DECLARATION FOR THE RECORD OF DECISION
CRAB ORCHARD NATIONAL WILDLIFE REFUGE
PCB AREAS OPERABLE UNIT

SITE NAME AND LOCATION

Sangamo Electric Dump/Crab Orchard National Wildlife Refuge
Carterville, Illinois

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the PCB Areas operable unit at the Crab Orchard National Wildlife Refuge Site near Carterville, Illinois, which was chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Contingency Plan. This decision is based on the administrative record for this Site.

The United States Department of the Interior, the current owner of the site, concurred on the proposed plan for the PCB Areas Operable Unit. At this time, the Department has not concurred on the final selected remedy.

The State of Illinois concurs with the treatment component for contaminated soils and sediments in the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present on imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This operable unit is the second of several planned for the Site. The remedy for the second operable unit addresses four distinct sites which contain soil and sediment contaminated primarily with polychlorinated biphenyls (PCBs) and lead. A Record of Decision was issued in March 1990 by U.S. EPA for a first operable unit, consisting of three distinct sites primarily contaminated with metals such as cadmium, chromium and lead. The remedy selected for the PCB Areas operable unit addresses the principal threats posed by the sites comprising the operable unit. The major components of the selected remedy include:

- Excavation of contaminated soil and sediment;

- Treatment of all excavated soil and sediment contaminated with PCBs in excess of established remediation goals using mobile incineration technology, or using in situ vitrification (ISV) technology, if a demonstration is made that ISV can meet or exceed the performance standards established for incineration technology.

- Stabilization/fixation of residues from incineration and non-incinerated soil and sediment contaminated with metals (if determined to be RCRA hazardous because of their metals leachability), to render them non-hazardous;

- On-site disposal of non-RCRA hazardous stabilized/fixed material and untreated residues exceeding the clean up targets in a landfill meeting the requirements of RCRA Subtitle D and 35 Illnois Administrative Code Part 807;

- Backfilling, placement of low-permeability caps and closure of areas where contamination is below the excavation criteria or from where contaminated soil and sediment have been excavated;

- Environmental monitoring and maintenance during and after remedial construction to ensure the effectiveness of the remedial action.

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are legally applicable or relevant and appropriate for this remedial action, is cost-effective and consistent with achieving a permanent remedy. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for this Site.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Aug 1, 1990
Date

FOR Valdas V. Adamkus
Regional Administrator

DECISION SUMMARY - PCB AREAS
CRAB ORCHARD NATIONAL WILDLIFE REFUGE
CARTERVILLE, ILLINOIS

I. SITE NAME, LOCATION AND DESCRIPTION

Sangamo Electric Dump / Crab Orchard National Wildlife Refuge
Carterville, Illinois

The Crab Orchard National Wildlife Refuge (the Refuge) site lies near Marion, Carterville and Carbondale, Illinois, primarily within Williamson County, extending into Jackson, Union and Johnson Counties in southern Illinois (See Figure 1 in Appendix A). The Refuge consists of approximately 43,000 acres of multiple-use land. The land is used as a wildlife refuge, and also for recreational, agricultural and industrial purposes.

The western end of the Refuge around Crab Orchard Lake is used for recreational purposes while the eastern end is used for manufacturing facilities. Access to the eastern portion is closed to the public, except for limited access to workers at the industrial sites and restricted access to hunters. The study sites which were the focus of the Remedial Investigation (RI) and Feasibility Study (FS) are located in the eastern, closed portion of the Refuge (See Figure 2 in Appendix A).

There are twelve lakes, including Crab Orchard Lake located within the Refuge. Crab Orchard Lake supports a large population of sports fish and is used as a drinking water source for the Refuge and nearby Marion Federal Penitentiary. Wetlands are found in some areas adjacent to the lakes. Wildlife on the Refuge include many game and non-game species. The Refuge has habitat suitable for one endangered species, the Indiana bat, and definitely houses another, with two active bald eagle nests.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Crab Orchard National Wildlife Refuge is owned by the U.S. government and is currently administered by the U.S. Fish and Wildlife Service (FWS) a bureau of the Department of the Interior (DOI). The Refuge was previously administered by the Department of Defense (DOD). During the DOD administration portions of the Refuge were leased to industrial tenants, primarily for the purpose of munitions and explosives manufacturing. In 1947, the DOD transferred the Refuge to the DOI. Several other industries moved onto the site to occupy buildings formerly used by the wartime industries. The production of explosives continued to be the principal industry on the Refuge. Other industries included the manufacturing of PCB transformers and capacitors, automobile parts, fiberglass boats, corrugated boxes, plated metal parts, tape, flares and jet engine starters. Manufacturing, primarily munitions, continues at the Site.

Congress, in passing the law that created the Crab Orchard National Wildlife Refuge, mandated a continuing industrial presence on Refuge property. Congress required that the lands must be used in a manner

consistent with the needs of industry, as well as those of agriculture, recreation, and wildlife conservation. The accompanying legislative history indicates that Congress viewed the industrial development of the Crab Orchard National Wildlife Refuge as central to the viability of the Refuge.

Disposal activities at the site apparently included dumping of waste material in unused areas of the site, and landfilling of waste materials in unlined landfills which were covered with earth. Other disposal might have included discharge of liquid material to surface water bodies and impoundments. The types of materials disposed of at the Refuge reflect the broad range of substances used in the various industrial and Refuge activities. There are no good estimates of the total volume of disposed material.

The site was proposed for the National Priorities List (NPL) in 1984 and finalized on the NPL in July 1987. The relative roles and responsibilities of other Federal Agencies and the United States Environmental Protection Agency (U.S. EPA) at Federal Facilities like Crab Orchard National Wildlife Refuge are prescribed in Section 120 of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), as amended, and Executive Order Number 12580. DOI is responsible for remedial action and compliance with CERCLA. The U.S. EPA is responsible for providing assistance and oversight to DOI for actions at the site taken pursuant to CERCLA. In addition, U.S. EPA, after consultation with DOI, is responsible for final remedy selection at the Site.

In addition to the roles and responsibilities of the DOI and U.S. EPA at the Refuge discussed above, DOD may have some responsibility for some of the hazardous substances at the Site, in accordance with Section 107 of CERCLA and under the Defense Environmental Restoration Program. Various other private parties may have responsibility for the hazardous substances at the Refuge in accordance with Section 107 of CERCLA.

In February 1986, the U.S. EPA and FWS entered into a Federal Facility Initial Compliance Agreement, which required the performance of a Remedial Investigation and Feasibility Study (RI/FS). The FWS, in conjunction with Sangamo Weston, Inc., a potentially responsible party (PRP) at the site, began an RI/FS at the Refuge in May 1986. In August 1988, an RI Report was finalized and made available to the public. In August 1989, the FS Report and proposed plans for the first two operable units (the Metals Areas and the PCB Areas) were made available to the public. On March 30, 1990, a Record of Decision (ROD) selecting the final remedy for the Metals Areas operable unit was signed by U.S. EPA, with the concurrence of DOI. The U.S. EPA served as the supporting agency during the RI/FS, and was lead Agency for the development of the proposed plans and the Metals Areas ROD and this ROD. The Illinois Environmental Protection Agency (IEPA) served as a supporting agency for the FS, proposed plans and this ROD.

A draft Interagency Agreement (IAG), pursuant to CERCLA Section 120(e)(2) is currently being developed between U.S. EPA, DOI, DOD and IEPA. The Department of the Army (DA) may participate in the IAG. Negotiations on this IAG were started in August 1989, and are expected to delineate Agency roles and responsibilities for future activities and will stipulate schedules for completion of the remedial action specified in this ROD and remedial action for other operable units.

In July 1989, DOI issued letters to approximately sixty individuals and entities pursuant to CERCLA Section 104(e), to request information relating to the identification, nature and quantity of materials treated, stored or disposed of at the Refuge, or transported to the Refuge; the nature or extent of any releases or threatened releases of a hazardous substance at the Refuge; and information relating to the recipient's ability to pay for a cleanup. DOI and U.S. EPA are jointly reviewing the responses to these letters to determine whether any of the respondents would be considered PRPs at the site. Special notice letters have not been issued to any PRPs at the site to date.

III. COMMUNITY RELATIONS HISTORY

Public participation requirements under CERCLA Sections 113(k)(2)(B) and 117 were satisfied during the RI/FS process. U.S. EPA has been primarily responsible for conducting the community relations program for this Site, with the assistance of FWS. The following public participation activities were conducted during the RI/FS:

- Establishment of Administrative Record repositories at the Southern Illinois University's Morris Library in Carbondale, Illinois and at U.S. EPA, Region V Office in Chicago, Illinois.

- Establishment of additional information repositories at Marion Carnegie Public Library in Marion, Illinois; Crab Orchard National Wildlife Refuge Headquarters in Carterville, Illinois; and Marion Federal Penitentiary in Marion, Illinois.

- Development of a mailing list of interested citizens, organizations, news media, and elected officials in local, county, state and federal government. Periodic mailings of Fact Sheets and other information to all persons or entities on the mailing list.

- Periodic news releases announcing various on-site activities and results of investigations.

- A Fact Sheet in August 1988, explaining the results of the remedial investigation. The Remedial Investigation Report was also released at this time.

- Paid newspaper advertisements announcing the RI public meeting and the FS and proposed plan availability sessions and public hearings.

- A public meeting in August 1988, to meet concerned citizens and discuss the results of the remedial investigation. Approximately 100 people attended the meeting.

- A Fact Sheet in January 1989, explaining the Feasibility Study and proposed plan process, discussing remedial technologies under consideration, and announcing a tentative schedule.

- A Fact Sheet in August 1989, explaining U.S. EPA's preferred alternatives for two operable units at the site, and discussing the availability of the FS and proposed plans for those operable units. This Fact Sheet also outlined the other remedial alternatives, announced the public comment period and solicited comment on the alternatives.

- An availability session in August 1989, to informally answer citizens' questions about the FS and proposed plans. Questions were answered by representatives of U.S. EPA, FWS and IEPA.

- A public hearing on August 30, 1989, on the proposed plans and the FS. Comments were taken on the record. Approximately 140 people attended. Presentations were made, and questions were answered by representatives of U.S. EPA, FWS and IEPA.

- A public comment period of thirty days was originally planned, running from August 18, 1989, to September 16, 1989. The public comment period was announced in the proposed plan for the operable unit, in the Fact Sheet of August 1989, and through paid newspaper advertisements in the Southern Illinoisan and the Marion Daily Republic. Based on comment taken at the public hearing on August 30, 1989, and letters received, the comment period for this operable unit was extended three times, until December 1, 1990, for a total comment period of 105 days. The extensions were announced by letters to the individuals and groups on the mailing list, at public meetings and by press releases.

- A second public hearing on October 3, 1989, specifically on the proposed plan and remedial alternatives for the PCB Areas operable unit. Additional public comment was taken on the record. Presentations were made, and questions were answered by representatives of U.S. EPA.

A Responsiveness Summary addressing comments and questions received during the public comment period on the RI/FS and proposed plan is included with this Record of Decision as the third section.

This decision document presents the selected remedial action for the PCB Areas operable unit at the Crab Orchard National Wildlife Refuge Superfund site, in Carterville, Illinois, chosen in accordance with CERCLA, as amended by SARA and the National Contingency Plan. The decision for this operable unit at the site is based on the Administrative Record.

IV. SCOPE AND ROLE OF OPERABLE UNIT

The first step in the RI process was a review of available Refuge files and old analytical results to target "study sites" to be investigated in depth. Thirty-three study sites were investigated during the RI, with seven of these carried into the FS for evaluation of remedial alternatives.

As with many Superfund Sites, the problems at the Refuge are complex. The results of the investigations of the study sites indicated that the Refuge consists of several geographically distinct areas with markedly different characteristics. These include differences in the contaminants, in the parties responsible for the contamination, and in the remedial actions and schedules that would be appropriate. Consequently, the Agency decided to address these areas individually as "operable units" of an overall site remedy. The following four operable units have been created:

> PCB Areas - those areas contaminated with PCBs, which may also be contaminated with other materials, such as lead and cadmium, including study sites 17, 28, 32 and 33.
>
> Metals Areas - those areas primarily contaminated with heavy metals, including study sites 15, 22 and 29;
>
> Explosive/ Munitions Areas (formerly designated as "DOD Areas") - those areas thought to be contaminated with chemicals from explosive or munitions manufacturing, including study sites 3, 4, 5 and 19; and
>
> Miscellaneous Areas - those areas that are thought to require no further work or that will need further investigation, monitoring or maintenance, including sites 7, 7A, 8, 9, 10, 11, 11A, 12, 13, 14, 16, 18, 20, 21, 24, 25, 26, 27, 30, 31, 34, and 35.

Under the National Contingency Plan, response actions may be conducted in operable units, provided such units are consistent with achieving a permanent remedy. Further, implementation of operable units should begin before selection of a final remedial action for the Site "when early actions are necessary or appropriate to achieve significant risk reduction quickly, when phased analysis and response is necessary or appropriate given the size or complexity of the site, or to expedite the completion of total site cleanup" [40 CFR 300.430(a)(1)(ii)]. These conditions are satisfied in this case. First, the proposed operable units are consistent with achieving a permanent remedy at the Site since they will, in fact, provide permanent remedies for the designated areas. Second, proceeding by operable units is sensible in this case because the nature of the problems in the different areas requires a phased approach given the size and complexity of the Site and the fact that the

implementation of remedies for the operable units will expedite Site cleanup and the reduction of risks from the operable units.

This Record of Decision addresses the PCB Areas operable unit. The four study sites comprising this operable unit are: the Job Corps Landfill (site 17); the Water Tower Landfill (site 28); the Area 9 Landfill (site 32); and the Area 9 Building Complex (site 33) (See Figure 2 in Appendix A). The remedy selected will address the principal threats of soil and sediment contamination at all four sites comprising the operable unit and will mitigate future surface water and groundwater contamination.

The remedy for the PCB Areas operable unit is the second of at least four operable units planned at the Site. The PCB Areas operable unit fits into the overall Site strategy by addressing the principal threats from the four sites contaminated with PCBs. (Lead is a co-contaminant at three of these sites). The waste materials will be treated to destroy the PCBs, and the metal-bearing residue will be contained on-site. Since the PCB Areas pose some of the most significant risks currently identified at the Refuge, remedial action for those areas should be initiated as quickly as possible.

Each of the other operable units is on a separate schedule. The schedule for each operable unit will be established in an upcoming revised Interagency Agreement among the U.S. EPA, DOI, DOD and IEPA, which is expected to be completed in September 1990. Depending on additional information, other operable units may be created or combined, as appropriate.

A Proposed Plan for the Metals Areas operable unit was released by U.S. EPA at the same time (August 1989) as the Proposed Plan for the PCB Areas operable unit. The Proposed Plan and required publication of notice occurred concurrently for the PCB Areas and Metals Areas operable units. Because of public concern about the incineration component of the preferred alternative, the public comment period for the PCB Areas was extended three times for a total of one hundred and five (105) days of public comment. A final remedy selection for the Metals Areas operable unit was made on March 30, 1990.

V. SITE CHARACTERISTICS

The RI/FS was conducted to identify the types, quantities and locations of contaminants at the Site and to develop ways of solving the problems they present. Because of the size of the Site, the first step in the RI process was a review of available Refuge files and old analytical results to target "study sites" to be investigated in depth. The nature and extent of actual or potential contamination related to the study sites was determined by a series of field investigations, including:

- geophysical surveys;
- surface soil sampling;
- exploratory test pit installation and sampling;
- installation and sampling of groundwater monitoring wells;

- surface water sampling; and
- sediment sampling.

Soil and sediment sampling in the four areas comprising the PCB Areas operable unit indicate the non-uniform presence of PCBs and lead, and the less consistent presence of other organic and inorganic contaminants. The four areas are all located in the portion of the Refuge where visitor access is restricted, so human exposure to the contaminants is sporadic and occasional. However, the areas are wooded and it is likely that wildlife are currently exposed to the contaminants.

The Job Corps Landfill site (study site 17) is comprised of an approximately one-acre landfill adjacent to a man-made pond which has been drained since the completion of the RI in 1988 (see Figures 3, 4 and 5 in Appendix A). Aerial photographs indicate that the area was used over an extended period for dumping, and became inactive sometime prior to 1960. The pond was created in the mid-1960's by damming a drainageway leading to Crab Orchard Lake. Soil samples from the landfill and sediment samples from the Job Corps Pond indicate the presence of PCBs, lead and cadmium, with other organic and inorganic contaminants of less concern found in the soil, sediments, pond water and groundwater. There are an estimated 1400 cubic yards of soil and sediment contaminated with PCBs. Approximately 620 cubic yards of this material are thought to be co-contaminated with metals.

The Water Tower Landfill (study site 28) consists of an open field which gradually slopes to the northeast. The sloping northeast face is heavily overgrown and slopes down to a wooded area. The fill area is approximately one acre, located north of the Water Tower (see Figures 6 and 7 in Appendix A). Aerial photographs indicate that the area was used intermittently over an extended period for dumping, and became inactive sometime prior to 1971. Down-slope drainage areas were also investigated. Soil sampling at the Water Tower Landfill showed some localized spots with PCB and lead contamination primarily below the surface. An estimated 1000 cubic yards of soil are contaminated with lead and PCBs. Other inorganic and organic contamination found in soil and groundwater at this study site will be addressed during confirmation sampling, or as part of remedial activities.

Area 9 is a manufacturing site on the Refuge. The Area 9 Landfill (study site 32) is located about 100 yards south of Crab Orchard Lake and 100 yards east of the Area 9 Building Complex (study site 33). The landfill is approximately 2.5 acres with an estimated depth of 6 to 10 feet (see Figures 8 and 9 in Appendix A). The landfill was reportedly used from the 1950s until 1964, and during the active life of the landfill a variety of industrial wastes were burned, compacted in a swale and covered. Runoff from the landfill can drain into an intermittent creek and into Crab Orchard Lake. The Area 9 Building Complex (see Figures 9 and 10) has been occupied by several industrial tenants, including Sangamo Weston, Inc. from 1946 to 1962. It is currently occupied by Olin, Corporation, and access to some areas has been closed. The contamination in the building complex primarily centered around two

buildings, numbers 1-1-2 and 1-1-23, and in two drainage ditches which receive runoff from the building complex. Approximately 36,000 cubic yards of soil and sediments in Area 9 are contaminated primarily with PCBs. Of these, approximately 2000 cubic yards are co-contaminated with lead. In addition, soil, sediment and groundwater at this study site showed some other inorganic and organic contamination of less concern.

VI. SUMMARY OF SITE RISKS

This Record of Decision addresses the PCB Areas operable unit. The RI Report included a risk assessment to define the actual or potential threat that the Site-related contaminants pose to human health and/or the environment. Since the Site is a National Wildlife Refuge, particular attention was paid to the potential impact on wildlife.

The DOI, as trustee for Refuge lands and for fish and wildlife on those lands, must ensure that remedies adequately protect and restore those trustee resources. Doing so, in many cases, requires standards more stringent than or different from those that may apply primarily for human health reasons for some contaminants. In promulgating the regulations for Natural Resource Damage Assessment (43 CFR Part 11; Type B Regulations, Final Rule, 51 FR 27673-27753, August 1, 1986) DOI addressed the difference in standards for natural resource damage assessment and remediation for human health purposes. The trustee can only agree to a covenant not to sue under Section 122(j) of CERCLA if a PRP agrees to undertake appropriate actions necessary to protect and restore natural resources damaged by actual or threatened releases of hazardous substances.

Damage assessment and restoration are carried out for the purpose of compensation to the public for damaged public natural resources. Comparison is made to "baseline" conditions which represent conditions in the absence of the contamination. In this case, because human health standards may not be sufficient to be protective of wildlife or may interfere with the Site's primary purpose as a wildlife refuge, restoration beyond human health standards is necessary to adequately compensate for the injuries to the public natural resources. Because standards for wildlife have not yet been promulgated, a risk assessment was carried out by the Fish and Wildlife Service that identified the levels necessary for restoration of the area as suitable wildlife habitat. For example, as a result of the risk assessment for the PCB Areas, a concentration of 1 milligram PCBs per kilogram of dry soil (mg/kg) has been determined by DOI to be protective of wildlife, as well as meeting the mission of the Refuge.

The choice of animal species for a risk assessment was dependent upon the availability of information on toxicity, life history, exposure and physiology. Sufficient information was not always available for species that are conspicuous Departmental trust resources. Small mammals are used in assessments for small contaminated areas because these mammals are frequently at greatest risk. Their limited home range as well as available toxicity information, reduce uncertainties in the resultant

assessment. There are no standards for wildlife exposure and wildlife contaminant residues, so risk assessments were used and exposures compared to toxicity information on other species.

The results of the risk assessment conducted as part of the RI focus on the contaminants which pose the highest risks of exposure to humans and the environment, even though other contaminants (posing lesser risks) may have been found at the site. Overall, the risk assessment indicates that the following problems present the greatest threat to human health and/or the environment from the four study sites that comprise the PCB Areas operable unit:

- Surface soils at the Job Corps Landfill, the Area 9 Landfill and the Area 9 Building Complex to both humans and wildlife;

- Subsurface soils at all four study sites, especially to burrowing wildlife;

- Sediments at the Job Corps Landfill and Area 9 to wildlife directly and to humans through food chain accumulation; and

- Exposures of small and burrowing wildlife to contaminated air at all four study sites.

Although contaminants were found in other media (groundwater and surface water) at the study sites comprising this operable unit, the risk assessment does not indicate that these contaminants currently pose a threat to human health and/or the environment. However, potential future groundwater contamination is of great concern because the aquifer is potentially usable and may discharge to a sensitive ecosystem, for example, a wetland. Also, the potential that runoff will adversely impact surface water is of concern particularly because Crab Orchard Lake is used as a drinking water source. The areas comprising the PCB Areas operable unit are within the portion of the Refuge where human access is currently restricted. However, if the restriction were relaxed in the future, the risks to humans could be higher unless remedial action has been taken. It is infeasible to restrict all wildlife access to contaminated areas.

A summary of the risk assessment from the RI Report for each of the sites comprising the PCB Areas operable unit follows:

A. SITE 17: JOB CORPS LANDFILL AND POND

1. Contaminant Identification

Sampling was done on the soil, sediment, groundwater, pond water and fish from the pond. Results indicated that the soil and sediment contained PCBs at 0.08 to 50,000 milligrams per kilogram (mg/kg), lead in a range of from less than 6 to 17,414

mg/kg, and cadmium in a range of from less than 1 to 57 mg/kg. Some of the contaminated soil is hazardous by the Resource Conservation and Recovery Act (RCRA) characteristic test for leachable metals (EP Toxicity). The pond water contained PCBs at 0.032 to 0.058 micrograms per liter (ug/L), which exceeds the Ambient Water Quality Criteria (AWQC) for freshwater aquatic life and human health. The ground water contained PCBs ranging from 0.01 to 15 ug/L, with these samples, exceeding the AWQC for freshwater aquatic life and human health and two samples exceeding the proposed Maximum Contaminant Level (MCL) of 0.5 ug/L. In addition, limited groundwater samples contained chloroform at 12 ug/L, which exceeds the AWQC for human health, pentachlorophenol at 19 ug/L which exceeds the AWQC for freshwater aquatic life, lead at 55 ug/L, which exceeds the MCL, and chromium at 74 and 139 ug/L, which exceeds the MCL.

2. Exposure Assessment

The exposure assessment conducted as part of the RI concluded that several media could be impacted by the contaminants at this site, and that there were several potential exposure routes for contamination. Mean and worst case levels of PCB contamination in soil were used to conduct the risk assessment. Also, upper bound estimates of soil contamination with lead and N-nitrosodimethylamine were used to estimate risk. Cadmium was assessed qualitatively.

The proximity of the pond and vegetative cover on the landfill make the site an attractive denning habitat. Exposure was quantified for deer, mallard ducks, rabbit, mouse, mink, heron and otter. Exposure of wildlife to contaminants would occur through ingestion, inhalation, and absorption through the skin or gills. Animals on the site would be exposed to contaminants through ingestion of soil, sediment and water as well as through consumption of contaminants that bioaccumulate (PCBs and cadmium) in vegetation and prey. Grooming and inhalation of contaminated dust and vapor also expose animals (especially burrowing animals) to contaminants in sediment or soil. Dermal or peropercular absorption is a primary exposure route for aquatic organisms such as fish and macroinvertebrates, and is also an exposure route for animals that maintain skin contact with contaminated soil or sediment. Calculations for the inhalation route included factors relating to active (one hour/day) and inactive periods.

Although access to humans is restricted, the exposure assessment indicates that there is the potential for occasional recreational users to be exposed via inhalation or ingestion of the contaminants, and through potential food chain accumulation. The exposure assessment assumed limited human access of three visits per year for four hours per visit. It

was also assumed that a human might inadvertently consume 100 mg of contaminated soil or sediment per visit by ingestion. (Ingestion of soil is a standard pathway for exposure in humans and wildlife risk assessments.) Inhalation exposure would be commonly assumed for FWS personnel on worksites or for incidental visitors to the contaminated sites.

3. Toxicity Assessment

Cadmium is highly toxic with a broad range of systemic effects, particularly to the respiratory, renal and reproductive systems. It is considered a probable human carcinogen by the inhalation route of exposure. Cadmium can bioaccumulate extensively in exposed individuals. Cadmium is particularly toxic to fish, even at low concentrations. It has also been demonstrated to cause birth defects in animals.

Lead has been shown to distribute in the blood of humans, and can adversely effect the central nervous system, the gastrointestinal tract, the kidneys and blood forming systems. Growing children are particularly sensitive to its impact upon the central nervous system. U.S. EPA has not assessed the carcinogenicity of lead, however, there are studies which have shown lead to be carcinogenic. Lead causes spinal deformities and reduced reproduction in aquatic organisms. Lead is active biochemically and reduces hemoglobin, hematocrit and other blood parameters in birds and other wildlife. Lead exposure also causes reduction in avian growth rates. Behavioral changes have been found in birds because of the impact of lead on the central nervous system.

N-nitrosodimethylamine is a suspected human carcinogen, based on animal data which demonstrates liver, kidney and lung tumors in some species. The compound has been shown to be mutagenic in a variety of tests, and has also been demonstrated to produce liver damage. A variety of animal species have shown increased incidence of cancer and other adverse impacts after exposure to the compound.

