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Nease Chemical Site
Operable Unit Three

Columbiana and Mahoning Counties, Ohio

Record of Decision

United States
Environmental Protection Agency

Region 5

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LIST OF ACRONYMS AND ABBREVIATIONS

AOC	administrative order on consent
ARAR	applicable or relevant and appropriate requirement
ATSDR	Agency for Toxic Substances and Disease Registry
BAF	bioaccumulation factor
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
COPC	chemical of potential concern
CSF	cancer slope factor
CSM	conceptual site model
DNAPL	dense non-aqueous phase liquid
EA	Endangerment Assessment
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
FS	feasibility study
HQ	hazard quotient
LOAEL	lowest observed adverse effect level
MFLBC	Middle Fork of Little Beaver Creek
mg/kg	milligrams per kilogram
MNR	monitored natural recovery
NCP	National Contingency Plan
NOAEL	no observed adverse effect level
NZVI	nanoscale zero-valent iron
ODA	Ohio Department of Agriculture
ODH	Ohio Department of Health
ODNR	Ohio Department of Natural Resources
OU	operable unit
PDI	pre-design investigation
RAO	remedial action objective
RfD	reference dose
RI	remedial investigation
RM	river mile
RME	reasonable maximum exposure
ROC	Rutgers Organics Corporation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SWAC	surface weighted average concentration
TBC	to be considered
ug/kg	microgram per kilgram
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound

Record of Decision - Nease Chemical Site, Operable Unit Three

Columbiana and Mahoning Counties, Ohio

This Record of Decision (ROD) documents the remedy selected for Operable Unit 3 (OU 3) at the Nease Chemical Site in Columbiana and Mahoning Counties, Ohio. The ROD is organized in two sections: Part I contains the *Declaration* for the ROD and Part II contains the *Decision Summary*. The *Responsiveness Summary* is included as Appendix A.

PART I: DECLARATION

This section summarizes the information presented in the ROD and includes the authorizing signature of the United States Environmental Protection Agency (U.S. EPA) Region 5 Superfund Division Director.

Site Name and Location

The Nease Chemical Superfund Site (CERCLIS # OHD980610018) is located in Columbiana and Mahoning Counties, Ohio. The Nease facility, a former chemical manufacturing plant, is located about 2 ½ miles northwest of the town of Salem, in Columbiana County. The Site consists of three operable units (OUs). OU 1 comprises non-time critical removal actions that were constructed in the mid-1990s. The removal actions included installation and maintenance of surface water and sediment control structures and construction and operation of two shallow groundwater collection systems. OU 2 addresses facility soils, source areas, and groundwater contamination on the Site. A ROD for OU 2 was signed in September 2005, and the remedial design for the selected remedy is underway. Because contaminated media in OU 2 were the source of contamination to OU 3, investigation and selection of the OU 2 remedy preceded this decision. OU 3, the subject of this ROD, addresses contaminated sediment in Feeder Creek, a small creek that drains the former plant, and contaminated sediment and floodplain soil in and along the Middle Fork of Little Beaver Creek (MFLBC), which receives flow from the former chemical manufacturing facility. The MFLBC extends into Mahoning County.

Statement of Basis and Purpose

This decision document presents the selected remedy for OU 3 of the Nease Chemical Site. The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Contingency Plan (NCP). Information used to select the remedy is contained in the Administrative Record file for the Site. The Administrative Record file is available for review at the U.S. EPA Region 5 Records Center, 77 West Jackson Boulevard, Chicago, Illinois, and at the Salem Public Library, 821 E. State St., Salem, Ohio. Information about the Site can also be found at the Lepper Library in Lisbon, Ohio and at Ohio EPA's office in Twinsburg, Ohio.

Assessment of the Site

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Description of Selected Remedy

The Nease Chemical Site is being addressed as three OUs under the framework set forth in CERCLA. The selected remedy specified in this ROD will serve as the final remedial action plan for OU 3, and will also serve as, in combination with the remedy specified in the OU 2 ROD, the final remedy for the entire Site. The selected remedy specifies response actions that will address chemically-contaminated floodplain soils and sediments at the Site. U.S. EPA believes the response actions outlined in this ROD, if properly implemented, will protect human health and the environment.

The NCP establishes the expectation that U.S. EPA will use treatment to address the principal threats posed by a Site whenever practicable. No principal threat wastes were identified for OU 3 media. Therefore this ROD cannot formulate treatment alternatives to address principal threats. Additionally, there is no practicable treatment component associated with the floodplain soil and sediment because there are no feasible, cost-effective, in-situ or ex-situ treatment technologies for mirex, the primary risk-driving contaminant in OU 3 media. However, the selected OU 2 remedy addresses the principal threat wastes for OU 2 media through the use of treatment technologies. Thus, the statutory preference for remedies that employ treatment as a principal element is satisfied for the Nease Chemical Site as a whole.

The major components of the selected remedy include:

- MFLBC Sediment – MFLBC sediment will be removed by dredging or dry excavation. Targeted sediment removal will be conducted in more highly contaminated areas to achieve the remediation goal while minimizing short-term impacts to aquatic and riparian habitats. The estimated sediment volume to be removed is approximately 4,300 cubic yards from a 6 ½ mile stretch downstream of the Nease facility. The selected remedy also includes the option of using post-removal backfilling in some areas to achieve the sediment remediation goal, if residual mirex levels are too high and additional removal is not practicable. Dredged sediment will be transported to the former Nease facility for consolidation with OU 2 contaminated soils within the Nease facility, and capped and covered as called for in the OU 2 ROD.

- MFLBC Floodplain Soil – Contaminated soil will be excavated with conventional equipment and excavated floodplain areas will be backfilled and graded. Targeted removal of floodplain soils will occur to meet the remediation goal while minimizing short-term impacts to riparian habitats. Based on current information, floodplain soils in three general locations downstream of the Nease facility exceed the remediation goal. These areas comprise about 6.5 acres, with an estimated in-place volume of 5,300 cubic yards of contaminated soil.

Excavated soil will be transported to the former Nease facility for consolidation with OU 2 contaminated soils within the Nease facility, and capped and covered as called for in the OU 2 ROD.

- Feeder Creek Sediment – Contaminated sediments in Feeder Creek will be removed and residuals (if any) covered to mitigate potential future releases of mirex into the MFLBC. Excavated sediments will be consolidated with OU 2 contaminated soils within the Nease facility, and capped and covered as called for in the OU 2 ROD. It is anticipated that sediment will be removed to a 2-foot depth along the entire creek, unless coarse material or bedrock is encountered first. The volume of contaminated sediment is estimated to be 2,600 cubic yards.

- The remediation goals for MFLBC sediment and floodplain soil, and the complete removal of contaminated sediment from Feeder Creek will allow for unrestricted use and unlimited access for those media once the goals are met. Therefore, no institutional controls or long-term operation and maintenance will be required for Feeder Creek, or MFLBC sediments or floodplain soils. However, soils and sediments will be consolidated with contaminated soils from OU 2 and contained on-Site. Institutional controls and long-term operation and maintenance of the consolidated materials will be as required for soils in the OU 2 ROD.

- A pre-design investigation (PDI) will be necessary before the remedial design can be finalized. The PDI will include further delineation of the distribution of mirex in sediments and floodplain soil, as well as establish pre-construction baseline conditions. Construction and performance monitoring are required for demonstrating compliance of the remedy with the remedial goals. Construction monitoring will be used to assess acute risks to the community, ecology, and workers that may occur as a result of implementing the remedy. Performance monitoring will be used post-remediation to assess whether short- and long-term risk reduction goals will be met by the implemented remedy.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to this remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies (or resource recovery) to the maximum extent practicable. The remedy in this OU does not satisfy the statutory preference for treatment as a principal element of the remedy because no principal threat wastes were identified for OU 3 media and there are no feasible, cost-effective, treatment technologies for mirex, the primary risk-driving contaminant in OU 3 media. This remedy will not result in hazardous substances, pollutants, or contaminants remaining in OU 3 soils and sediments above levels that allow for unlimited use and unrestricted exposure. However, the OU 3 soils and sediments that will be consolidated on-site are anticipated to contain mirex at levels that do not allow for unlimited use and unrestricted exposure at the completion of the remedial action, and the selected remedy for OU 2 will result in hazardous substances, pollutants, or contaminants remaining on some portions of OU 2 above levels that allow for unlimited use and

unrestricted exposure at the completion of the remedial action. Because the remedies at the Nease Site will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of the first remedial action to ensure that the remedies are, or will be, protective of human health and the environment.

Data Certification Checklist

The following information is included in the Decision Summary section (Part II) of this ROD. Additional information can be found in the Administrative Record file for this Site.

- Contaminants of concern and their respective concentrations (Section 5);
- Baseline risk represented by the contaminants of concern (Section 7);
- Cleanup levels established for contaminants of concern and the basis for these levels (Section 8);
- How source materials constituting principal threats are addressed (Section 11);
- Current and reasonably anticipated future land use assumptions used in the baseline risk assessment and ROD (Sections 6 and 7);
- Potential land use that will be available at OU 3 of the Site as a result of the selected remedy (Section 12);
- Estimated total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (Sections 9 and 12); and
- Key factors that led to selecting the remedy (Sections 10 and 12).

Support Agency Acceptance

The Nease Site Remedial Investigation and Feasibility Study investigations were conducted under a tri-party order with Ohio EPA, U.S. EPA, and Rutgers Organics Corporation, the responsible party. Ohio EPA has worked cooperatively with U.S. EPA in the RI/FS process, and state concurrence with the ROD is anticipated. Any correspondence from the State regarding concurrence with the selected remedies will be added to the Administrative Record.

Authorizing Signature

Richard C Karl

Richard C. Karl, Director
Superfund Division
United States Environmental Protection Agency, Region 5

9-24-08
Date

PART II: DECISION SUMMARY

1.0 Site Name, Location and Brief Description

The Nease Chemical Superfund Site (CERCLIS # OHD980610018) is located in Columbiana and Mahoning Counties, Ohio. The former Nease Chemical plant is located about 2 ½ miles northwest of Salem, Columbiana County, Ohio and approximately one-quarter mile northwest of the intersection of State Route 14 and Allen Road. The facility is located in a rural area. It is bounded by small light-industrial operations and residences along Allen Road to the east and northeast, residential homes along State Route 14, and wooded areas and pasture lands to the north. Conrail railroad tracks traverse the facility.

Figure 1 shows the location and some of the important features of the Nease Chemical facility. The former chemical plant covers about 44 acres. Chemical manufacturing occurred west of the railroad tracks, while wastewater disposal occurred on both sides of the tracks. Five former wastewater treatment ponds (Ponds 1, 2, 3, 4, and 7) and drum disposal areas (Exclusion Areas A and B), as well as contaminated soil throughout the plant area acted as sources of contamination to groundwater, surface water, and creek sediment.

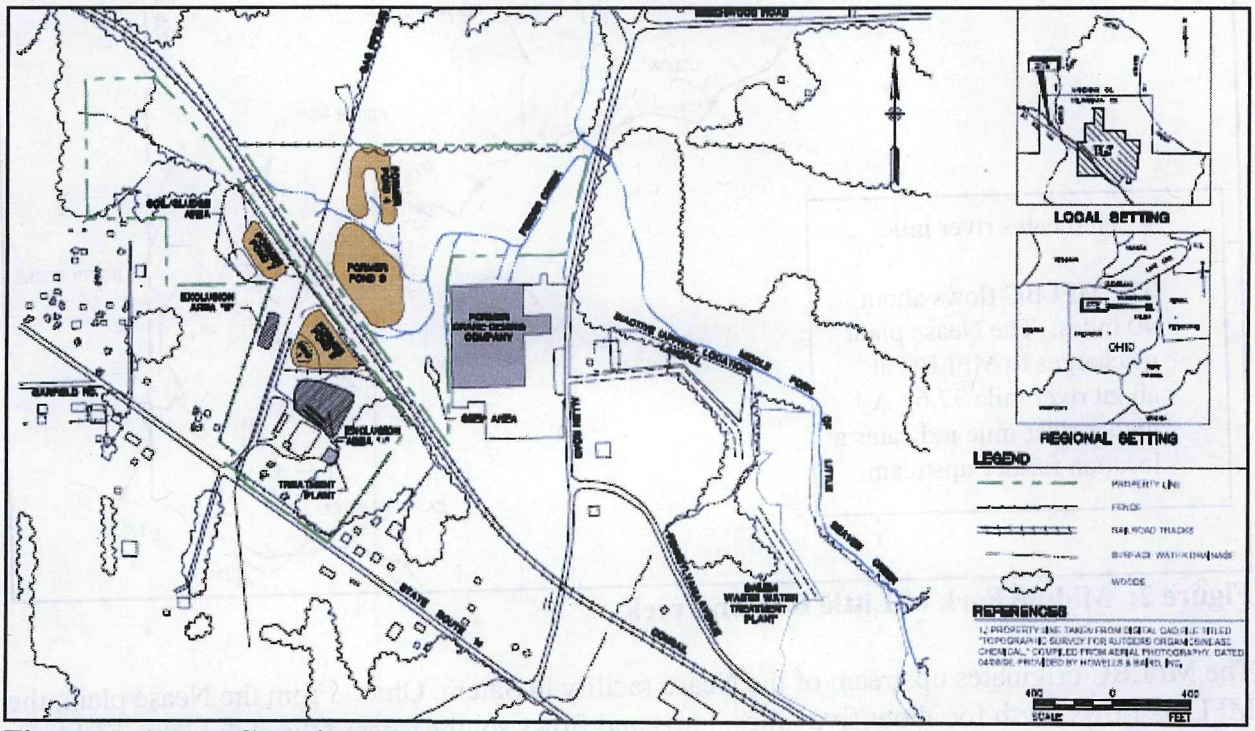

Figure 1: Nease Chemical Plant

Feeder Creek is a very small creek that originates from the contaminated former manufacturing area close to the railroad tracks. The Nease facility is on a topographic high. Surface water drainage from the plant flows via Feeder Creek to the main surface water body in the area, the Middle Fork of Little Beaver Creek (MFLBC), located about 1,800 feet east of the facility. Feeder Creek joins the MFLBC at approximately river mile (RM) 37.6, and was the primary transport route for Site-related contaminants into the MFLBC system. Figure 2 shows the MFLBC and the location of the Nease facility relative to the creek.

