause severe irritation, headaches, weakness, confusion, nausea, and asphyxiation.

Due to the **alkaline nature** of spent potlining, severe eye and skin irritation can occur subsequent to handling. Dusts can be irritating to the upper respiratory tract.**Fluorides** can cause eye, skin and respiratory tract irritation. Overexposure to fluoride dust over prolonged periods can result in fluoride deposition in bones and cartilage as evidenced by x-ray changes (fluorosis) which may be accompanied by stiffness of joints.

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Acute overexposures to **cyanide compounds (including hydrogen cyanide)** can cause headaches, dizziness, irregular heartbeats, unconsciousness, coma and death. Cyanide compounds are fast acting and can be fatal within minutes. Chronic overexposures can cause irritation of the eyes and upper respiratory tract, dermatitis, skin ulcers, nose bleeds, dizziness, confusion, and damage to the kidneys and central nervous system. Cyanides can be absorbed through the skin in toxic amounts.

Dust containing **carbon** can cause eye, mucous membrane, and upper respiratory tract irritation. Overexposure to dust containing carbon can cause scarring of the lungs.

Alumina is a low health risk by inhalation and should be treated as a nuisance dust as specified by the ACGIH.

Aqueous ammonia (ammonium hydroxide): Eye contact can cause corrosive burns and corneal damage. Skin contact can cause corrosive chemical burns of all tissues that come in contact with the liquid. Inhalation of high levels of mist or vapors can cause spasm and swelling of the throat, upper airway obstruction, bronchial tube constriction, and fluid in the lungs (pulmonary edema). Chronic overexposures may cause damage to the lungs.

Phosphine may cause irritation of exposed mucous membranes, depression of central nervous system and can cause lung edema. Acute poisoning with phosphine may cause headache, malaise, vomiting, stomach pain, cough, drowsiness, seizures and difficult breathing.

Hydrogen sulfide gas may cause headache, confusion, nausea, and irritation of the eyes and upper respiratory tract. Severe exposures may result in asphyxiation and death.

Medical conditions aggravated by exposure to the product:

Skin rashes, asthma and chronic lung disease.

4. FIRST AID MEASURES

EYES: Flush eyes with plenty of water or saline for at least 20 minutes. Consult a physician.

SKIN: Wash with soap and water for at least 15 minutes. Consult a physician if irritation persists.

INHALATION: Remove to fresh air. Check for clear airway, breathing, and presence of pulse. Provide CPR for persons without pulse or respirations. Consult a physician.

INGESTION: If swallowed, dilute by drinking large amounts of water. *Never give anything by mouth to a convulsing or unconscious person. Do not induce vomiting.* Consult a physician immediately.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES: Spent potlining does not normally burn.

FIRE/EXPLOSION: Contact of spent potlining with water can generate toxic and/or flammable gases (e.g., ammonia, phosphine, methane and hydrogen). These gases could present a health or explosion hazard in confined or poorly ventialed spaces. Rates of generation under fire conditions are unknown.

EXTINGUISHING MEDIA Use extinguishing agent suitable for surrounding materials.

FIRE FIGHTING INSTRUCTIONS: Fire fighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

6. ACCIDENTAL RELEASE MEASURES

Minimize dusting and skin contact during clean-up. Collect and place in tanks or containers (drum, roll-off). Prevent water run-on and contact with precipitation.

7. HANDLING AND STORAGE

Store spent potlining in a dry, well ventilated area; do not store spent potlining directly on the ground.

During storage and transportation, protect spent potlining from water run-on, including precipitation.

Collect, test, and if necessary, treat any run-off. Prevent contact of spent potlining with acids.

Avoid practices which reduce the alkalinity of spent potlining.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Use with adequate ventilation to meet exposure limits listed in Section 2 .

RESPIRATORY PROTECTION: Use NIOSH-approved respiratory protection as specified by an Industrial Hygienist or other qualified professional if potential for overexposure exists.

EYE PROTECTION: Wear appropriate eye protection (e.g., safety glasses) to prevent any eye contact.

SKIN PROTECTION: Wear appropriate clothing to prevent skin irritation.