PCBs have a high affinity for fat, resist metabolic destruction and tend to accumulate in the fatty tissues of exposed individuals. PCBs are a probable human carcinogen, and are associated with reproductive and central nervous system problems, liver damage, and skin disfigurement. Animals exposed to PCBs exhibit many of the same adverse effects, including cancer, reproductive impairment, birth defects, and damage to liver, stomach, skin and other organs. The combination of stability and high bioconcentration potential is significant to Refuge ecosystems because it causes PCBs to be accumulated in toxic concentrations in fish and wildlife which feed on organisms living in or feeding on soil or sediment.

4. Risk Characterization

Using a unit risk factor of 7.7 $(mg/kg/day)^{-1}$ for human exposure to PCBs, the unremediated site shows a potential increased cancer risk of 1.1×10^{-3}. Using a comparison to estimated cancer risk, the human exposure to N-nitrosodimethylamine would result in an excess cancer risk of 2×10^{-7}. This risk would be additive with the risk from PCB exposure, resulting in a current risk exceeding U.S. EPA's guidelines for "acceptable risk". This assessment is based on very limited human exposure, as discussed above, and represents current risk from the unremediated site. If future use were to allow greater access to the Site, the risk from the unremediated Site would be greater. The qualitative assessment conducted for cadmium concludes that chronic human exposure to cadmium-contaminated soil should be investigated quantitatively. The risk characterization indicates that no chronic or acute systemic health effects to humans would result from exposure to the lead contamination at the site under current access limitations.

Since the Refuge was established to protect wildlife, the risk assessment also considered risk to wildlife as a primary factor in the selection of the remedy. Small mammals are used in assessments for small contaminated areas because these mammals are frequently at greatest risk, and their small home range and available toxicity information reduces uncertainties in the resultant assessment.

The risk characterization for wildlife compared estimated exposures to PCBs for deer, mallards, rabbits, mice, mink, heron and otter to data from laboratory tests. The conclusion is that the fish-eating species may be the most affected, and that the unremediated site may present concerns for reproductive and teratogenic effects, possible overt lethality, and other systemic toxicity in vertebrate species. It is reasonable to assume that predators and omnivores could be at great risk, through consumption of organisms with bioaccumulated levels. A small animal, such as a mouse or rabbit, will consume a proportionally very high amount of PCBs which could have adverse effects on the animal. In addition, burrowing animals potentially receive levels of exposure to PCBs, lead, and N-nitrosodimethylamine which could result in a variety of adverse effects, including carcinogenic response, reproductive impairment, and other impacts.

B. SITE 28: WATER TOWER LANDFILL

1. Contaminant Identification

Most of the information characterizing the waste at this site is a result of the test pit sampling done for the RI. There

was no evidence of containers or containerized wastes in the investigation. The surface soil of the site generally appears to be free of contamination. However, subsurface soil was found to be contaminated at some locations. Results indicated that soil is contaminated with PCBs (from less than 0.01 to 8,900 mg/kg) and lead (from 13 to 4,300 mg/kg). Inorganic compounds of in concentrations of less concern than lead were also detected in some soil samples. The lead levels are thought to be high enough that the soil would be considered RCRA hazardous waste for the characteristic of EP Toxicity. Unfiltered groundwater samples exceeded the MCLs for iron (from 425 to 94,600 ug/L) and manganese (from 357 to 2780 ug/L); however, the MCLs for iron and manganese are secondary MCLs, based on odor or taste. One unfiltered groundwater sample also contained chromium (165 ug/L) and lead (76 ug/L) in exceedance of their MCLs, but the dissolved metal concentrations were below these standards (dissolved levels may be more representative of contaminant movement than total unfiltered levels).

2. Exposure Assessment

The exposure assessment conducted as part of the RI concluded that, in general, impact on environmental components is limited where the contaminants are found at depth. However, exposures could result if burrowing mammals dug dens or raceways in the fill material, or if the site experienced erosion or other disturbance.

3. Toxicity Assessment

The toxicity of PCBs and lead are discussed in paragraph A.2 above.

4. Risk Characterization

Quantitative risk assessment was not completed for this study site due to the limited routes of current exposure. Since the exposure assessment concluded that the wastes are found only at depth in isolated patches, there is currently no potential route by which human receptors may be exposed. Some uncertainties which were not addressed would be the future use of the land and the resultant fate and transport of contaminated groundwater.

The risk assessment concluded that exposure to humans and surface-dwelling wildlife was likely to be minimal because clean soil provides a barrier to contamination from subsurface soil. However, animals burrowing into the fill material would be exposed to lead and PCBs and could receive potential levels of exposure which could result in a variety of adverse effects,

including carcinogenic response, reproductive impairment and other impacts.

C. SITE 32: AREA 9 LANDFILL

1. Contaminant Identification

Analysis of soil on the surface and at depth in this landfill and in soil samples downgradient of the landfill indicate that lead (from 11 to 20,500 mg/kg) and PCBs (from less than 0.5 to 88,000 mg/kg) were found. Further analysis of the soil was conducted to assess the presence of chlorinated dibenzo-p-dioxin (DD) and dibenzofuran (DF) isomers. These compounds are typically found as co-contaminants where PCBs are manufactured. In this case, they may be elevated beyond expected levels due to uncontrolled burning of PCB products. Soil analysis showed elevated levels in some samples of tetrachloroDF (from 0.14 to 26.3 micrograms per kilogram (ug/kg)), pentachloroDF (0.34 ug/kg) and octachloroDD (from 0.6 to 20.6 ug/kg). Sediment samples taken from the drainage channel up and down stream of the landfill showed contamination with PCBs (from less than 0.5 to 11 mg/kg) and lead (from 11 to 29 mg/kg). PCBs were also found in lake sediment samples (from less than 0.5 to 4.09 mg/kg). The groundwater contained PCBs in some wells above the ambient water quality criteria for human health (from less than 0.005 to 0.044 ug/L). In addition, chromium was found in one unfiltered sample above the MCL (92 ug/L). However, the dissolved level in this sample was below the MCL (1.2 ug/L) and dissolved levels may be more representative of contaminant movement than total levels.

2. Exposure Assessment

The exposure assessment conducted as part of the RI concluded that several media could be impacted by the contaminants at this site, and that there were several potential transport routes. The viable exposure routes for humans evaluated in the risk assessment include air, surface water (including the bioaccumulation of contaminants in edible fish tissues) and direct contact. A mean level of PCB contamination in soil of 3,200 mg/kg was used to conduct the risk assessment. In addition, a representative intermediate concentration of 4,000 mg/kg for lead was used in the assessment.

Although access to humans is restricted, the exposure assessment indicates that there is the potential for occasional recreational users to be exposed via inhalation or ingestion of the contaminants, and through potential food chain accumulation. The exposure assessment assumed limited human access of three visits per year for four hours per visit. It was also assumed that a human might inadvertently consume 100 mg of contaminated soil or sediment per visit by ingestion.

(Ingestion of soil is a standard pathway for exposure in humans and wildlife risk assessments.) Inhalation exposure would be commonly assumed for FWS personnel on worksites or for incidental visitors to the contaminated sites.

The presence of contaminants in surface soils and sediments indicates that direct contact by wildlife could result in exposure through ingestion of the soil, sediment or water, and through potential consumption of contaminated vegetation and prey because potential food chain exposure is particularly likely with PCBs; through inhalation, especially by burrowing animals; and through direct exposure of aquatic organisms or ingestion of water, sediments and organisms associated with surface water as the contaminants migrate toward Crab Orchard Lake. To assess potential wildlife exposure, an assumption of one hour of active burrowing per day was weighted with a resting exposure estimate including breathing, feeding and grooming activities.

3. Toxicity Assessment

The toxicity of PCBs and lead are discussed in paragraph A.2 above.

Polychlorinated dibenzo-p-dioxins and dibenzofurans are of concern because two members of these classes, 2,3,7,8 - tetrachloro DD and 2,3,7,8 - tetrachloro DF, are highly toxic with acute and chronic exposure and produce a number of chronic disorders including immunotoxicity, teratogenicity, reproductive toxicity and suspected human carcinogenicity. Although other isomers are also toxic, removal or addition of chlorine atoms decreases toxicity, as does substitution to other positions.

4. Risk Characterization

Using estimates of exposure to lead, an occasional visitor to the contaminated area could be exposed to 8.7 ug/kg/visit. This is below a chronic, no-effect level of 0.32 mg/kg/day for human exposure to ingested lead, therefore the unremediated Area 9 Landfill site would not result in exposure to lead that would result in toxic effects under the current access limitations. This assessment is based on very limited human exposure, as discussed above, and represents current risk from the unremediated site. If future use were to allow greater access to the Site, the risk from the unremediated Site would be greater.

An estimate of exposure from inadvertent ingestion and inhalation of PCBs indicates an exposure rate for humans of 7 ug/kg/visit could occur. Compared to the estimate of exposure of 11 ug/kg/visit at the Job Corps Pond, this exposure to the

unremediated site shows a potential increased cancer risk of 7×10^{-4}. This assessment is based on very limited human exposure, as discussed above, and represents current risk from the unremediated site. If future use were to allow greater access to the Site, the risk to humans from the unremediated Site would be greater. Additionally, a variety of human exposure scenarios for PCB-contaminated fish from Crab Orchard Lake result in a range of potential increased cancer risk as high as 2×10^{-3} (see Table 1).

Significant wildlife exposure is likely. The risk characterization for wildlife compared estimated chronic PCB exposures for mallard ducks, rabbits and mice to U.S. EPA chronic no-effect levels based on rat studies. The conclusion is that the fish-eating species may be the most affected, and that the unremediated site may present risks for behavioral, immunological and other systemic toxicity in vertebrate species. It is reasonable to assume that predators and omnivores could be at great risk, through consumption of organisms with bioaccumulated levels. A small animal, such as a mouse or rabbit, will consume a proportionally very high level of PCBs which could have adverse effects on the animal. In addition, burrowing animals and other terrestrial wildlife receive potential levels of exposure to lead which could result in a variety of adverse effects, including behavioral, reproductive impairment, and other impacts. The conclusion is that the unremediated site would pose a risk to wildlife of chronic, toxic effects from lead.

D. SITE 33: AREA 9 BUILDING COMPLEX

1. Contaminant Identification

Analysis of soil within this building complex indicates that contamination primarily centered around two buildings, numbers 1-1-2 and 1-1-23, and in two drainage ditches which receive runoff from the building complex. Soil in the building complex and sediment in the drainage ditches were contaminated with PCBs (from less than 1 to 120,000 mg/kg). Further analysis of the soil was conducted to assess the presence of chlorinated dibenzodioxin (DD) and dibenzofuran (DF) isomers. As discussed in paragraph C.1 above, these compounds are found as co-contaminants of PCBs. Soil analysis showed elevated levels around building 1-1-23, with DF isomers ranging from 28 to 249 ug/kg. The highest concentrations were associated with hexachloroDF (249 ug/kg) and pentachloroDF (158 ug/kg), and the lowest concentrations associated with tetrachloroDF (28 ug/kg). Dioxins range from less than 0.11 ug/kg for tetrachloroDD to 169 ug/kg for octachloroDD. A few limited soil samples were contaminated with 1,2,4 - trichlorobenzene (23.5 mg/kg) and 2 - chloronapthalene (6820 mg/kg). The groundwater in the building complex contained PCBs above the ambient water quality

criteria for human health (from 0.006 to 0.144 ug/L). Chromium was found in two unfiltered samples above the MCL (from 50 and 113 ug/L). However, the dissolved levels in these samples were below the MCL (1 and 1.3 ug/L, respectively) and dissolved levels may be more representative of contaminant movement than total levels. In addition, trichloroethene was found in one well above the ambient water quality criteria for protection of human health (906 ug/L).

2. Exposure Assessment

The exposure assessment conducted as part of the RI concluded that several media could be impacted by the contaminants at this site, and that there were currently three functional transport routes for human exposure including groundwater, surface water and direct contact. However, because there are no current users of groundwater and because of the relatively low mobility of the contaminants, the risk assessment concluded that the groundwater exposure route is not currently functional. The assessment further concluded that the air route of exposure was non-functional because of the restrictions to employees only. Levels of PCB contamination in soil of 5,000 mg/kg and in sediments of 200 mg/kg were used to conduct the risk assessment. Access to humans is restricted at the building complex to employees, therefore the exposure assessment only considered inadvertent exposures to sediments in the drainage ditches downgradient of the building. A further assessment should be done to consider potential (including inadvertent) exposures to employees at the building, as well as future use scenarios.

The presence of contaminants in surface soils and sediments indicates that direct contact by wildlife could result in exposure through ingestion of the soil, sediment or water, and through potential consumption of contaminated vegetation and prey because potential food chain exposure is particularly likely with PCBs; and through inhalation, especially by burrowing animals. However, the exposure assessment concluded that due to the industrial nature and restricted access to the site, the diversity and abundance of wildlife would be less than at other areas of the Refuge. To assess potential wildlife exposure, an assumption of one hour of active burrowing per day was weighted with a resting exposure estimate including breathing, feeding and grooming activities.

3. Toxicity Assessment

The toxicity of PCBs is discussed in paragraph A.3 above.

The toxicity of polychlorinated dibenzodioxins and dibenzofurans is discussed in paragraph C.3 above.

4. Risk Characterization

Using estimates of exposure to PCBs in ditch sediment only, an occasional visitor to the contaminated area could be exposed to 0.29 ug/kg/visit. This is below acute or sub-acute threshold criteria, therefore the unremediated Area 9 Building Complex site would not result in exposure to PCBs that would result in systemic toxic effects. Compared to the estimate of exposure of 11 ug/kg/visit at the Job Corps Pond, this exposure to the unremediated site shows a potential increased cancer risk of 3×10^{-5}. This assessment is based on extremely limited human exposure, as discussed above, and represents current risk assessed only for the relatively low levels of PCB contamination outside the fenced area. The risk within the fenced areas would be substantially higher. If future use were to allow greater access to the Site, the risk from the unremediated Site would be greater. A further risk characterization should include a quantitative assessment of the risk from the polychlorinated DD and DF isomers.

The risk characterization for wildlife compared estimated chronic PCB exposures for rabbits and mice to U.S. EPA chronic no-effect levels based on rat studies. The conclusion is that the unremediated site may present concerns for behavioral, immunological and other systemic toxicities in vertebrate species. It is reasonable to assume that predators and omnivores could be at great risk, through consumption of organisms with bioaccumulated levels. A small animal, such as a mouse or rabbit, will consume a proportionally very high amount of PCBs which could have adverse effects on the individual.

While potential adverse impacts were identified, the RI did not measure any actual, current impacts on wildlife. Research done by the FWS has indicated the potential for adverse impacts on wildlife above the Site-specific cleanup criteria established by the FWS. There is on-going research by the FWS, Southern Illinois University and others to continue to assess the impacts of contaminants at the Refuge to wildlife. The Refuge provides suitable habitat for an endangered species, the Indiana bat. Also, the Refuge definitely houses another endangered species, the bald eagle.

Actual or threatened releases of hazardous substances from the sites comprising this operable unit, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, wildlife, or the environment.

VII. DESCRIPTION OF ALTERNATIVES

During the Feasibility Study (FS), the FWS and Sangamo Weston, Inc. identified and evaluated a list of alternatives that could be used to

address the threats and/or potential threats identified at the study sites within the operable unit. The FWS and Sangamo Weston, Inc. screened the list of alternatives based on their effectiveness (i.e. protection of human health and/or the environment, reliability), implementability (i.e. technical feasibility, compliance with identified State and Federal regulations) and relative costs (i.e. capital, operation and maintenance).

In the Proposed Plan, eight remedial technologies, which were combined into thirty-four (34) alternatives in the FS, were described. The alternatives presented in the FS ranged from containment of the waste in place to treatment to the maximum extent possible. Various combinations of the eight remedial technologies outlined below were considered for one or more of the four study sites comprising the PCB Areas operable unit. Several of the thirty-four alternatives presented in the FS incorporate two or more of these technologies in the alternative. Finally, some of these eight technologies were incorporated into "consolidated remedial alternatives" which are unique because they are the only alternatives to address all of the study sites together. Public comment was solicited on the four "consolidated remedial alternatives" which were presented in the Proposed Plan, on the thirty four alternatives discussed in the FS, and on the eight technologies which were combined to create the various alternatives.

Below is a brief description of the eight remedial technologies which were incorporated in the RI/FS into remedial alternatives; and the four "consolidated remedial alternatives," as well as the "no action alternative" presented in the Proposed Plan:

A. <u>CONTAINMENT REMEDIAL TECHNOLOGIES</u>

i. Industrial Landfill - Contaminated soils and sediments would be excavated and placed in an industrial landfill. This "industrial landfill" would be a solid waste landfill as regulated by Subtitle D of RCRA and 35 Illinois Administrative Code Part 807. The landfill would be constructed, at a minimum, with a single compacted soil liner and drainage layer. After placement of the contaminated soil and sediment, the landfill would be covered with a cap constructed of compacted soil, a drainage layer, gravel, soil fill and topsoil. Upon completion, the landfill would be vegetated. Groundwater and leachate monitoring, and routine maintenance would be elements of the long-term requirements. Variations include construction of the industrial landfill either on-site or off-site.

ii. TSCA Landfill - The Toxic Substances Control Act (TSCA) regulates certain activities involving PCB contamination. A TSCA Landfill is one that meets the design criteria required by this law. PCB-contaminated soils and sediments would be excavated and placed in a TSCA landfill. The landfill would be constructed of a compacted soil liner, a drainage layer, a synthetic membrane liner, and a second drainage layer. After placement of the

contaminated material, the TSCA landfill would be covered with a cap constructed of compacted soil, a synthetic membrane, a drainage layer, gravel, soil fill, and topsoil. Upon completion, the TSCA landfill would be vegetated. Groundwater and leachate monitoring, and routine maintenance would be elements of the long-term requirements. Variations include construction of the TSCA landfill either on-site or off-site.

iii. TSCA Cap - PCB-contaminated soils and sediments would be left in place and covered with a low permeability TSCA cap. The cap would be constructed of compacted soil, a synthetic membrane, a drainage layer, gravel, soil fill and topsoil. Prior to construction of the cap, sediments would be dewatered and allowed to dry, and the contaminated area would be sloped and graded to provide drainage and a good construction surface. Groundwater monitoring and routine maintenance would be part of the long-term requirements.

iv. Slurry Wall - Certain remedial alternatives which involve the construction of a TSCA cap also require the construction of a slurry wall for more complete containment. A slurry wall is a vertical barrier around the contaminated area. The slurry wall is typically constructed of a cement or bentonite mixture with a very low permeability. The slurry wall acts as a barrier to the movement of contaminated groundwater. This containment system is coupled with groundwater extraction wells to remove the contaminated groundwater for treatment. This technology is considered to provide additional safeguards against potential future groundwater contamination if waste is left in place. The risk assessment did not indicate that contaminated groundwater currently poses a risk. A slurry wall is considered in alternative 3C for the Water Tower Landfill (Section 5 of the FS) and alternatives 2E and 3B for Area 9 (Section 7 of the FS). However, since slurry wall technology is not feasible for all of the PCB-contaminated sites, it was not incorporated into any of the consolidated alternatives presented in the Proposed Plan.

v. Low Permeability Cap - Areas where contamination is below the excavation criteria, or from where contaminated soil and sediment have been excavated would be closed and covered with a low permeability cap. The cap would be constructed of compacted soil, a drainage layer, soil fill and topsoil. Routine maintenance of the cover, as well as groundwater monitoring would be part of the long-term operation and maintenance requirements.

B. <u>TREATMENT REMEDIAL TECHNOLOGIES</u>

vi. Incineration/Thermal Destruction - Contaminated soils and sediments would be excavated and treated by incineration/ thermal destruction in a TSCA compliant incinerator. High temperatures would permanently destroy the PCBs and other organic chemicals. Any metal contamination would not be destroyed by incineration/

thermal destruction, but would be captured in the ash residue. If the ash is determined to be uncontaminated with the constituents of concern, it would be replaced in the excavated areas. If the ash is contaminated it would be contained in an industrial landfill (remedial technology i). The incinerator/ thermal treatment unit would be either on-site or off-site. During operation, air pollution control measures would be used to prevent contamination from being released to the air.

vii. Stabilization/Fixation - Contaminated soils and sediments and contaminated incinerator ash would be treated with bonding agents which fix contaminants within the stabilized waste. This treatment makes the contaminants more resistant to leaching. Cement-based and lime-based stabilization processes are commonly used for fixation of metals and have also been used for treatment of PCB wastes. The stabilized material would be contained in an industrial landfill (remedial technology i) or a TSCA landfill (remedial technology ii).

viii. In situ Vitrification (ISV) - Vitrification is a fixation process which would seal the contaminated soils and sediments in a glass or synthetic silicate mineral material. An electric current generates high temperatures which pyrolyzes organic chemicals, such as PCBs and encapsulates inorganic compounds, such as metals. The contaminated materials would be treated in place and covered with clean soil. This technology would be considered innovative treatment for the contaminated material. In situ vitrification is considered in alternative 1C for the Water Tower Landfill (Section 5 of the FS) and alternatives 1C and 2C for Area 9 (Section 7 of the FS). However, since this technology is not feasible for all of the PCB-contaminated material without excavation and consolidation of soil and sediment from geographically distinct study sites, it was not incorporated into any of the consolidated alternatives below.

C. CONSOLIDATED REMEDIAL ALTERNATIVES

The FS presents several consolidated remedial alternatives which incorporate the above remedial technologies to achieve a cleanup for all of the study sites comprising the PCB Areas operable unit. The advantages to a consolidated remedy are that the cleanup can progress more quickly and efficiently and that some costs can be saved.

In reviewing the PCB Areas operable unit Proposed Plan, the public was asked to consider the consolidated remedial alternatives, and site-specific remedial alternatives discussed in the FS, as well as other possible combinations of the eight remedial technologies listed above. These consolidated alternatives are discussed in Section 8 of the FS. The consolidated alternatives also include some actions which affect the Metals Areas operable unit, which were addressed in the March

1990 ROD for those areas. In outlining the consolidated alternatives below, only the actions which effect the PCB Areas operable unit are discussed.

Consolidated Alternative 1

Estimated Total Remedial Cost: $25,195,035 present worth
Estimated Time to Implement: 2.5 to 5 years

Consolidated Alternative 1 includes the following components:

Excavation of Soil and Sediment - Contaminated soil and sediment would be excavated using conventional equipment. The excavated material would be moved to a storage area on-site, where it would be stored until it was treated or disposed.

Incineration - Soils and sediments which are contaminated with PCBs, but with no excessive metal contamination would be incinerated on-site, as described in remedial technology vi. Non-contaminated incinerator ash would be backfilled in the excavated areas.

Stabilization/Fixation - Soils, sediments and incinerator residues which are contaminated with both PCBs and metals would be treated by stabilization/fixation, as described in remedial technology vii.

TSCA Landfill - Materials which are treated by stabilization/fixation would be disposed of in an on-site TSCA landfill, as described in remedial technology ii. This alternative proposes using an existing five-million gallon concrete tank now on the Site, which would be retrofitted to meet the required design standards.

TSCA Cap - In Area 9, some contaminated soil would be left in place. This area would be covered with a TSCA cap, as described in remedial technology iii.

Low Permeability Caps - Soils and sediments which do not exceed the cleanup standards at each of the four study sites would be covered in place with a low permeability cap, as described in remedial technology v.

Consolidated Alternative 2

Estimated Total Remedial Cost: $6,156,161 present worth
Estimated Time to Implement: 2 years

Consolidated Alternative 2 includes the following components:

Excavation of Soil and Sediment - Same as described in Consolidated Alternative 1.

Stabilization/Fixation - Soils and sediments which are contaminated with high levels of PCBs (greater than 1000 parts per million, or 0.1 percent) and heavy metals would be treated by stabilization/fixation, as described in remedial technology vii.

TSCA Landfills - Two TSCA Landfills, as described in remedial technology ii, would be constructed on-site. The first would involve retrofitting an existing concrete tank to meet the design standards. This landfill would be used to contain the majority of the wastes treated by stabilization/fixation. The second would be newly constructed near Area 9 and would contain all treated waste that did not fit in the first landfill and untreated contaminated soil and sediment.

TSCA Cap - Same as described in Consolidated Alternative 1.

Low Permeability Caps - Same as described in Consolidated Alternative 1.

Consolidated Alternative 3

Estimated Total Remedial Cost: $8,910,700 present worth
Estimated Time to Implement: 2.5 to 3 years

Consolidated Alternative 3 includes the following components:

Excavation of Soil and Sediment - Same as described in Consolidated Alternative 1.

Incineration - Soils and sediments which are contaminated with "non-sorbed PCBs" would be incinerated on-site, as described in remedial technology vi. Non-sorbed PCBs are those which are not chemically bound to the soil or sediment, and which may be more available to move. Non-sorbed PCBs are estimated to be found in soils or sediments with contamination higher than 5000 parts per million (or 0.5 percent). Before incinerating the soils and sediments, tests would be completed to determine the precise levels at which PCBs are sorbed, and thus, which soils and sediments would require incineration. Non-contaminated incinerator residue might be backfilled in the excavated areas.

Stabilization/Fixation - Soils and sediments which are contaminated with high levels of PCBs (greater than 1000 parts per million, or 0.1 percent), which have not been incinerated, (and which are co-contaminated with metals) would be treated by stabilization/fixation, as described in remedial technology vii.

TSCA Landfills - Same as described in Consolidated Alternative 2.

TSCA Caps - Same as described in Consolidated Alternative 1.

Low Permeability Caps - Same as described in Consolidated Alternative 1.

Consolidated Alternative 4

Estimated Total Remedial Cost: $23,858,330 present worth
Estimated Time to Implement: 2 years

Consolidated Alternative 4 includes the following components:

Excavation of Soil and Sediment - Same as described in Consolidated Alternative 1.

Stabilization/Fixation - Soils and sediments which are contaminated with "free PCBs" (and co-contaminated with metals) would be treated on-site by stabilization/fixation, as describe in remedial technology vii. As described in consolidated alternative 3, free (or non-sorbed) PCBs are those which are not chemically bound to the soil or sediment.

Off-Site TSCA Landfill - Both treated and untreated contaminated soils and sediments would be taken off the Refuge and disposed of in a TSCA landfill, as described in remedial technology ii.