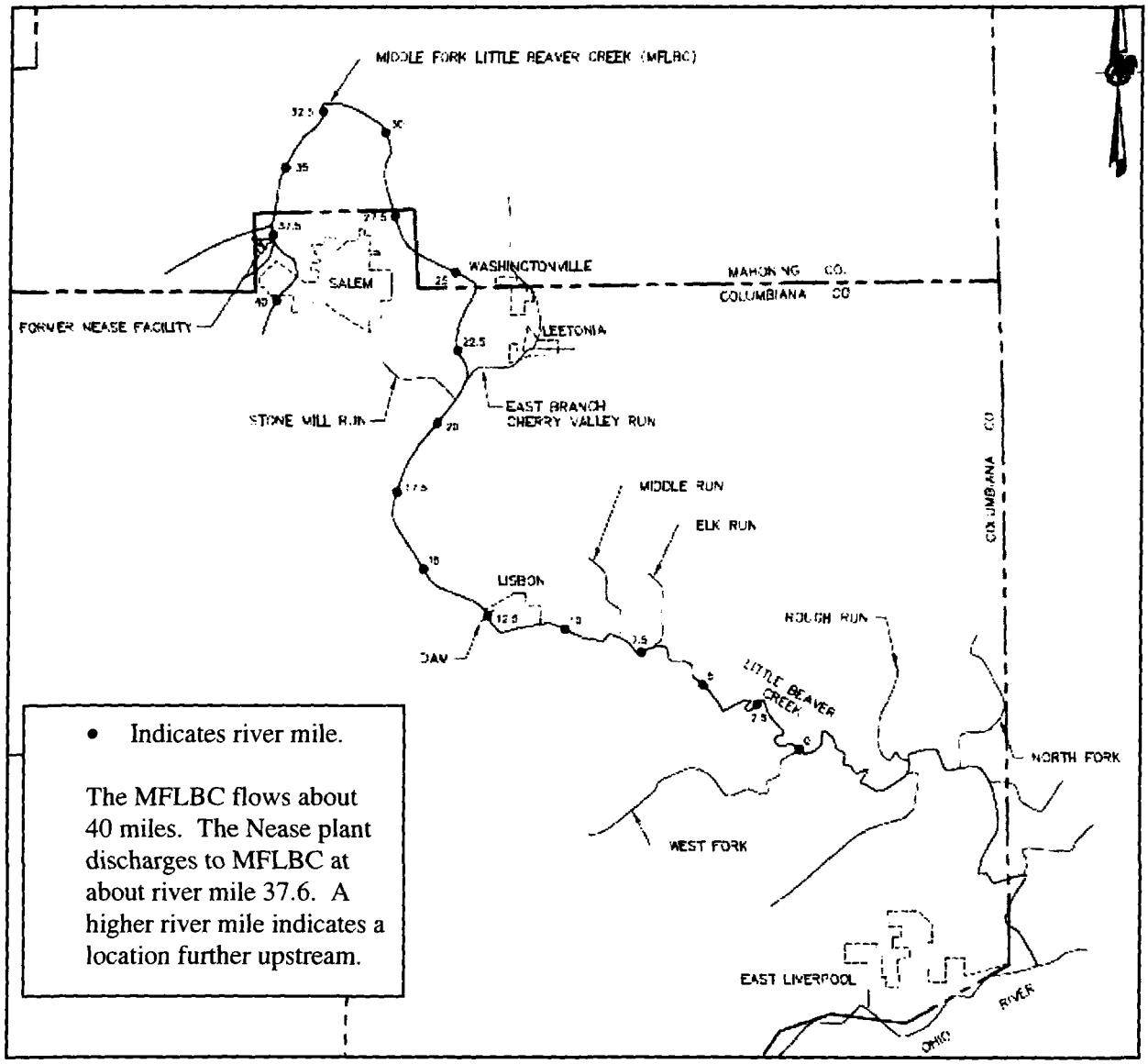

Figure 2: Middle Fork of Little Beaver Creek

The MFLBC originates upstream of the Nease facility in Salem, Ohio. From the Nease plant, the MFLBC flows north for about five miles, turns and flows southeastward through Lisbon, Ohio, and eventually joins other tributaries to form Little Beaver Creek. Little Beaver Creek flows into the Ohio River near East Liverpool, Ohio. The most northerly portion of the MFLBC is located

in Mahoning County, while the Nease plant and much of MFLBC is located in Columbiana County. The MFLBC extends approximately 40.6 river miles. Its waters are designated for agricultural, industrial, and direct contact uses, but not for drinking.

This Record of Decision (ROD) addresses contaminated sediments in Feeder Creek and contaminated sediments and floodplain soils in and along portions of the MFLBC, comprising Operable Unit 3 (OU 3) of the Nease Site.

Rutgers Organics Corporation (ROC) currently owns the former Nease property. The Nease Site[1] was added to the National Priorities List on September 30, 1983. ROC began a remedial investigation and feasibility study (RI/FS) at the Site in 1988. Both U.S. EPA and Ohio EPA have provided oversight of ROC's work under a 1988 Administrative Order on Consent (AOC). ROC completed the *Remedial Investigation Report, Nease Site, Salem, Ohio* (RI) for the Site in January 1996 and the *Feasibility Study for Operable Unit 3, Nease Chemical Company, Salem, Ohio* (FS) in June 2008. In addition, in 2004, ROC completed the *Endangerment Assessment for the Nease Chemical Company Salem, Ohio Site* (EA), which includes the human health and ecological risk assessments. U.S. EPA anticipates that the pre-design investigation (PDI), design of the remedy, and implementation of the remedy selected in this ROD will be carried out by ROC under a federal consent decree.

2.0 Site History and Enforcement Activities

2.1 Source of Contamination

From 1961 until 1973, a portion of the Site was owned and operated by the Nease Chemical Company as a chemical manufacturing plant producing specialty chemicals such as pesticides, fire retardants, household cleaning compounds and chemical intermediates used in agricultural, pharmaceutical and other chemical products. Products and chemical intermediates were manufactured in batch processes, and raw materials and finished products were stored in warehouses, bulk storage, and tanks. Some wastes from the plant processes were put into 55-gallon drums, which were buried on-site. Five unlined ponds (designated Ponds 1, 2, 3, 4 and 7) were used for the treatment and storage of acidic plant wastes or lime slurries from the neutralization of acidic wastes.

After settling in the ponds, neutralized liquids were discharged to the Salem Wastewater Treatment Plant from the late 1960s to 1973. Following notification by Ohio EPA of wastewater violations, the Nease Chemical Company agreed in a Consent Judgment in 1973 to discontinue

1 The NCP defines a Site as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action." For the purposes of this Record of Decision, the Site includes: the former Nease facility, portions of the former Crane-Deming facility, and the underlying areas where groundwater is contaminated (comprising OU 2); Feeder Creek and portions of MFLBC (comprising OU 3); and nearby areas necessary for the implementation of the response actions.

manufacturing operations at the facility until such time as it obtained a new wastewater permit from Ohio EPA. Instead, Nease decided to close the facility. Nease neutralized and removed water in the various ponds to the Salem Wastewater Treatment Plant and filled/graded the ponds by December 31, 1975. Only Pond 1 retains any standing water. In addition, Nease removed the majority of buildings and manufacturing equipment during decommissioning activities. Only one building, which currently houses the groundwater treatment system, remains at the former manufacturing facility.

During and after operation of the chemical plant, the waste ponds and contaminated soil were a source of contamination to the groundwater and the creeks. Surface runoff from the facility carried contaminants into Feeder Creek and then on to the MFLBC. Groundwater flows generally west to east across the site in both the unconsolidated deposits and bedrock. Figure 3 shows the contaminated bedrock groundwater at the Site. Monitoring of surface water in the MFLBC and adjacent groundwater indicates that groundwater discharge is not a significant source of contaminants into the creek. Although drums, some contaminated soil, and liquids in the ponds have been removed, chemical contamination remains in the surface soil and in the soil/fill within the ponds. These remaining chemicals continue to act as a source of groundwater contamination and a potential contaminant source to sediment and floodplain soil. Soil, sources areas (such as the old ponds), and groundwater will be addressed by the remedy previously selected for OU 2, thus removing these potential sources of creek contamination.

2.2 Previous Investigations

2.2.1 Field Investigations

ROC began environmental investigations at the facility and surrounding areas in 1982 at the request of Ohio EPA. This investigation included soil borings at the chemical facility, shallow and deep groundwater monitoring wells in the overburden and bedrock, magnetic surveys to identify possible buried drums, and collection of samples of surface water, soil and sediment to characterize conditions on and adjacent to the facility. Additional monitoring wells were installed by ROC between 1983 and 1986. Several rounds of groundwater samples have been collected between 1982 and 2007. Soil samples were collected during remediation activities in 1983 in Exclusion Areas A and B, and the ponds. Additional soil borings were drilled in 1985 and 1986 east of the facility.

Sediment, fish, and surface water samples were collected from the MFLBC at various times between 1983 and 1987 by ROC, U.S. EPA, and Ohio EPA. Between 1982 and 1991, Ohio EPA periodically sampled residential water supply wells in the vicinity of the facility and in the floodplain of the MFLBC. The RI sampling program for the MFLBC was conducted by ROC between 1987 and 1995, and included analysis of samples collected from surface water, stream sediment, floodplain soil, and fish (both whole body and fillet) at locations along the MFLBC from upstream of the facility to near East Liverpool, Ohio. The RI sampling covered approximately 40 river miles, with the majority of samples located closer to the plant. Samples were analyzed for a wide array of compounds, including volatile organic compounds (VOCs), semi-volatile organic compounds, metals, and pesticides. During the RI, detailed sediment body

mapping was conducted from upstream of the Nease plant to RM 21.5, about 16 miles downstream of the confluence of Feeder Creek and MFLBC at RM 37.6. The RI also included sediment and surface water sampling in Feeder Creek.

Considerable post-RI sampling has occurred, focusing on the pesticide mirex (for further discussion of mirex, see Sections 5.5 and 7.1.3 below). Additional fish, sediment, floodplain soil and/or surface water samples were taken by ROC and/or Ohio EPA in the MFLBC in 1997, 1999 to 2001, and 2005 to 2006, with small sampling events in 2003 and 2004. In 1999, Ohio EPA and ROC jointly conducted a comprehensive biocriteria assessment of the MFLBC involving fish community, benthic macroinvertebrate community, and habitat surveys. An additional detailed sediment body mapping was conducted in 2005, confirming the historic results and extending the study down to RM 12.5. The post-RI results are found in the Middle Fork of Little Beaver Creek Mahoning and Columbiana Counties, Ohio Impact Assessment Report (March 2000) and the MFLBC Database, included in the Administrative Record, and are summarized in the FS. The post-RI sampling confirmed the findings in the RI Report regarding the nature and extent of mirex contamination in OU 3.

2.2.2 Mirex in Biota and Consumption Advisories

In July 1987, Ohio EPA shared preliminary results of its data from fish in the MFLBC, which reported mirex detected in fish specimens for a distance of at least 12 miles downstream from the facility. In October 1987, the Ohio Department of Health (ODH) issued a fish consumption advisory for the MFLBC between Allen Road in Salem and the bridge at State Route 11 near Elkton, Ohio, covering about 27 river miles downstream of the Nease plant. The advisory was due to mirex and recommended that no fish of any species be eaten from this stretch of MFLBC. In March 1988, ODH expanded the advisory to include warnings against wading and swimming. ODH began posting signs along the MFLBC during the summer of 1988. After finalization of the EA, U.S. EPA and Ohio EPA requested ODH to review the contact advisory, in light of the EA findings. Based on the most recent fish sampling, Ohio EPA has modified the fish consumption advisory. Due to mirex, the current advisory recommends consuming no more than one meal per month of carp between Allen Road and State Route 14 in Millville, a distance of about 12 river miles.[2] More information on Ohio's fish consumption advisory for the MFLBC can be found at www.epa.state.oh.us/dsw/fishadvisory/waters/Middle.html.