COMPOUNDS WHICH MAY BE GENERATED ON CONTACT WITH WATER OR ACIDS

| Component | CAS No. | EXPOSURE LIMITS (TWA in ppm) | |
|---|-----------|------------------------------|--|
| | | ACGIH TLV | OSHA PEL |
| Compounds Generated on Contact with Water | | | |
| Ammonia | 7664-41-7 | 25, 35 (STEL) | 50 |
| Phosphine | 7803-51-2 | 0.3, 1 (STEL) | 0.3 |
| Methane | 74-82-8 | — | — |
| Hydrogen | 1333-74-0 | — | — |
| Additional Compounds Generated on Contact with Acids | | | |
| Hydrogen cyanide | 74-90-8 | 4.7 (ceiling) as CN | 10 |
| Hydrogen sulfide | 7783-06-4 | 10, 15 (STEL) | 20 (ceiling), 50 (10 minute peak, once per 8-hr shift) |

See Section 3 for related health effects.

The addition of acid to spent potlining releases hydrogen cyanide and hydrogen sulfide gases in concentrations which can be potentially lethal.

The concentration of ammonia is generally much greater than that of phosphine. However, the degree of irritation perceived from the ammonia is not necessarily a reliable means of determining if potentially harmful concentrations of phosphine are present.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical Form: Solid (variable sized lumps)

Boiling Temperature: Not applicable

Freeze-Melt Temperature: Not determined

Vapor Pressure: Not applicable

Evaporation Rate: Not applicable

Specific Gravity: 2.6-2.9

Density: 86 lb/ft³ (loose packed; 7/16" size lumps) or 1.38 g/cm³

Water Solubility: 10% of the material is water soluble fluoride

pH: 11-12 (20% solution)

Color: Gray to Black

Odor: Slight ammonia odor

10. STABILITY AND REACTIVITY

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CAUTION: Explosive gases may accumulate to hazardous levels if stored in a poorly ventilated, confined space. Spent potlining can react with water or moisture in air to release flammable gases (e.g., methane, hydrogen, ammonia and phosphine). These flammable gases are released slowly for significant lengths of time and present a fire hazard in a poorly ventilated, confined space.

Ammonia and phosphine are also toxic and may accumulate to hazardous levels if material is stored in a poorly ventilated, confined space.

Leaching with water will extract cyanides and fluorides.

Contact with acids can result in the formation and release of appreciable amounts of hydrogen cyanide (HCN) and hydrogen sulfide (H₂S) gases.

11. TOXICOLOGICAL INFORMATION

LD₅₀ or LC₅₀ found for oral, dermal or inhalation routes of administration: No information found.

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL/CHEMICAL FATE INFORMATION: No information found.

13. DISPOSAL CONSIDERATION

Dispose in a federal or state approved hazardous waste treatment facility or hazardous waste landfill segregated from acid wastes and preferably with alkaline wastes.

RCRA Hazardous Waste No. Federally regulated as K088. State regulation varies; refer to individual state RCRA regulation.

14. TRANSPORT INFORMATION

| U.S.A. DOT: | Note(s) |
|---|-----------|
| PSN #1 Waste Aluminum processing by-products, 4.3, UN 3170, PG III, RQ, (K088), Dangerous when wet, DOT-E 11602. | (1)(4)(6) |
| PSN #2 Aluminum processing by-products, 4.3, UN 3170, PG III, RQ, (K088) Dangerous when wet, DOT-E 11602. | (2)(4)(6) |
| PSN #3 Aluminum processing by-products, 4.3, UN 3170, PG III, RQ, (cyanides), Dangerous when wet, DOT-E 11602. | (3)(5)(6) |

Note (1) Applies to SPL when shipped on a hazardous manifest [e.g. Carbon Cathode Lining, 1st cut; and mixed 1st and 2nd cut (Insulation Lining)]. STCC 48-163-16 applies and is required for rail. Land Banned (LDR) = Yes, effective 97-07-08.

Note (2) Applies to SPL when shipped non-manifested (e.g. treatability study, samples). Includes 1st cut, or 1st and 2nd cut mixed. STCC 49-163-21 applies and is required for rail. Land Banned (LDR) = No.