TSCA Cap - Same as described in Consolidated Alternative 1.

Low Permeability Caps - Same as described in Consolidated Alternative 1.

D. NO ACTION REMEDIAL ALTERNATIVES

Estimated Total Remedial Cost: $657,724
Estimated Time to Implement: less than 1 year

The National Contingency Plan (NCP) which contains the codified regulations of the Superfund program, requires that the "no action" alternative be considered at every site. Under this alternative, action at any of the contaminated areas is generally limited to monitoring of site conditions. All wastes, routes of contaminant migration, and long-term human and environmental exposure pathways will remain unchanged. This alternative would not reduce the threats and potential threats to human health and/or the environment identified at the site.

VIII. THE SELECTED REMEDY

The Selected Remedy, as outlined below, will permanently remediate the four study sites comprising the PCB Areas operable unit. The Selected Remedy is divided into three major components: 1) treatment, 2) containment, and 3) general operation and maintenance. However, the Selected Remedy allows for the treatment and containment components to be modified based on a stringent demonstration of the performance of an

alternative treatment technology, in situ vitrification or ISV. Unless otherwise specified, the term "Selected Remedy" when used in this document refers to the use of in situ vitrification only if a successful demonstration of the technology is made.

The Selected Remedy will address the principal threats to human health and the environment that currently exist at the four study sites comprising the operable unit, and will prevent future threats and environmental degradation. The treatment processes selected for the contaminated soil and sediment constitute treatment to the maximum extent practicable. Containment of any metal-bearing waste or treatment residue will allow safe long-term control of this material. The labor and equipment necessary to implement the Selected Remedy are, or will be demonstrated to be, currently available. Specific details on various aspects of the Selected Remedy follow.

A. MAJOR COMPONENTS OF SELECTED REMEDY

The Selected Remedy for PCB Areas operable unit at the Crab Orchard National Wildlife Refuge is an alternative which was not specifically outlined in the FS, but which includes the Preferred Alternative in the Proposed Plan and is a combination of technologies identified in the FS. The Selected Remedy allows for the modification of the selected treatment and containment components by substituting an alternative, innovative treatment technology, in situ vitrification, for incineration, based on the demonstration outlined in Section 3 below. If this demonstration is not satisfactorily completed as described, the remedy as outlined in Section 1 below will be implemented. The Selected Remedy, if incineration is used as the treatment technology, will take an estimated 3 to 5 years to implement. If ISV technology is implemented in the Selected Remedy, implementation will require an estimated two years.

1. [redacted]

[redacted] - Soil and sediment which is contaminated above the remediation goals presented in Section B below, will be excavated using conventional equipment. The excavated material will be moved to a storage area on-site, where it will be stored until it is treated or disposed. Design of the project will require methods to prevent contaminated sediment from moving into surface water and methods to minimize dust. Design will also include considerations to ensure compliance with applicable or relevant and appropriate requirements (ARARs), listed below in Section X.B. The excavated material will be sampled to determine whether it is hazardous as defined by RCRA, and hazardous and non-hazardous material will be stored separately.

[redacted] - All excavated soil and sediment which is contaminated with PCBs in excess of the PCB remediation goals will be treated by incineration/ thermal destruction. The incinerator will be a temporary, mobile unit brought on-Site for the duration of the project. After completion of the incineration of

the PCB-contaminated soil and sediment, the incinerator will be decontaminated and removed from the Site. Prior to full operation, a trial burn of the incinerator will be used to establish the operating conditions, and on-going monitoring of the unit will be performed to establish that the remediation goals and incinerator performance standards are being met. Non-contaminated incinerator residue will be backfilled in the excavated areas.

Stabilization/ Fixation - Soils, sediments and any incinerator residue which is considered RCRA hazardous because of the characteristic to leach metals (EP Toxicity or Toxicity Characteristic Leaching Procedure (TCLP), whichever is the approved regulatory test at the time of the remedial action) will be treated by stabilization/ fixation. Stabilization/ fixation is a treatment process where contaminated soils and sediments will be treated with bonding agents which fix contaminants within the stabilized waste. This treatment makes the contaminants more resistant to leaching. Cement-based and lime-based stabilization processes are commonly used for fixation of metals. During the remedial design process, appropriate mixtures of treatment materials will be evaluated to assess their ability to immobilize the contaminants at the Site and to effectively render the material non-hazardous and the most effective mixture(s) will be chosen. Also, a treatment quality assurance plan will be developed to document the performance of the full scale treatment process.

Industrial Landfill - Excavated treated waste and untreated non-hazardous materials which exceed the remediation goals will be disposed of in an on-Site industrial landfill. This "industrial landfill" will be a solid waste landfill as regulated by Subtitle D of RCRA and 35 IAC Part 807. The landfill will be constructed, at a minimum, with a single compacted soil liner and drainage layer. After placement of the contaminated soil and sediment, the landfill will be covered with a cap constructed, at a minimum, of compacted soil, a drainage layer, a barrier to prevent burrowing animals, soil fill and topsoil. The final design will be determined by site-specific characteristics, the object being to provide adequate containment of the waste material. The final location of the on-Site landfill will be determined by investigations (including hydrogeologic) conducted during the remedial design phase to establish acceptable siting characteristics. Upon completion, the landfill will be covered and vegetated. Groundwater and leachate monitoring, and routine maintenance will be part of the long term requirements.

Backfill Excavation - Clean soil will be placed in the areas where contaminated material had been removed.

Low Permeability Caps - Areas where contamination is below the excavation criteria, or from where contaminated soil and sediment have been excavated would be closed and covered with low permeability caps. The caps would be constructed of compacted soil,

a drainage layer, soil fill and topsoil. Routine maintenance of the cover would be part of the long-term requirements.

Monitoring and Maintenance - The on-Site landfill and excavated areas will require monitoring of groundwater and surface water. Long-term maintenance will be required for the landfill and the low permeability caps.

Institutional Controls - The Refuge is currently under the management of the DOI, and access restrictions are in place. The Interagency Agreement which is required by Section 120 of CERCLA and which is expected to be completed by September 30, 1990, will incorporate land use and transfer restrictions to be imposed at the Site.

The components of this Selected Remedy are conceptual, and are based on specific remediation goals, performance standards and ARARs. As a result of the remedial design and construction processes, some minor changes may be made to the design features outlined above.

2. Selected Remedy (with Alternative Treatment Technology, ISV)

Excavation and/or Consolidation of Soil and Sediment - Contaminated soil and sediment will be consolidated in one of the existing areas of contamination (most likely Area 9). Contaminated soil and sediment from geographically distinct study sites will be excavated using conventional equipment and consolidated into the selected area. Design of the project will require methods to prevent contaminated sediment from moving into surface water and methods to minimize dust. Design will also ensure compliance with ARARs.

In situ Vitrification - Vitrification would be used to treat all contaminated soil and sediment which had been consolidated into a single area of contamination. No separation of soil and sediment contaminated with heavy metals will occur. The process would use electrodes to generate an electric current through blocks of the contaminated material to create a glass or synthetic silicate mineral material. The electric current would generate high temperatures which will pyrolyze the PCBs and other organic chemicals. The inorganic compounds, such as lead will be encapsulated in the glassy matrix. The area of contamination which is selected to be the site of consolidation of the waste will be determined by site-specific characteristics, the purpose being to provide adequate containment of the waste material and to minimize impacts on any sensitive ecosystem. The final location of the vitrified site will be determined by investigations conducted during the remedial design phase to establish acceptable siting characteristics.

Backfill Excavation - Clean soil will be placed in the areas where contaminated material had been removed.

Low Permeability Caps - Both the vitrified area and other areas where contamination is below the excavation threshold criteria, or from where contaminated soil and sediment have been excavated, would be closed and covered with low permeability caps. The caps would be constructed of compacted soil, a drainage layer, soil fill and topsoil. Routine maintenance of the cover would be part of the long-term requirements.

Monitoring and Maintenance - The vitrified area and excavated areas will require monitoring of groundwater and surface water. Long-term maintenance will be required for the low permeability caps.

Institutional Controls - The Refuge is currently under the management of the DOI, and access restrictions are in place. The Interagency Agreement which is required by Section 120 of CERCLA and which is expected to be completed by September 30, 1990, will incorporate land use and transfer restrictions to be imposed at the site.

The components of the Selected Remedy using this Alternative Treatment Technology, are conceptual, and are based on specific remediation goals, performance standards and ARARs. As a result of the remedial design and construction processes, some minor changes may be made to the design features outlined above. The Alternative Treatment Technology will only be implemented as part of the Selected Remedy if certain demonstrations and conditions, as outlined in Section 3 below, are met.

3. Demonstration to Allow Alternative Treatment Technology to be Implemented as Part of the Selected Remedy

In order for the Alternative Treatment Technology outlined in Section 2 to be implemented rather than the Selected Remedy in Section 1, certain conditions and demonstrations must be met, and approved by U.S. EPA. The components of the demonstration are outlined below.

a. Within the negotiation period (not to exceed 120 days) pursuant to Section 122(e) of CERCLA and following the issuance of a special notice letter relating to the performance of remedial design and remedial action for the PCB Areas Operable Unit at the Refuge, the potentially responsible party [redacted]

b. The party responsible for implementing the Selected Remedy, (DOI, or other parties in accordance with the Interagency Agreement due to be signed on or before September 30, 1990 or with the Consent Decree covering the remedial design and remedial action for the PCB Areas Operable Unit, if any) if they so wish to perform the demonstration of the Alternative Treatment Technology described above, must submit to U.S. EPA a [redacted] for the performance of treatability testing for the vitrification process [redacted]

of the date on which U.S. EPA issues special notice letters to any PRPs relating to the performance of remedial design and remedial action on the PCB Areas Operable Unit at the Refuge.

c. Upon approval by U.S. EPA of the treatability testing workplan, the responsible party(ies) must complete the work required within the schedule specified in the workplan.

d. If a treatability testing workplan is not submitted within the time period specified in b., above, or if U.S. EPA does not approve the treatability testing work plan, the Selected Remedy as outlined in Section VIII.A.1., above, must be implemented.

e. If a treatability testing workplan is implemented, the party responsible for implementing the Selected Remedy must submit to U.S. EPA, on or before the date that treatability testing results are due, a demonstration that there is a commercial vendor (or vendors), of the vitrification process that is able and available to implement the work on the scale and within the schedule required. If no such vendors are available, then the Selected Remedy as outlined in Section 1, above, must be implemented.

f. If a treatability testing workplan is implemented, the results of the performance evaluation for the vitrification process will be assessed by U.S. EPA. All of the following performance standards must be demonstrated (and the conditions above must be met), in order for U.S. EPA to find that the Alternative Treatment Technology (ISV) may be implemented rather than the incineration technology as outlined in the Selected Remedy:

(1) A comprehensive evaluation of the destruction of PCBs and co-contaminant dioxins and furans by the vitrification process must be made. Vitrification must be able to match or exceed the destruction and removal efficiency of 99.9999 % for the PCBs and organic co-contaminants;

(2) Vitrification must be able to meet or exceed the 1 milligram per kilogram dry soil remediation goal for PCBs as required in Section B below;

(3) A comprehensive evaluation of vitrification's ability to immobilize metals which are RCRA hazardous waste constituents must be made. Vitrification must be shown to render non-hazardous all material which is hazardous because of the characteristic to leach metals as measure by the TCLP test;

(4) Leachability testing results for the vitrified waste must be combined with hydrogeologic modelling to demonstrate that none of the groundwater cleanup standards required in Section B below, will be exceeded at the point of compliance (which would be the vertical plane through the downgradient boundary of the area of contamination to be vitrified);

(5) Treatability testing results, combined with appropriate modeling, must demonstrate that the surface water remediation goals required in Section B below, will be met;

(6) A comprehensive evaluation of the air emissions from the vitrification process must be made. Vitrification must be shown

to meet or exceed the air emission standards required in Section X.B below; and

(7) The treatability testing results must demonstrate that vitrification will meet the requirements of 40 CFR 761.60(e) pertaining to performance of treatment alternatives to incineration under TSCA.

g. If U.S. EPA finds that any of the performance standards set forth in (e), above, cannot be demonstrated, or that any other condition listed above in Section VIII.A.3 has not been met, then the Selected Remedy, as outlined in Section 1, above, must be implemented. If U.S. EPA finds that all of the performance standards set forth in (e), above, can be demonstrated and that all the other conditions listed above have been met, U.S. EPA will send a notice in writing to that effect to the party responsible for implementing the Selected Remedy. Within 30 days of receipt of such notice, the party responsible for implementing the Selected Remedy must inform U.S. EPA in writing as to whether it will implement the Alternative Treatment Technology (ISV) or the incineration technology as outlined in the Selected Remedy.

B. REMEDIATION GOALS

Remediation goals have been established for the study sites comprising the PCB Areas operable unit. The goals are based on the risk assessment performed in the RI Report, which evaluates potential risk to human health and the environment. The goals were then further refined to reflect DOI's specific concerns and statutory mandates for the protection of fish and wildlife at the Refuge, and U.S. EPA's regional and national policies in establishing remediation goals. Further refinement of the remediation goals, particularly with respect to sufficient clean soil cover to prevent translocation of contaminants by burrowing animals, may be necessary as a result of additional risk assessment evaluations. The remediation goals for the study sites in the PCB Areas operable unit are discussed briefly below. Since, under the Selected Alternative, some compounds will remain at the Refuge in an on-site landfill, the effectiveness of the remedial action will have to be re-evaluated at least every five years. Similarly, under the Alternative Treatment Technology, some contaminants will remain immobilized in the treated area of contamination, so a five-year review, pursuant to Section 121(c) of CERCLA will be necessary.

1. SOIL AND SEDIMENT REMEDIATION GOALS

Contaminated soil and sediment at all of the study sites comprising the operable unit will be remediated to the following specific levels: lead to 450 milligrams (mg) per kilogram (kg) dry soil (1 mg per kg is equivalent to 1 part per million); cadmium to 10 mg per kg dry soil; PCBs in the top foot (12 inches) of soil to 1 mg per kg dry soil; PCBs in soil below one foot depth to 25 mg per kg dry soil; and PCBs in sediments to 0.5 mg per kg dry sediments. It is believed that a remedial action which meets these criteria will address all of the other contaminants at the sites. However, the risk from all of the chemical contaminants present above naturally occurring background levels established for the Site in the soil and sediment shall not exceed an excess cancer risk of one in one million (10^{-6}) and shall not exceed concentrations determined to produce any non-cancer chronic health effects.

In addition to being treated to levels protective of wildlife and of human health by direct contact, the PCB- and lead-contaminated soils and sediments shall be treated to a level that is protective of the groundwater. The soil remediation goals shall be established at levels that will not allow leaching to the groundwater and create groundwater contamination in exceedance of the groundwater remediation goals established in Paragraph 2 below. The method for calculating the soil remediation goals shall be approved by U.S. EPA. Methods for the development of soil remediation goals can be found in "Determining Soil Response Action Levels Based on Potential Contaminant Migration to Groundwater: A Compendium of Examples" (EPA, October, 1989). The method must be compatible with the site soil conditions and contaminants.

2. GROUNDWATER REMEDIATION GOALS

The groundwater at each of the study sites will be monitored during and after construction of the remedial action. The monitoring results will be evaluated to assure that after completion of the remediation of the contaminated soils and sediments, the risk from all of the contaminants in the groundwater (measured at the source of contamination) above naturally occurring background levels shall not exceed any excess human health risk or any standard. If, at any time, groundwater at any of the remediated study sites exceeds a 10^{-6} cumulative life-time cancer risk, or MCLs for carcinogens, whichever is more stringent; and MCLs, maximum contaminant level goals (MCLGs), or a hazard index of 1.0, whichever is more stringent, for non-carcinogens, additional remedial work as determined by U.S. EPA, shall be performed. The risk assessment shall follow procedures established in the "Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual" (RAGS) (EPA/540/1-89/002) or any amendments thereof.

3. SURFACE WATER REMEDIATION GOALS

The surface water of the Job Corps Pond will be monitored during and after construction of the remedial action, if appropriate. Since this pond was created by damming a creek, it is likely that there will be no water in the pond during active remediation, and no decision has been made whether this pond will continue to exist after remediation. Any surface water at this site will be monitored and the results will be evaluated to assure that after completion of the remedial action of the contaminated soils and sediments, the cumulative risk from all of the contaminants in surface water above naturally occurring background levels established for the site must not exceed an excess cancer risk of one in one million (10^{-6}) and must not exceed any non-cancer chronic health effects. In addition, after the remedial action is complete, the water in the Job Corps pond must show no degradation and must meet all chemical-specific ARARs established for this site (see Section X.B. below).

The surface water at Area 9 will also be monitored during and after construction of the remedial action. The results will be evaluated to assure that after completion of the remedial action for the contaminated soils and sediments, the cumulative risk from all of the contaminants in surface water above naturally occurring background levels established for the site shall not exceed an excess cancer risk of one in one million (10^{-6}) and shall not exceed any non-cancer chronic health effects. In addition, after construction of the remedial action, the water in the Area 9 Embayment of Crab Orchard Lake must show no degradation and must meet all chemical-specific applicable or relevant and appropriate regulations (ARARs) established for this site.

C. COST

The following are cost estimates for the Selected Alternative and the Selected Alternative with the modification of the Alternative Treatment Technology. The major cost differences are found in direct capital costs because of the differences in the treatment and containment components as a result of implementing the Alternative Treatment Technology. For example, direct costs of implementing incineration include excavation and handling of contaminated soils and sediments, as well as stabilization/fixation of materials contaminated with heavy metals. In situ vitrification would likely require excavation and handling of a smaller volume of contaminated material and no further stabilization/fixation after treatment.

1. Selected Alternative

a. Direct Capital Costs

The direct capital cost estimates include site preparation, excavation, treatment, placement, landfill construction, cover construction, backfilling of excavated areas, verification sampling, construction health and safety, and installation of fencing and monitoring wells. The breakdown for each study site follows:

Site 17: 1390 cubic yards	$1,073,877
Site 28: 1000 cubic yards	$752,375
Sites 32 and 33: 36,000 cubic yards	$14,908,820

b. Indirect Capital Costs

The indirect capital cost estimates include a contingency allowance of 25 percent, engineering fees of 15 percent, and legal fees of 5 percent of the direct capital costs. The breakdown for each study site follows:

Site 17:	$483,245
Site 28:	$338,569
Sites 32 and 33:	$6,708,968

c. Operation and Maintenance Costs

Operation and maintenance cost estimates include site maintenance and inspection, sampling and analysis, and a reserve fund and insurance. The breakdown for annual costs for operation and maintenance for each study site follows:

Site 17:	$34,978
Site 28:	$28,047
Sites 32 and 33:	$316,676

d. Total Present Value Cost

The total present value cost estimate includes all of the costs listed above for each of the sites, and estimates an operation and maintenance period of thirty years with a five percent interest rate. The total present worth cost estimate for the selected alternative is approximately $25,000,000.

2. Alternative Treatment Technology

The costs for the Alternative Treatment Technology are taken from the costs for Alternative 1C from Chapter 7 of the FS. These costs represent the costs for vitrification of the Area 9 contamination. Vitrification costs were not estimated for each of the study sites. Since Area 9 is expected to contribute over

95% of the mass of contaminated soil and sediments, the costs listed here are expected to be reasonable estimates. However, the cost of the Alternative Treatment Technology may be higher because there will be costs related to excavation and handling of contaminated materials from other study sites. Also site-specific soil characteristics can affect the cost estimates.

a. Direct Capital Costs

The direct capital cost estimates include site preparation, treatment by vitrification, cover construction, verification sampling, construction health and safety, and installation of fencing and monitoring wells.

The cost estimate is $9,240,000.

b. Indirect Capital Costs

The indirect capital cost estimates include a contingency allowance of 25 percent, engineering fees of 15 percent, and legal fees of 5 percent of the direct capital costs.

The cost estimate is $4,338,045.

c. Operation and Maintenance Costs

Operation and maintenance cost estimates include site maintenance and inspection, sampling and analysis, and a reserve fund and insurance.

The estimate for annual costs is $201,800.

d. Total Present Value Cost

The total present value cost estimate includes all of the costs listed above for each of the sites, and estimates an operation and maintenance period of thirty years with a five percent interest rate. The total present worth cost estimate for the selected remedy is $17,080,215.

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

The Selected Remedy for the PCB Areas operable unit at the Crab Orchard National Wildlife Refuge includes treatment technology (incineration) and an alternative treatment technology (in situ vitrification) which could be implemented based on a strict performance demonstration. The Selected Remedy involves excavation and/or consolidation of PCB and metal-contaminated soil and sediment, treatment of organic contamination by incineration or vitrification, treatment of hazardous materials by stabilization/ fixation or vitrification to render it non-hazardous, and residue management in either an on-site industrial landfill or in the vitrified area of containment. Based on current information and assuming

the Selected Remedy using in situ vitrification has been demonstrated as set forth above in Section VIII.A.3, the Selected Remedy provides the best balance among the nine criteria that U.S. EPA uses to evaluate alternatives. This section provides a summary of the comparative analysis of the alternatives for the PCB Areas operable unit.

Overall Protection. Each alternative, with the exception of the no-action alternative, would provide adequate protection of human health and the environment for those sites specifically addressed. Protection would result by eliminating, reducing, or controlling risk through treatment, engineering controls, or institutional controls. However, those alternatives which address only one or two of the four study sites comprising the PCB Areas operable unit eliminate, reduce or control risk only for those study sites addressed, and not the whole operable unit. In order to meet the threshold criterion of protectiveness, the Alternatives which address only one or two of the study sites would have to be combined to provide overall protection for the operable unit. The Selected Remedy addresses the principal threats to public health and the environment for all of the study sites by treatment to the maximum extent practicable of contaminated soil and sediment and containment of the residues.

Compliance with ARARs. All alternatives would meet all applicable or relevant and appropriate requirements of Federal and State environmental laws. Potential ARARs for each alternative are extensively discussed in the FS report. The ARARs for the Selected Remedy are presented in Section X.B, below.

Long-term Effectiveness and Permanence. The Selected Remedy would provide the greatest long-term effectiveness and permanence. Both treatment technologies in the Selected Remedy involve excavation and/or removal or consolidation of approximately 36,000 cubic yards of PCB-contaminated soil and sediment, of which approximately 3,620 cubic yards are estimated to be co-contaminated with metals. Treatment will provide that all of the organic compounds will be permanently destroyed, for the maximum long-term effectiveness. Of the 3,620 cubic yards of metal-contaminated material, approximately 1,250 cubic yards is thought to be RCRA-hazardous. The hazardous inorganic metals will be treated by stabilization/ fixation or by vitrification to render the material non-hazardous, with secure containment of the residues and the non-hazardous metal-bearing material to provide the maximum long-term effectiveness and permanence for the metal contamination. Contaminated soil and sediment constitutes the principal threat from this operable unit. The Selected Remedy also addresses the threat from surface water and groundwater by removing the material that could contaminate the water.

The alternatives developed in the FS and the Consolidated Alternatives differ in whether treatment will be utilized, the

types of treatment utilized, the volumes of soil and sediment to be treated, and ultimate disposal location. Each of the Consolidated Alternatives proposes to leave levels of PCBs above the remediation goals in the deep soils of Area 9 Building Complex, and to contain them in place. This containment is not as permanent as treatment, and the effectiveness will depend on the long-term operation and maintenance and institutional controls. Each of the four Consolidated Alternatives includes treatment by stabilization/ fixation for some of the PCB-contaminated waste. The long-term effectiveness and permanence of this treatment has not been proven for PCBs. Consolidated Alternatives 1 and 3 utilize incineration to permanently destroy PCBs, however, neither alternative proposes to use incineration on all of the material contaminated with PCBs.

For all of the alternatives, the long-term risks associated with exposure to and migration of the remaining wastes and treatment residues will be reduced (by varying degrees) by ensuring operation and maintenance of the landfills, maintenance of the caps/covers, groundwater monitoring and monitoring of drainageways and Crab Orchard Lake.

Reduction of Toxicity, Mobility, or Volume. The Selected Remedy will reduce toxicity, mobility, and volume to the maximum extent for PCBs and other organic chemicals. By permanently destroying these compounds, the volume of the hazardous materials is reduced and toxicity and mobility are eliminated. The mobility of the metals is reduced by stabilization/ fixation and containment, or by vitrification. Although stabilization/ fixation increases the volume of the treated material, it does not increase the mass of the hazardous components. Vitrification would reduce the volume of the contaminated soil, but would not effect the mass of the hazardous metal components.

All of the Consolidated Alternatives include varying degrees of treatment by stabilization/ fixation. This treatment would reduce the mobility of the treated contaminants, which would include both PCBs and metals. Stabilization/ fixation would not reduce toxicity or volume of the contaminants. Because they incinerate portions of the contaminated material, Consolidated Alternatives 1 and 3 would reduce toxicity, mobility, and volume of some PCBs by permanent destruction of lesser amounts of the contamination. None of the other alternatives would reduce toxicity, mobility or volume to the degree of the Selected Remedy.

Short-term Effectiveness. All of the alternatives under consideration could present a threat to workers and the environment during the construction/ implementation phase of the remedial action because of the potential for dust generation or the movement of contaminated sediments in surface water. The

utilization of various protective measures will minimize these threats.

Consolidated Alternatives 2 and 4 and the Selected Remedy using ISV would take the least amount of time to implement (approximately 2 years), Consolidated Alternative 3 would take slightly longer (approximately 2 to 3 years), and Consolidated Alternative 1 and the Selected Remedy using incineration would take the most time to implement (approximately 3 to 5 years). The difference in time is primarily based on the availability of incineration/ thermal destruction equipment. The availability of in situ vitrification equipment is also questionable. Protective measures would be used for the entire time the action is occurring.

Implementability. All Consolidated Alternatives and the Selected Remedy (using incineration) use standard, reliable technologies which are feasible for implementation. The availability of a mobile incinerator is a potential difficulty which could affect the implementability of the Selected Remedy and Consolidated Alternatives 1 and 3. However, this equipment is currently available. The availability of a commercial vitrification process that could meet the remediation goals and performance standards for the Site is a concern. However, this issue is one which must be addressed before the Alternative Treatment Technology (ISV) could be implemented.