During the period when the fish consumption and contact advisories were first issued in 1987, the Ohio Department of Agriculture (ODA) raised the possibility that Grade A dairy herds that watered in the MFLBC might be ingesting mirex. In August 1987, ODH tested milk supplies from three farms and detected mirex in several samples at levels below the Food and Drug Administration (FDA) action level that was in place at that time. In 1988 and 1989, ODA also tested meat from two herds that had access to the MFLBC. Mirex was detected above the FDA

2 There are other fish consumption advisories on the MFLBC for carp and other fish due to contaminants unrelated to the Nease Site (PCBs and mercury). Additionally, there is a state-wide advisory to eat no more than one meal of fish per week from any source.

action level in place at that time in seven out of eighteen samples. In 1987 through 1989, ROC worked with the farmers to provide alternate water sources and restrict access of livestock to the creek and potentially contaminated floodplain soil by fencing. ODA sampling has not detected mirex in milk or beef since 1990, after access of livestock to the creek was restricted.

In 1989, ODH and the Ohio Department of Natural Resources (ODNR) took samples of blood and fat from raccoons and opossums at nine sites along the MFLBC. The samples contained low levels of mirex. These data were used to support assessment of potential risks from game consumption in the EA.

2.2.3 ODH Health Assesments

In 1990 and 1996, ODH conducted public health assessments trying to target people around the Nease Site that were most likely to have been exposed to site-related contaminants, specifically mirex. Individuals most likely to have been exposed to mirex were surveyed and a subset of respondents was sampled for blood levels of mirex. Mirex was detected in the blood of 14 of 42 area residents sampled in 1990 (levels ranging from 0.25 to 2.2 ppb), and in 8 of 177 area residents sampled in the 1996 study (levels ranging from 0.29 to 2.69 ppb).

1990 ODH Study: On October 4, 1990, ODH issued a report of a study that included resident blood sampling results and an analysis of potential exposure pathways to mirex associated with the MFLBC. The study included some former Nease employees. ODH concluded:

> "We found strong evidence that some people living near the Nease Superfund site and MFLBC have acquired body burdens of mirex released from the site or acquired while working there. However, most people who reported activities that could have resulted in uptake of mirex did not have detectable amounts of mirex in their serum.
>
> Having mirex in the blood was associated with two activities: 1) consuming animal products from animals probably contaminated with mirex and 2) work at the Nease chemical plant.
>
> In the group participating in this study, fishing, contact with contaminated stream sediment and soil, and eating gardens (sic) products grown in possibly contaminated soil were not associated with the presence of mirex in serum. Only two of the fourteen people with mirex in their serum did not report exposure to either contaminated food products or occupational exposure, but did report a variety of other activities which may have lead to their uptake of mirex.
>
> This study does not provide any evidence of widespread human uptake of mirex in people living in the vicinity of the site or MFLBC. The total number of samples was not large and the selection of people was biased toward participation by people who we thought would be most likely to have taken up mirex.
>
> The mirex levels in this study population were slightly lower or much lower than in all groups reported in published account (sic) to have any amount of mirex in their serum. Most reported exposures were in people who were probably exposed to mirex applied widely in large amounts to kill fire ants in the southern United States or who ate mirex contaminated fish from Lake Ontario ..."

1996 ODH Study: In December 1996, ODH in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR) issued the results of a larger study. While the study did not include children under seven years of age, the study looked at a much larger group than the 1990 study. ODH concluded:

> "At this time ODH will not recommend further health study of the general population in the vicinity of MFLBC. This decision is based on the fact that a large portion of the study participants reported no potential exposure pathways. Among those who did report potential exposure pathways, very few had detectable levels of mirex in the blood. For these reasons, we do not believe there has been widespread exposure to mirex in this community... Results indicate the general population living near the Middlefork of Little Beaver Creek does not show evidence of widespread exposure to Mirex. However, the pilot study did show an association of mirex detection and employment at Nease... ODH should continue to post advisories and make the community aware of the advisories... Most participants responding to the questionnaires indicated that they knew of the advisories and had curtailed activities advised against. One of the reasons for the low detection of mirex in the general population may be prudent risk management on the part of the community members as a result of these advisories."

2.2.4 ATSDR Public Health Assessment

In February 1997, ATSDR issued a public health assessment based on sampling data for the MFLBC, including 1991 sediment data, 1987-91 floodplain soil data, 1991 fish samples, 1990 raccoon and opossum blood and fat samples, and 1987-91 milk data. Based on its review, ATSDR concluded the "contamination of MFLBC (associated with the Nease Chemical site) represents a public health hazard, because of past exposure and the possibility of future exposures."

2.3 Previous Response Actions

In 1983, ROC voluntarily implemented various steps including the removal of drums and associated affected soils. A total of 115 drums were removed from Exclusion Area A. Additionally, more than 9,500 cubic yards of contaminated soil were removed from Exclusion Areas A and B, Pond 1, and a nearby ditch. The soil and drums were disposed at an off-site hazardous waste landfill. At the same time efforts were made to prevent contaminated sediment from leaving the Site. The efforts included seeding Pond 2, and installing of fabric barriers across drainage swales and ditches, rock dams, and hay-bale barriers.

In late 1991, ROC instituted further stabilization measures to reduce potential off-site transport of contaminants. Additional surface water diversion measures, berms and sediment control structures were constructed. These measures successfully reduced migration of contaminants into the MFLBC.

Under an AOC with U.S. EPA, starting in 1993 ROC took measures to control leachate releases and seeps. To reduce potential discharge of shallow groundwater to the ground surface, ROC constructed a collection trench and aggregate drain downgradient from Exclusion Area A and Ponds 1 and 2 and a collection drain and recovery well immediately downgradient of Pond 2. Shallow groundwater from these systems is presently pumped to the on-site treatment plant or transported off-site for treatment and disposal. Since the start of operations, over 23 million gallons of highly contaminated shallow groundwater have been captured and treated. In addition, water in Pond 1 is periodically pumped out and treated to prevent runoff. See Section 4.1 below for more information concerning the interim remedial measures taken under this agreement.

During the PDI for OU 2, ROC discovered unanticipated conditions at the Site which ROC took immediate actions to address. In 2007, ROC voluntarily provided vapor mitigation systems to two homes near the Site (located south of the facility along State Route 14) to prevent intrusion of contaminated vapors from the groundwater plume. Additionally, ROC removed several gallons of dense non-aqueous phase liquids (DNAPL) [3] from the Site.

2.4 Enforcement Activities

On December 30, 1977, the assets of Nease Chemical Company (including the non-operational Salem facility) were acquired and the company merged with Ruetgers Chemicals, Inc. to form Ruetgers-Nease Chemical Company, Inc. (now known as Rutgers Organics Corporation or "ROC"). ROC has never operated at the Site. Since 1982, ROC has cooperated with Ohio EPA and U.S. EPA to address the Site.

In January 1988, an AOC was signed by ROC, Ohio EPA and U.S. EPA, which required ROC to conduct a RI/FS. The RI/FS work described in this ROD was conducted by ROC under the terms of the 1988 AOC, with oversight by U.S. EPA and Ohio EPA. In November of 1993, ROC and U.S. EPA entered into an AOC calling for specific removal activities to address all leachate releases and seeps (See Sections 2.3 and 4.1 for more information on the removal activities). In May of 2006, ROC and U.S. EPA entered into an AOC which requires ROC to conduct the PDI and remedial design of the remedy for OU 2 (See Section 4.2 for more information on OU 2).

3.0 Community Participation

U.S. EPA made the Proposed Plan for OU 3 of the Nease Site available to the public for comment on July 9, 2008. Copies of the Proposed Plan and the final RI, FS, and EA reports (as well as other supporting documents) were placed in the local Information Repositories located at the Salem Public Library and the Lepper Library in Lisbon, Ohio. Documents are also available at Ohio EPA's office in Twinsburg, Ohio. U.S. EPA mailed copies of the Proposed Plan to more than 4,000 interested persons on U.S. EPA's community involvement mailing list for the Site. Copies of all documents supporting the remedy outlined in the Proposed Plan are located in the

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[3] A dense non-aqueous phase liquid (DNAPL) is a liquid that is denser than water and does not dissolve or mix easily in water (it is immiscible). In the presence of water it forms a separate phase from the water and can be a long-term source of groundwater contamination. Many chlorinated solvents are DNAPLs.

Administrative Record file for the Site, located at the U.S. EPA Records Center, 77 West Jackson Boulevard, Chicago, Illinois and the Salem Public Library, 821 E. State St., Salem, Ohio.

The public comment period ran for thirty days, from July 14 through August 13, 2008. U.S. EPA held a public meeting at the Salem Public Library on July 31, 2008, to present the Proposed Plan and approximately 35 people attended. The notice announcing the public meeting and the availability of the Proposed Plan was published in the *Salem News* and in the *Lisbon Morning Journal* on July 2, 2008. A press release was issued on July 11, 2008, to alert media in Salem, Lisbon, and Youngstown about issuance of the Proposed Plan and the start of the public comment period. Representatives of U.S. EPA and Ohio EPA were present at the public meeting, as were representatives of ROC, to answer questions regarding the proposed remedy. Responses to comments received during the public comment period (including comments received at the public meeting) are included in the Responsiveness Summary which is Appendix A of this ROD. These comments were considered prior to selection of the final remedy for OU 3 at the Nease Chemical Site.

In addition to the public involvement activities noted above, U.S. EPA mailed out fact sheets in April 1990, July 1992, November 1992, January 1994, September 1995, March 1996, November 1996, December 2004, and June 2005. Additional public meetings were held on February 3, 1988, July 14, 1992, February 10, 1994 and June 22, 2005. These fact sheets and meetings were used to inform the public about Site progress, discuss concerns about mirex toxicity and health effects, and discuss the interim and OU 2 cleanup actions. U.S. EPA developed a Community Involvement Plan when RI/FS activities began at the Site in 1988, and the plan was updated in 1996. The mailing list was revised in 2004 to add additional community members and to ensure that it was up to date. U.S. EPA also developed a website dedicated to the Nease Site. More recent factsheets, technical documents, and other information have been placed on the website, and are available at http://www.epa.gov/region5/sites/nease/index.htm.

4.0 Scope and Role of Response Action and Operable Units

Like many Superfund sites, the problems at the Nease Chemical Site are complex. As a result, U.S. EPA has organized the work into three OUs:

- OU 1: Long-term Removal Actions;
- OU 2: Soils, Source Areas, and Groundwater; and
- OU 3: Feeder Creek and MFLBC.

Because the Nease Chemical Site is being addressed as multiple OUs under the framework set forth in CERCLA, there are multiple RODs for the Site. This ROD is the second of two RODs for the Nease Chemical Site, and is intended to be the only ROD for OU 3. The ROD for OU 2 was signed in September 2005. The selected remedy specified in this ROD, in combination with the remedy selected in the OU 2 ROD, will serve as the final action for the entire Site.

4.1 Operable Unit 1

Long-term Removal Action: As discussed in Section 2.3 of this ROD, there were interim response actions conducted by ROC under a 1993 AOC with U.S. EPA. The removal actions that were conducted under that AOC have been called "OU 1." These actions included measures to control leachate releases and seeps. Two shallow groundwater collection systems were constructed downgradient of Ponds 1 and 2 and Exclusion Area A. These systems are presently in operation and contaminated groundwater is either pumped to the on-site treatment system or transported off-site for treatment and disposal. Since the start of operations, over 23 million gallons of highly contaminated shallow groundwater have been captured and treated. In addition, surface water and sediment control measures were constructed, including berms, sediment outlet control structures, fabric barriers in Feeder Creek, and runoff diversions.

Because the response actions in OU 1 were taken using removal authorities, U.S. EPA has issued no ROD for OU 1, and no ROD is planned. The ROD for OU 2 largely incorporated the elements of OU 1 that address groundwater, or have superseded them. The actions selected in the OU 2 ROD for shallow groundwater address the functions of the existing shallow groundwater collection systems implemented in the response actions for OU 1. The final design for the shallow groundwater system under the OU 2 remedy will require replacement of the existing collection trenches. Response actions selected in the ROD for OU 2 to address source areas and soils will mitigate the need for runoff control currently provided by OU 1 measures, and the final design will provide for management of surface water flow.

The OU 1 measures that relate to sediments in Feeder Creek, preventing migration of additional contaminants to the MFLBC (berms, sediment control structures, and fabric barriers), are superseded by this OU 3 ROD. Remediation of sediments in Feeder Creek, as selected in this ROD, will eliminate the need for sediment control. Those OU 1 measures will continue until they are removed during the construction of the OU 3 remedy.

4.2 Operable Unit 2

Soils, Source Areas, and Groundwater: OU 2, the subject of a ROD signed in September 2005, addresses the contaminated soils, actual or potential source areas, and groundwater. The contaminants at OU 2 of the Nease Site originated from production processes at the Nease Chemical Company from 1961 to 1973. Products and waste materials were stored and/or disposed on the facility. Upon closure of the plant, contaminants remained in unlined ponds that had been filled in, buried in drums, and in soil that had become contaminated. The chemicals in the unlined ponds, drums, and contaminated soil leached to the overburden (shallow) and bedrock (deep) groundwater. The primary contaminants of concern are VOCs in groundwater (largely chlorinated ethenes and ethanes) and mirex in soil. VOCs are found in groundwater and within the wastes of Ponds 1 and 2 as DNAPL, as well as in the dissolved state.

The major components of the selected remedy include:

- Ponds 1 and 2 will be treated by in-situ air stripping, followed by stabilization and solidification.

