

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

**RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA725)**

Current Human Exposures Under Control

Facility Name: **Zeneca, Inc.**
Facility Address: **333 Main Street, Dighton, MA**
Facility EPA ID #: **MAD051505477**

1. Has all available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been considered in this EI determination?

If yes - check here and continue with #2 below.

If no - re-evaluate existing data, or

if data are not available skip to #6 and enter "IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

RDMS DocID

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REFERENCES. The references listed below were relied upon to prepare this EI evaluation and are located in the EPA RCRA Records Center located on the first floor of 1 Congress Street, Boston.

Draft final Future Land Use Report, dated August 2004.

Draft Environmental Indicator Checklist, Current Human Exposures Under Control, dated September 12, 2005.

Draft Human Health Risk Assessment, dated October 2004.

Draft Phase II Muddy Cove Human Health Risk Assessment, dated August 2003.

Supplemental RFI Interim Final Report, dated September 2004.

BACKGROUND INFORMATION

The Zeneca site, which is located in Dighton, MA, consists of the closed Zeneca manufacturing/chemical plant and the adjacent Muddy Cove which empties into the Taunton River. The former manufacturing portion of the facility is surrounded by a chain link fence, and is located between Elm Street to the west, Main Street to the north, and Route 138 to the east. Property to the south is heavily wooded and vacant. The facility operated between 1861 and the early 1990's. Products manufactured at the site included cashmere wool, furniture, water colors, soap, textile dye, dyestuffs, Halothane, antioxidants, tire cord adhesives, fire fighting chemicals, concrete superplasticizers, and other specialty items. All buildings on-site have either been demolished and removed or are currently in the process of being demolished and removed. The concrete slabs of the former buildings remain intact at the site.

In 1994, Zeneca entered into an agreement with EPA to conduct Corrective Action activities on a voluntary basis. Over the past decade, Zeneca has conducted numerous investigations, including several phases of field investigations and ecological and human health risk assessments, as well as several soil and/or sediment remediation efforts and a wetland restoration. In May 2004, EPA and Zeneca signed a 3008(h) Consent Order to conduct the remaining Corrective Action activities. Zeneca has submitted numerous reports which detail the findings and results of these activities. Many of these reports are listed in a draft CA725 Environmental Indicator prepared by Zeneca in September 2005. The original reports can be found in the Region I RCRA records center on the first floor of 1 Congress Street, Boston.

Land use surrounding the site is a mixture of residential and commercial properties. Site topography is relatively flat, with an average elevation of approximately 10 feet above sea level. Portions of the site near Muddy Cove Brook and Muddy Cove are within the 100 year flood zone. A 24 acre reservoir formerly used for non-contact cooling water and fire protection is located across Elm Street to the west of the site. Muddy Cove Brook flows east from the reservoir, through the main facility, to Muddy Cove, and finally to the Taunton River. Groundwater is relatively shallow across the site. In general, shallow groundwater under the main facility discharges to Muddy Cove Brook. Deeper groundwater discharges to the Taunton River. There are approximately 100 monitoring wells and piezometers currently located at the site.

Under the 2004 Consent Order, the site is divided into five Areas of Concern (AOCs). Four of the five AOCs are located on the main facility property. AOC 2, Muddy Cove, is located across Route 138 from the main facility.

AOC 1 consists of the encapsulated lagoon and a former service station. Prior to the early 1970's, untreated wastewater was discharged directly into Muddy Cove Brook. In 1973, the Brook was diverted and the contaminated wetland was 'encapsulated'. The former service station, which was closed in 1992, is located on the eastern edge of AOC 1, along Route 138. Leaking gasoline and diesel underground storage tanks were removed in 1992, and subsequent remedial measures performed under the Massachusetts Contingency Plan (MCP) regulations have resulted in the removal of hydrocarbon impacted soil from this area. Shallow soils in the encapsulated lagoon are contaminated with DNAPL and elevated concentrations of arsenic, mercury, chlorobenzenes, nitrobenzene, and PCBs. Soils at the former service station are contaminated with lead. Groundwater is contaminated with arsenic, chlorinated solvents, BTEX, MTBE, chlorobenzenes and nitrobenzene.

AOC 2 consists of Muddy Cove, which is an approximately 3 acre tidally influenced embayment of the Taunton River. At low tide a stream channel divides an extensive area of mudflats that are surrounded by tidal wetlands, upland woods, roads, and residential development. Muddy Cove is located at the mouth of Muddy Cove Brook, which flows from west to east through the center of the site and past a hurricane gate before it empties into Muddy Cove. The majority of Muddy Cove and an area bordering to the north of the Cove is owned by Zeneca. A narrow strip of land along the southwestern edge of the Cove, and adjacent properties to the west and south are owned by private residents. Contaminants detected in the sediments of Muddy Cove include PCBs, mercury, methyl mercury,

arsenic, lead, and PAHs. Many of the same contaminants have been detected in Taunton River sediments near the mouth of Muddy Cove, although concentrations of these contaminants drop off rapidly in both upstream and downstream sediment samples, moving away from the mouth of Muddy Cove.