Cost. For the Selected Remedy (using incineration and using ISV), and each Consolidated Alternative, the total remedial costs (capital plus operation and maintenance) in present net worth are:

-	Selected Remedy (incineration)	$25,000,000
-	Selected Remedy (ISV)	17,080,215#
-	Consolidated Alternative 1	25,195,035*
-	Consolidated Alternative 2	6,156,161*
-	Consolidated Alternative 3	8,910,700*
-	Consolidated Alternative 4	23,858,330*

As previously explained, the costs for the Alternative Treatment Technology (ISV) are taken from the costs for Alternative 1C from Chapter 7 of the FS. These costs represent the costs for vitrification of the Area 9 contamination. Since Area 9 is expected to contribute over 95% of the mass of contaminated soil and sediments, the cost listed here is a reasonable estimate, but may be greater.

* Each of the consolidated alternatives includes some costs for remediation of the Metals Areas operable unit. The costs listed above would be approximately 5 to 15 percent less for only the PCB Areas operable unit.

Support Agency Acceptance. The DOI, the current owner of the site, concurred on the proposed plan for the PCB Areas Operable Unit. At this time, the Department has not concurred on the final selected remedy.

The State of Illinois concurs with the treatment component for contaminated soils and sediments in the selected remedy (see Appendix C).

Community Acceptance. A thirty-day public comment period was originally scheduled to run from August 18, 1989, to September 16, 1989. Based on concerns expressed at the public hearing on August 30, 1989, and in letters to the U.S. EPA, the comment period was extended three times until December 1, 1989. This allowed for a total public comment period of 105 days. In addition, a second public hearing was held on October 3, 1989, when additional comment was taken.

A number of commentors presented oral comments at one or both of the public hearings. Numerous written comments relating to the PCB Areas operable unit were also received during the official public comment period, including letters from organizations and political entities. The comments related to the Superfund decisionmaking process and/or the technical merits of the alternative preferred in the Proposed Plan. Commentors focussed especially on the incineration component of the preferred alternative. Additionally, approximately 700-800 signatures were submitted on petitions opposing incineration. The comments received have been summarized and addressed in the Responsiveness Summary portion of this ROD.

The comments received during the public comment period are one measure of the community's acceptance of U.S. EPA's proposed Selected Remedy. The vast majority of comments submitted on the PCB Areas Proposed Plan either opposed the incineration treatment process or expressed concern with the safety of its implementation. Most commentors that opposed incineration stated that there was a clear need for remediation of the contaminated areas, but that they were concerned with the "safety" of an incinerator. Along with the vocal opposition to the incineration treatment, there was extensive concern expressed that the public needs to be involved in the implementation of the remedy. As expressed in the Responsiveness Summary portion of this ROD, U.S. EPA strongly supports the active involvement of the community in the continued Superfund activities at the Site.

Another measure of community acceptance is the organization of diverse elements of the community into the Crab Orchard Response Team (CORT). This group organized as a response to concerns from many sectors of the community and is becoming involved as a focal point to express continued community concerns. The comments

received from CORT are included as official documents in the Administrative Record.

In conclusion, the community near the Refuge has expressed opposition to the incineration component of the Selected Remedy, or is concerned that the implementation of the incineration process must ensure the safety of the local communities. In addition, the community is generally dissatisfied with the Superfund decisionmaking process, and individuals and groups feel that they need far more involvement in on-going activities.

In summary, at this time the Selected Remedy represents the best balance among the alternatives of the evaluation criteria used to evaluate remedies. The Selected Remedy emphasizes long-term effectiveness and permanence and reduction of toxicity, mobility and volume. The Selected Remedy is safe and provides short-term effectiveness, and is implementable. The demonstration to allow an Alternative Treatment Technology (ISV) is an attempt to keep the same balance of the evaluation criteria, and at the same time to address community concerns.

X. STATUTORY DETERMINATIONS

A. PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The Selected Remedy (using incineration or, if successfully demonstrated, in situ vitrification) is protective of human health and the environment for the four study sites comprising the PCB Areas operable unit. Also, the Selected Remedy is consistent with the mission of the Refuge, which is to provide a safe and protective setting for wildlife. The Selected Remedy provides adequate protection by a combination of treatment of contaminated soil and sediment by incineration to destroy the organic contaminants, stabilization/ fixation of the RCRA characteristic metal-bearing material to render it non-hazardous, the engineered control of an on-site solid waste landfill for the treated and untreated contaminated residues, and institutional controls by continuing to restrict public access, particularly to the constructed landfill.

The Alternative Treatment Technology (ISV) would provide the same degree of protectiveness by destruction of the organic material and immobilization of the metal-bearing material by in situ vitrification, the engineered control of a low-permeability cap over the treated residues, and institutional controls. The remedial alternatives, including on-site landfills, were developed with the understanding that the Site would continue to be a wildlife refuge, with restricted public access in order to protect the wildlife. An interagency agreement will require DOI to maintain the on-site landfill and to impose access restrictions for the landfill, if the land use were to change in the future.

The remediation goals for the study sites comprising the operable unit have been established so that human exposure levels will be reduced for

the sum of all contaminants to no greater than a 10^{-6} excess cancer risk level. In addition, the non-carcinogenic hazard indices for the sum of all contaminants shall be less than one. Also, chemical-specific remediation goals have been established by the FWS which are believed to be protective of wildlife at this site. The remediation goals established in this document are consistent with DOI's concerns and statutory mandates. Implementation of the selected remedy will not pose unacceptable short-term risks and will not cause cross-media impacts.

The Selected Remedy would remediate the four study sites that comprise the operable unit so that future access restrictions to those areas would not be needed (although the vitrified masses may require limited restrictions). Because the Selected Remedy will leave contaminants at the site in either an on-site landfill or in the vitrified area of contamination, CERCLA Section 121(c) requires that the remedy be reviewed at least every five years to ensure that it continues to be protective to public health and the environment.

B. COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The selected remedy will comply with all Federal and any more stringent State ARARs. The major ARARs that will be attained by the components of the Selected Remedy are listed below. The list of ARARs below is intended to be comprehensive, however, implementation of the ARARs will be determined, and identification of ARARs may require further refinement, during remedial design and remedial action.

1. Surface Water Discharge

Clean Water Act

- If pond or stream water from site 17 or stream or ditch water from Area 9 (sites 32 and 33) must be discharged to a surface water body during site preparation, the discharge shall meet the effluent standards and prohibitions and water quality standards established under Sections 301, 302, 303, 307, 318 and 405 of the Clean Water Act (40 CFR 122.41 and 122.44).

2. Excavation of Soil and Sediment

Resource Conservation and Recovery Act, Subtitle C

- Excavated material which is RCRA hazardous will be handled and stored in accordance with the substantive technical standards applicable to generators of hazardous waste and for owners and operators of hazardous waste storage facilities (40 CFR 262.34; and 264, Subparts B, C, I, J, and L).

- Excavated material which is RCRA hazardous will be handled and stored in accordance with the land disposal restrictions (40 CFR 268).

- The excavation activities, when completed shall meet the closure performance standards for clean closure (40 CFR 264, Subpart G) for the specific hazardous waste constituents.

- The excavation and storage activities must also meet any more stringent State of Illinois equivalent provisions (35 IAC Part 724 design requirements).

Toxic Substances Control Act

- Excavated material which contains PCBs at concentrations greater than 50 parts per million will be handled and stored in accordance with the requirements of 40 CFR 761.65.

Clean Air Act

- During excavation the national ambient air quality standards (NAAQS) for particulate matter and lead shall not be exceeded (40 CFR 50.6 and 50.12).

3. Incineration of Soil and Sediment

Toxic Substances Control Act

- All contaminated soil and sediment that contains PCBs above the remediation goal shall be disposed of in accordance with the disposal requirements of 40 CFR 761.60(a)(4)(i) and (d).

- The design and operation of the on-site mobile incinerator will meet the substantive technical requirements of the TSCA incineration regulations (40 CFR 761.70).

Resource Conservation and Recovery Act, Subtitle C

- The design and operation of the on-site mobile incinerator will meet the substantive technical requirements of the RCRA, Subtitle C incineration regulations (40 CFR 264, Subpart O).

- The incinerator ash will be analyzed to determine if it is a RCRA characteristic waste in accordance with 40 CFR 262.11.

- Incinerator ash which is RCRA hazardous will be handled and stored in accordance with the substantive technical standards applicable to generators of hazardous waste and for owners and operators of hazardous waste storage facilities (40 CFR 262.34; and 264, Subparts B, C, I, J, and L).

- Incinerator ash which is RCRA hazardous will be handled and stored in accordance with the land disposal restrictions (40 CFR 268).

Clean Air Act

- During incineration the national ambient air quality standards (NAAQS) for particulate matter and lead shall not be exceeded (40 CFR 50.6 and 50.12).

4. Vitrification

Toxic Substances Control Act

- All contaminated soil and sediment that contains PCBs above the remediation goal shall be disposed of in accordance with the substantive technical disposal requirements of 40 CFR 761.60(d) and (e).

- The design and operation of the on-site vitrification unit will meet the substantive technical performance standards of the TSCA incineration regulations (40 CFR 761.70).

Resource Conservation and Recovery Act, Subtitle C

- The design and operation of the on-site vitrification unit will meet the substantive technical requirements of the RCRA, Subtitle C miscellaneous unit regulations (40 CFR 264, Subpart X).

- RCRA characteristic waste may only be consolidated in a non-contiguous area of contamination if the substantive technical requirements of 40 CFR 264.301(b) and 268.6 have been met.

- If the final rulemaking specifies a specific treatment technology for metal-bearing characteristic waste, the substantive technical requirements of 40 CFR 268.42(b) will be met, if required.

Clean Air Act

- During treatment the NAAQS for particulate matter and lead shall not be exceeded (40 CFR 50.6 and 50.12).

5. Stabilization/ Fixation

Resource Conservation and Recovery Act, Subtitle C

- RCRA hazardous material will be treated by this process to render it non-hazardous. The treatment shall be in accordance with any promulgated treatment standards for waste which is EP Toxic for cadmium and/or lead (40 CFR 268 for D006 and/or D008 waste).

- Treatment shall be in units designed to meet the substantive technical requirements for either containers, tanks, waste piles or miscellaneous units (40 CFR 264, Subparts I, J, L or X).

- Treatment units must meet any more stringent regulatory design standards of the State of Illinois (35 IAC Part 724).

Clean Air Act

- During treatment the NAAQS for particulate matter and lead shall not be exceeded (40 CFR 50.6 and 50.12).

6. Disposal or Decontamination of Equipment

Resource Conservation and Recovery Act, Subtitle C

- During remediation and closure all equipment, structures and soils that are used on/with RCRA hazardous materials must be properly decontaminated or disposed of (40 CFR 264.114).

- Decontamination of equipment structures and soils that are used on/with RCRA hazardous materials must meet any more stringent regulatory decontamination or disposal standards of the State of Illinois (35 IAC Part 724).

Toxic Substances Control Act

- During remediation and closure all equipment, structures and soils that are used on/with TSCA regulated PCB-contaminated soil and sediment must be properly decontaminated (40 CFR 761.79).

7. Industrial Landfill or Caps

Solid Waste Disposal Act as amended by RCRA Subtitle D

- The design and operation of the on-site solid waste disposal cell or the cap over the vitrified area of contamination will meet the substantive technical requirements of the RCRA, Subtitle D guidelines for the land disposal of solid waste (40 CFR 241, Subpart B).

- Since all of the RCRA hazardous material will be rendered non-hazardous prior to placement in the landfill, the requirements of the land disposal regulations of 40 CFR 268 do not apply, nor are they relevant or appropriate.

- The design and operation of the landfill will meet any more stringent technical regulations of the State of Illinois (35 IAC Part 807).

8. Backfill Excavation

Clean Air Act

- During backfilling activities the NAAQS for particulate matter shall not be exceeded (40 CFR 50.6).

9. Monitoring and Maintenance

Resource Conservation and Recovery Act, Subtitle C

- Groundwater monitoring for the remediated study sites shall be in accordance with the groundwater monitoring requirements of RCRA (40 CFR 264, Subpart F).

Solid Waste Disposal Act as amended by RCRA Subtitle D

- Groundwater and leachate monitoring for the on-site landfill shall be in accordance with the RCRA Subtitle D, solid waste landfill requirements (40 CFR 241.204).

- Groundwater and leachate monitoring for the on-site landfill will meet any more stringent technical regulations of the State of Illinois (35 IAC Part 807).

10. Personnel Protection

Occupational Safety and Health Act (OSHA)

- During all remedial activities the requirements of the Occupational Safety and Health Act for the training and safety of workers will be observed (29 CFR 1910.120 and 1926, Subparts C, D, E, and P).

11. Remediation Goals

Crab Orchard Enabling Legislation (16 U.S.C. 666f and g)

National Wildlife Refuge Administration Act (16 U.S.C. 668dd)

Eagle Protection Act of 1940 (16 U.S.C. 668a)

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-711), as amended

- The chemical specific remediation goals which have been established for the study sites comprising the PCB Areas, and any others that will be established for this operable unit will be consistent with the statutory requirements cited above.

For implementation of the Selected Remedy, U.S. EPA, DOI and IEPA have agreed to consider a number of procedures as guidance. These include, but are not limited to: U.S. EPA's Risk Assessment Guidance for

Superfund; U.S. EPA's Superfund Remedial Design and Remedial Action Guidance; U.S. EPA's RCRA Technical Enforcement Guidance Document; U.S. EPA's proposed MCL for PCBs; any proposed revisions to U.S. EPA's design standards for RCRA Subtitle D landfills, which are available before remedial design; the State of Illinois Waste Management Facilities Design Criteria; and State of Illinois Monitoring Well Construction and Installation Criteria.

C. COST EFFECTIVENESS

The Selected Remedy for this operable unit appears to be cost-effective. The costs are reasonable for the overall effectiveness of the chosen remedy. Other Alternatives which were less costly provided less long-term effectiveness and permanence; less reduction of toxicity, mobility or volume; or less implementability.

D. UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The Selected Remedy for the PCB Areas operable unit utilizes permanent solutions and treatment technologies to the maximum extent practicable.

The evaluation of the five primary balancing criteria is discussed in Part IX., above. The analysis of the criteria supports the Selected Alternative and the Alternative Treatment Technology, as providing the best balance among the developed Alternatives. The analysis of the criteria demonstrates that the Selected Remedy utilizes permanent solutions to the maximum extent practicable. The Selected Remedy was chosen as the final remedial action for the PCB Areas operable unit because it provides the greatest long-term effectiveness and permanence and reduction of toxicity, mobility and volume through treatment.

The Alternative Treatment Technology (ISV) is included to allow the party(ies) responsible for the implementation of the remedy to demonstrate that vitrification, an alternative treatment technology, is as effective as incineration, which is a proven technology for PCB contamination. If the demonstration allowed in Part VIII.A.3 indicates that the required treatment and performance standards can be met by vitrification, then the treatment component of the Selected Remedy may include this Alternative Treatment Technology.

E. PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The Selected Alternative uses treatment as a principal element to address the threats posed by the sites comprising the PCB Areas operable unit. The results of the risk assessment conducted as part of the RI indicate that the greatest threats to human health and/or the environment are from contaminated soil and sediment, and potential surface water and food chain contamination resulting from run-off from the uncontrolled areas. The Selected Alternative requires that the organic contaminants in the soil and sediment (principally PCBs) be permanently destroyed by incineration or vitrification. The soil, sediment and any incinerator

residue which is hazardous because of the characteristic to leach metals be treated by stabilization/ fixation or vitrification to render the material non-hazardous and to reduce mobility of the contaminants. Incineration and stabilization/ fixation treatment technologies have been demonstrated to be extremely effective for soil and sediment contaminated with PCBs and metals respectively. Vitrification has not been fully demonstrated for the principal contaminants, but is a promising alternative treatment technology.

XI. DOCUMENTATION OF SIGNIFICANT CHANGES

A. ORIGINAL PREFERRED ALTERNATIVE

The Proposed Plan for the PCB Areas operable unit was made available to the public on August 18, 1989. The preferred alternative identified in the Proposed Plan was a consolidated remedial alternative which included the following components:

Excavation of Soil and Sediment - Contaminated soil and sediment would be excavated using conventional equipment. The excavated material would be moved to a storage area on-site, where it would be stored until it was treated or disposed.

Incineration/ Thermal Destruction - All excavated soil and sediment which is contaminated with PCBs would be treated by incineration/ thermal destruction. Non-contaminated incinerator residue would be backfilled in the excavated areas.

Stabilization/Fixation - Residues from incineration/ thermal destruction, and non-incinerated soil and sediment which contain metals at levels which are hazardous because of the characteristic for leachable metals, as defined by RCRA, would be treated by stabilization/fixation.

Industrial Landfill - Contaminated residues from incineration/ thermal destruction and materials treated by stabilization/ fixation would be disposed of in an on-site industrial landfill, meeting at a minimum, the applicable or relevant and appropriate requirements of Subtitle D of RCRA and 35 IAC Part 807.

Low Permeability Caps - Areas where contamination is below the excavation criteria, or from where contaminated soil and sediment have been excavated would be closed and covered with a low permeability cap. The cap would be constructed of compacted soil, a drainage layer, soil fill and topsoil. Routine maintenance of the cover would be part of the long term requirements.

Backfill Excavation - Clean soil would be placed in the areas where contaminated material had been removed.

Monitoring and Maintenance - Groundwater and surface water monitoring would be conducted around the on-site landfill and

excavated areas. Inspection and maintenance of the landfill would also be required.

B. DESCRIPTION OF SIGNIFICANT CHANGES

The only significant change which has been made to the Selected Remedy from the Preferred Alternative discussed in the Proposed Plan for the PCB Areas operable unit is that the remedy selected in this Record of Decision allows a demonstration to select an Alternative Treatment Technology, if specific criteria can be met. This change would allow the party(ies) responsible for the implementation of the remedy to perform a treatability study to demonstrate that in situ vitrification, an innovative technology for PCB-contaminated soil and sediment, will meet specific requirements. The Selected Remedy is the same as the Preferred Alternative in the Proposed Plan unless the Alternative Treatment Technology is utilized. The Alternative Treatment Technology and the demonstration required in order to implement it are discussed extensively in Sections VIII.A.2 and 3, respectively.

C. REASON FOR CHANGES

On March 8, 1990, the National Contingency Plan (NCP) was revised. The revised NCP is the regulatory framework for the implementation of CERCLA. The revised NCP continues to emphasize treatment of contaminated material as a principal element of Superfund remedies. In addition, the revised NCP provides for the utilization of innovative or alternative treatment technologies, where appropriate. U.S. EPA, in selecting final remedies for sites or operable units, must balance a number of statutory mandates. These mandates are discussed in Part X. above. The revised NCP provides guidance in the application of the statutory determinations for remedy selection.

U.S. EPA is considering using the innovative technology described because it offers the potential for comparable or superior treatment performance or implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies.

For the PCB Areas operable unit at the Refuge, U.S. EPA believes that treatment of the principal threats is required. Further, U.S. EPA believes that the Selected Remedy will accomplish this goal, will meet all of the statutory mandates, and will provide the best balance among the remedy evaluation criteria. However, in order to accommodate the revised NCP's emphasis on innovative technology, and to try to respond to community concern, an Alternative Treatment Technology (ISV) has been included in the Selected Remedy. This alternative treatment may only be implemented if a demonstration successfully shows that the innovative treatment can meet the remediation goals for the PCB Areas operable unit.

CRAB ORCHARD NATIONAL WILDLIFE REFUGE
PCB AREAS OPERABLE UNIT ROD

APPENDIX A
FIGURES

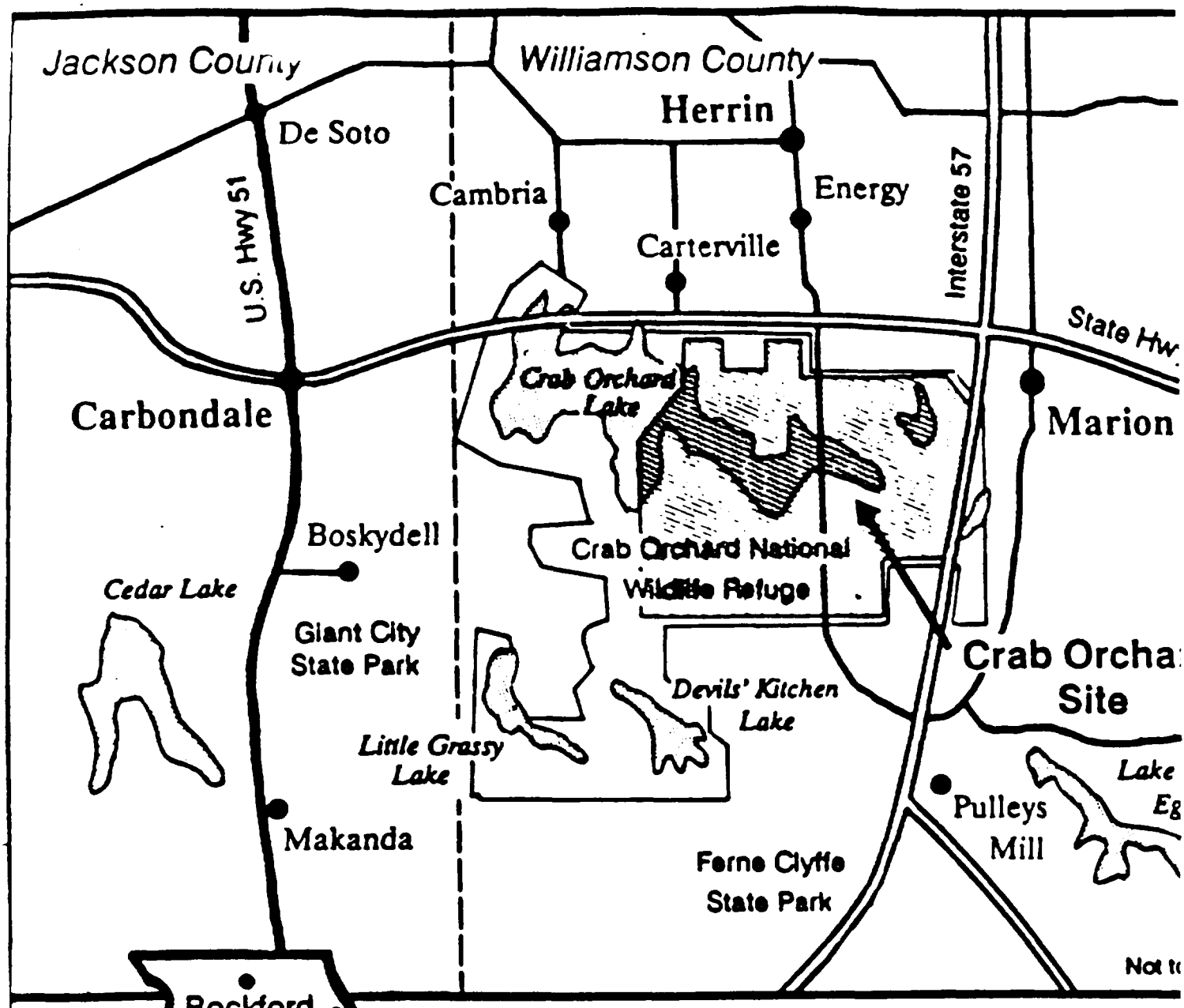
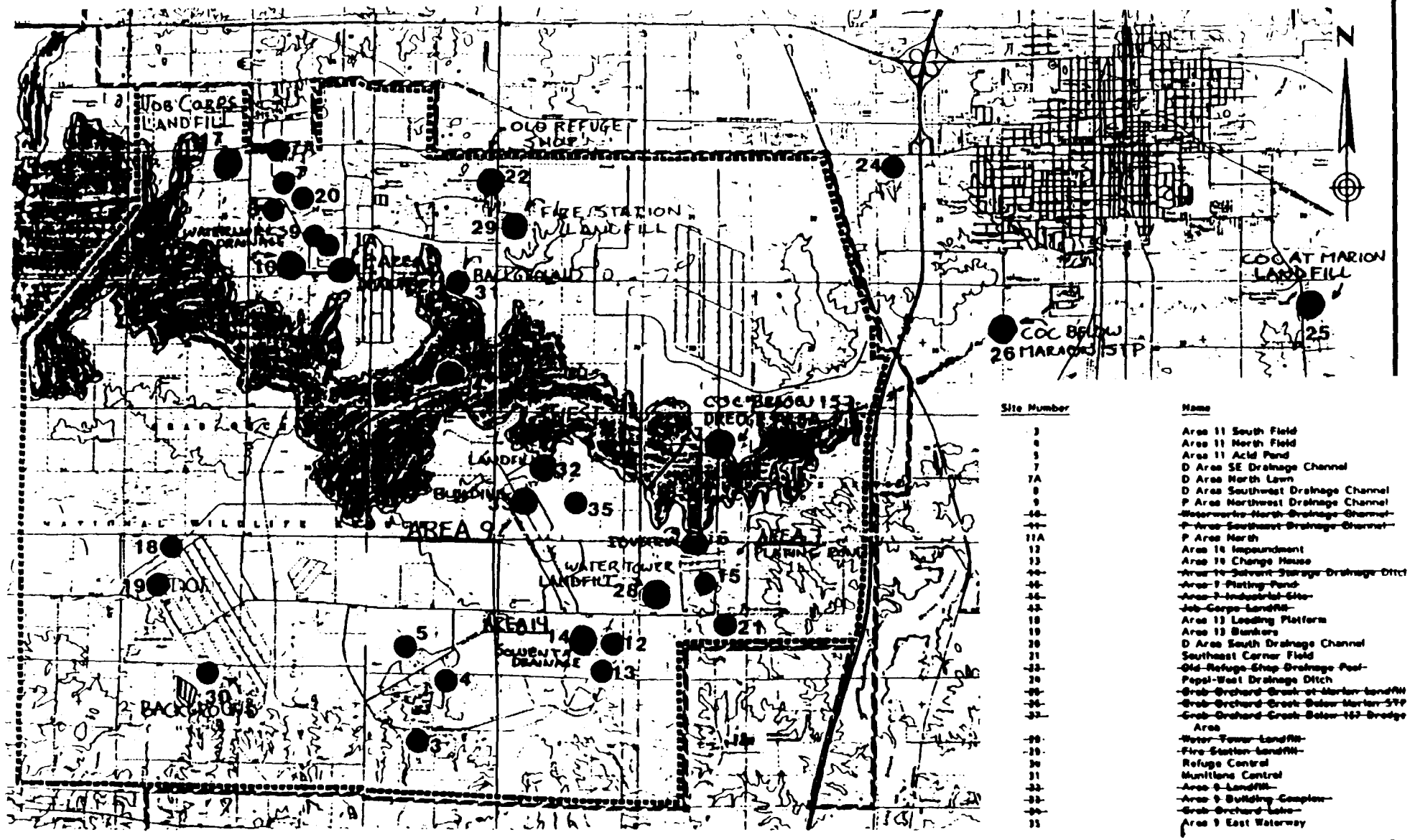