- Soil exceeding the remediation goal of 1 mg/kg of mirex in surface soil and the other former ponds will be capped using either an impermeable geosynthetic membrane covered with clean soil, or only clean soil. The Site will be configured to manage surface water flow and prevent erosion.

- Shallow groundwater will be captured in a new collection trench, pumped above ground and treated ex-situ in a new or modified treatment plant.

- Deep groundwater will be treated by injection of nanoscale zero-valent iron (NZVI) into the most contaminated part of the plume. NZVI treatment may be followed by accelerated biological treatment if monitoring during the first few rounds of NZVI injections indicates the design performance standards might not be met by NZVI alone. Monitoring of natural attenuation will occur to ensure remediation of the far downgradient portion of the plume.

- Institutional controls and long-term operation, monitoring and maintenance will be required for OU 2.

U.S. EPA signed the OU 2 ROD on September 29, 2005. Ohio EPA concurred on the selected remedy. U.S. EPA initiated negotiations with ROC that resulted in an AOC effective May 10, 2006, that requires ROC to conduct the remedial design of OU 2. A major component of the remedial design is a PDI. ROC conducted the PDI work in 2006 to 2007, including major treatability studies for the stabilization/solidification and the NZVI treatment of groundwater. The treatability studies were generally successful. The PDI results are currently under review by the Agencies, and will be the basis for the OU 2 design.

During the PDI for OU 2, unanticipated conditions were discovered. Based on groundwater monitoring during the PDI, sub-slab vapor monitoring was conducted at two residential properties near the Site along State Route 14. No indoor air samples were taken, however in 2007, ROC voluntarily provided vapor mitigation systems to the two homes to prevent potential intrusion of contaminated vapors from the groundwater plume. Additionally, ROC removed several gallons of DNAPL from the Site. U.S. EPA anticipates that implementation of the OU 2 remedy will be carried out by ROC under a federal consent decree.

4.3 Operable Unit 3

Feeder Creek and MFLBC: The third OU, subject of this ROD, addresses contaminated sediments in Feeder Creek and contaminated sediments and floodplain soils in and along portions of the MFLBC. The selected remedy specified in this ROD will serve as the final action for the entire Site.

The source of the contamination is discussed more fully in Sections 2.1 and 5.4 of this ROD.

Runoff carried contaminants from the plant facility into Feeder Creek and on into MFLBC. The old Nease facility is hilly and drainage flowed through ditches and intermittent streams into Feeder Creek in the northeast portion of the facility. From there, water and sediment migrate to MFLBC. The MFLBC originates upstream of the facility in Salem, Ohio, and flows north for about five miles, turns and flows eastward and then southeastward and eventually joins other tributaries to form Little Beaver Creek, which discharges to the Ohio River.

Section 2.3 of this ROD discusses some interim actions that have been taken to mitigate contaminant migration into Feeder Creek and the MFLBC. Section 2.2 discusses fish consumption and contact advisories that were put in place as a result of ODH's public health assessments, as well as measures taken to restrict access of livestock to contaminants in the creek. U.S. EPA and Ohio EPA have sent the findings of the human health risk assessment in the EA and other new information to ODH, requesting ODH to review the existing direct contact and recreational use restriction advisories. The degree and extent of contamination in OU 3 is discussed in Section 5.6 of this ROD.

The actions to remediate OU 2 will constitute source control actions for OU 3.

5.0 Operable Unit Characteristics

5.1 Conceptual Site Model for OU 3

The conceptual site model (CSM) provides an understanding of the Site based on the sources of the contaminants of concern, potential transport pathways and environmental receptors. Figure 4 depicts a highly simplified CSM for OU 3 of the Nease Site. Based on the nature and extent of the contamination and the fate and transport mechanisms described in the RI, FS, and EA Reports, the CSM includes the following components:

- Chemical contaminants from operations in the 1960s and early 1970s at the Nease Chemical plant were released to the environment. Wastewater was stored in five unlined ponds. Drums were disposed on-site. It is likely that spills occurred.

- Over time, leaking drums, runoff, and/or spills spread contamination to the facility soils. Some interim cleanup actions were conducted to remove buried drums and the most highly contaminated soil. However, surface soil over portions of the old Nease facility remains contaminated. These soils will be addressed under the selected OU 2 remedy.

- The primary contaminant of concern (COC) in OU 3 is mirex.

- Feeder Creek is the main route of surface water drainage from the former plant. Runoff carried contaminants from surface soil into Feeder Creek and on into the MFLBC. It is likely that mirex contamination remained bound to soil particles suspended in surface water.

- Mirex contaminated soil particles settled as sediment into areas of the MFLBC that were conducive to sediment deposition. Over time, relatively low amounts of mirex-contaminated sediment were transported further downstream.

- During flooding events, some of the contaminated sediment washed up and deposited in floodplain soil. There is little evidence of significant erosion of contaminated floodplains back into the MFLBC, although this could occur in certain areas.

- Biota in the MFLBC (e.g., fish) and along the contaminated floodplains (e.g., grazing cattle) bioaccumulate mirex.

- Consumers of contaminated biota would be exposed to mirex. Also, small mammals living in the contaminated floodplains would be exposed to mirex through the food chain and via direct contact.

Figure 5 depicts the CSM for the human health risk assessment used to illustrate contaminant distribution, release mechanisms, potential exposure pathways and migration routes, and potentially-exposed populations. Because the EA was completed before the Site was separated into operable units, this CSM is far more complex and includes many sources, media, and pathways associated with OU 2.

5.2 Operable Unit Overview

OU 3 of the Nease Chemical Site is located in both Mahoning and Columbiana Counties, Ohio. Figure 2 shows the old Nease plant, the MFLBC, and the county boundaries. The old plant has the approximate geographic coordinates 40° 54.9'N and 80° 53.5'W.

As discussed above, Feeder Creek is a small creek that provides the main surface water drainage of the former plant site to the MFLBC. Figure 6 shows the main stem of Feeder Creek and four "branches" that drain the former facility. Feeder Creek is only a few feet deep and wide. Feeder Creek joins the MFLBC at approximately RM 37.6. The Nease facility is on a topographic high that slopes to the northeast towards the MFLBC. The elevation at the former facility ranges from approximately 1,160 to 1,200 feet above mean sea level.

The MFLBC flows north from the City of Salem into Mahoning County, turns to the east, then flows southeast through Columbiana County until it joins other tributaries to form Little Beaver Creek. Little Beaver Creek flows into the Ohio River near East Liverpool, Ohio. The MFLBC extends approximately 40.6 river miles with an average gradient of 11.8 feet per mile. Gradients vary, as shown on Figure 7, with steeper gradients generally corresponding to higher velocity stream flow and generally less accumulated sediment. The MFLBC drains a total area of approximately 496 square miles. Creek widths vary from 10 to 120 feet (see Figure 8) and creek depths are relatively shallow (less than a foot in certain areas of concern).

The MFLBC consists of a series of riffles and pools. Sediment deposition is a complex process. Soft sediment does not cover the entire bottom of the MFLBC and is influenced by stream morphology and hydrology. In the 6 ½ miles downstream of the Nease facility, fine-grained sediment bodies only cover about 14% of the total creek bed surface. The creek substrate includes bedrock outcrops, rubble-gravel-boulders, sand, silt, and clay at various locations. From RM 38.3, upstream of the plant, to RM 29, where the creek enters an area known as Egypt Swamp, sediment accretion rates are generally constant, with a steadily increasing cumulative sediment volume (see Figure 9). Total sediment volumes increase sharply within Egypt Swamp (RM 29 to RM 24), likely due to decreased stream gradients and increased stream bed and floodplain widths. There is a spillway at RM 12.5 called "Lisbon Dam" and sediment has accumulated behind this structure.

Surface water flow was measured during the RI. The average MFLBC velocity was less than 0.5 meters per second, with a discharge of 5 to 40 cubic feet per second above the Lisbon Dam at RM 12.5 and 100 to 300 cubic feet per second below. The closest United States Geological Survey (USGS) stream gage is located in Little Beaver Creek near its confluence with the Ohio River. Data from the Little Beaver Creek gage can be extrapolated to estimate MFLBC conditions. Data from the USGS gage shows that there are three years, 1964, 1990, and 2004, with exceptionally high peak discharge rates. These three high flow, high energy events are associated with significant storm events (such as hurricanes). Comparing data from before and after high energy storm events provides information on sediment scouring, significant downstream transport, or modified deposition of sediments that could result in the redistribution of contaminants. No significant changes in stream morphology or distribution of fine grained sediments were observed as a result of the most recent high energy storm events.

Along the banks of the MFLBC the topography varies greatly, from very flat areas with wide floodplains to steep slopes with narrow floodplains. Within 6 ½ miles downstream of the Nease facility, floodplain widths range from about 60 feet to about 1,000 feet, with an average width of about 375 feet and a total area in this reach of approximately 300 acres.

5.3 Sampling Strategy

Prior to the start of RI work, sediment, fish, and surface water samples were collected from the MFLBC at various times between 1983 and 1987 by ROC, U.S. EPA, and Ohio EPA. Additionally, Ohio EPA periodically sampled residential water supply wells in the floodplain of the MFLBC to evaluate any impacts from the creek on adjacent groundwater. The strategy behind these sample events was generally to respond to Agency and/or public concerns at a time of high public interest.

A work plan that presented the scope of work for the RI was approved by the agencies on March 28, 1990, and ROC initiated work on April 16, 1990. The RI work was conducted before the Site was separated into operable units, and included an extensive sampling strategy to define the nature and extent of contamination in all media. All RI investigation activities were conducted by ROC under the supervision of U.S. EPA and Ohio EPA. The RI was conducted in phases. Site-wide field investigation activities conducted as part of the RI included:

- Air monitoring;
- Geophysical investigations;
- Monitoring well drilling and installation;
- Soil borings and samples;
- Test pit soil sampling;
- Pond borings;
- Groundwater sampling;
- DNAPL investigation;
- Aquifer testing;
- Soil hydraulic conductivity testing;
- Residential well survey;
- Topographic mapping and surveying;
- Surface water sampling;
- Sediment sampling;
- Floodplain soil sampling; and
- Fish sampling (whole body and fillet).

The RI sampling covered approximately 40 river miles in MFLBC, with the majority of samples located closer to the plant. Samples were analyzed for a wide array of compounds, including VOCs, semi-volatile organic compounds, metals, and pesticides. During the RI detailed sediment body mapping was conducted over about 16 river miles adjacent to and downstream of the plant. Physical characteristics such as depth, width, and flow were measured. The RI also included sediment and surface water sampling in Feeder Creek. In October 1993, an ecological habitat inventory and stream survey was conducted along the MFLBC riparian corridor. The results of these RI activities are described in the 1996 RI Report.

The MFLBC has variable stream flow and flooding. Several high flow events have occurred during the investigation work at the Site. Because of potentially changeable conditions, and to observe trends over time, ROC and/or Ohio EPA conducted considerable post-RI sampling, focusing on the pesticide mirex. Section 2.2.1 discusses the additional fish, sediment, floodplain soil, and surface water investigations conducted by ROC and/or Ohio EPA in the MFLBC since the RI. Data is summarized in the FS and other documents in the Administrative Record.

5.4 Source of Contamination

As discussed in Section 2.1 of this ROD, the contaminants at OU 3 of the Nease Site originated from production processes at the former Nease Chemical Company. During the operation period of the Nease Chemical plant (1961 to 1973), environmental waste regulations were very different from today's laws, and spills, leaks, and disposal of waste contaminated the Site. Upon closure of manufacturing operations, widespread contamination remained on the plant site. Runoff from the facility carried contaminants (primarily mirex) into drainage ditches, Feeder Creek and then on to the MFLBC, including areas of sediments and floodplains. Once mirex entered the MFLBC system, it bioaccumulated in fish and other biota.

Soil data was collected from test pits and soil borings during the RI. A summary of key findings includes:

- The highest contaminant concentrations in soils were found in the drum disposal areas (Exclusion Areas A and B), and the former production area (especially northwest of Ponds 1 and 2). VOCs in these areas appear to increase with depth. The primary VOCs detected were perchloroethene, 1,1,2,2-trichloroethane, trichloroethene, and benzene. Total VOC ranges by depth are:
    - 0 to 0.5 feet - non-detect to 1.4 mg/kg
    - 0.5 to 3.5 feet - non-detect to 6.5 mg/kg
    - 3.5 to 6.5 feet - non-detect to 18.7 mg/kg

- Mirex was detected primarily in shallow soil. Mirex detected below 0.5 feet is generally limited to Exclusion Areas A and B, and the former production area (especially northwest of Ponds 1 and 2). Where it is found at depth, mirex levels in soil generally decrease with depth. Mirex ranges by depth are:
    - 0 to 0.5 feet - non-detect to 2,080 mg/kg
    - 0.5 to 3.5 feet - non-detect to 126 mg/kg
    - 3.5 to 6.5 feet - non-detect to 32.8 mg/kg

It is likely that most runoff of contaminants that migrated to the MFLBC occurred from plant site soil nearest the surface (0 to 0.5 feet). While the RI data indicate that VOCs were detected in surface soil, the primary COC for OU 3 is mirex (discussed in more detail in Section 5.5 below). It is likely that if any VOCs were carried into the MFLBC, they would volatilize and/or degrade. The contaminated soil at the plant site will be addressed by the remedy selected for OU 2, and will no longer be a potential source of contamination to OU 3.