AOC 3 is an approximately 14 acre former manufacturing parcel located north of Muddy Cove Brook. Shallow groundwater is contaminated with chlorobenzenes, TCE, PCBs, and metals. Soils are contaminated with metals, PCBs, and SVOCs. In 2004, MADEP and Zeneca signed a Grant of Environmental Restriction (GER) for AOC 3, which is an institutional control designed to prevent certain future uses and activities such as drinking the groundwater, residential or agricultural development, and exposure to contaminated groundwater or soils.

AOC 4 is an approximately 13 acre former manufacturing parcel located south of Muddy Cove Brook. DNAPL has been discovered near the bedrock surface. Contaminants in soils and groundwater include metals, PCBs, chlorobenzenes, chlorobiphenyls, and TCE.

AOC 5 consists primarily of Muddy Cove Brook, up-stream portions of which have been excavated and successfully reconstructed by Zeneca over the last few years. Groundwater near the brook is contaminated with metals, chlorobenzenes, naphthalene, nitrobenzene, and chlorinated solvents. Sediments from the downstream, unremediated portions of the Brook are contaminated with metals, PCBs, chlorobiphenyls, SVOCs, and chlorobenzenes. Contaminants detected in surface water include arsenic and vinyl chloride.

In addition to the AOCs, groundwater contamination has been detected at downgradient, off-site commercial properties located immediately east of Route 138 and AOC 1, and near residential properties east of Muddy Cove and AOC 1. Groundwater contaminated with chlorobenzenes, SVOCs, and BTEX has been detected on the commercial properties on the east side of Route 138. Recently, Zeneca installed new monitoring wells and sampled groundwater adjacent to the northeast side of Muddy Cove, upgradient of several residents. Chlorobenzene was detected in several of these new wells, although only relatively low levels of chlorobenzene were detected in wells located nearest to the private residents.

All residents and businesses in the vicinity of the site are connected to the municipal water supply which is drawn from well fields and surface water reservoirs located several miles away. An off-site well survey updated in 2004 indicates that there are no private wells within 1,000 feet downgradient of the site. A portion of the overburden in the northeast section of the site was identified by USGS as a medium-yield aquifer, and MADEP has designated the area as a Potentially Productive Aquifer (PPA). Zeneca contends that based on site specific hydrogeologic and other factors, the PPA designation is not appropriate and should not apply. EPA is currently considering this issue. However, Zeneca suggests that a portion of the overburden aquifer off-site to the east is likely appropriately classified as a medium yield PPA.

2. Are groundwater, soil, surface water, sediments, or air media known or reasonably suspected to be “contaminated”¹ above appropriately protective risk-based “levels” (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

	<u>Yes</u>	<u>No</u>	<u>?</u>	<u>Rationale / Key Contaminants</u>
Groundwater	<u>X</u>	___	___	_____
Air (indoors) ²	___	<u>X</u>	___	_____
Surface Soil (e.g., <2 ft)	<u>X</u>	___	___	_____
Surface Water	<u>X</u>	___	___	_____
Sediment	<u>X</u>	___	___	_____
Subsurf. Soil (e.g., >2 ft)	<u>X</u>	___	___	_____
Air (outdoors)	<u>X</u>	___	___	_____

_____ If no (for all media) - skip to #6, and enter “YE,” status code after providing or citing appropriate “levels,” and referencing sufficient supporting documentation demonstrating that these “levels” are not exceeded.

X If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

 If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

The appropriately protective risk-based "levels" (applicable promulgated standards) used for this question include Region IX PRGs (Preliminary Remediation Goals), Federal Ambient Water Quality Criteria, and MCP Method 1 risk characterization standards.

GROUNDWATER

Since groundwater both on and off-site is not currently used as a source of drinking water, MCLs and MCP GW-1 standards are overly conservative for purposes of answering Question 2. The MCP considers groundwater at all disposal sites to be a potential source of discharge to surface water, and is categorized, at a minimum, as category GW-3. GW-2 standards are applicable if the groundwater is located within 30 feet of an existing building and the average annual depth to groundwater is 15 feet or less. Since there are currently no functional buildings on-site, GW-2 does not apply on-site. However, there are commercial buildings and residences off-site. Therefore, for the purpose of answering question 2 of this EI, EPA is using the GW-2 and GW-3 standards for off-site, and the GW-3 standards for on-site as the appropriately protective risk based level for groundwater.