Figure 1
Site Area Map
Crab Orchard Site
Williamson County, Illinois

Refuge Boundary
Closed Site Area
Surface Water

FIGURE 2



Site Number	Name
3	Area 11 South Field
5	Area 11 North Field
9	Area 11 Acid Pond
7	D Area SE Drainage Channel
7A	D Area North Lawn
8	D Area Southwest Drainage Channel
9	P Area Northwest Drainage Channel
~~10~~	~~Waterworks North Drainage Channel~~
~~11~~	~~P Area Southeast Drainage Channel~~
11A	P Area North
12	Area 14 Impoundment
13	Area 14 Change House
~~14~~	~~Area 14 Solvent Storage Drainage Ditch~~
~~15~~	~~Area 9 Plating Pond~~
~~16~~	~~Area 9 Industrial Site~~
~~17~~	~~Job Corps Landfill~~
18	Area 13 Loading Platform
19	Area 13 Bunkers
20	D Area South Drainage Channel
21	Southeast Corner Field
~~22~~	~~Old Refuge Shop Drainage Pool~~
24	Pepsi-West Drainage Ditch
~~25~~	~~Crab Orchard Creek at Marion Landfill~~
~~26~~	~~Crab Orchard Creek Below Marion STP~~
~~27~~	~~Crab Orchard Creek Below 13? Dredge Area~~
~~28~~	~~Water Tower Landfill~~
~~29~~	~~Fire Station Landfill~~
30	Refuge Central
31	Munitions Central
~~32~~	~~Area 9 Landfill~~
~~33~~	~~Area 9 Building Complex~~
~~34~~	~~Crab Orchard Lake~~
35	Area 9 East Waterway

REFUGE BOUNDARY

CLOSED AREA

SCALE IN FEET

0 4000 8000

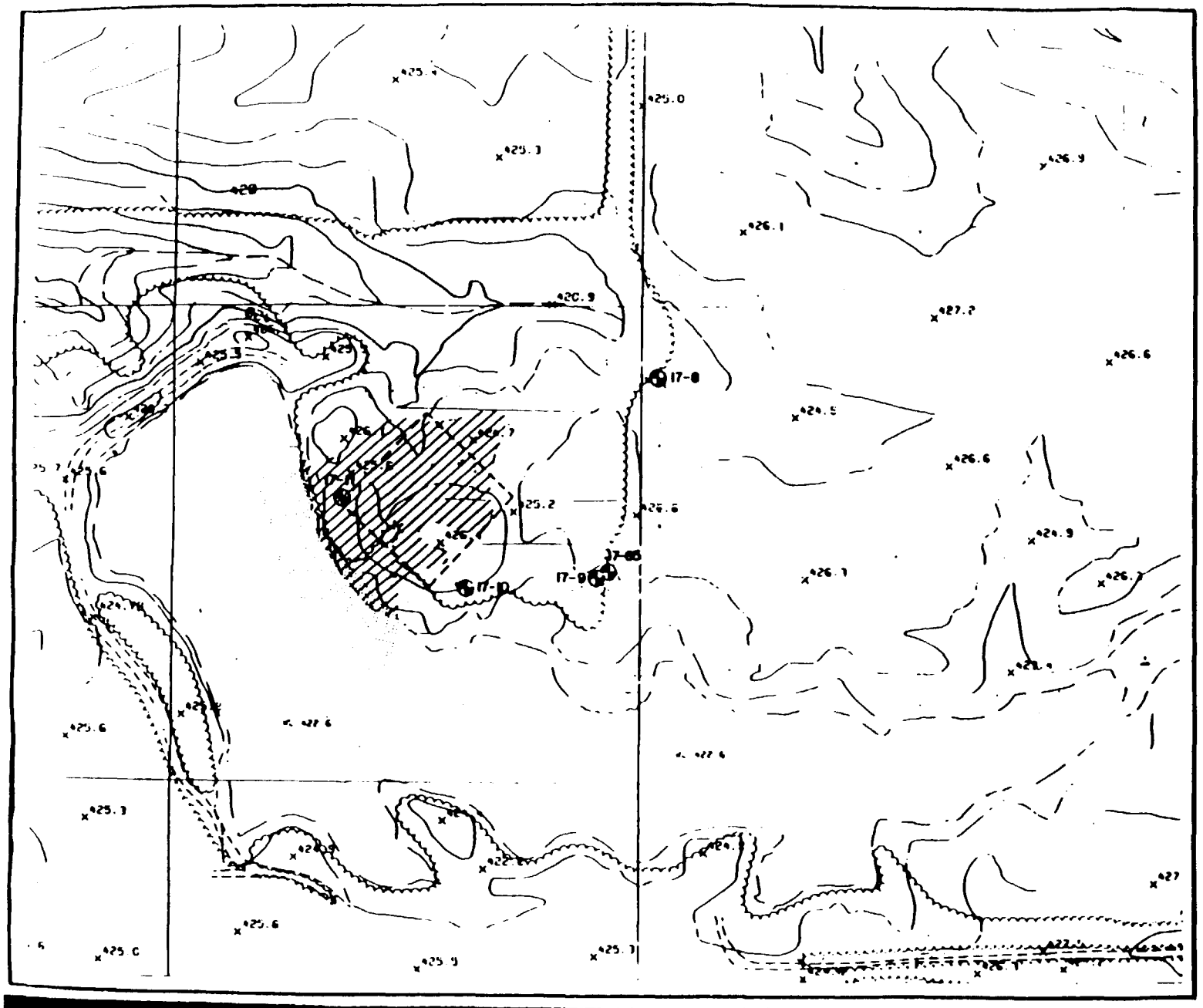
CRAB ORCHARD NATIONAL WILDLIFE REFUGE
LOCATIONS OF SAMPLING SITES

● MOVED TO FS

● MONITORING

O'BRIEN & GERE

FIGURE 3



N

CRAB ORCHARD NATIONAL WILDLIFE REFUGE

SITE 17 FEASIBILITY STUDY

LEGEND

- PROPOSED REMEDIATION AREA (SOIL) > 50 PPM PCI
- PROPOSED REMEDIATION AREA (SEDIMENT) >50 PPM
- GROUNDWATER MONITORIN WELL

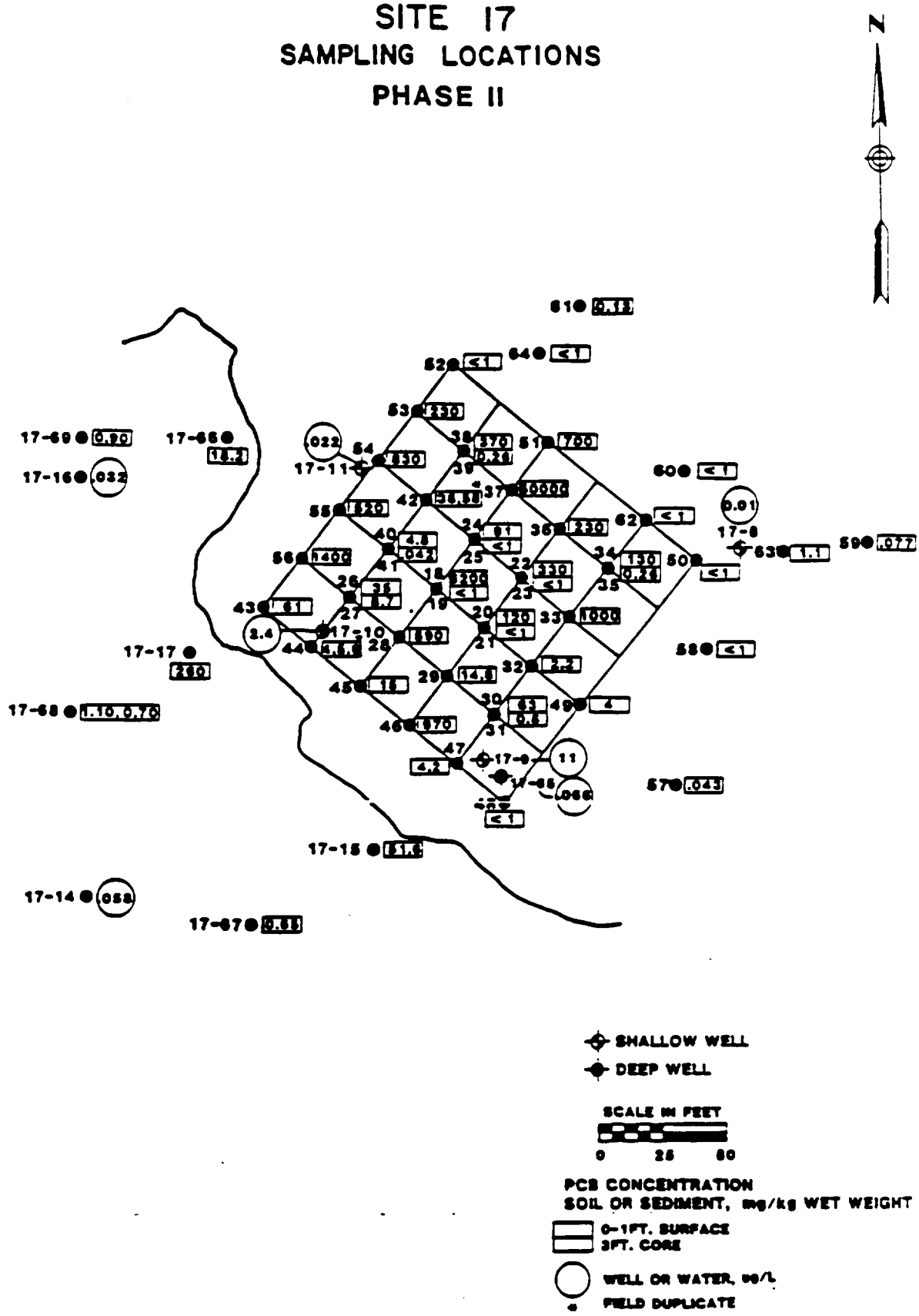
SCALE IN FEET

0 100 200

O'BRIEN & GERE

FIGURE 4

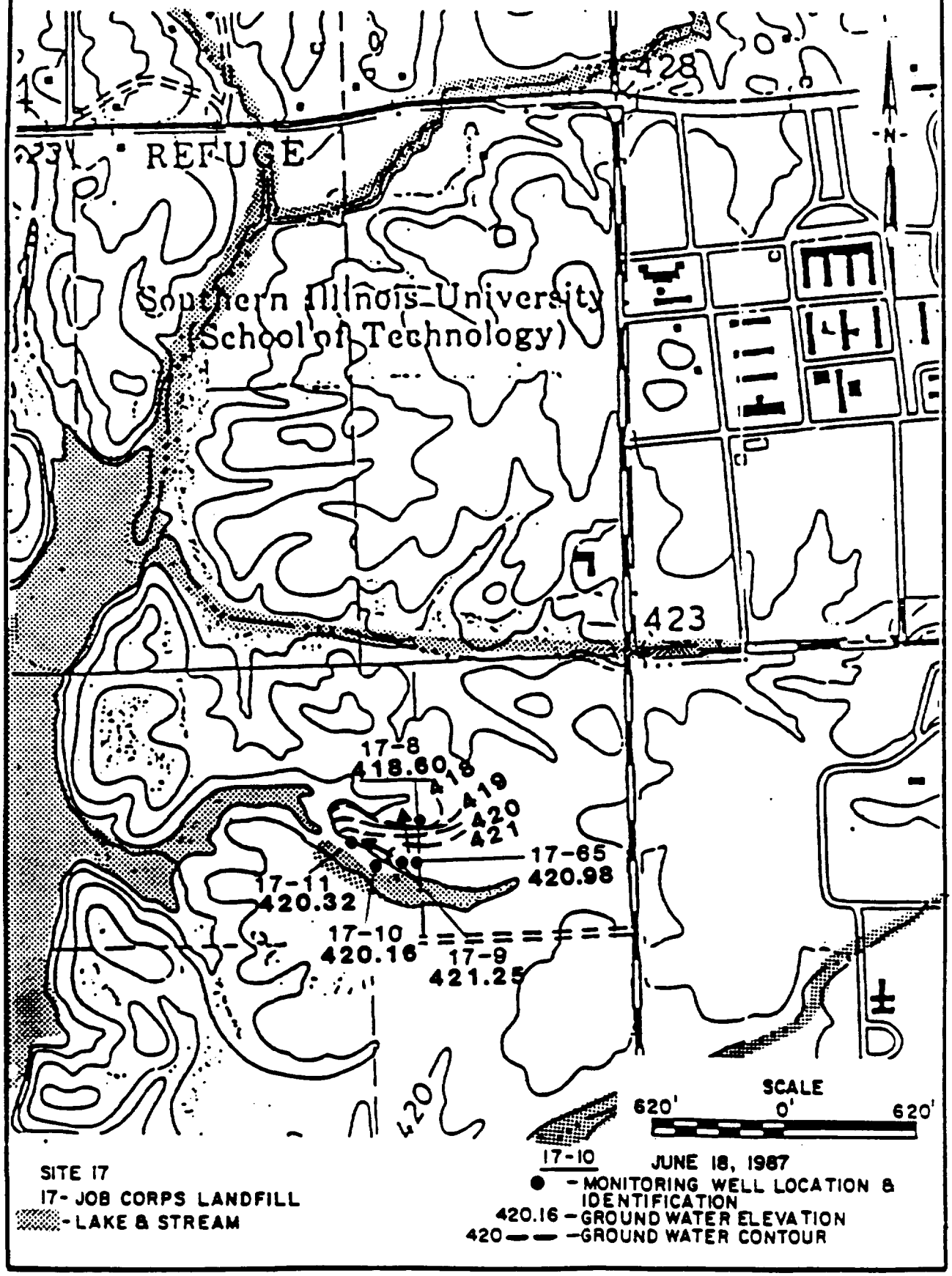
SITE 17
SAMPLING LOCATIONS
PHASE II



O'BRIEN & GERE

FIGURE 5

SITE 17 GROUNDWATER FLOW MAP



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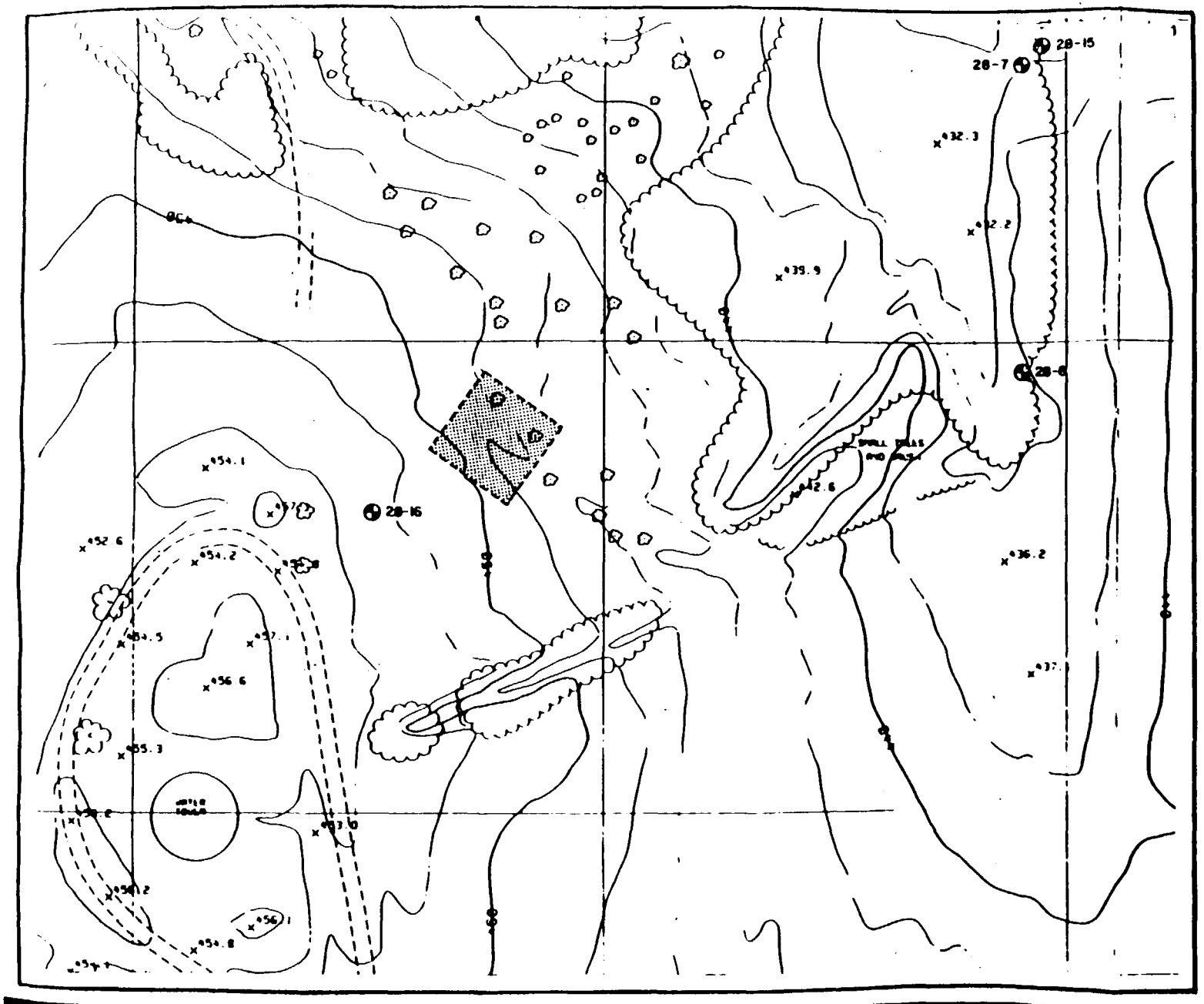


FIGURE 6

N

CRAB ORCHARD NATIONAL WILDLIFE REFUGE

SITE 28
FEASIBILITY STUDY

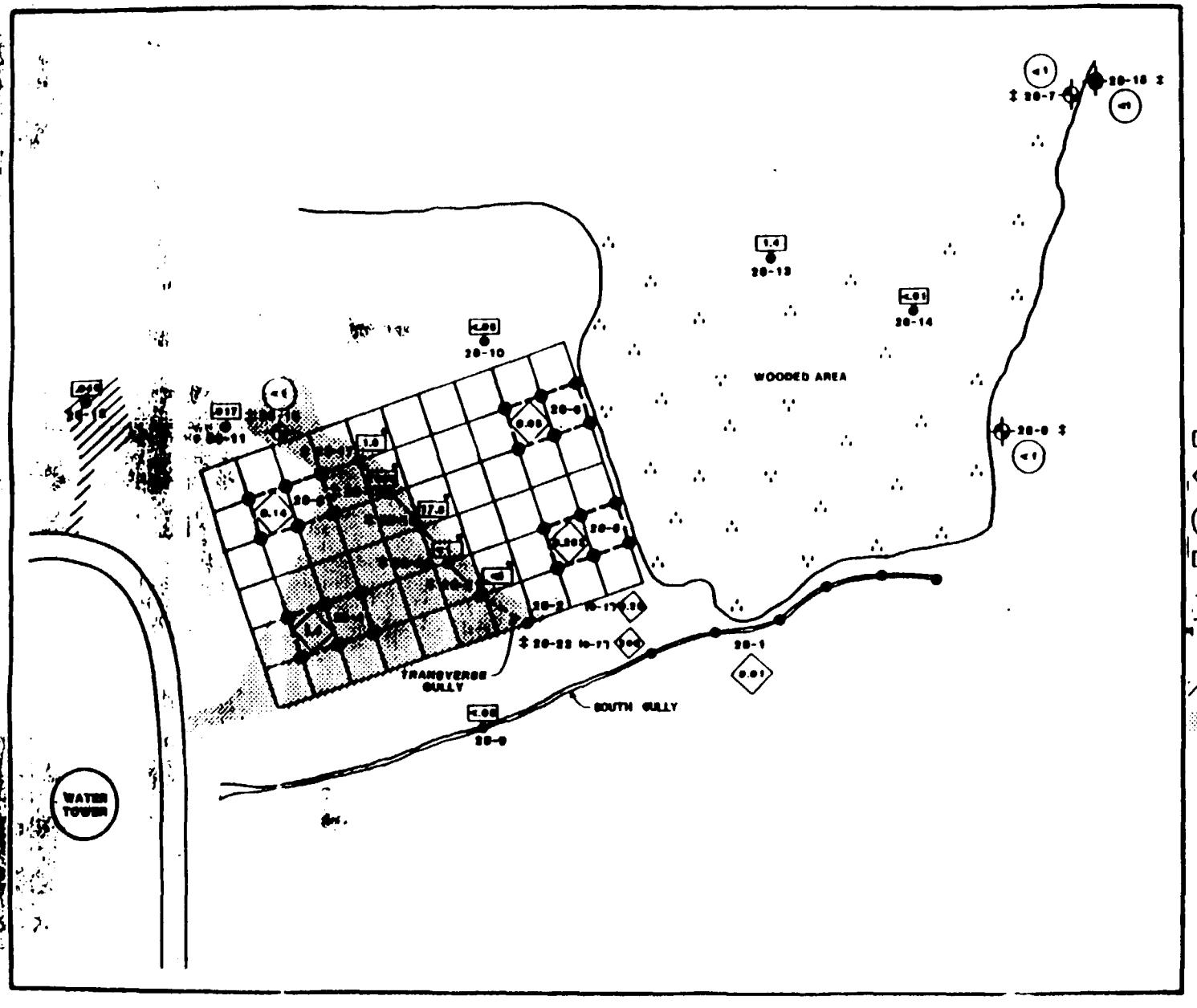
LEGEND

- PROPOSED REMEDIATION A
- GROUNDWATER MONITORIN WELL

SCALE IN FEET

0 50 100

FIGURE 7



N

SITE 28
WATER TOWER LANDFILL
PHASE I & II

LEGEND

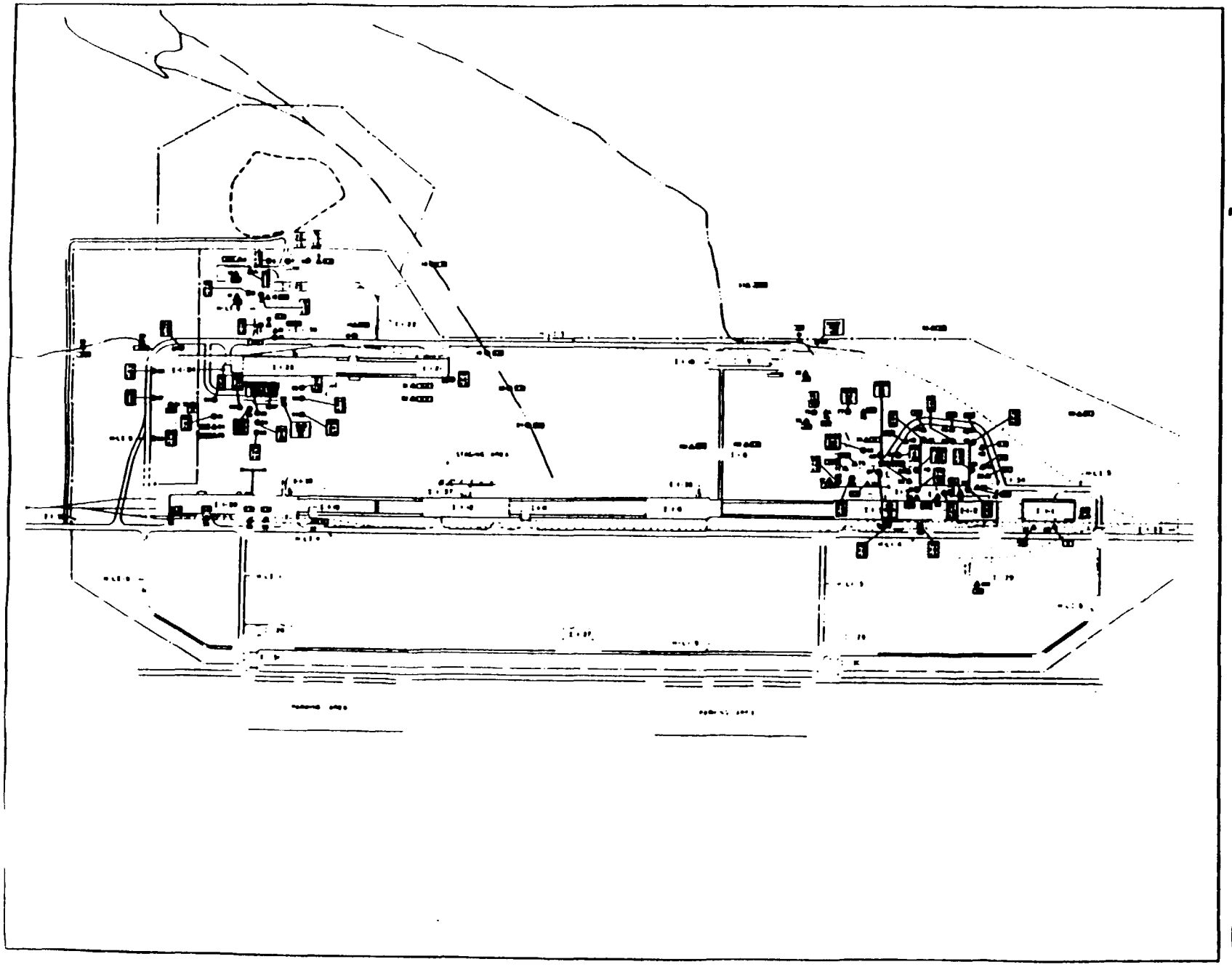
PCB CONCENTRATIONS

- GRAB SAMPLE SOIL, mg/kg WET WEIGHT
- AREAL SURFACE COMPOSITE SOIL, mg/kg WET WEIGHT
- WELL, mg/L
- SOIL, mg/kg WET WEIGHT 0-7' TEST PIT
- SHALLOW WELL
- DEEP WELL
- ‡ PHASE II SAMPLES
- - AREA OF SITE ACTIVITY INDICATED ON 1948 AIR PHOTO
- - AREA OF SITE ACTIVITY INDICATED ON 1965 AIR PHOTO