5.5 Types of Contaminants and Affected Media

Since the Nease Site housed an old chemical manufacturing facility that operated in an era before there was much regulation or sound environmental management of waste, it is not surprising that there is a large array of chemical contaminants found in several media. At the Site, air, soil, groundwater, surface water, sediment, and biota were analyzed for a variety of contaminants. The investigations found 155 chemicals detected at least once in the sampled media.[4] The EA carefully evaluated which of these chemicals and affected media were most important in driving potential risk at the Site. These findings are summarized in Section 7 of this ROD, but extensive evaluation is found in the EA. This ROD focuses on the contaminant and affected media that are most important in OU 3.

Mirex, a chlorinated hydrocarbon manufactured at the Nease Site, is the primary site-related

4 The RI and EA were substantially complete before the Site was separated into Operable Units. This ROD attempts to focus on OU 3, but at times it was difficult to separate the OU 3 assessment from the broader site-wide work. Additional detailed information is found in the Administrative Record.

COC found in OU 3. Mirex is an odorless, white, crystalline solid. It was used in pesticide formulations, and was especially common in the southern United States, where it was frequently applied to control fire ants. It was also used as a flame retardant in products such as plastics, rubber, paint, paper and electrical goods. Mirex is a very uncommon COC at Superfund sites, and has been identified at only a few other sites.

Mirex was banned in the United States in 1978. Like other chlorinated pesticides, it breaks down very slowly in the environment and can persist for years. Its breakdown product, photomirex[5], is also toxic and persistent. See Section 7.1.3 below for more discussion concerning the toxicity of mirex and photomirex. Mirex is highly sorptive and has a very low solubility (approximately 1 ug/L). These physical properties mean that mirex is likely to bind to particulate matter (especially fines and organic material) and is unlikely to travel in a dissolved state in water. Mirex can bioaccumulate in biota in the food chain, and is typically associated with lipid.

Mirex has been found in several media at the Nease Site. Within OU 3, mirex has been found in Feeder Creek sediments, Feeder Creek surface water (the results may be associated with suspended particulate matter), MFLBC sediments, and MFLBC floodplain soil. Additionally, mirex has been found in MFLBC fish, beef and milk of cattle exposed to the creek and floodplain, and other biota (raccoons and opossums) living near the MFLBC.

5.6 Extent of Contamination

This section presents a summary of the results associated with the RI and subsequent investigations conducted at the Site. A full description of the RI activities and sampling results prior to 1996 is contained in the RI Report. Additional descriptions of the extent of contamination at the Site are found in the EA, FS, and other documents regarding post-RI activities and sampling which are included in the Administrative Record for the Site. This summary discussion will focus on mirex, the primary site-related COC that is most important in creating potential risk in OU 3.

5.6.1 Feeder Creek

Feeder Creek sediment samples were collected during the RI and in a subsequent study in 1996. During the RI sediment samples were collected from seven locations. Mirex concentrations ranged from 0.38 to 129 mg/kg. During the 1996 sampling, sediment was analyzed for depth-discreet samples (0-3, 3-6, 6-10, and 10-14 inches below the surface) at six locations. Mirex was highest in the top six inches, with a maximum detection of 0.845 mg/kg.

Four samples of surface water were collected from Feeder Creek during the RI. Mirex was detected in three samples at concentrations ranging from 0.0304 to 0.362 ug/L. Detections of mirex in surface water in Feeder Creek are likely due to the presence of suspended solids since mirex adheres to fine-grained sediments and organic matter and does not dissolve easily in water.

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5 Photomirex is considered to have toxicological effects similar to mirex, so where applicable, photomirex concentrations and mirex concentrations have been summed.

5.6.2 MFLBC Sediment

The first major sediment sampling effort on the MFLBC was conducted in 1990 as part of the RI work and included 42 sediment samples. The highest mirex concentrations were detected between river miles 31.4 and 35 with a maximum concentration of 1.68 mg/kg. Mirex was detected in sediments as far downstream as RM 1.9, but at much lower concentrations. As part of the RI, in 1993-1995 19 additional sediment samples were taken from the MFLBC in conjunction with soil samples collected from adjacent floodplains. Mirex concentrations in 1993-1995 were consistent with those found in 1990, with the highest concentrations between RM 32 and RM 35.5 and a maximum detection of 1.19 mg/kg. Additional sampling occurred in 1999 and the results show a trend similar to the previous sampling, i.e. the highest concentrations were detected in the upstream portion of the stream near the former Nease facility and lower concentrations were measured downstream. In 2005, mirex was detected in 18 of 19 surface sediment samples. The highest detections were between RM 37 and RM 33.3 with a maximum concentration of 2.03 mg/kg at RM 35.4.

Figure 10 shows the results of all sediment mirex sampling events together. Over multiple sampling events spanning 15 years, results and trends of mirex in MFLBC sediment have been relatively consistent. The main area of contaminated sediment is the approximately 6.6-mile creek stretch from RM 31 to RM 37.6. Mirex binds preferentially to organic carbon and this may reduce its bioavailability. Figure 11 shows all sediment mirex results normalized according to the total organic carbon content in the sample. This supports that the area of most concern for mirex bioavailablity is from RM 31 to RM 37.6. Due to concerns for potential downstream transport of contaminated sediment over time, depositional areas such as Egypt Swamp (RM 29 through RM 24) and upstream of the Lisbon Dam were extensively investigated. Although these areas showed substantial sediment volume, they showed relatively low levels of mirex contamination. These results suggest that there has not been a large-scale movement of mirex mass downstream (although low levels of mirex have moved as far downstream as RM 1.9), even during several high-energy storm events that occurred since the original release.

5.6.3 MFLBC Floodplain Soils

During the RI, ROC conducted floodplain soil sampling in three primary phases. Phase I was in 1990 and used transects across the stream. Each transect included two samples of the top 1 foot of soil from either bank (total of four samples per transect). This sampling approach confirmed that floodplain soils closer to the creek are more likely to have higher concentrations of mirex. Separate from ROC's RI work, in August 1991, Ohio EPA collected samples from an area known as Colonial Villa (approximately RM 35.4) where there was a potential for exposure to nearby residents. Discrete samples were collected from 0-6 inch and 6-12 inch depths at each sample location. Results for these samples showed mirex concentrations ranging from non-detect to 6.65 mg/kg (the maximum value detected in floodplains), with mirex concentrations consistently decreasing with depth. In 1993, Phase II of the RI was conducted, which included "grid" sampling in three areas along the stream. These areas were selected due to the expectation that there was significant deposition in these areas based on 1990 sampling results. In 1995,

Phase III sampling was conducted to address areas where samples had not previously been collected. The results of floodplain soil sampling from the various investigations conducted between 1990 and 2005 are summarized on Figure 12. Each multi-colored bar represents the maximum, average, and minimum detection at each river mile sampled.

Additional floodplain soil sampling was conducted in September 2006. The agencies and ROC selected several floodplain soil locations where RI results showed elevated mirex concentrations or where significant potential for human exposure exists (e.g. public parks, dairy farms, and residential areas). A total of 10 primary floodplain locations were assessed using composite samples. The 2006 results generally confirm the floodplain soil sampling data collected during the RI (see Figure 13). The maximum value was about 3 mg/kg, found in a duplicate sample near Colonial Villa. Similar to sediment, the main areas of contaminated floodplain soil are in certain locations along the approximately 6 ½ mile reach from RM 31 to RM 37.6.

5.6.4 MFLBC Fish

Since 1987, ROC and/or Ohio EPA conducted several significant fish sampling events. The 1987 event included fillet and whole body data. Fillet mirex concentrations ranged from non-detect to 0.37 mg/kg with no detections of mirex downstream of RM 17.5. In 1990, as part of the RI, 27 whole-body fish and 26 fish fillet samples were collected from the MFLBC and other nearby surface water bodies. Mirex was detected in all MFLBC fillet samples with concentrations ranging from 0.0193 mg/kg to 1.82 mg/kg. In 1999, an additional 18 fish fillet samples were collected and analyzed by ROC. Although reported concentrations were lower than in previous events, the distribution of mirex appears to be similar. In addition, fillet testing performed by Ohio EPA in 1997-2001 confirms that mirex concentrations have remained relatively low downstream of RM 25.5. ROC and Ohio EPA jointly collected additional fish tissue samples in 2005 in preparation for the FS. Ohio EPA's mirex results show a range of concentrations from about 0.07 to 1.64 mg/kg and the maximum detection was found within approximately 1 river mile of the maximum detection from the 1990 investigation. Only one sample in 2005 exceeded mirex levels of 0.875 mg/kg, which is Ohio EPA's current threshold value for the 1 meal/month advisory (i.e. fish tissue concentrations below 0.875 mg/kg are safe to consume as frequently as 1 meal/week). However, several samples exceeded mirex levels of 0.2 mg/kg, which is Ohio EPA's current threshold value for unrestricted fish consumption.

The complete fish fillet data set (i.e. all years combined) is shown on Figure 14. This graph shows that only one fish fillet sample location (from 1990) had a mirex concentration above 0.8 mg/kg downstream of approximately RM 31.5. These results indicate that the area of highest fish tissue mirex concentrations generally coincides with the highest mirex concentrations in sediment. It is important to note that the values shown on Figure 14 represent only the maximum detection at each location. In the case of fish samples, multiple fish species were often collected at each sampling location and carp usually had the highest mirex concentrations. Mirex levels in the samples not shown were often considerably lower than the maximum value shown.

In addition to the fillet sample results described above, several investigations have included analyses of whole-body fish samples, which are relevant to ecological food chain exposure

pathways. The most significant whole-body fish data set is from 1990, when the majority of samples showed mirex concentrations of 1.0 mg/kg and less. The only three samples that exceeded 1.0 mg/kg were of common carp, including the maximum detection of 6.2 mg/kg. Other investigations in 1985, 1987, and 2001 show similar concentrations to those measured in 1990. Whole body samples collected in 2001 at and downstream of Lisbon Dam (RM 12.5) had concentrations of approximately 0.2 mg/kg and less.

The highest concentrations of mirex in fish are generally detected in the upstream segment of the creek where the sediment has higher mirex values. However, because fish are mobile and have different life cycles and behavior, fish with mirex are also detected in areas with relatively lower mirex in sediment. For example, one common carp fish tissue sample collected in 2005 from Egypt Swamp (an area of relatively lower mirex levels in sediment) had a mirex level of 790 ug/kg. However, based on the lengths of the three fish used for this sample, it is likely that these particular common carp were relatively mature in age because the lengths of these fish suggest that they were more than 5 years old. The mirex concentration in this particular common carp sample is therefore likely the result of long-term mirex accumulation in a relatively wide ranging species, and is not necessarily representative of typical mirex uptake into fish within this area of the creek.

5.6.5 MFLBC Surface Water

Seventeen samples of surface water were collected during the RI in the MFLBC. Mirex was not detected in any MFLBC surface water samples. In 2005, Ohio EPA requested that additional surface water samples be collected from the MFLBC for analysis with a detection limit not to exceed 0.001 ug/L. Ohio EPA personnel collected four surface water samples in October 2005 during a period of low flow in the stream. These samples were analyzed and were found to have no measurable mirex at the requested detection limit. In March 2006, Ohio EPA personnel collected four additional samples at the same locations, but this sampling event targeted high stream flow to assess whether resuspended sediments might cause detectable mirex levels during high energy storm events. Mirex was not detected in any of these surface water samples, confirming that mirex is not a COC in surface water of the MFLBC.

6.0 Current and Potential Future Land and Resource Uses

For purposes of the risk and ecological assessment for this Site, current and reasonably anticipated future land uses and current and potential beneficial surface water and/or resource uses were identified. Because OU 3 covers a large geographical area and there are potentially different exposure populations, the EA distinguishes between "on-facility" areas (the original Nease plant facility), adjacent "off-facility" areas (e.g., the former Crane-Deming property, residential property along State Route 14), and locations along MFLBC both up and downstream of Lisbon Dam (RM 12.5).

Current land use at the old facility of the Nease Chemical Site is industrial. The on-facility area is home to a decommissioned and largely demolished chemical manufacturing plant. Portions of

the Site are surrounded by security fencing that precludes casual access to these areas. The remaining areas can only be accessed from the active railroad line or the former Crane-Deming property. The railroad line and former Crane-Deming property act somewhat as a buffer for the unfenced areas of the plant (including Feeder Creek and soil areas west of the rail tracks). The only remaining building on the former Nease facility currently houses the groundwater treatment system used as part of the OU 1 interim remedial measures. There are very few workers on the facility, who conduct short daily visits to perform monitoring and maintenance, and they are appropriately trained in health and safety requirements. The off-facility area to the east-northeast along Allen Road is industrial and houses an industrial building (the former Crane-Deming building, now occupied by MAC Trailer).

ROC owns the property around Feeder Creek and its use is industrial. The properties bordering the MFLBC include residential, recreational, agricultural, and commercial/industrial uses. In the 6 ½ miles downstream of the Nease facility, land use is primarily agricultural. There are at least two dairy farms in this reach, as well as other farms where cattle are not currently kept. There are several residences in this reach, including a residential area called Colonial Villa at about RM 35.4 that houses 300 to 400 residents in a trailer park. Colonial Villa formerly had recreation facilities in the MFLBC floodplain, but removed the facilities due to concern with mirex.