Contaminants detected off-site above the GW-2 and/or GW-3 standards, and contaminants detected on-site above the GW-3 standards, include chlorobenzene, 1,2,4-trichlorobenzene, arsenic, chromium, lead, mercury, nickel, zinc, PCBs, and SVOCs.

SURFACE SOILS

For surface soils, EPA is using both the Region IX PRGs and MCP soil standards. For on-site surface soils, EPA is using the Region IX PRGs for an industrial site, and the MCP soil classification S-3 (soil is accessible, children are not present, and an adult's frequency and intensity of use are both considered to be low, which is appropriate for on-site workers.) and S-2 (soil is accessible, children are present, but the intensity and frequency are low, which is appropriate for trespassers). For off-site surface soils, EPA is using Region IX PRGs for residential soils, and the MCP category S-1 standards (soil is accessible, and a child's frequency or intensity is high).

Key contaminants detected in on-site surface soils include arsenic, lead, PCBs, and PAHs. Arsenic is a key contaminant detected in off-site surface soils.

SUBSURFACE SOILS

For subsurface soils, EPA is using both Region IX PRGs and MCP standards. For on-site subsurface soils, EPA is using the Region IX PRGs for an industrial site, and the MCP soil classification S-3 (soil is potentially accessible, children are not present, and both the frequency and intensity are low.) For off-site subsurface soils, EPA is using the MCP category S-2 standards (soils are potentially accessible, children are present, and either the frequency or intensity are low).

Arsenic is a key contaminant detected in off-site subsurface soils. Key contaminants detected in on-site subsurface soils include arsenic, lead, PCBs, PAHs, trichlorobenzenes, dichlorobenzenes, and chlorobenzenes.

SURFACE WATER

For surface water, Ambient Water Quality Criteria (Human Health for Consumption of Water and Organisms) were used as the appropriately protective risk based level. Arsenic and vinyl chloride were the key contaminants detected

in surface water.

SEDIMENTS

For on-site sediments (AOC 5), EPA is using Region IX PRGs for industrial soils and MCP soil classification S-2 (sediment is accessible and a child’s frequency and intensity are considered to be low.) Key contaminants detected in on-site sediments include arsenic, mercury, PCBs, PAHs, dichlorobenzenes and chlorobenzene. For sediments in Muddy Cove, EPA is using Region IX PRGs for residential soils. Key contaminants include PCBs, methyl mercury, mercury, arsenic, lead, PAHs, dichlorobenzene, and nitrobenzene.

OUTDOOR AIR

For outdoor air, EPA used site soil and groundwater data to estimate ambient air concentrations, which were then compared to Region IX PRGs for ambient air. The calculations and estimated ambient air concentrations were taken from Appendix G of the October 2004 Draft Human Health Risk Assessment. Key contaminants included arsenic, chromium, trichlorobenzene, dichlorobenzene and chlorobenzene, and various other VOCs and SVOCs.

Footnotes:

¹ “Contamination” and “contaminated” describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriately protective risk-based “levels” (for the media, that identify risks within the acceptable risk range).

² Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

- 3. Are there **complete pathways** between “contamination” and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table

Potential **Human Receptors** (Under Current Conditions)

<u>“Contaminated” Media</u>	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food ³
Groundwater	No	No	No	Yes	No	No	No
<u>Air (indoors)</u>							
Soil (surface, e.g., <2 ft)	No	Yes	No	Yes	Yes	No	No
Surface Water	Yes	Yes	No	Yes	Yes	No	Yes
Sediment	Yes	Yes	No	Yes	Yes	No	Yes
Soil (subsurface e.g., >2 ft)	No	No	No	Yes	No	No	No
Air (outdoors)	No	Yes	No	yes	Yes	No	No

Instructions for Summary Exposure Pathway Evaluation Table

- 1. Strike-out specific Media including Human Receptors’ spaces for Media which are not “contaminated”) as identified in #2 above.
- 2. enter “yes” or “no” for potential “completeness” under each “Contaminated” Media -- Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

- ___ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).
- X If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation.
- ___ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code

Rationale and Reference(s):

Groundwater and subsurface soils. Groundwater is not used for drinking purposes anywhere in the vicinity of the site. Construction workers are the only likely potential receptors of contaminated groundwater and subsurface soils.

Surface soils and outdoor air. Workers, construction workers, and trespassers are the potential receptors of contaminated surface soils and outdoor air.

Sediments and surface water. Residents, workers, construction workers, trespassers and fish/crab consumers are the potential receptors of contaminated sediments and surface water.