SCALE IN FEET

0 50 100

FIGURE 8



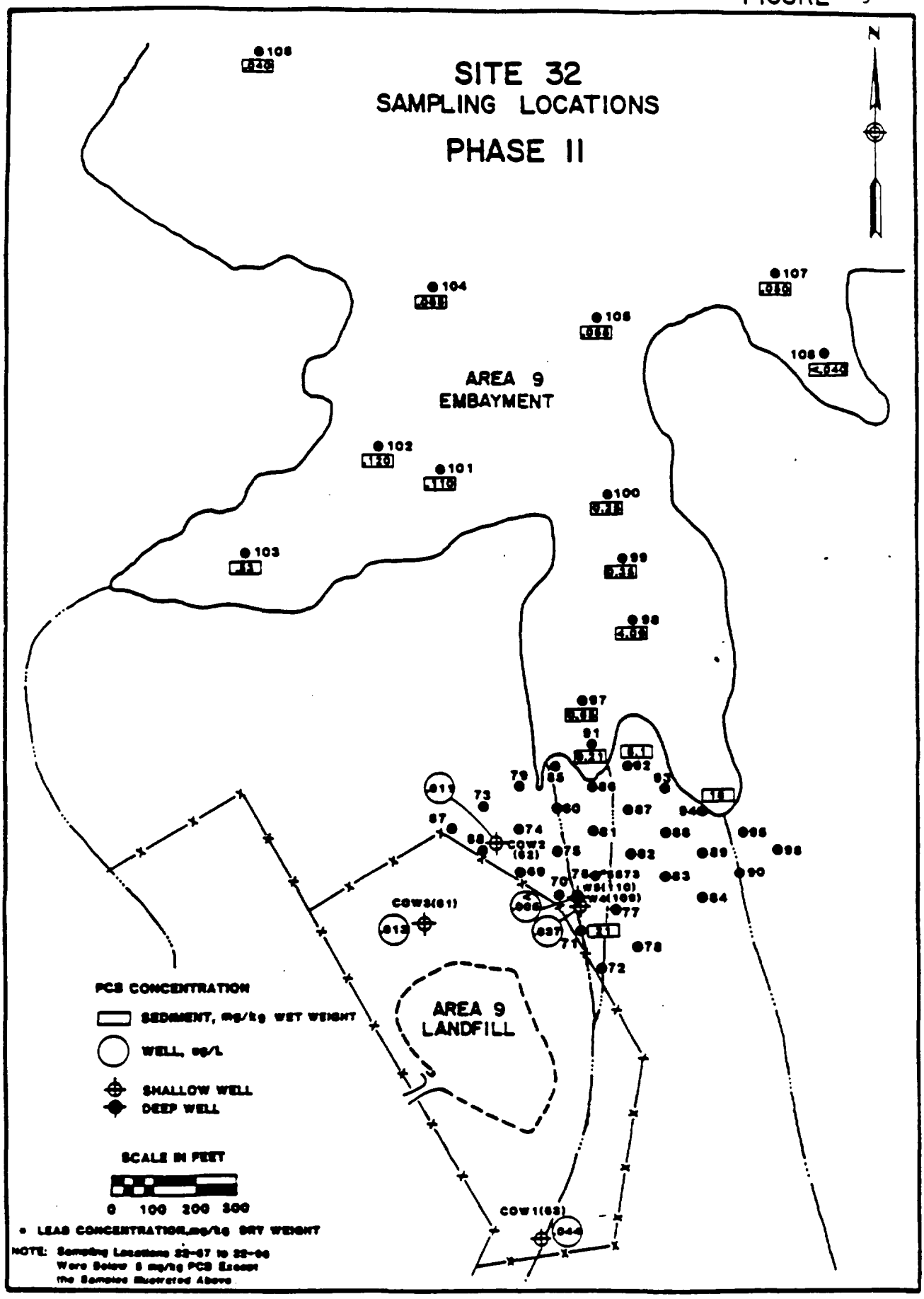
SITE 33

PHASE I SAMPLING LOCATIONS

LEGEND

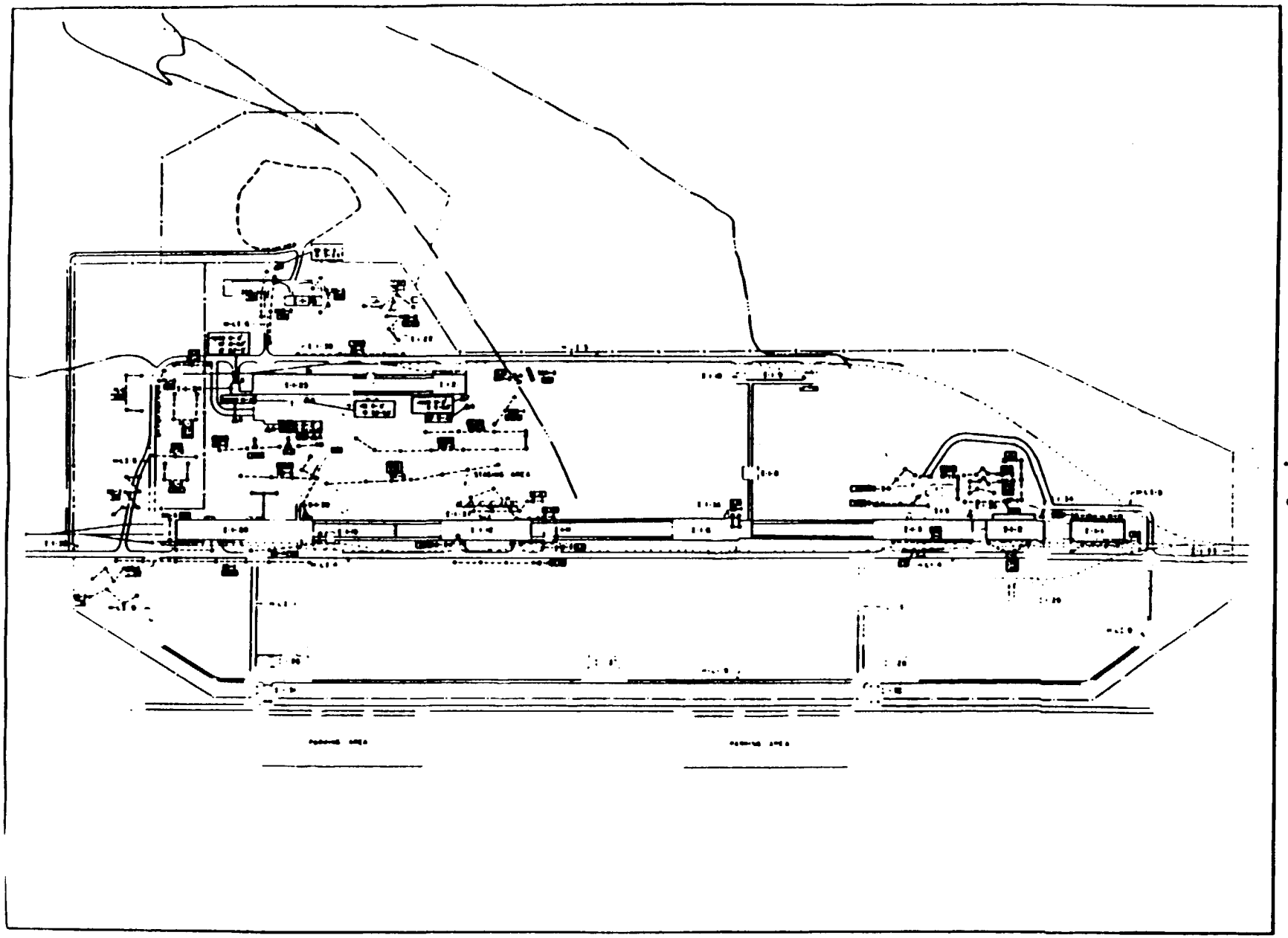
O'BRIEN & GERE

FIGURE 9



O'BRIEN & GERE

FIGURE 10



SITE 33

AREA 9 BUILDING COMPL

(OLIN DATA)

LEGEND

CHEMSENSE

CRAB ORCHARD NATIONAL WILDLIFE REFUGE
PCBS AREAS OPERABLE UNIT ROD

APPENDIX B
TABLE

TABLE 1
CRAB ORCHARD LAKE

ESTIMATED RISK TO HUMANS
DUE TO CONSUMPTION OF FISH TISSUE

ASSUMPTIONS:
- 100 % of fish diet is captured at Crab Orchard Lake.
- Consumption of Crab Orchard fish continues over a 70-year lifetime, or during a 10-year or 5-year period.
- Undetected values are calculated as one half the analytical detection limit (0.2 mg/kg for RI data).
- Cancer unit risk factor of 7.7 $(mg/kg/day)^{-1}$ for Aroclor 1260 (*)
- East/West division denoted by Wolf Creek (200 fishable acres on eastern area, 7000 fishable acres total for lake.)

SCENARIO	AVERAGE PCB CONCENTRATION (mg/kg ww) (1)	(2)	<------ RISK LEVELS+ ------> 70-year Lifetime	10-year Exposure	5-year Exposure
I. Average Fisherman (6.5 g fish per day or 10-20 meals per year)					
a) 95% West Bass/5% East Bass	0.34	0.20	2.5E-04	3.5E-05	1.8E-05
b) 100% West Catfish/Bullhead	0.32	0.08	2.3E-04	3.3E-05	1.6E-05
c) 95% West /5% East Catfish	0.61	0.51	4.3E-04	6.1E-05	3.0E-05
d) Creel Census (4)	0.30	--	1.7E-04	2.4E-05	1.2E-05
e) National Average (5,#) 1976-1979	0.29	--	2.1E-04	3.0E-05	1.5E-05
f) National Average (6,#) 1980-1981	0.18	--	1.3E-04	1.8E-05	9.2E-06
II. Sports Fisherman (30 g fish per day or 50-100 meals per year)					
a) 95% West Bass/5% East Bass	0.34	0.20	1.2E-03	1.6E-04	8.3E-05
b) 100% West Catfish/Bullhead	0.32	0.08	1.1E-03	1.5E-04	7.4E-05
c) 95% West /5% East Catfish	0.61	0.51	2.0E-03	2.8E-04	1.4E-04
d) Creel Census (4)	0.30	--	7.8E-04	1.1E-04	5.6E-05
e) National Average (5,#) 1976-1979	0.29	--	9.6E-04	1.4E-04	6.8E-05
f) National Average (6,#) 1980-1981	0.18	--	5.9E-04	8.5E-05	4.2E-05

NOTES & REFERENCES:

(1) Averages are calculated assuming fish without detected PCB residues contain such residues at one half the analytical detection limit.
(2) Averages are calculated assuming fish without detected PCB residues are free of such residues.
(3) Derived using a 1976 Creel Census survey and average concentrations in fish species detected in the RI and in monitoring studies conducted by the State of Illinois (see Section 2.7). Based on the Creel Census data, the relative catch per boat expedition at Crab Orchard Lake is comprised of roughly, 35% bass, 31% bluegill sunfish, 14% catfish, 12% crappie and 8% bullhead.
(4) ATSDR (November, 1987). Draft Toxicological Profile on PCBs.
(5) Schmidt, CJ et al. (1985). National Pesticide Monitoring Program. Arch. Environ. Contam. Toxicol.; 14:225-60.

(#) Fillet residues calculated as one third reported whole body residue.
(*) The potency factor of 7.7 $(mg/kg/day)^{-1}$ is based on studies using Aroclor 1260; only Aroclor 1254 residues were detected at Crab Orchard Lake. Available data neither demonstrate nor preclude the carcinogenicity of Aroclor 1254.
(+) Additive risks due to PCB/TCDF residues in fish might be obtained by adding 15 percent to risk level noted for PCBs.

CRAB ORCHARD NATIONAL WILDLIFE REFUGE
PCBS AREAS OPERABLE UNIT ROD

APPENDIX C
SUPPORT AGENCY CONCURRENCE

Illinois Environmental Protection Agency · P.O. Box 19276, Springfield, IL 62794-9276

IEPA Record of Decision Declaration for the PCB Operable Unit
at the Crab Orchard National Wildlife Refuge
NPL Site near Marion, Illinois

With the exception of the specified landfill design, the selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate for this remedial action, and is cost-effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

Because this remedy will result in hazardous substances remaining on site, U.S. EPA is expected to conduct a review no less than five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

The adequacy of the U.S. EPA landfill design continues to be an outstanding issue with the State of Illinois and becomes the primary issue for complete concurrence at this time. Based on this information, the IEPA selectively concurs with the decision the U.S. EPA has made in selecting this remedy.

7/19/90
Date

Bernard P. Killian
Bernard P. Killian
Director
Illinois Environmental Protection Agency

BPK:SD:sap/2534n,60

RESPONSIVENESS SUMMARY FOR THE RECORD OF DECISION
CRAB ORCHARD NATIONAL WILDLIFE REFUGE
PCB AREAS OPERABLE UNIT

I. RESPONSIVENESS SUMMARY OVERVIEW

The United States Environmental Protection Agency (U.S. EPA) held a public comment period from August 18, 1989, through December 1, 1989, for interested parties to comment on the Proposed Plan for remediating contamination problems at the PCB Areas operable unit of the Crab Orchard National Wildlife Refuge Superfund site near Carterville, Illinois. Comments were also taken on any documents in the administrative record, including the Remedial Investigation/Feasibility Study (RI/FS). The required public hearing on August 30, 1989, focused on the results of the FS and U.S. EPA's preferred remedial alternative (Proposed Plan). Comments were taken on both the Metals Areas and PCB Areas operable units at the hearing on August 30, 1989. A second public hearing was held on October 3, 1989, to take additional comments on the remedial alternatives for the PCB Areas operable unit. The public comment period was held in accordance with Section 117 of CERCLA.

The public comment period for the PCB Areas operable unit was initiated concurrently with the comment period for the Metals Areas operable unit. The comment period for the Metals Areas was closed earlier (on September 23, 1989) and a Record of Decision was issued for the Metals Areas operable unit on March 30, 1990. Since the hearing held on August 30, 1989, covered both operable units and since the preferred alternative for each operable unit shared some similar components, most of the comments received for the Metals Areas operable unit also apply to the PCB Areas operable unit. The exception is those comments that address specific procedural aspects of the Metals Areas operable unit. The Record of Decision for the Metals Areas operable unit which was signed by U.S. EPA on March 30, 1990, included a Responsiveness Summary which responded to all comments which were raised regarding that operable unit. The Metals Areas Responsiveness Summary is hereby incorporated by reference into this Responsiveness Summary.

The purpose of this responsiveness summary is to document the U.S. EPA's and the U.S. Department of Interior's (DOI) responses to comments received during the public comment period. These comments were considered prior to selection of the final remedy for the PCB Areas operable unit at the Crab Orchard National Wildlife Refuge Superfund site, which is detailed in the Record of Decision (ROD).

II. BACKGROUND ON COMMUNITY INVOLVEMENT

The DOI, in conjunction with U.S. EPA, is responsible for conducting the community relations program for this site. A community relations program was established by DOI for the Refuge in June 1987. It established a process for a two-way flow of project information between local officials, concerned citizens, the media and DOI. The program was updated in July 1988, at the time of the completion of the RI, to broaden

U.S. EPA's role in community relations activities. Four information repositories were established in the local area: at the Marion Federal Penitentiary, the Marion Carnegie Public Library, the Crab Orchard National Wildlife Refuge Headquarters and the Morris Library at Southern Illinois University in Carbondale. Several different press releases and fact sheets were issued to announce field activities and the findings of the RI and FS. A public meeting on the findings of the RI was held in Carterville in August 1988. Community relations activities are summarized in the ROD, if additional information is desired.

III. PUBLIC HEARINGS

The required public hearing on the Proposed Plans for the Metals Areas and PCB Areas operable units was held on August 30, 1989, from 7:00 p.m. to 10:30 p.m., at the John A. Logan College in Carterville, Illinois. Approximately 140 persons attended, including the U.S. Congressman for the district, several local or federal officials or their representatives, representatives of some companies or industries that have been tenants at the Refuge, and members of the press (television, radio and newspapers).

A second public hearing to discuss only the PCB Areas operable unit was held on October 3, 1989, from 7:00 p.m. to 11:00 p.m., at the Student Center at Southern Illinois University in Carbondale, Illinois. Approximately 95 persons attended. Additional public comment was taken at this hearing.

IV. SUMMARY OF SIGNIFICANT COMMENTS RECEIVED AND RESPONSES

As discussed above, most of the comments taken for the Metals Areas operable unit are pertinent to the PCB Areas operable unit as well. U.S. EPA has responded to those comments in the Responsiveness Summary to the Metals Areas Record of Decision signed on March 30, 1990. The Responsiveness Summary for the Metals Areas is therefore incorporated by reference into this Responsiveness Summary.

Additional questions and comments received during the public comment period for the PCB Areas operable unit are paraphrased and organized into seven discrete sections within this summary. The Agencies' response is given after each question or comment.

A. Comments on the Superfund Process
B. General Comments and Questions About the Site
C. Comments on the Safety of Incineration
D. Comments and Questions on the Safety of Other Remedial Components
E. Comments and Questions Regarding Other Remedial Alternatives
F. Comments and Questions Regarding Implementation of the Remedy
G. Comments from Sangamo Weston

A. Comments on the Superfund Process

Comment 1:

Numerous commenters felt that the information in the repositories was too lengthy and technical, and that more review time was required.

Response 1:

The National Contingency Plan (NCP) which was effective at the time of public notice of the Proposed Plan required that the Feasibility Study (FS) be available for public comment for not less than twenty one days (40 CFR 300.67(d)). Because of concern that twenty-one days was not sufficient time to review and comment on the FS, the original comment period for this operable unit was thirty days. Based on concern expressed at the public hearing on August 30, 1989, the public comment period was extended for an additional thirty days. Based on additional comments that were received in writing, the public comment period was extended a total of three times, making a total comment period of one-hundred and five days. While the information in the administrative record is technical in nature, it is no more technical than that ordinarily generated for similar sites and U.S. EPA believes that the unusually lengthy comment period provided sufficient time for review and comment on the proposed remedy.

Comment 2:

Some commenters felt that it was difficult to locate information on mobile incineration.

Response 2:

This comment was raised early in the public comment period. In response to this concern, additional material on mobile incineration was sent to the information repositories. The material included U.S. EPA reports and journal articles which included additional references.

Comment 3:

One commenter stated that there was a lot of community opposition to the proposed remedy, but that the Superfund public comment process is structured to make it seem otherwise.

Response 3:

The NCP establishes a regulatory framework for the implementation of CERCLA. As discussed in Response 1, the NCP includes provisions for the minimum requirements for public participation. Among these requirements was that the Feasibility Study (FS) be available for public comment for not less than twenty-one days (40 CFR 300.67(d)). As was stated in Response 1, the original comment period for this operable unit was longer

than the minimum requirement, and three additional extensions to the comment period were granted based on public comment. The total comment period for this operable unit was one hundred and five (105) days. This comment period is far longer than normal, and was allowed in response to specific community concerns.

Comment 4:

Some commenters expressed the opinion that the final remedy had been decided and that the public comments would not have any influence on the final remedy selection.

Response 4:

All public comment which was received during the comment period was seriously considered prior to the final decision on a remedial action. Just because one individual comment, or a number of comments may not have changed the final decision, does not mean that the process is a "token gesture". Comments received expressed a diversity of opinion about what action is needed to clean up the site, and not all opinions could be satisfied by any one decision. Also, community acceptance is only one of nine criteria used to evaluate remedial alternatives, and must be weighed against the other criteria. In addition to the criteria of community acceptance, U.S. EPA is required to meet a number of statutory mandates in the selection of the final remedy. The balance between the decision criteria (including community acceptance), and the assessment of the statutory mandates are discussed in Sections IX. and X., respectively, of the Decision Summary of the Record of Decision.

U.S. EPA believes that the ROD reflects a direct influence by public comment on the decision making process. Opposition to the use of incineration technology at Crab Orchard contributed to U.S. EPA's decision to include in the ROD, a provision for a demonstration of in situ vitrification (ISV) as an alternative treatment technology that meets the performance standards of incineration.

Comment 5:

One commenter expressed concern about the other operable units at the Refuge, specifically the "DOD Areas", and wondered whether they might be "swept under the rug".

Response 5:

The operable units are each on a separate schedule for completion of remedial work. Section 120 of CERCLA requires DOI, the current owner of the Site, to enter into an interagency agreement (IAG) with U.S. EPA before September 30, 1990. Currently, DOI, U.S. EPA and the Illinois Environmental Protection Agency ("IEPA") are negotiating the interagency agreement. The Department of the Army may participate in the IAG. The operable unit, formerly referred to as "DOD Areas", is now referred to as "Munitions/Explosives Manufacturing Areas", and a specific schedule for

work at this operable unit is being developed for the interagency agreement. This schedule will require the initiation and completion of a remedial investigation of areas that may have been contaminated as a result of munitions or explosives production. If contamination is found at levels of concern, options to clean up the operable unit will be developed. The interagency agreement and remedial work done on the operable unit will all be subject to public review and comment.

Comment 6:

One commenter questioned whether the characterization of the operable unit as the "PCB Areas" masks potential problems with the metal co-contamination.

Response 6:

The creation of separate operable units was discussed extensively in the Responsiveness Summary to the Record of Decision for the Metals Areas (which is incorporated by reference here). The characterization of the operable units at the Site is not intended to be misleading, and the titles of the operable units simply characterize the major contaminants within each unit. This does not mean that other contaminants may not be present, as is the case of the PCB Areas operable unit, where lead contamination has always been acknowledged and discussed, and is addressed in this ROD.

Comment 7:

One commenter stated that there have been problems in the past with other Superfund sites when remedies have been selected because the U.S. EPA will not give 100% guaranties of safety.

Response 7:

U.S. EPA has made the determination that the risk from the unremediated site is of sufficient magnitude that there is an actual or potential risk to human health or the environment. Once the site has been shown to produce a risk, various remedies to address the risk are evaluated. The projected result of each of these remedies must be a reduction of the risk to fall within a range of "acceptable risk" (as defined by CERCLA and the NCP), but no one can give a 100% guarantee that the remedy will entail no risk. However, each of the remedies will result in less risk than would be present were no action taken at the site.

Comment 8:

A few commenters expressed the opinion that the government, or President Bush himself, is behind an effort to push incineration.

Response 8:

Congress has directed U.S. EPA to meet certain statutory mandates for remedy selections at Superfund sites. These mandates include the preference for treatment as a principal element of the remedy and the utilization of permanent solutions and alternative treatment technologies to the maximum extent practicable. The government has not, on a national basis, specifically selected any one treatment method. Incineration is considered a technology that can be used in many circumstances to meet these mandates because it has been demonstrated to treat and permanently destroy organic contaminants.

Comment 9:

A few commenters were concerned that there are no checks and balances on EPA.

Response 9:

CERCLA provides that U.S. EPA must consult with support agencies during the remedy selection process. The support agencies for this remedy selection are the DOI and Illinois EPA (IEPA). Each of these agencies has had opportunities to comment on the remedy selection for the PCB Areas. CERCLA also requires that public comment be taken and considered before the final remedy is chosen. Superfund remedies must comply with all Applicable or Relevant and Appropriate Requirements (ARARs), which ensures that programmatic and legal requirements are met for every remedy. Finally, Section 310 of CERCLA has provisions to allow citizen suits to be brought against the government. These procedures and statutory obligations provide a variety of "checks and balances" on the remedial action selection and implementation at Superfund sites.

Comment 10:

One commenter stated that the public wants an "unbiased" opinion from someone other than U.S. EPA. They supported the creation of a local task force to look into the process and activities at the Site.

Response 10:

Any member of the public, including scientists and technicians, may comment on U.S. EPA's proposed remedial action. In addition, the public may solicit input and comment from anyone they feel will be "unbiased". U.S. EPA supports the idea of a local task force that can be involved in the Superfund activities throughout the entire process. U.S. EPA has a technical assistance grant (TAG) program which allows community groups to receive grant money to hire their own technical consultants. A local group, the Crab Orchard Response Team (CORT), is in the process of applying for this grant money. If CORT is awarded the grant, they may use the money to hire an independent technical advisor. U.S. EPA will

work with any groups and/or individuals that want to be involved in any of the upcoming Superfund activities at the Refuge.

Comment 11:

Commenters asked why the company(ies) responsible for the contamination are not paying for the cleanup.

Response 11:

Since the Crab Orchard National Wildlife Refuge is owned by the Federal government, particular legal standards of CERCLA apply. Section 120(e)(1) of CERCLA states that "...the department, agency, or instrumentality which owns or operates such facility shall, in consultation with the Administrator and appropriate State authorities, commence a remedial investigation and feasibility study for such facility." U.S. EPA would therefore consider that the requirement to conduct the RI/FS is strictly DOI's. Nothing in CERCLA prevents DOI from entering into an agreement with another party for that party to assist DOI with its obligation. In this case, Sangamo Weston, Inc., a company that produced electrical equipment at the Refuge, and DOI entered into an independent, voluntary agreement to perform the RI/FS. Both DOI and Sangamo Weston, Inc. have contributed to the costs of the work which has been done to date at the Site.

Congress has directed U.S. EPA on the broader issue of how to work with private parties that may have been responsible for contamination at Superfund sites. Congress has established provisions in CERCLA that allow private parties to do work at Superfund sites (Sections 106 and 122 of CERCLA) while U.S. EPA retains the oversight responsibility to ensure that the work is done correctly (including any and all additional work U.S. EPA determines to be necessary). Under CERCLA Sections 120(e)(6), 106 and 122 U.S. EPA has the authority to allow or require Sangamo Weston, Inc. or other potentially responsible parties to perform and/or pay for remedial action activities at the Refuge.