Populations that were evaluated in the EA as having the potential for current exposure to the contaminants from OU 3 of the Site include: industrial workers; trespassers; off-facility residents (southeast of the Site); MFLBC recreational visitors; and MFLBC residents.

According to Ohio, the MFLBC is classified as Warmwater Habitat from the headwaters to the Lisbon Dam (RM 12.5) and Exceptional Warmwater Habitat from RM 12.5 to the mouth. All waters of the MFLBC are designated for agricultural, industrial, and direct contact uses, but not for drinking. The Beaver Creek watershed use classifications can be found at Ohio EPA's website at: http://www.epa.state.oh.us/dsw/rules/01-15.pdf. Portions of the MFLBC below the Lisbon Dam (RM 12.5) and Little Beaver Creek are designated by the State of Ohio and/or the Federal government as wild or scenic rivers.

A detailed description of habitat and wildlife along the MFLBC is provided in the RI and EA reports. Oak-hickory represents the dominant forest of Columbiana and Mahoning Counties. A number of wetland and riparian habitat types are found in association with the MFLBC. A variety of birds, mammals, reptiles and amphibians, and aquatic organisms make their home in or around the MFLBC. Table 1 lists the plant and animal species found in the MFLBC corridor identified by ODNR as threatened, endangered or rare. More detail on MFLBC flora and fauna can be found in the RI and EA reports.

Based on current zoning and development patterns in the area, future land and resources uses are expected to remain generally the same. However, water and waterfront areas are generally becoming more valuable for certain land uses and as resources.

7.0 Summary of Operable Unit Risks

ROC, with oversight by U.S. EPA and Ohio EPA, prepared a baseline human health risk assessment and an ecological risk assessment for the Nease Site to evaluate potential risks to human health and the environment if no action was taken. This process characterizes current and future threats or risks to human health and the environment posed by contaminants at the Site. The risk assessment provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline human health risk assessment and the ecological risk assessment relevant to OU 3.

In accordance with U.S. EPA guidance on preparing RODs, the information presented here focuses on the information that is driving the need for the response action, and does not necessarily summarize the entire baseline human health or ecological risk assessment. The information in this ROD focuses on OU 3, although the assessment was conducted for the entire Site. Further information is contained in the 2004 EA.

7.1 Summary of Human Health Risk Assessment

The human health risk assessment evaluated the potential risks that could result to people from exposure to the contaminants at the Site. The human health risk assessment conducted at this Site used Risk Assessment Guidance for Superfund and other supplemental guidance to evaluate human health risks. The risk assessment evaluated the risks associated with both reasonable maximum exposure (RME) and central tendency exposure scenarios. Based on the current and anticipated future land use at the site, the EA considered the risks associated with several land use scenarios and receptors. Figure 5 shows the CSM used in the human health risk assessment.

Because OU 3 covers a large geographical area and there are potentially different exposure populations, the EA distinguishes between "on-facility" areas (the original Nease plant facility), adjacent "off-facility" areas (e.g., the former Crane-Deming property, residential property along State Route 14), and locations along MFLBC both up and downstream of Lisbon Dam (RM 12.5). Although the EA considers the entire Site, for purposes of selecting the remedy for OU 3, the FS and this ROD for OU 3 consider only the OU 3 media, which include the on-facility and off-facility Feeder Creek and MFLBC media (surface water, sediments, floodplain soil, fish, game, beef, milk, and vegetables). Other media (groundwater, facility soil, source areas) were addressed in the ROD for OU 2.

7.1.1 Identification of Contaminants of Concern

A variety of contaminants including pesticides, inorganics, VOCs and semi-volatile organic compounds, media (soil, sediment, surface water, groundwater, and air), and biota (fish, game, cattle products) were sampled at the Site. As part of the human health risk assessment, the EA identified a number of chemical contaminants that were carried through the risk assessment evaluation.

Contaminants of concern (COCs) are compounds that are present at the site in sufficient quantities to present an unacceptable risk to human health or the environment. COCs for the entire Site were identified by the following screening process:

- Samples from the various media present – including surface water, sediment, floodplain soil, and fish were analyzed for a variety of contaminants.

- Based on available data, 155 chemicals detected at least once in the on-facility or off-facility samples were retained for further evaluation.

- The 155 chemicals were evaluated for selection as chemicals of potential concern (COPCs) based on the following criteria: (1) the frequency of detection; (2) whether the chemical is facility-related; (3) availability of toxicity data; and (4) a concentration-toxicity screen.

- A total of 49 chemicals were retained for consideration in the quantitative risk assessment in at least one environmental medium.

The results of the EA indicated that mirex is the only COPC in the MFLBC that is related to the Nease site and which caused estimates of potential risk above U.S. EPA's acceptable risk levels for human and/or ecological receptors. While risk estimates from exposure to photomirex did not exceed acceptable risk levels, photomirex and mirex toxicity may be additive, and so the risk estimates presented herein are summations of risks due to both mirex and photomirex. Data quality and usability was addressed in the EA, and all data used in the risk assessment were found suitable for use.

Table 2 summarizes the primary risk-driving contaminants in OU 3, as well as the range of detected concentrations, the frequency of detection and the exposure point concentration. Note that other contaminants were detected in media within OU 3 and were retained in the risk assessment, but did not present unacceptable risks in those media. As a result, information on those other contaminants is not included in Table 2, but can be found in the EA.

7.1.2 Exposure Assessment

The EA evaluates potential exposures using parameters for both adult and child populations in evaluating residential (on-facility, off-facility, MFLBC) and recreational visitor populations for the following four pathways: ingestion of soil; sediment; milk; and fish. Adult and child receptors were considered through the calculation of age-adjusted intake rates, which combine the exposure for a 1- to 6- year-old with that of an adult, to provide lifetime exposures for assessment of cancer risks. Noncancer risks were assessed based only on child parameters to ensure risks were not underestimated.

The risk assessment evaluated several exposure pathways for on-facility, off-facility, and MFLBC exposures in both current and reasonably anticipated future use scenarios. An exposure

pathway is a means by which a person may come in contact with Site contaminants. Section V of the EA contains the exposure assessment for the site. The exposure assessment estimates the magnitude, frequency, duration, and routes of exposure to the COPCs at the site, and describes all assumptions, data and methods used to evaluate the potential for human exposure to the site contaminants. The exposure pathways evaluated are described as follows.

Current Use Scenario - On-Facility Locations

- Current on-facility trespasser exposures to COPCs in Feeder Creek surface water and sediments were evaluated for several pathways. These included incidental ingestion of surface water, dermal contact with surface water, incidental ingestion of sediments, and dermal contact with sediments.

Current Use Scenario - Off-Facility Locations

- Current off-facility industrial worker exposures to COPCs in surface water and sediments were evaluated for several pathways. These included incidental ingestion of surface water, dermal contact with surface water, inhalation of air above surface water, incidental ingestion of sediments, and dermal contact with sediments.

- Current off-facility resident exposures to COPCs in game were evaluated for the ingestion pathway.

Current Use Scenario –MFLBC Locations

- Current MFLBC recreational visitor exposures to COPCs in floodplain soil, sediments, surface water, fish, and game were evaluated for several pathways upstream and downstream of Lisbon dam. These included incidental ingestion of soils, dermal contact with soil, inhalation of wind-blown soil dust, incidental ingestion of surface water, dermal contact with surface water, incidental ingestion of sediments, dermal contact with sediments, ingestion of fish, and ingestion of game.

- Current MFLBC residential exposures to COPCs in floodplain soil, sediments, surface water, fish, game, and vegetables were evaluated for several pathways upstream and downstream of Lisbon dam. These included incidental ingestion of soils, dermal contact with soil, inhalation of wind-blown soil dust, incidental ingestion of surface water, dermal contact with surface water, incidental ingestion of sediments, dermal contact with sediments, ingestion of fish, ingestion of game, and ingestion of home-grown vegetables.

Future Use Scenario – On-Facility Locations

- Future on-facility industrial worker exposures to COPCs in Feeder Creek surface water and sediments were evaluated for several pathways. These included incidental ingestion of

surface water, dermal contact with surface water, inhalation of air above surface water, incidental ingestion of sediments, and dermal contact with sediments.

- Future on-facility resident exposures to COPCs in Feeder Creek surface water and sediments were evaluated for several pathways. These included incidental ingestion of surface water, dermal contact with surface water, incidental ingestion of sediments, and dermal contact with sediments.

Future Use Scenario – Off-Facility Locations

- Future off-facility industrial worker exposures to COPCs in Feeder Creek surface water and sediments were evaluated for several pathways. These included incidental ingestion of surface water, dermal contact with surface water, inhalation of air above surface water, incidental ingestion of sediments, and dermal contact with sediments.

- Future off-facility residential exposures to COPCs in game, beef, milk, and fish were evaluated for the ingestion pathway.

Future Use Scenario – MFLBC Locations

- Future MFLBC recreational visitor exposures to COPCs in soil, surface water, sediments, fish, game, beef, and milk were evaluated for several pathways upstream and downstream of Lisbon dam. These included incidental ingestion of soil, dermal contact with soil, inhalation of wind-blown soil dust, incidental ingestion of surface water, dermal contact with surface water, incidental ingestion of sediments, dermal contact with sediments, ingestion of fish, ingestion of game, ingestion of beef, and ingestion of milk.

- Future MFLBC residential exposures to COPCs in soil, surface water, sediments, fish, game, vegetables, beef, and milk were evaluated for several pathways upstream and downstream of Lisbon dam. These included incidental ingestion of soil, dermal contact with soil, incidental ingestion of surface water, dermal contact with surface water, incidental ingestion of sediments, dermal contact with sediments, ingestion of fish, ingestion of game, ingestion of home-grown vegetables, ingestion of beef, and ingestion of milk.

7.1.3 Toxicity Assessment

U.S. EPA has conducted toxicological assessments on many frequently occurring environmental chemicals and has developed standardized toxicity values for use in the risk assessment. In general, U.S. EPA derived toxicity values were used in the EA. These toxicity values - reference doses (RfDs) and reference concentrations for noncarcinogenic effects, and cancer slope factors (CSFs) and unit risks for known, suspected, or possible carcinogens are published by U.S. EPA in Health Effects Assessment Summary Tables and the on-line Integrated Risk Information System.

However, in-depth evaluations were conducted by ROC for mirex, photomirex and kepone (related chlorinated pesticides or the breakdown chemicals) because of the significance of these chemicals at the Site and the toxicological data bases that exist for these chemicals. Based on a toxicological literature review, ROC requested a revision to the mirex RfD that was in use in 1992. Subsequently, U.S. EPA has developed a verified RfD for mirex (based on a study of chronic liver and thyroid effects in rats), which was used in the EA. In 1987, U.S. EPA had classified mirex as in Group B2, probable human carcinogen and reported a CSF. In 1992, ROC submitted information relevant to the carcinogenic classification and CSF for mirex. Based on ROC's requested toxicity reassessment, U.S. EPA prepared issue papers and provisional revisions of the mirex CSF. The EA, particularly Appendix D, contains abundant information related to the reassessment of mirex toxicity. Based on the extensive review, U.S. EPA determined a CSF for mirex for use in the human health risk assessment.

Additionally, U.S. EPA has not developed toxicity criteria (Agency verified RfD or CSF values) for photomirex or kepone. Based on ROC's review of the toxicological data for photomirex (a breakdown product of mirex), U.S. EPA believes that photomirex is more toxic than mirex (based on a reproductive toxicity study in the rat). A derived RfD for photomirex was used for the EA. Based on the literature review, photomirex may qualify as Group D carcinogen, not classifiable as to human carcinogenicity. Based on ROC's review of the toxicological data for kepone (a related pesticide), a chronic oral RfD was derived (based on a mouse study). After evaluation of the literature review, and consultation with other scientists, U.S. EPA Region 5 determined that the available data were inadequate to allow evaluation of the carcinogenic potential of kepone at this time. The toxicity information of the other chemicals found at the Site can be found in Appendix A of the EA.

7.1.4 Risk Characterization

U.S. EPA's risk guidance identifies a target cancer risk range of 10^{-4} to 10^{-6} (1 in 10,000 to 1 in a million) excess cancer risk for Superfund sites. If site contamination poses a risk of less than 10^{-6}, there is generally no need for action. Cancer risks greater than 10^{-4} generally require action to reduce and/or abate the risk, and cancer risks between 10^{-4} and 10^{-6} present a potential cause for remedial action. U.S. EPA's guidance also indicates that a non-cancer hazard index exceeding 1.0 generally is a cause for action to reduce and/or abate the potential non-cancer risks associated with site contamination, while a hazard index less than 1.0 generally does not require action. Table 3 shows all exposure pathways and calculated risks from mirex and photomirex for the future RME and central tendency exposure scenarios that were evaluated in the risk assessment relevant to OU 3 (current scenarios and other COPCs are not show in Table 3 because they do not exceed acceptable risk criteria). The primary risks from mirex (the primary COC) in OU 3 media are summarized in Table 4[6] and discussed below.

6 The "total" risk numbers shown in Tables 3 and 4 are not identical because Table 4 is intended only to summarize the major exposure media and scenarios that are the primary risk drivers for OU 3, while Table 3 includes all exposure media and scenarios for mirex (plus photomirex). For the MFLBC resident upstream of Lisbon Dam (future use scenario), 41 to 42% of the total risk is associated with ingestion of fish containing mirex and 14 to 24 % is associated with ingestion of beef with mirex.