Food. In addition to the media discussed in question 2 above, fish and crab samples collected from Muddy Cove were screened against EPA Region 3 Risk Based Concentrations (RBCs) for fish, which are based on a person eating 54 grams of fish per day, or about 2 fish meals per week. Key contaminants included PCBs, mercury, and pentachlorophenol. Residents are potential consumers of contaminated fish/crabs.

³ Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

- 4 Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be "**significant**"⁴ (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

No If no (exposures can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

___ If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

_____ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

Rationale and Reference(s):

Construction workers are potentially exposed to contaminated groundwater, surface and subsurface soils, surface water, sediments, and outdoor air. However, construction workers are not reasonably expected to have significant exposures for the following reasons: 1) according to Zeneca's September 2005 CA725 EI, there is presently no construction being conducted nor is any planned by Zeneca for the on-site areas; 2) any construction by Zeneca will be controlled by health and safety plans which will require appropriate PPE; 3) any construction activities performed in AOC 3 will also be controlled by the GER; 4) off site, concentrations in contaminated media are relatively low, and construction workers would be expected to have relatively low frequency compared to the screening level assumptions used in Question 2.

On-site workers are potentially exposed to contaminated surface soils, surface water, sediments, and outdoor air. However, workers are not reasonably expected to have significant exposures under current conditions because currently the site is vacant and only part time maintenance workers are employed at the site. According to Zeneca's September 2005 CA725 EI, once the demolition of the remaining buildings is completed, there will be considerably lessened maintenance requirements. In addition, much of the site is either paved or covered with the concrete slabs from former buildings. Therefore, for the current on-site worker, the actual magnitude of exposure is likely considerably less than assumed in the screening level assumptions used in Question 2.

Residents are potentially exposed to contaminated sediments, surface water, and fish/crabs from Muddy Cove. However, EPA believes that these residents are not reasonably expected to have significant exposures for the following reasons: 1) Muddy Cove is a poor habitat for fish given its tidal nature and small size. Any fish present are transient due to the tides; 2) crabs are present during only part of the year; 3) there are few fish of sufficient size for consumption that can be caught within the Cove; 4) there are much better areas located nearby for swimming, wading, and fishing; 5) in general, the most heavily contaminated portions of the Cove have a several feet thick layer of very soft mud, which makes walking around in the Cove extremely difficult; 6) according to Zeneca's September 2005 CA725 EI, routine observations of the use of the Cove indicate that people are not commonly observed in the Cove, and it is likely that actual exposures are quite low. In summary, EPA believes that under current conditions, it is unlikely that local residents frequent Muddy Cove for the purposes of swimming, wading, or fishing for the reasons cited above. As discussed in Zeneca's September 2005 draft EI, under a Central Tendency exposure scenario in which Zeneca used somewhat conservative assumptions, the risks to people using Muddy Cove slightly exceed an HI of 1. Under the more conservative Reasonable Maximum Exposure scenario, where more frequent use of Muddy Cove is assumed, the calculated risks exceed acceptable levels. The Muddy Cove Ecological Risk Assessment also concludes that there are some indications that ecological risks may be significant. Therefore, EPA believes that a final remedy for the site will likely require some form of remedial action within Muddy Cove to reduce risks to both human health and the environment.

Trespassers are potentially exposed to contaminated surface soils, surface water, sediments, and outdoor air. However, trespassers are not reasonably expected to have significant exposures because the following reasons: 1) the main facility is surrounded by a chainlink fence, and the thick layer of mud in Muddy Cove is very likely to discourage trespassers from entering the Cove; 2) the actual magnitude of exposure for trespassers is expected to be much less than the screening values.

⁴ If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

5 Can the "significant" exposures (identified in #4) be shown to be within acceptable limits?

_____ If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why

all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

_____ If no (there are current exposures that can be reasonably expected to be "unacceptable")- continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

_____ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code

6. Check the appropriate RCRIS status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

 YE YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the Zeneca facility, EPA ID # MAD051505477, located at 333 Main Street in Dighton, MA under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

_____ NO - "Current Human Exposures" are NOT "Under Control."

_____ IN - More information is needed to make a determination.

Completed by (signature) Robert W. Brackett Date 9/29/05
 (print) Robert W. Brackett
 (title) RCRA Facility Manager

Supervisor (signature) Matthew R. Hoagland Date 9/29/05
 (print) Matthew R. Hoagland
 (title) Chief, RCRA Corrective Action Section
 (EPA Region or State) EPA New England

Locations where References may be found:

The references can be found in the RCRA Records Center at 1 Congress Street.

Contact telephone and e-mail numbers

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FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.