Note (3) Applies to SPL, 2nd cut (insulation Lining) only, when shipped as a waste with or without a manifest, or non-waste (e.g. treatability studies or samples). STCC 49-163-21 applies and is required for rail. Land Banned (LDR) = n/a. Not a hazardous waste, therefore the word waste should not appear in the proper shipping name (PSN).

Note (4) Delete "RQ" and "(K088)" references for packages 10 lb. or less.

Note (5) Delete "RQ" and "(cyanides)" reference in packages 5,000 lb. or less.

Note (6) In the U.S., Wet dug, which may only meet a class 8 definition, can ship as a UN 3170.

General: Shipment forbidden wet or hot. In the U.S., bulk material may be loaded in non-specification 55 gallon drums when loaded into dedicated, sift-proof trailers or rail cars per Exemption DOT-E 11602.

Canadian TDG Hazard Class & PIN: 4.3, UN 3170

15. REGULATORY INFORMATION**Federal Regulations**

TSCA Status: Components of this product are listed on the TSCA inventory.

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CERCLA HAZARDOUS SUBSTANCES: Cyanide (soluble salts and complexes).

SARA TITLE III:

Section 311/312 Physical and Health Hazard Categories: Immediate (acute), delayed (chronic).

Section 313 Toxic Chemicals: Cyanide (soluble compounds).

International Regulations

CANADIAN DOMESTIC SUBSTANCES LIST: All components of this product are listed on the Canadian DSL.

EUROPEAN COMMUNITY: All components of this product are listed on ECOIN, the European Core Inventory.

AUSTRALIA: All components of this product are listed on the AICS inventory.

16. OTHER INFORMATION

MSDS STATUS: Changes in Sections 3 and 16.

MSDS System Number: 115802

PREPARED BY: Hazardous Materials Control Committee

- Guide to Occupational Exposure Values-1996, Compiled by the American Conference of Governmental Industrial Hygienists (ACGIH).
- Documentation of the Threshold Limit Values and Biological Exposure Indices, Sixth Edition, 1991, Compiled by the American Conference of Governmental Industrial Hygienists, Inc. (ACGIH).
- NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, June 1994.
- Dangerous Properties of Industrial Materials, Sax, N. Irving, Van Nostrand Reinhold Co., Inc., 1984.
- Patty's Industrial Hygiene and Toxicology: Volume II: Toxicology, 4th ed., 1994, Patty, F. A.; edited by Clayton, G. D. and Clayton, F. E.: New York: John Wiley & Sons, Inc.

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LEGEND:

| | | | |
|------------------|---|--------|---------------------------------|
| ACGIH | American Conference of Governmental Industrial Hygienists | atm | atmosphere |
| AICS | Australian Inventory of Chemical Substances | cm | centimeter |
| CAS | Chemical Abstract Services | g, gm | gram |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act | in | inch |
| CFR | Code of Federal Regulations | kg | kilogram |
| DOT | Department of Transportation | lb | pound |
| DSL | Domestic Substances List (Canada) | m | meter |
| ECOIN | European Core Inventory | mg | milligram |
| EPA | Environmental Protection Agency | ml, ML | milliliter |
| IARC | International Agency for Research on Cancer | mm | millimeter |
| LC ₅₀ | Lethal concentration (50 percent kill) | n.o.s. | not otherwise specified |
| LC _{Lo} | Lowest published lethal concentration | ppb | parts per billion |
| LD ₅₀ | Lethal dose (50 percent kill) | ppm | parts per million |
| LD _{Lo} | Lowest published lethal dose | psia | pounds per square inch absolute |
| NFPA | National Fire Protection Association | μ, u | micron |
| NIOSH | National Institute for Occupational Safety and Health | μg | microgram |
| NTP | National Toxicology Program | | |
| OSHA | Occupational Safety and Health Administration | | |
| PEL | Permissible Exposure Limit | | |
| PIN | Product Identification Number | | |
| RCRA | Resource Conservation and Recovery Act | | |
| SARA | Superfund Amendments and Reauthorization Act | | |
| STEL | Short Term Exposure Limit | | |
| TCLP | Toxic Chemicals Leachate Program | | |
| TDG | Transportation of Dangerous Goods | | |
| TLV | Threshold Limit Value | | |
| TSCA | Toxic Substances Control Act | | |
| TWA | Time Weighted Average | | |