Location	Scenario	Exposure Pathway	RME Risks	
			Cancer	Hazard Index
MFLBC Upstream	Resident (future)	Fish ingestion	1.32E-04	5.44E+00
		Beef ingestion	7.25E-05	1.61E+00
		Milk ingestion	3.11E-05	9.44E-01
		TOTAL	2.36E-04	7.99E+00
	Recreational visitor (future)	Fish ingestion	1.32E-04	5.44E+00
		Beef ingestion	1.45E-05	3.20E-01
		Milk ingestion	6.23E-06	1.89E-01
		TOTAL	1.53E-04	5.95E+00
MFLBC Downstream	Resident (future)	Fish ingestion	4.63E-06	1.93E-01
		Beef ingestion	7.25E-05	1.61E+00
		Milk ingestion	3.11E-05	9.44E-01
		TOTAL	1.08E-04	2.75E+00
Off-Facility	Resident (future)	Fish ingestion	4.93E-05	2.04E+00
		Beef ingestion	7.25E-05	1.61E+00
		Milk ingestion	3.11E-05	9.44E-01
		TOTAL	1.53E-04	4.59E+00

Table 4: Summary of Potential Human Health Risks from Primary OU 3 Exposure Media

In summary, the EA contains the following findings regarding potential human health risks:

- None of the current use scenario exposure pathways resulted in potential risks exceeding U.S. EPA's acceptable risk range.

- None of the calculated potential risks for the future trespasser, future on-facility or off-facility industrial worker, future on-facility resident, or the future MFLBC recreational visitor downstream exceed U.S. EPA's acceptable risk range.

- Exposure to mirex in fish by ingestion is responsible for a large proportion of the unacceptable potential risk calculated for the future MFLBC upstream resident and future MFLBC upstream recreational visitor.

- Exposure to mirex in beef and/or milk by ingestion, when combined with ingestion of fish is also responsible for unacceptable potential risk calculated for the future MFLBC upstream resident, future MFLBC downstream resident, future MFLBC upstream recreational visitor, and future off-facility resident scenarios.

Risk assessment provides a systematic means for organizing, analyzing, and presenting information on the nature and magnitude of risks posed by chemical exposures. Nevertheless, uncertainties and limitations are present in all risk assessments because of the quality of available data and the need to make assumptions and develop inferences based on incomplete information

about existing conditions and future circumstances. In general, the uncertainties and limitations in the risk assessment may be associated with measurement uncertainty, model uncertainty, and data gaps, and generally fall into the following categories: environmental sampling and laboratory measurement; mathematical fate and transport modeling; receptor exposure assessment; and toxicological assessment. These uncertainties are discussed in detail in the EA.

7.2 Summary of Ecological Risk Assessment

ROC conducted an ecological risk assessment for OU 3 of the Nease Site to help understand the actual or potential risks to the environment posed by the contaminants at the OU. The assessment for the MFLBC can be found in Chapter IX of the EA. The ecological risk assessment considers those chemicals that were detected in surface water, sediment, fish, and/ floodplain surface soils. The assessment incorporates both measured and modeled estimates of exposure, the available guidance and published information on the environmental fate and toxicities of the chemicals evaluated, and the expected/known habitats and likely species in the area. More detailed information can be found in Chapter IX of the EA.

7.2.1 Site Characterization

OU 3 of the Nease Site is described in Section 5.2. For purposes of the ecological risk assessment, the MFLBC was split into three reaches for assessment of floodplain soil risks and 15 reaches for assessment of sediment risks. The reach designations can be found on Figures IX-1A and IX-6 of the EA.

7.2.2 Selection of Chemicals for Evaluation

A total of 82 chemicals were detected in one or more media of concern (surface water, whole body fish, sediment, floodplain soil). For each medium, the chemicals were screened to identify which might potentially contribute to ecological risk. Selection criteria included background concentrations, toxicological screening benchmarks, site-relatedness, spatial distribution, frequency of occurrence, and the potential for bioaccumulation.

After the screening process, the following were retained for further evaluation in the ecological risk assessment: 1 of 3 chemicals detected in surface waters; 8 of 34 chemicals detected in fish; 20 of 51 chemicals detected in sediment; and 21 of 60 chemicals detected in floodplain soil. Table 5 shows the retained chemicals for each media. Mirex and its degradation product, photomirex are the principal ecological COCs.

7.2.3 Characterization of Exposure

U.S. EPA defines characterization of exposure as an evaluation of the interaction of stressors with one or more ecological components. Potential ecological exposure pathways and receptors are shown on Figure 15, the CSM for the ecological risk assessment. Exposure routes include incidental ingestion, contact, root absorption, and consumption of contaminants in the food chain. Six primary assessment endpoints were considered:

- Maintenance of viable populations and communities of herbivorous vertebrates in the MFLBC and/or adjacent floodplains.

- Maintenance of viable populations and communities of insectivorous vertebrates in the MFLBC and/or adjacent floodplains.

- Maintenance of viable populations and communities of carnivorous vertebrates in the MFLBC and/or adjacent floodplains.

- Maintenance of viable populations and communities of piscivorous vertebrates in the MFLBC and/or adjacent floodplains.

- Maintenance of a viable fish community in the MFLBC.

- Maintenance of a viable benthic macroinvertebrate community in the MFLBC.

Because of the complexity of ecosystems, receptor species were chosen to represent the larger biological community for the Nease Site ecological risk assessment. The following species were chosen for exposure modeling and risk characterization in the MFLBC assessment: American woodcock; belted kingfisher; mallard; red-tailed hawk; spotted sandpiper; meadow vole; mink; northern short-tailed shrew; and red fox. Also, aquatic and semiaquatic biota, terrestrial invertebrates, and plants were considered in the EA.

7.2.4 Characterization of Ecological Effects

U.S. EPA defines the characterization of ecological effects as the portion of an ecological risk assessment that evaluates the ability of a stressor to cause adverse effects under a particular set of circumstances. The ecological risk assessment for the Nease Site uses measurement endpoints to characterize potential effects for potential receptors. The measurement endpoints include screening level toxicological benchmarks for lower trophic level biota in surface water, sediment, and soils, as well as toxicological benchmarks for dietary ingestion.

Potential risks to lower trophic level biota were assessed by comparing concentrations at individual sample locations against toxicological benchmarks for that media. Risks to the upper trophic level species (chosen to be representative) were calculated based on an area-wide assessment using mean chemical concentrations in the various media. Hazard quotients (HQs) were calculated by comparing the estimated exposure point concentration in the media against the corresponding toxicological benchmarks for that media. In assessing the characterization results, if the value of the HQ is less than or equal to one, it is believed that no unacceptable impacts will occur in the exposed population of receptors. If the value of the HQ exceeds one, then an unacceptable impact may occur, with the predicted likelihood and/or severity of the impacts increasing as the value of the HQ increases.

7.2.5 Risk Conclusions

The ecological risk assessment is a comprehensive and conservative baseline assessment intended to characterize the potential risks to ecological receptors based on the available ecological, exposure and toxicological information. A general summary of the risk characterization indicates:

- There are no significant risks predicted in floodplain Reach 3 (downstream of Lisbon Dam at RM 12.5) for any receptors.

- There are no significant risks predicted for herbivorous, carnivorous or piscivorous birds, or for herbivorous mammals that would be exposed via food chain pathways.

- There are predicted exceedances of dietary NOAELs[7] for the insectivorous short-tailed shrew for mirex plus photomirex. The predicted exceedances are relatively low (HQ values of about 2.11 in floodplain reach 1, and 3.46 for all MFLBC reaches combined) based on the 1990 survey data. These HQ values are less than 1 when based on dietary LOAELs.[8]

- There are predicted exceedances of dietary NOAELs for the carnivorous red fox for mirex plus photomirex in floodplain reaches 1 and 2. HQ values of 5.85 and 2.5 were estimated for mirex plus photomirex for reaches 1 and 2, respectively, and 9.59 for all MFLBC reaches combined, based on the 1990 survey data. The HQ values for mirex plus photomirex are about 1.8 and 0.78 in Reaches 1 and 2 based on dietary LOAELs.

- There are predicted exceedances of dietary NOAELs for the piscivorous mink for mirex plus photomirex in 9 of the 15 sediment reaches. HQ values range from about 1.1 to 4.5 based on 1990 survey data. The HQ values are all less than 1 when based on dietary LOAELs.

- In Feeder Creek mirex (including photomirex) concentrations exceeded benchmark levels for surface water and sediment, although surface water detections of mirex were considered likely due to the presence of suspended particulates, rather than dissolved mirex. These exceedances of benchmark values indicate that there is a potential for adverse ecological effects on lower trophic level biota.

There are uncertainties associated with the ecological risk assessment that may over or under estimate risks. The actual ecological risk associated with exceeding, for example, a calculated toxicological benchmark for ingestion is contingent on all of the assumptions that are used in an extrapolation from available literature data to the site-specific situation under assessment. The

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7 No observed adverse effects level - The highest tested dose of a substance that has been reported to have no adverse health effects on the target organism.

8 Lowest observed adverse effects level - The lowest tested dose of a substance that has been reported to cause adverse health effects on the target organism.

chemical selection process relied primarily on a comparison of maximum observed media concentrations with conservative, medium-specific screening benchmarks. A number of chemicals lacked screening benchmarks for one or more media or did not meet the screening criteria. These chemicals are evaluated by media based on their facility-relatedness, frequency of occurrence, and potential contribution to overall risk.

7.3 Basis for Action

A response action at OU 3 of the Nease Chemical Site is warranted because, using RME assumptions, the cumulative excess lifetime carcinogenic risk to human health exceeds 10^{-4} for the future residential and future recreational use scenarios along the MFLBC and for the future residential scenario at the off-facility portion of the Site (property adjacent to the Nease plant). In addition, a HQ of one is exceeded for the same use scenarios, indicating the potential for non-carcinogenic risk. Additionally, there are potential ecological risks to biota within OU 3 that may be exposed to mirex in sediment and associated uptake into fish, or the floodplain soil. The response action selected in this ROD is necessary to protect the public health or welfare or the environment from the actual or threatened releases of hazardous substances into the environment.

8.0 Remedial Action Objectives and ARARs

8.1 Remedial Action Objectives

Remedial Action Objectives (RAOs) provide a general description of what the remedial alternatives will accomplish. For OU 3 of the Nease Site, RAOs were developed through a consensus-based process between U.S. EPA, Ohio EPA and ROC. The FS contains more detail on each RAO, including the site-specific goals developed to address potential risks to human health and the environment. It is important to note that term "mitigate" refers to site-specific targets to achieve acceptable risk goals.

The following RAOs apply to OU 3 of the Nease Chemical Site:

- RAO 1 – Mitigate mirex uptake in fish from exposure to MFLBC sediment.
- RAO 2 – Mitigate additional mirex contamination of the floodplain from MFLBC sediment.
- RAO 3 – Mitigate ecological exposures to unacceptable levels of mirex in floodplain soil.
- RAO 4 – Protect cattle from unacceptable mirex uptake from floodplain soil.
- RAO 5 – Mitigate additional mirex contamination of MFLBC from Feeder Creek.

The preliminary remediation goals (PRGs) to achieve the RAOs for this Site were generated consistent with the NCP and U.S. EPA's RI/FS guidance. PRGs finalized within this ROD are then known as remediation goals. The following remediation goals, selected through a weight-

of-evidence approach in accordance with U.S. EPA guidance, are established for OU 3 of the Nease Site:

8.1.1 MFLBC Floodplain Soil

Since there are no promulgated soil standards for mirex, the remediation goal for OU 3 floodplain soils has been developed based on the EA. PRG ranges for mirex in floodplain soil have been estimated based on two potential exposures/receptors of concern:

- Ecological risks associated with direct and food-chain exposure to floodplain soils; and,
- Human health risks associated with consumption of beef and dairy products produced from cattle grazing within the contaminated floodplain.

The approaches used to develop a range of PRGs for mirex in surface soil are presented in more detail in the FS.

Ecological Exposures

A range of ecological PRGs for mirex in floodplain soil was determined by using a food chain model to back calculate a soil concentration that would result in a HQ of one for the receptors of concern. Food chain modeling methods are described in detail in Chapter IX of the EA. The two most sensitive terrestrial ecological receptors are the short-tailed shrew and the red fox. For the red fox, the home range plays an important role in the calculation of PRGs. For OU 3, the PRG calculations incorporate the home range of the fox by including the percentage of the range that is comprised of floodplain soil potentially containing mirex. No adjustments to the home range were made for the less wide-ranging short-tailed shrew.

To account for possible variations along the MFLBC, the floodplain area potentially within the home range of the red fox was determined in two separate areas of the creek, one where the floodplain is narrow, and another where the floodplain is very wide. The floodplain accounts for 5% to 24% of the home range of the red fox in these two areas. Using the exposure point concentration and estimated LOAEL- and NOAEL-based HQs from the EA, a back calculation was performed to determine the floodplain soil concentration that would result in a HQ of one. More detail on this assessment can be found in Appendix I of the FS. Table 6 shows the calculated mirex soil concentrations resulting in a HQ of one for each receptor, including consideration of home range for the red fox.