Comment 12:

Some commenters wanted to know who has the burden of proof if a suit is brought against U.S. EPA by Illinois or citizens. They felt that the burden of proof should be on U.S. EPA to prove that the operation of the remedy implementation is safe.

Response 12:

Citizens, including the State, may bring an action against U.S. EPA under CERCLA Section 310, 42 U.S.C. §9659, alleging that a removal or remedial action taken under CERCLA Section 104 or secured under CERCLA Section 106 was in violation of one or more of the non-discretionary provisions of CERCLA. However, under CERCLA Section 113(h), 42 U.S.C. §9613(h), no such citizen challenge to a removal or remedial action may occur prior to completion of the remedy. In addition, under CERCLA Section 113(j), 42

U.S.C. §9613(j), judicial review of any issues concerning the adequacy of the response action taken, including issues of short-term effectiveness and safety, shall be limited to the administrative record, and the court will uphold U.S. EPA's decision in selecting the response action unless the objecting party can demonstrate, on the administrative record, that the decision was arbitrary and capricious or otherwise not in accordance with law.

Comment 13:

Some commenters pointed out that the Toxic Substances Control Act ("TSCA"), is U.S.C. §2601 et seq., allows for alternative treatment methods to be used rather than incineration and one commenter read several excerpts of the TSCA regulations into the record.

Response 13:

U.S. EPA is aware of the TSCA regulations, and has considered TSCA in the ARAR process. TSCA does allow for alternative treatment methods to be used. The regulations of 40 CFR 761.60(e) allow U.S. EPA to consider a alternative treatment if the alternative treatment meets the performance equivalent to an incinerator as required by 40 CFR 761.70 (i.e., equal destruction of PCBs) and will not present "...an unreasonable risk of injury to health or the environment." The alternative treatment technology demonstration of in situ vitrification provided in the ROD is based upon the TSCA ARAR for the allowance of alternatives to incineration. Section X.B of the Decision Summary portion of this ROD includes a discussion of the TSCA regulations that will be met by the Selected Remedy for the PCB Areas Operable Unit.

Comment 14:

A few commenters demanded formal written responses to their comments before the end of the public comment period.

Response 14:

Section 117 of CERCLA requires the U.S. EPA to allow an opportunity to comment on the Proposed Plan for remedial action. Section 117(b) requires that the final plan (the ROD) "... be accompanied by ... a response to each of the significant comments, criticisms, and new data submitted in written or oral presentations...." This ROD is the final plan for the PCB Areas at the Refuge. The U.S. EPA is mandated to provide its formal responses to comments as part of the ROD, thus, they were not provided before the end of the comment period.

Comment 15:

One commenter asked about other similar Superfund sites where incineration was not chosen as the remedy, and asked for information on why incineration was not chosen.

Response 15:

A number of Superfund sites have soil and/or sediment contaminated with PCBs, and frequently with other hazardous substances. A U.S. EPA document dated September 22, 1989, titled Draft Guidance on Selecting Remedies for Superfund Sites with PCB-contamination discusses a number of similar sites, the remedies that have been selected for these sites, and the rationale for the remedy selection. For 50% of similar sites with PCB-contaminated soil and sediment, incineration was the selected remedy. For the majority of sites where incineration was not selected, the high cost of incineration was a primary consideration to support another remedy. For additional details, copies of this document have been sent to the information repositories.

Comment 16:

Some commenters wondered why the parties involved in the development of the RI and FS could have different interpretations of the information and different recommendations about a suitable remedy. Specifically, people questioned why O'Brien & Gere Engineers had recommended stabilization treatment rather than incineration.

Response 16:

O'Brien & Gere Engineers, the consultants that produced the RI and FS reports, were retained by Sangamo Weston, Inc., a company that produced PCB-laden electrical equipment at the Refuge. Sangamo Weston, Inc. had hired O'Brien & Gere to do the RI/FS work as part of a cooperative agreement with the Fish and Wildlife Service. In its review of the FS, U.S. EPA requested removal of O'Brien & Gere's recommendation for remedy selection, because the FS should be limited to a comparative assessment of each of the remedial alternatives against the nine remedy selection criteria. O'Brien & Gere and Sangamo Weston, Inc., as members of the public, are entitled to express their comments regarding U.S. EPA's preferred remedy. They are not entitled to select the remedy for the Site. They have supported stabilization treatment rather than incineration based on a different interpretation than U.S. EPA of the balancing criteria, primarily, the cost criteria.

Comment 17:

One commenter stated that U.S. EPA is not meeting its mandates from Congress in the selection of remedies for Superfund sites. Specifically, U.S. EPA is not selecting permanent remedies, is not weighing protection of health more heavily than cost, and is not paying enough attention to community input.

Response 17:

U.S. EPA has met its statutory mandates in the selection of this remedy for the PCB Areas operable unit. There is an extensive discussion of how

this remedy meets these mandates in Section X. of the Decision Summary portion of the ROD.

Comment 18:

One commenter felt that the public should be fully informed and then allowed to vote on the selected remedial action.

Response 18:

Section 121 of CERCLA discusses the selection of remedies for Superfund sites. Congress has directed that the President select remedial actions for sites after evaluating numerous specific issues. The President, in carrying out his Congressional mandate, has delegated the authority for remedy selection to U.S. EPA. CERCLA further specifies the provisions for public involvement in Sections 113(k) and 117. These provisions allow for public input, but do not allow the public to select remedies by voting or other processes.

Comment 19:

Several commenters wondered why the preferred alternative identified in the Proposed Plan was not one which was outlined in the FS.

Response 19:

Although not presented as a consolidated alternative, the preferred alternative identified in the Proposed Plan was outlined in the FS as alternatives 3-1B, 5-1B and 7-1B. For each of the study sites to be remediated, the preferred alternative was fully screened against the remedy selection criteria in each of the relevant chapters of the FS.

Comment 20:

One commenter stated that information was not available at the information repository at Marion Federal Penitentiary.

Response 20:

U.S. EPA's Community Relations Coordinator checked the information repository at Marion Federal Penitentiary and found that the documents are available through the prison library and are up to date.

B. General Comments and Questions About the Site

Comment 21:

People questioned how safe the Refuge is for humans such as children and pregnant women, whether wildlife is endangered, and whether the fish in Crab Orchard Lake are safe to eat. To one extreme, one commenter felt that no one is currently at risk from the PCB-contamination in the ground.

Response 21:

Sediment, water and fish samples were taken from Crab Orchard Lake as part of the Remedial Investigation, and the analysis of these samples was used to support the risk assessment that evaluated the safety of the Site. In general, the risk assessment indicated that Crab Orchard Lake, outside of the Area 9 Embayment, is safe for recreational activities such as swimming and boating, and the water is safe for human consumption. There is a fishing advisory on the Lake which was placed by the IEPA, Illinois Department of Public Health and Illinois Department of Conservation. The advisory was placed because some fish showed elevated levels of contamination. U.S. EPA recommends that people comply with the fishing advisory. The risk assessment in the RI indicates that high levels of fish consumption may pose an elevated risk to individuals. The assumption that no one is at risk from the PCB-contamination at the Site is not supported by the risk assessment. The unremediated study sites pose potential excess risk to both human health and wildlife.

Comment 22:

Some commenters pointed out that the contaminants have been at the Refuge for decades, and asked how long the material remains hazardous.

Response 22:

PCBs and lead are the major contaminants of concern at this operable unit. Lead is a naturally occurring element which is not destroyed in the environment. PCBs are very chemically stable under a variety of conditions, and are exceptionally persistent in the environment.

Comment 23:

One commenter asked why EPA did not take action at the Site sooner, if they knew about the contamination problem.

Response 23:

In proposing the Crab Orchard National Wildlife Refuge for inclusion on the National Priorities List (NPL), U.S. EPA evaluated existing site information and made the determination that a release or substantial threat of a release of hazardous substances had occurred or would occur that would endanger human health or the environment. However, because of the limited access of humans to the contaminated areas and the efforts of DOI to further reduce exposure by issuing warnings and fish advisories, U.S. EPA determined that emergency response action was not warranted. The Fish and Wildlife Service (FWS) and U.S. EPA began action in 1986, prior to final listing of this site on the NPL, by initiating the RI/FS that provides the basis for this informed decision on appropriate remedial action.

Comment 24:

One commenter stated that the time frame to clean up the entire Site could be 20 to 30 years, rather than the 2.5 to 5 years discussed in the Proposed Plan because there are areas at the Refuge that have not been investigated.

Response 24:

Because of the size of the Refuge and the number of potential areas at the Refuge that may have been adversely impacted by industrial activities at the Site, it is true that the entire Superfund process is expected to be lengthy. In order to streamline the process, problems which are apparently related have been grouped into operable units, and each of these operable units will be on independent, but possibly concurrent, schedules to complete the necessary remedial action. The schedules will reflect available information about the magnitude of the threat to human health or the environment, and will prioritize the units accordingly. The schedules for each operable unit are being finalized in the interagency agreement which is expected to be signed by September 30, 1990 (see the Response to Comment 5). The 2.5- to 5-year schedule is an estimate for the implementation of the Selected Remedy for this operable unit using incineration technology.

Comment 25:

One commenter expressed concern with the concept of a "walk away site", if toxics will be left buried in the ground.

Response 25:

The object of the selected remedy is to minimize the areas at the Refuge that will require long-term monitoring and maintenance, and to permanently destroy those compounds that can be treated. The area where the metals will be managed as residuals will require long-term monitoring and maintenance, and property management (including land use restrictions) as long as the contaminated residuals remain at the Site. The areas where remediation is complete and where no contaminants are left above the remediation goals will require no future monitoring or land use restrictions.

Comment 26:

Several commenters expressed concern about the effects of incineration technology on the community in general. Specific concerns were raised about property value reduction, damage to tourism and an adverse effects on enrollment at Southern Illinois University (SIU).

Response 26:

The impact of remedial alternatives on local communities is evaluated through the criteria of short-term effectiveness, long-term effectiveness

and permanence. The design of the Selected Remedy will prevent adverse short-term impacts to the area, such as air emissions, potential dust generation or surface water run-off, by using engineering methods to prevent these from occurring. The impact of the selected remedy on tourism or SIU enrollment is difficult to assess quantitatively. However, the evaluation of short-term effectiveness in the FS indicates that the impact from incineration will be no greater than the impact from the other alternatives, and is likely to be much less than the adverse effects on tourism (or SIU enrollment) that have occurred because of the existing contamination problem at the Refuge. Refuge figures indicate that annual numbers of visitors to the Refuge declined from 1,200,000 to 800,000 because the public is aware of existing contamination problems. Clearly, permanently eliminating these problems can only improve tourism and decrease adverse impacts on the nearby community.

Comment 27:

Some commenters expressed concerns that exposure to toxic compounds can take place through various pathways which will be influenced by the transport process and the receptor organisms.

Response 27:

U.S. EPA agrees that contamination of several media can result in exposure of different organisms through various pathways. To address this concern fully, the risk assessment process includes a comprehensive evaluation of the exposures of various sensitive receptors to a variety of potential exposure scenarios.

Comment 28:

One commenter was concerned that the remedy for the Site does not take the contaminants out of the sediments in Crab Orchard Lake or out of the fish in the lake.

Response 28:

The remedy selected in this ROD does specify a remediation goal for contaminated sediments in Crab Orchard Lake, and removal of sediments which contain concentrations of contaminants above this goal are required. The remedy does not propose any remedial actions specific to the fish population of the lake. However, sediment cleanup targets have been established to protect wildlife, and have been set to minimize bioaccumulation of PCBs into fish tissue. The removal of the sources of contamination (soils and sediments) should allow the levels of PCBs in fish tissue to drop in the future.

Comment 29:

Several commenters felt that the cost of the incineration alternative is far too high, especially considering the questions about its safety.

Response 29:

Cost is only one of the nine criteria which are considered before a remedy is selected. Although incineration appears to be more costly than other alternatives, implementation of incineration provides a better balance of long-term effectiveness, permanence and reduction of toxicity, mobility and volume than any of the other alternatives. ISV may also provide this balance of the demonstration set forth in Section VIII.A.3 of the Decision Summary is successful.

C. Comments on the Safety of Incineration

Comment 30:

Numerous commenters felt that incineration is not a safe or proven technology and that incineration's "track record" is too short. Commenters said implementation of incineration does not fulfill the overall criteria of protection of public health and the environment. Concern was expressed over the lack of an evaluation of the potential adverse impacts of incineration on wildlife, plants and terrestrial ecosystems.

Response 30:

Incineration technology has been in use since communities first began burning refuse. The technology has evolved and become refined as the waste industry developed its use for disposing of hazardous wastes, among them, PCBs. Numerous applications of incineration technology under the Toxic Substances Control Act (TSCA), which regulates the handling and disposal of PCB-contaminated wastes, have resulted in U.S. EPA's determination that, when operated subject to strict controls and performance standards, incineration represents the best demonstrated technology available to dispose of PCBs in the concentrations found at the Crab Orchard site. Contrary to the concern over a lack of evaluation of adverse impacts to wildlife, plants and associated ecosystems, the risk characterization and exposure assessments conducted during the RI/FS specifically address those impacts and establish remediation goals which will mitigate them.

Comment 31:

Numerous commenters expressed concern with potential air emissions from the incinerator. A group of comments involved the fact that all incinerators, regardless of the standards required, would permit an "allowed" amount of emissions for various contaminants, specifically: metals (particularly lead), dioxins and furans, inhalable particles or compounds that may contribute to acid rain, global warming or depletion of the ozone. In addition, commenters expressed doubt in EPA's methods and ability to model and subsequently measure the amounts of emissions and their potential impacts on human health and the environment. Concerns were also expressed about the adverse impacts of malfunctions of the incineration process.

Response 31:

It is generally true that incinerators, regardless of the air pollution control devices attached, will produce some air emissions. The expected byproducts of combustion are water vapor and carbon dioxide, which would not cause harm to nearby humans or wildlife. For compounds other than water and carbon dioxide, strict emissions standards must be met and the incinerator will be designed to achieve those standards. The first step to minimize emissions is to design the incinerator to assure the most complete combustion of organic material possible by choosing optimum parameters for 1) the retention time of the waste in the combustion chambers, 2) the highest temperature necessary for complete combustion of the waste and 3) ample mixing of the waste to be combusted and the heated combustion gasses. This design will minimize emissions of dioxins, furans, unburned PCBs as well as pollutants which have been associated with global warming and depletion of the ozone layer.

The second line of defense to meet the emission standards involves a specially designed air pollution control system. Typically, such a system incorporates several control devices, usually in a series, which sequentially remove pollutants. When pollutants like heavy metals, and organics, such as dioxins and furans, are entrained on particles of uncombusted material, physical methods such as baghouses, venturi separators and electrostatic precipitators are employed. For removing pollutants that occur as gasses, such as vaporized metals, organic fumes and acid fumes (sulfur and nitrogen oxides), devices such as wet scrubbers and carbon strippers can be used.

Once the appropriate incinerator design and pollution control system are chosen, multiple monitoring systems and safety controls are added. A trial burn of a low concentration waste is conducted to determine the settings and adjustments that provide for day-to-day operation which meets the stringent performance standards. Malfunctions of any of the incinerator processes or pollution control equipment trigger automatic shutdown controls on the incinerator until the malfunction is located and repaired. As discussed in the ROD, ancillary systems are added to the incinerator unit to prevent fugitive emissions from the incinerator or from material handling.

Incinerator designs and their control systems chosen by U.S. EPA are typically conservative or "over-designed", so that emissions standards are met within a large margin of safety. Likewise, the predictive dispersion models used are equally conservative so that incinerators will be sited and operated such that impacts to human health and the environment will be negligible, if measurable at all.

Comment 32:

Some commenters asked questions about the fuel used to fire the incinerator. Concerns were raised over the potential emissions from

the fuel. One commenter felt the energy costs would be extremely high and another asked if there was any connection to a proposed waste blending plant.

Response 32:

The control of emissions generated from the fuel would be addressed in the incinerator design and pollution control systems discussed above. Natural gas, a "clean burning" fuel, will likely be used to maintain the high temperatures needed for complete PCB combustion. Energy costs do make incineration comparatively more costly than non-treatment technologies, however, the result of incineration is permanent destruction of PCBs, as opposed to merely containing the highly toxic compounds with a non-treatment remedy. The Selected Remedy using incineration technology or in situ vitrification, is not related to a proposed waste blending plant.

Comment 33:

Several commenters referred to the Liquid Waste Disposal (LWD) incinerator in Calvert City, Kentucky as evidence that incinerators are unsafe. The commenters expressed concerns that the LWD incinerator has released millions of pounds of carcinogens to the air which have adversely impacted agriculture, the surrounding environment and have caused cancer and other illnesses in the local population.

Response 33:

The LWD incinerator facility in Calvert City is an "interim status" facility under Resource Conservation and Recovery Act (RCRA), which means it is not now operating under a hazardous waste permit. The State of Kentucky is responsible for issuing that permit and for imposing strict requirements for the proper operation of the facility. However, the decision has proved extremely controversial and the State has been unable to complete finalization of the permit. In the meantime, the facility operates under conditions developed during a trial burn at the facility; conditions which will ultimately be imposed in the final permit. The incinerators (there are two interim status incinerators at the facility) are not allowed to burn PCBs in excess of 50 ppm, which would require additional restrictions under TSCA.

Concerns that LWD is responsible for adverse environmental impacts and is the cause of cancer and other illnesses in the local population are unfounded and possibly inaccurate. The Calvert City area is one of heavy industry, particularly known for its several chemical manufacturing facilities. Such chemical facilities have often been associated with increased levels of illness in the surrounding population. However, no epidemiological information has been developed which can directly link specific illnesses with the LWD incinerator. In short, where people have lived in heavily industrialized areas and been exposed for decades to multiple environmental pollutants, it is impossible to differentiate the

sources or the causes of various illnesses in the population. What this means for the Crab Orchard site is discussed in the next response.

Comment 34:

Several commenters stated that communities with operating incinerators have excess cases of cancer and other health effects. They expressed concern that there have been no long-term health studies on such communities.

Response 34:

As discussed in Response 33, some heavily industrialized areas have been known to be areas of elevated incidences of cancers and other illnesses, as compared to the incidence of those same cancers and illnesses in populations in non-industrialized areas. Such industrialized areas may contain steel mills, chemical factories and fossil-fuel power plants, in addition to the incinerators in question. Multiple sources operating over several decades make it impossible to pin any particular increase in illness on a specific source. Where incinerators operate in non-industrialized areas like the Refuge, such health studies cannot separate out those illnesses that may occur due to (or be exacerbated by) an individual's activities, such as smoking or diet.

The remediation goals selected for the Crab Orchard site are intended to reduce the risk from exposure to the PCBs now in place on the Refuge to approximately 1×10^{-6}, or one in one million. This means that in a hypothetical population of one million people who are continually exposed to the PCB residuals left at the site (i.e. Job Corps Landfill and Pond) each day for a lifetime of 70 years, only one has an additional chance of contracting cancer specifically due to the exposure. This should be balanced against the current health risk at the site of 1.1×10^{-3}, or one in 1000 people, using the same exposure scenario. U.S. EPA has deliberately chosen these very conservative levels (1×10^{-6}) for human health protection, which will be virtually unmeasurable against the average lifetime cancer risk of one in every four people.

Comment 35:

One commenter cited a study by the EPA Science Advisory Board dated April 1985, Inhalation Pathway Risk Assessment of Hazardous Waste Incineration Facilities. They stated that this study concluded incineration is not necessarily a safe process, and asked how EPA can now state at this Site that incineration is a safe process.

Response 35:

The above referenced report identified safety problems with incinerators operated prior to 1985. Reports such as this have resulted in the application of more stringent standards for incinerator units which have been subsequently selected by U.S. EPA for the incineration of hazardous waste. As discussed in comment 7, U.S. EPA cannot guarantee 100%

"safety" of any remedy. However, incinerators can be operated safely so as to reduce the risk of PCB-contamination at the site to within a range of "acceptable risk" as opposed to the unacceptable risks associated with taking no action at the site.

Comment 36:

One commenter stated that the operation of an incinerator may not be safe because the incinerator operators are "sleazy", that they have no reason to operate well, and are more interested in profit than safety.

Response 36:

In choosing contractors to operate incinerators, U.S. EPA carefully screens out contractors who cannot show that they will operate the incinerator safely and within the law. Once chosen, the operator faces civil and criminal penalties should the operator operate the incinerator in violation of performance standards.

Comment 37:

One commenter wanted to know which incinerator operators U.S. EPA has used or approved in the past.

Response 37:

Many incineration contractors have operated under the various auspices of U.S. EPA programs including Superfund, RCRA, TSCA and under permits issued pursuant to the CAA; however, U.S. EPA does not officially endorse or (without formal proceedings) denounce incinerator operators. Some large incinerator contractors which are operating or have operated in Region V include Westinghouse-Haztech, Chemical Waste Management, Weston and Ogden Environmental.

Comment 38:

Some commenters expressed concerns that the trial burn only provides a snapshot, and does not indicate actual everyday operating conditions.

Response 38:

On the contrary, a trial burn is designed to specifically identify the range of "everyday" operating conditions outside of which the incinerator will not be permitted to operate.

Comment 39:

One commenter questioned why groups such as Greenpeace, the Citizens Clearinghouse for Hazardous Waste, the National Toxic Campaign Against Incineration, and many local groups would oppose incineration if it is safe.

Response 39:

U.S. EPA cannot speak for or represent the opinions of these groups, but generally such groups oppose incineration not as an "unsafe" technology but as a technology that poses too many unacceptable risks to be widely applied in dealing with our national waste disposal problem. They may feel the comparative risks from incineration to the risks of other technologies favor the development of other technologies. In choosing a remedy for Crab Orchard, however, U.S. EPA is making a decision on the comparative risks of incineration, which permanently destroys PCBs, versus the risk of leaving concentrations of PCBs on the Site that may threaten human health and the environment.

Comment 40:

One commenter expressed concern with the potential safety hazard from the location of the incinerator (and its stack) in the vicinity of the county airport.

Response 40:

The stacks of mobile incinerators are generally not tall enough (<100 feet) to pose a physical danger to nearby aviation. However, the possible impact of any water vapor plume will be considered when choosing a site for the incinerator.

Comment 41:

Some commenters expressed concerns with the location of the incinerator in an area of seismic activity, and the potential adverse effects on the incinerator that could occur.

Response 41:

Areas of known and frequent seismic activity will be avoided when choosing the incinerator site. Safety systems will be designed into the incinerator to account for various natural disasters, including seismic activity.

Comment 42:

Some commenters stated that they felt incineration was the best remedy for the PCB-contamination.

Response 42:

U.S. EPA agrees that incineration is the best remedy for the PCB-contamination at the Refuge, and, therefore, U.S. EPA has selected incineration as the remedy for this operable unit. The basis for the selection of incineration is discussed in the Decision Summary portion of the ROD. However, because vitrification may be able to be demonstrated to attain the same performance standards as incineration, it may be

implemented if a treatability study demonstrates that the standards can be met.

D. Comments and Questions on the Safety of Other Remedial Components

Comment 43:

One commenter asked how contaminated dust which could potentially be generated during excavation of contaminated soil and sediment will be controlled.

Response 43:

As explained in the ROD, procedures for dust control during material handling will be required in the design of the selected remedy. U.S. EPA is aware that excavation of contaminated soil and sediment has the potential to create cross-media impacts, such as releases of dust to the air or run-off to surface water. Safeguards are established as a part of the remedial design to prevent these potential adverse impacts. Specific design features will address dust suppression and run-off control. Typical dust suppression measures for earthwork include wetting of the material and certain handling techniques. The design will also include methods to control dust emissions from the stabilization/ fixation treatment process. In addition to the engineering controls to prevent releases of contaminants, the remedial design will include monitoring requirements to ensure that the control processes are working and a contingency plan on how to address and correct any malfunction that could damage the environment.

Comment 44:

Some commenters questioned how the determination would be made that the incinerator ash is "clean" before it is replaced into the excavated areas.

Response 44:

Incinerator ash which meets all of the cleanup targets and ARARs discussed in the Decision Summary portion of the ROD would be considered clean. The ash would be tested in accordance with an approved sampling and analysis plan to establish whether the standards had been met. Ash that does not meet the cleanup targets will be solidified in an industrial landfill.

Comment 45:

One commenter questioned whether the incineration of soil and sediment co-contaminated with metals will increase the potential for the metals to leach.

Response 45:

The metal contamination may be less mobile because of its association with certain soils such as clay. Incineration should not affect this relationship. However, the selected remedy requires that ash be monitored for the mobility of the metals, and all of the soil and ash with mobile metals (EP Toxicity or TCLP) will be treated in order to render the metals less mobile.

Comment 46:

One commenter felt that the requirements for the long-term monitoring of the on-site landfill were too vague, especially as to how long the monitoring would continue.

Response 46:

Monitoring of the landfill would be required for the life of the landfill. CERCLA requires a review at least every five years to ensure the continued safety of completed remedies when hazardous substances are left on-site. Since the metal waste constituents will be treated and left at the Refuge, the integrity of the landfill will be monitored to support the evaluation.

Comment 47:

Some commenters expressed concern that landfills will ultimately leak and contaminate the groundwater.

Response 47:

The problems of potential leaking from the landfill are addressed in two ways. First, the landfill is designed with a leachate collection system. This system is monitored routinely to see if any leachate is generated by the landfill, and if so, whether it contains hazardous substances. The second method to assess potential groundwater contamination is the requirement for routine groundwater monitoring around the landfill. These monitoring assessments allow early detection of any releases from the landfill, so that corrective action can be taken.

Comment 48:

A number of commenters opposed the location of the landfill on-site, and expressed a preference that the material be moved off-site.

Response 48:

Because metal contamination can be treated but not permanently destroyed, the remedial alternatives evaluated in the FS all included a component of long-term containment (except the no action alternative). The FS Report includes an assessment of both on-site and off-site landfills, with or

without treatment of the material prior to disposal. The alternatives of on-site versus off-site landfilling were compared against the nine criteria used to evaluate potential remedies, and were also evaluated against the goals and mission of the DOI for long-term Refuge management.

The comparative assessment of the landfill locations indicates that an on-site landfill is preferred. The Agencies believe that it is easier to ensure the long-term effectiveness and permanence of an on-site landfill for the treated material through aggressive long-term operation, monitoring and maintenance. Disposal of the treated material in an off-site landfill may allow the material to be mixed with other waste which might adversely affect the treatment process and increase the mobility of the contaminants. In addition, the costs of disposing of the material in an off-site landfill are significantly higher without providing any additional benefit.

CERCLA Section 121(b) states that "The off-site transport and disposal of hazardous substances or contaminated materials ... should be the least favored alternative remedial action ...." IEPA has assessed the capacity of commercial landfills in the State of Illinois and this assessment indicates that capacity is limited. In addition, DOI believes that an on-site landfill is consistent with its mission and obligations for the Refuge. Because the Agencies believe that an on-site landfill is safe and provides the best balance of the remedy selection criteria, an on-site landfill has been selected as the disposal component of the selected remedy.

Comment 49:

Several commenters expressed the opinion that a RCRA design for the landfill component of the remedy is more suitable than a solid waste landfill design. They felt that a RCRA landfill would be more protective in the long run.

Response 49:

A solid waste landfill was selected because the regulatory requirements for landfill design are based on the type of waste to be disposed. A RCRA landfill is required for the disposal of hazardous waste, as defined in 40 CFR 261.3. Since the material to be disposed here will not be a hazardous waste when it is disposed, a RCRA landfill design will not be selected as an ARAR. However, as part of the remedial design process, various landfill designs will be evaluated to see which design provides the necessary containment of the waste. The final landfill design will be based on technical requirements, and will meet, at a minimum, the legal design requirements.

Comment 50:

Several commenters questioned whether a water tank at the Refuge could be safely retrofitted to dispose of hazardous waste residues.

Response 50:

There is a five-million-gallon concrete tank on the Refuge which was constructed as a water reservoir in 1942. Based on an initial engineering review of the as-built drawings of the tank, it appears to be technically feasible that the tank could be retrofitted to meet the design requirements of the selected landfill. However, before this could be chosen as the final landfill site, an assessment would be made as part of the design process to establish whether the current condition and setting of the tank would meet all of the ARARs. The exact location of the on-site landfill was not identified in the FS, although several locations were proposed. The Refuge is a large area and there are several potential locations that would meet the requirements of an on-site landfill. The RI Report provides an initial hydrogeologic assessment of many of the study sites. This data can be extrapolated to indicate good candidate areas for further investigation during the design phase of the remediation. The remedial design will include further investigations of the most suitable areas, including the water tank, before the final location is selected. The final location will be the one which is the most appropriate and least disruptive to the Refuge of those that meet all of the legal requirements and standards discussed in this ROD.

E. Comments and Questions Regarding Other Remedial Alternatives

Comment 51:

In commenting on the remedial alternatives, numerous commenters expressed opinions on whether a remedy for the PCB-contaminated material needs to be selected and implemented now, or whether a remedy could wait until some time in the future.

The range of opinions on this issue is expressed below:

a. Some commenters felt that the PCB-contamination requires immediate action, especially since PCB-contamination has been found in the fish of Crab Orchard Lake.

b. Some commenters felt that, given the questions regarding the safety of incineration, it is better to wait and do nothing at this time.

c. Some commenters felt that since the waste has been sitting at the Site for a long time, it would be better to cap (i.e., a TSCA cap or a plastic sheeting cover) the material now, and wait to evaluate future technologies.

d. Some commenters felt that since alternative technology is being developed, the remedy selection should wait.

e. Several commenters suggested that the PCB-bearing material be placed in above-ground storage and monitored until future technologies develop.

Response 51:

CERCLA Section 121(b) requires that U.S. EPA "... conduct an assessment of permanent solutions and alternative treatment technologies or resource recovery technologies that, in whole or in part, will result in a permanent and significant decrease in the toxicity, mobility or volume of the hazardous substance, pollutant, or contaminant.... The President shall select a remedial action that is protective of human health and the environment, that is cost effective, and that utilizes permanent solutions and alternative treatment technologies or resource recovery to the maximum extent practicable."

While interim measures can be designed for the PCB operable unit which are protective in the short-term of public health and the environment, a remedy which required storage until future technologies develop would not meet the statutory requirement to select permanent solutions. The remedy selected would also not result in a permanent decrease of toxicity, mobility, or volume. The risk assessment for the study sites comprising the PCB Areas operable unit indicates that there is existing potential risk to human health and wildlife from the unremediated Site. This documentation of endangerment from the Site requires that a remedy to address the principal threats must be selected. Because a proposal to defer action indefinitely would not meet the statutory requirements, it could not be selected by U.S. EPA.

Comment 52:

Some commenters questioned whether degradation of the PCB-contamination by microorganism or other biological means had been fully considered. One commenter felt that although the research on biodegradation of PCBs has not shown full success, this is a possible solution for the future.

Response 52:

The initial screening of remedial alternatives includes an evaluation of three criteria: effectiveness, implementability and cost. Biological treatment of the PCB-contaminated soil and sediment was not fully considered because the data on bioremediation of PCBs indicate that, at this time, the processes are not fully effective or implementable.

U.S. EPA agrees that the research on biodegradation of PCBs looks promising for the future. New research indicates that different strains of organisms may be developed that are more viable over a broader range of environmental conditions (including resistance to co-contaminants), and that are better able to handle the wide range of PCB isomers. However, at this time, bioremediation technologies have not been fully effective at handling the types and concentrations of contaminants found at the Refuge.

Comment 53:

One commenter suggested that a two-phase process to handle the PCB-contamination might be more acceptable. The first phase would be separation of the PCBs from the soil, which would eliminate the immediate risk to the environment. The second phase would be incineration of the separated PCBs utilizing newer incineration technology such as the plasma torch.

Response 53:

Although innovative separation technologies are currently being investigated, no proven technology exists for physical separation of PCBs from a soil substrate. Thermal treatments such as incineration using a plasma torch achieve the objectives of both proposed "phases" above. However, plasma torch technology has not been adequately developed to be included in consideration of alternatives for the Crab Orchard site.

Comment 54:

Some commenters expressed a preference for containment of the waste as the selected remedy. One commenter suggested the construction of an earthquake-proof building to store the waste.

Response 54:

Response #51 explains that CERCLA requires that U.S. EPA must select a remedy which is permanent and will reduce the toxicity, mobility or volume of contaminant to the maximum extent practicable. Storage, even in an earthquake-proof building, is not a viable alternative because it does not fulfill either of these goals. Storage is particularly unacceptable when compared with technologies such as incineration, which permanently destroys PCBs.

Comment 55:

A few commenters had questions and comments about polyethylene glycolate dechlorination treatment processes (commonly known as APEG or KPEG).

Response 55:

Chemical dechlorination processes use specially synthesized chemical reagents to destroy hazardous chlorinated molecules (like PCBs) or to detoxify them to form other compounds that are considered less harmful and environmentally safer. These treatment processes are currently being investigated by U.S. EPA, but are not developed enough to be considered for full-scale use for Superfund sites for, among other things, the following reasons:

1. Water can adversely affect the rate of reaction.
2. Reaction byproducts are currently not well understood and may be more toxic than the contaminants being treated.

3. The need to deliver, mix and heat the reagent (which is expensive and non-recoverable when used in situ) and the soil may limit the applicability of the technology.

Comment 56:

One commenter asked why a specific amount of the contaminated material (up to 10,000 cubic yards) could not be given to a number of treatment vendors to allow them to demonstrate their own systems. One commenter suggested that innovative technologies such as the use of ultrasound, light and ozone, or technologies using electron donors be used to destroy the PCBs.

Response 56:

U.S. EPA maintains information on technologies suitable for the treatment of various types of hazardous wastes. Among the information which is available and updated on a regular basis are reports on treatment technologies in use, treatability studies and reports on developing innovative technologies. In assessing the treatment technologies available for the PCB and lead bearing waste from the PCB Areas operable unit, these sources were consulted. Consideration of the applicability of a technology includes an evaluation of whether the technology has been demonstrated to be effective, whether the process is available at full scale, whether it has potential adverse effects on the co-contaminants, and legal restrictions on what type of treatment may be used. Although the above-mentioned technologies may one day score highly under such an evaluation, they are not viable for selection at this time.

A Site-specific remedy is not the place to allow a number of different treatment vendors to try to demonstrate that their processes may be effective. A major problem with this proposal is that an successful system may make the situation at the Site worse.

Comment 57:

One commenter, a vendor of waste treatment processes, submitted information pertaining to two treatment processes that felt would adequately remediate the Site. The processes are: the ABSKO process which is said to be an organic reduction process which removes chlorine from hydrocarbons and produces a synthetic fuel; and the BioVersal process which is said to remove hydrocarbons from soil. The commenter requested a sample of material to run tests to demonstrate the two processes.

Response 57:

The data submitted to support the processes raise serious questions and concerns. First, the processes were used on oils, but there is no data specific to PCBs. Second, the processes were said to leave approximately 200 parts per million (ppm) of residue, which far exceeds the acceptable cleanup target for the Refuge. Third, the ABSKO process is said to

produce a synthetic fuel which is not characterized and may be hazardous or toxic. This fuel would require subsequent treatment or disposal which cannot be evaluated since its makeup is unknown.

Comment 58:

Some commenters expressed a preference for stabilization/fixation treatment of the PCB-contaminated material because it is cheaper and appears to be safer and effective.

Response 58:

Stabilization/fixation was evaluated as a technology and incorporated into the Consolidated Alternatives in the FS and Proposed Plan. It is also incorporated into the Selected Remedy to address soils and sediments contaminated with heavy metals (approx. 3,600 cubic yards) and incinerator residue, as appropriate. Although stabilization/fixation appears to be cheaper than incineration and may have fewer short-term risks than those attributed to incineration, stabilization/fixation does not provide treatment of PCBs to reduce their mobility, toxicity or volume to the degree that incineration does. When compared to the Selected Remedy, stabilization/fixation fails to fulfill the CERCLA statutory mandate for treatment of the principal threats at a site and the mandate for permanent remedies where possible.

Comment 59:

One commenter questioned whether the hazardous materials could be recovered and recycled.

Response 59:

Recovery technologies are not available for the contaminants found at the study sites comprising the PCB Areas operable unit. Technologies such as those used in mining have not been applied to hazardous waste and have not been shown to achieve the cleanup targets required. Soil washing is one technology which has potential to be used on metal contamination. This process extracts contaminants from the soil using a liquid medium as a washing solution. This technology will reduce the volume of contaminated soil and increase the concentration of the contaminants in the residual. The potential theoretically exists that the metal contaminants could be concentrated to the point where recovery was feasible. However, there are several reasons why this technology was not considered for the metal co-contamination at the Refuge. The reasons include: 1) the process is not commercially available for soils contaminated with metals; 2) the process works best on coarser soils, while the soils at the Refuge tend to consist of fine particles (silts and clays), so the feasibility of the treatment is questionable; 3) lead contamination poses problems for the process because lead is not chemically associated with any particular fraction of the soil and therefore there are difficulties in washing it; 4) the cadmium, chromium and lead react differently to chemical and physical conditions so that a

washing solution suitable for all of them would be difficult to specify; and 5) concentrating the metal contamination from the soil and sediment at the Refuge might make the concentrations high enough to render the immobilization treatment less effective.

Comment 60:

The Shawnee Group of the Sierra Club recommended a remedial alternative that would include incineration of only those materials that are not co-contaminated with metals, treatment by stabilization/fixation of toxic incinerator ash and non-incinerated soils, and landfilling of the residue preferably in an above-ground landfill (otherwise in a TSCA landfill). This recommendation was made with caveats that certain assurances and implementation requirements (discussed elsewhere in this Responsiveness Summary) would be met.

Response 60:

The remedial alternative proposed virtually mirrors the Selected Remedy chosen by U.S. EPA and described in the ROD. The one exception to the Club's proposal is the inclusion of an Alternative Treatment Technology, ISV, to replace the incineration and stabilization/fixation components of the Remedy. This Alternative Technology will only be used, however, after a demonstration that ISV successfully meets the remediation goals and performance standards established for the Selected Remedy.

The assurances sought by the Club include stringent monitoring and malfunction controls for the incineration (discussed in Response #31) as well as testing of the ash for hazardous characteristics and proper landfilling and closure for residuals which remain on-site. Steps to provide those assurances are discussed in this ROD.

F. Comments and Questions Regarding Implementation of the Remedy

Comment 61:

Some commenters felt that if incineration is used, there should be independent studies and oversight to monitor the performance of the incinerator, and that the public should have input into all of the monitoring plans and data.

Response 61:

As much as possible, U.S. EPA will allow interested parties to conduct independent studies and monitoring of the implementation of the Remedy. As discussed in Response #10, U.S. EPA recommends the TAG process as a forum for achieving the input desired in the planning and implementation of the Selected Remedy.

Comment 62:

Commenters again raised questions regarding specifics of incinerator design and operation. Examples include: Specifically where will the unit be located? What type and model will it be? What will the technical and operational specifications of the unit be? Others made recommendations as to conditions to be met as a pre-requisite to operation. Such recommendations included: having emergency procedures in place against operational failures, having monitoring schedules and testing methods specified, and periodic monitoring to ensure performance standards are being met.

Response 62:

Several of these concerns were discussed in Response #31 as well as in the ROD itself, however, most of these concerns cannot be addressed until the design phase of the remedial action begins. A general discussion of the incinerator and its control/safety systems is given in response #31. However, the actual design and specifications will be developed by an experienced incinerator design contractor. Once designed and built, the incinerator operating conditions will be determined after an actual "trial burn" is conducted. A range of operating parameters will be established for long-term operation, such as 1) the feed rate of waste, 2) the amount of fuel needed to maintain combustion and 3) threshold levels for shutdown of the incinerator in malfunction situations. The methods and schedules for effluent and emission testing, will also be established after the trial burn. As discussed earlier, input from community interest groups is encouraged during the design and implementation process and U.S. EPA will place the appropriate information in repositories for access to all interested parties.

Comment 63:

One commenter stated that scrubbers (pollution control devices) produce sludge and questioned what would be done with the sludge.

Response 63:

Because the objective of the scrubber is to remove heavy metals and organic fumes, the scrubber sludge would probably be determined to be RCRA hazardous, thus, the sludge would be treated with stabilization/ fixation to render it nonhazardous and landfilled in the on-site industrial landfill.

Comment 64:

Several commenters expressed concern that once an incinerator was brought to the Site, other waste material from off-site would be brought in and the incinerator would be left running full-time.

Response 64:

The Selected Remedy will be designed and implemented only for the hazardous substances found on the Refuge. Although an on-site Superfund incinerator does not require an operating permit, it must meet the substantive requirements of TSCA and RCRA. In order to accept other wastes from off-site, U.S. EPA would need to obtain a RCRA permit for commercial operation of a hazardous waste incinerator. Since U.S. EPA has no such permit, and will not be applying for one, the incinerator will be prohibited from accepting any wastes from off-site.

Comment 65:

Commenters questioned whether wastes from other operable units at the Refuge would be candidates for treatment in the incinerator.

Response 65:

Incineration may prove to be a feasible technology to deal with wastes from future operable units, for example, destruction of any ordnance material found in the explosive/munitions areas. However, the incinerator design necessary for destruction of PCBs may not necessarily be appropriate for ordnance destruction. At this time, it is not prudent to try to develop a "dual-design" incinerator on the speculation that the incinerator <u>might</u> be used for other operable units.

Comment 66:

One commenter had specific questions and concerns regarding components of the remedy other than the incinerator. These include:

a. How will the landfill be constructed?

b. What type of cap will be constructed, and how will it be monitored and maintained?

c. Will funds be available for maintenance of the cap?

Response 66:

The performance standards and requirements for the landfill design are discussed in Section VIII.A.1. of the ROD, however, specific design parameters such as siting and cap specifications will be refined in the remedial design process. The monitoring and maintenance of the cap will be conducted by the party implementing the ROD (i.e., DOI or potentially responsible parties (PRPs)), who will be required to maintain adequate funds for long-term operation and maintenance of the cap.

G. Comments from Sangamo Weston, Inc.

Comment 67:

Sangamo Weston, Inc. repeated the comments that they made for the Metals Areas operable unit regarding the creation of separate operable units. They provided their comments on the Metals Areas as an attachment to the comments on the PCB Areas. In general, Sangamo commented that they opposed U.S. EPA's decision to treat the Metals and PCB Areas as separate operable units.

Response 67:

U.S. EPA reiterates its response to Sangamo's original comments regarding the creation of operable units. U.S. EPA stands by its decision to create the two separate operable units from the study sites discussed in the FS (at least two more operable units have been developed, pertaining to the "munitions areas" and "miscellaneous areas." Moreover, since the ROD for the Metals Areas was signed by U.S. EPA, the National Contingency Plan (NCP) has been revised (Federal Register Vol. 55, No. 46, March 8, 1990, effective date April 9, 1990). The new NCP states in 40 CFR 300.430(a)(ii) that operable units generally should be used "when early actions are necessary or appropriate to achieve significant risk reduction quickly, when phased analysis and response is necessary or appropriate given the size or complexity of the site, or to expedite the completion of total site cleanup." The stipulation is that "Operable units... should not be inconsistent with nor preclude implementation of the expected final remedy." The creation of separate Metals and PCB Areas operable units clearly meets these requirements and management principles.

Comment 68:

Sangamo Weston, Inc. commented that the potential risks from the sites comprising the PCB Areas do not warrant the "extreme" remedy. Sangamo Weston, Inc. stated that "... the desire for 'permanence' does not alone justify selection of the most extreme and costly treatment remedy available...." They state that costly treatment technologies should be reserved for highly mobile or highly toxic wastes that cannot be reliably controlled through other means. Sangamo Weston, Inc. believes that alternatives other than complete incineration fully satisfy CERCLA criteria and goals and states that "Sangamo believes that EPA did not adequately balance the statutory criteria in developing its incineration remedy."

Response 68:

The Decision Summary of the ROD and the accompanying Administrative Record document in great detail how U.S. EPA applied the risk assessment and remedy selection process to choose the Selected Remedy. U.S. EPA believes that the CERCLA criteria and goals were applied consistent with

the National Contingency Plan (as required) and disagrees that the risks at Crab Orchard do not support the choice of incineration or ISV. These technologies were chosen not out of a "desire" for permanence, but in response to a clear statutory mandate from Congress. The mobility and toxicity of such contaminants as heavy metals and PCBs, particularly at the levels found at Crab Orchard, clearly warrant reliable control technologies, as Sangamo has stated. Incineration and stabilization/fixation technologies have been repeatedly demonstrated to provide that reliability, or permanence, at full-scale operation. Other alternatives, including the least-costly alternative of in-place containment preferred by Sangamo, are not permanent solutions and compared to the Selected Remedy, leave unacceptable risks of exposure at the Refuge.

Comment 69:

Sangamo Weston, Inc. is concerned that the cleanup targets for the PCB Areas are overly stringent, inappropriate or unfounded in light of the risk assessment in the RI/FS. Specific concerns with the cleanup standards follow:

a. Sangamo Weston, Inc. felt that the threshold criteria above which excavated soil and sediment would be treated and below which the materials would be disposed of without treatment was not clear in the Proposed Plan. They felt that an approach consistent with RCRA and other laws would be to treat by stabilization/ fixation only the excavated material that exhibits the characteristic of Extraction Procedure (EP) Toxicity when tested in accordance with U.S. EPA protocols.

b. Sangamo Weston, Inc. objects to the blanket application of a cleanup criteria for soil and sediment of 1×10^{-6} excess cancer risk. The reasons for their objection follow:

(1) They state that the compound-specific cleanup targets as developed in the RI/FS prepared for Sangamo by O'Brien and Gere are sufficient because they were developed to protect against the potential risks of the substances identified in the RI/FS, and that "There is no need to specify a cleanup criterion in the ROD for other substances that have not been discovered ..."

(2) They are concerned that U.S. EPA failed to assure that calculations of cumulative risk would be based on "realistic and site-specific exposure scenarios rather than on potentially inappropriate general assumptions."

(3) Further, they believe that "The 10^{-6} risk level should not be a rigid requirement, but at most a goal to be considered", and that the ROD should provide for the cleanup goal to be stipulated as an excess risk range of 10^{-4} to 10^{-7}.

c. Sangamo Weston, Inc states that they believe the stated cleanup level for groundwater c. 10^{-6} excess cancer risk is inappropriate for several reasons. These reasons are outlined below:

(1) Because there are no current users of the Refuge groundwater, and no future use is expected for groundwater, there are no receptors for this route of exposure. Sangamo Weston, Inc. states that the ROD should therefore not establish a specific groundwater cleanup standard.

(2) The RI/FS did not analyze impacts of using a 10^{-6} risk level as a cleanup standard for groundwater, and Sangamo Weston, Inc. expressed concern that this standard might require substance-specific cleanup levels that are below the method detection limits for such compounds. This would make the cleanup level technically impracticable to attain at the site.

(3) As with soil and sediment, Sangamo Weston, Inc. is concerned that U.S. EPA has not assured that the calculation of risk will reflect realistic and site-specific exposure scenarios.

(4) As with soil and sediment, the use of 10^{-6} as the cleanup standard, rather than a risk range of 10^{-4} to 10^{-7}, is inappropriate.

Response 69:

In order to clarify some of the issues raised by Sangamo Weston, Inc. and to address some of their concerns, U.S. EPA expanded the discussion of the cleanup standards in the Decision Summary portion of this ROD. Specific concerns are addressed below:

a. U.S. EPA agrees with Sangamo's position with regard to using threshold criteria which delineate which waste must be treated and which waste will be landfilled without treatment. In the Proposed Plan, the criteria for the stabilization/ fixation treatment process was "Soils and sediments which are considered hazardous because of their characteristic to leach metals would be treated..." This approach is consistent with RCRA and other laws. The intent of this was to require treatment of only material which is RCRA hazardous because of the characteristic to leach metals (EP Toxicity). Language has been added in the Decision Summary portion of this ROD to clarify this.

b. U.S. EPA is retaining the 1×10^{-6} excess cancer risk as a cleanup standard for soil and sediment for this operable unit. This criterion is established for the protection of public health and falls within the 10^{-4} to 10^{-6} risk range established in the revised NCP and considered by the Regional Administrator when choosing remediation goals. The 10^{-6} excess risk standard has been selected in numerous RODs issued by Region V in the past, and is consistent

with criteria established at other sites where multiple contaminants are present. Responses to Sangamo Weston, Inc.'s specific comments follow:

(1) The compound-specific cleanup targets, as developed in the RI/FS, the Proposed Plan and this ROD, were developed to protect against the potential risks of the target substances identified in the RI/FS, including the risks to exposed wildlife for the specific compounds addressed. However, the target compounds were refined without estimating the risk from other compounds that were found at the study sites. The risk assessment assumed that many of these other compounds would be addressed by the remediation for specific chemicals. However, U.S. EPA must assure that this occurs and the 10^{-6} excess risk level is the criterion against which this will be assessed. CERCLA requires that hazardous substances that "have not been discovered" must also be addressed if they are found at the site.

(2) U.S. EPA's policy in assessing risk from Superfund sites is that the assessment be based on a reasonable, worst case risk assessment. Therefore, in estimating the residual risk from the remediated areas, the calculations of risk to establish whether the cleanup target has been met will be based on "realistic and site-specific exposure scenarios rather than on potentially inappropriate general assumptions." The final assessment for the remediated areas will follow the U.S. EPA guidance on performing risk assessments.

(3) The revised NCP allows for consideration of cleanup targets within an excess risk range of 10^{-4} to 10^{-6}. However, U.S. EPA Region V has determined that 10^{-6} provides an appropriate standard of protectiveness as a cleanup target, based on the Regional Administrator's decision on acceptable risk management practices. There is no evidence that the 10^{-6} excess cancer risk cleanup target for the PCB Areas operable unit is in conflict with the statutory mandates of CERCLA. Also, the risk assessment in the RI supports that these levels are attainable for the study sites to be addressed. Therefore, this risk level will be retained as the cleanup level for the soil and sediment in this operable unit.

c. In the preamble to the revised NCP, U.S. EPA's approach to groundwater remediation is discussed. The preamble states "The goal of EPA's Superfund approach is to return usable ground waters to their beneficial uses within a timeframe that is reasonable given the particular circumstances of the site." The groundwater at the Refuge is a usable resource and contributes flow to a unique environment. The RI Report indicated that there was groundwater contamination associated with the PCB Areas operable unit, but did not document risks from the groundwater. U.S. EPA believes that the removal of sources of contamination will control any potential

groundwater problems. However, if monitoring activities during and after remediation indicate that there is potential risk from the groundwater, additional remediation activities will be considered.

Since a remedy other than source control was not selected for groundwater, the 10^{-6} excess cancer risk target level discussed in the Proposed Plan and selected in this ROD will not necessarily be a cleanup level, but will trigger a review of conditions at the sites. Language has been added to the Decision Summary portion of the ROD to clarify this. In addition to the excess cancer risk standard to trigger a review of the groundwater conditions at the study sites, there are standards for non-cancer chronic health effects. These standards have also been clarified in this ROD.

Specific comments are addressed below:

(1) Groundwater is an environmental media that has been impacted by the past disposal activities at the study sites comprising the PCB Areas operable unit. Because groundwater is a valuable resource, U.S. EPA's goal is to maintain the beneficial uses of groundwater. In addition, the groundwater at some of the study sites discharges to Crab Orchard Lake and potential discharge of contaminants to the Lake is a concern. As discussed above, since the risk from the sites should be addressed by the removal of contaminant sources, the standards specified in the ROD are not cleanup standards, but standards to evaluate how effective source control has been. If the standards specified in the ROD are exceeded, the groundwater situation will be evaluated to determine if further remedial action is necessary.

(2) As stated, the standards specified in this ROD for groundwater are not cleanup standards, but triggers for further review and evaluation of groundwater conditions. Therefore, the RI/FS did not analyze the impacts of using them as cleanup standards for groundwater. Sangamo Weston's concern regarding substance-specific levels that are below the method detection limits for such compounds is one which is easily addressed in the remedial design phase. Remedial design and remedial action will require a workplan that specifies, among other things, the constituents to be monitored for groundwater and the quality assurance required. The risk assessment is most likely to include constituents that have actually been detected in accordance with the approved Quality Assurance Project Plan.

(3) As discussed in paragraph b(2) above, the risk assessment calculations for groundwater will reflect realistic and site-specific exposure scenarios, in accordance with U.S. EPA guidance.