Receptor	NOAEL -Based PRG (mg/kg)	LOAEL -Based PRG (mg/kg)
Short-tailed Shrew	0.186	0.930
Red Fox	0.267 to 1.281	0.862 to 4.14

Table 6: Soil Mirex Concentration Resulting in a Hazard Quotient of One

Human Exposures – Beef and Milk Ingestion

As described in the EA and Section 2.2.2 of this ROD, mirex was detected in milk and beef samples collected from three farms along the MFLBC. Fences were constructed on those farms to exclude cattle from the MFLBC and contaminated portions of the floodplain. In the years since the fences were installed, mirex has not been detected in milk or beef.

The uptake of mirex into cattle is a complicated process where both uptake from soil to feed plants, as well as biotransfer from feeding (including incidental soil ingestion) into beef and milk fat need to be considered. Since it is not possible to determine exactly which floodplain soil concentrations produced corresponding levels of mirex in cattle, a number of assumptions were made about the uptake of mirex into cattle. U.S. EPA used a methodology based on the existing literature related to uptake of mirex into beef and milk fat to calculate PRG ranges based on a range of potential plant uptake of mirex, a range of incidental soil ingestion rates, and a range of supplemental (uncontaminated) feed ingestion rates.[9]

The PRG ranges shown in Table 7 have been calculated based on a 10^{-5} cancer risk level and a hazard index of 1. Although U.S. EPA's approach uses the best available published literature, there are several uncertainties in the calculations, including: the amount of forage available from the contaminated floodplain to grazing cows; amount of time that cows are kept indoors during the cold winter months and the source of feed at that time; the pharmacokinetics of mirex distribution and elimination in cows; and soil ingestion rates. In the absence of more specific information, conservative assumptions have been made for each parameter. The use of multiple conservative assumptions suggests that the lower end of the PRG range represents an overestimation of potential risks. Additionally, comparison of the calculated modeled values with actual beef and milk levels from the late 1980s indicates that the lower end of the PRG range is not consistent with actual observed values.

Cattle Food Source	**Product**	**Soil Mirex PRG Range (mg/kg)**	
		Cancer = 10^{-5}	**Hazard Index = 1**
Graze in and/or provided forage from contaminated floodplains (100 % of total)	Beef	0.6 to 2.8	2.7 to 13
	Milk	0.3 to 1.4	1.0 to 4.5
Graze in or provided forage from contaminated floodplains (26 %) with supplementary clean feed (74 % of total)	Milk	0.5 to 1.6	1.6 to 5.4

Table 7: Soil Mirex PRGs for Cattle and Dairy Pasture

Floodplain Soil Remediation Goal

Based on the desired risk reduction endpoints, using multiple lines of evidence, and considering the uncertainties associated with the assessments, U.S. EPA is selecting 1.0 mg/kg of mirex as the floodplain soil remediation goal. This level will assure no material adverse ecological effect on the identified receptor populations and will ensure that cattle exposed to floodplain soil will

9 For more information on this determination, see U.S. EPA memorandum, "Preliminary Remedial Goals for Soil Mirex Based on Beef and Milk from Cows in Floodplain Areas Downstream of the Nease Chemical Site," May 1, 2008 (SDMS ID: 299751) in the Administrative Record Record and included as Appendix J of the OU 3 FS Report.

not accumulate mirex at unacceptable levels. This level is also consistent with the remediation goal for soil in OU 2, which was selected to be protective of ecological receptors and potential human exposures.

Floodplain soils exceeding the remediation goal of 1.0 mg/kg of mirex will be included in response actions established to meet RAOs 3 and 4. It is anticipated that attainment of this goal will be measured based on the average mirex concentration within surface soil (0 to 6 inches) within an exposure area of about one acre. However, PDI information will be used to determine exactly how attainment of the remediation goal will be measured and will consider valuable habitat and resources within the floodplain. Additionally, it is anticipated that PDI information may be used to define a mirex level in floodplain soil that cannot be exceeded within the remediation area.

8.1.2 MFLBC Sediment

Since there are no promulgated sediment standards for mirex, the remediation goal for OU 3 MFLBC sediments has been developed based on the EA. PRG ranges for mirex in MFLBC sediment have been estimated based on two potential exposures/receptors of concern:

- Ecological risks to wildlife associated with consumption of contaminated fish; and
- Human health risks associated with consumption of contaminated fish.

Ecological Exposures

The EA identified the mink as the most sensitive ecological receptor that potentially consumes fish from the MFLBC. In the EA, potential risks for the mink were calculated directly using measured fish concentrations and assessed against NOAEL and LOAEL based HQs of one. U.S. EPA used a methodology for calculating a sediment-biota accumulation factor (BAF) for mirex in the MFLBC based on correlations between measured sediment and fish concentrations. U.S. EPA then used the BAF to calculate sediment concentrations that would result in levels of mirex in whole fish that would be protective of mink.[10] U.S. EPA considered a number of uncertainties including: limited co-located fish and sediment data; limited whole fish samples; limited species with sufficient data; home range of the fish species; biased approach to sediment sampling in the RI; lack of organic carbon data; variation in lipid and analytical results between Ohio EPA and ROC samples; and others. U.S. EPA calculated a sediment PRG range of 0.339 to 0.753 mg/kg of mirex for the LOAEL criterion using the 1990 whole fish data.[11] Noting the uncertainty in these calculations, U.S. EPA recommended the upper third of this PRG range as the most appropriate (0.477 to 0.753 mg/kg of mirex).

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10 For more information on this determination, see U.S. EPA memorandum "Bioaccumulation of Mirex in Fish, Preliminary Remedial Goals for Sediment, and the Horizontal Pattern of Sediment Mirex in the Middle Fork of Little Beaver Creek," March 26, 2007 (SDMS ID: 299745) in the Administrative Record and included as Appendix H of the OU 3 FS Report.

11 The PRG range calculated based on the corrected 2005 data is 0.372 to 1.123 mg/kg of mirex, but these calculations are considered less reliable. Among other uncertainties, only fillet data was available in 2005.

Human Exposures – Fish Ingestion

The estimated carcinogenic and non-carcinogenic risks to residents and recreational visitors consuming fish from the upstream portions of MFLBC exceeded U.S. EPA's acceptable criteria as shown in Table 4 and discussed in Section 7 of this ROD. The RME exposure point concentrations calculated for the EA assumed that all fish consumed from the MFLBC would contain mirex at a concentration of 1.27 mg/kg. However, as shown on Figure 14, more recent sampling indicates that fish tissue levels are improving and that in 2005 only one sample of carp at a single location (RM 33.3) had fish with mirex concentrations above this value. Based on the results of the human health risk assessment, and extrapolations using the EA calculations and U.S. EPA's approach to calculating BAFs (but applied to fillet data), reducing sediment concentrations to below the ecological PRG is expected to bring the human health risks from fish consumption to within U.S. EPA's acceptable risk range.

MFLBC Sediment Remediation Goal

Based on the desired risk reduction endpoints, using multiple lines of evidence, and considering the uncertainties associated with the assessments, U.S. EPA is selecting 0.5 mg/kg of mirex as the sediment remediation goal. However, because portions of the MFLBC are high quality habitat, in certain cases, based on the PDI data and existing habitat quality, the remediation goal may be modified in remedial design to be as high as 0.75 mg/kg for those stretches. Over time, the remediation goal will assure no material adverse effects from fish consumption due to mirex uptake and will prevent additional mirex contamination of the floodplain from MFLBC sediment.

Sediments exceeding the remediation goal of 0.5 mg/kg of mirex (or as modified to protect habitat) will be included in response actions established to meet RAOs 1 and 2. Attainment of the remediation goal will be measured based on the surface weighted average concentration (SWAC) of mirex within surface sediment (expected to be 0 to 6 inches), since bioavailable surface contamination over an exposure area is the driver of mirex levels in fish. The SWAC approach will be used to measure post-remediation attainment of the mirex goal in MFLBC sediments. It is anticipated that the SWAC goal will be calculated over each one mile reach within the remediation area. However, since soft sediment does not cover the entire creek bottom and since previous sampling may have been biased to mostly soft sediment areas, the SWAC approach may need to be modified to focus on the depositional areas. PDI information will be used to determine exactly how attainment of the SWAC-based remediation goal will be measured. Additionally, it is anticipated that PDI information may be used to define a mirex level in sediment that cannot be exceeded within the remediation area.

8.2 Applicable or Relevant and Appropriate Requirements (ARARs)

Section 121(d) of CERCLA requires that Superfund remedial actions at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as ARARs, unless such ARARs are waived under CERCLA Section 121(d)(4). Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous

substance, pollutant, contaminant, remedial action, location, or other circumstance found at a Superfund site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not applicable, address problems or situations sufficiently similar to those encountered at the Superfund site that their use is well-suited to the particular site.

In addition to ARARs, guidance materials that have not been promulgated or regulatory standards that are not applicable or relevant and appropriate may be considered (including local/county requirements); these are referred to as items "to be considered" (TBC). While TBCs may be considered along with ARARs, they do not have the status of ARARs.

The ARARs and TBCs identified for the Site are categorized into three types: chemical-specific, action-specific and location-specific. Chemical-specific ARARs establish the acceptable amounts or concentrations of a chemical that may be found in, or discharged to the ambient environment. Action-specific ARARs are technology- or activity-based performance or design requirements associated with the potential remedial activities being considered. Location-specific ARARs establish requirements that protect environmentally-sensitive areas and other areas of special interest.

A list of the potential ARARs and TBCs identified for remedial actions for OU 3 of the Nease Site is presented in Table 8.

8.2.1 Identification of Federal ARARs

This section presents a summary of those federal regulations that may be found to be applicable or relevant and appropriate to OU 3 of the Nease Chemical, specifically:

<u>The Comprehensive Environmental Response, Compensation and Liability Act</u>
CERCLA, last amended in January 2002, provides the U.S. EPA Administrator the authority to respond to any past disposal of hazardous substances and any new uncontrolled releases of hazardous substances. Within CERCLA, a trust fund has been established for cleanup of abandoned past disposal sites and leaking underground storage facilities, as well as the authority to bring civil actions against violators of this act. The National Contingency Plan (NCP), which guides removal and remedial actions at Superfund sites, was developed subject to this act.

The Superfund Amendments and Reauthorization Act (SARA) of 1986 extensively amended CERCLA. The major goals of SARA were to include more public participation, and to establish more consideration of State clean-up standards, with an emphasis on achieving remedies that permanently and significantly reduce the mobility, toxicity, or volume of wastes.

<u>The Clean Water Act</u>
The Federal Water Pollution Control Act, amended by the Clean Water Act of 1977, was last amended October 1992, and is commonly referred to as the Clean Water Act (CWA). Federal Ambient Water Quality Criteria documents have been published for 65 priority pollutants listed

as toxic under the CWA. These criteria are guidelines that may be used by states to set surface water quality standards. Although these criteria were intended to represent a reasonable estimate of pollutant concentrations consistent with the maintenance of designated water uses, states may appropriately modify these values to reflect local conditions. Under SARA, however, remedial actions must attain a level or standard of control that will result in surface water conditions equivalent to these criteria, unless a waiver has been granted.

The water quality criteria are generally represented in categories that are aligned with different surface water-use designations. These criteria represent concentrations that, if not exceeded in surface water, should protect most aquatic life against acute or chronic toxicity. For many chemical compounds, specific criteria have not been established because of insufficient data. The criteria are used to calculate appropriate limitations for discharges to surface water. These limitations are incorporated in the National Pollutant Discharge Elimination System (NPDES) permits.

The provisions of the CWA are potentially applicable to remedial actions that include a discharge of treated water to surface water.

The Clean Air Act

The Clean Air Act (CAA), with amendments through December 1991, was enacted to protect and enhance the quality of air resources to protect public health and welfare. The CAA is intended to initiate and accelerate national research and development programs to achieve the prevention and control of air pollution. Under the CAA, the Federal Agencies are to provide technical and financial assistance to state and local governments for the development and execution of their air pollution programs. The U.S. EPA is the administrator of the CAA and is given the responsibility to meet the objectives of the CAA. The CAA establishes emission levels for certain hazardous air pollutants that result from treatment processes.

Requirements of the CAA are potentially applicable to remedial actions that result in air emissions, such as excavation.

Floodplains/Wetlands

Appendix A of 40 C.F.R. Part 6 describes the requirements for floodplain/wetlands review of proposed U.S. EPA actions. These regulations are potentially applicable for work to be done in the creeks or other wetland areas, and for remedial activities within the floodplain.

8.2.2 Identification of State ARARs

The purpose of this section is to identify ARARs that exist based on Ohio state regulations that must be complied with when performing a remedial action. The agency charged with developing and enforcing environmental regulations for Ohio is the Ohio EPA. The Ohio EPA provided a generic list of potential ARARs for OU 3 which is included in Appendix L of the FS.

9.0 Description of Alternatives

Following development of the RAOs, a screening and evaluation of potential remedial alternatives was conducted in accordance with CERCLA and the NCP in the OU 3 FS Report.

In simplest terms, OU 3 has three primary source media that contribute to risks from exposure media at the Site. Each primary source media requires a distinct remedial approach. These are:

- MFLBC sediment;
- MFLBC floodplain soil; and
- Feeder Creek sediment.

First, a number of technology types and process options[12] for addressing the main problem areas were identified and screened (evaluated) based on technical implementability. Those retained after the first screening were then evaluated based on the expanded criteria of effectiveness, implementability and relative cost. The technology types and representative process options retained following the screening process were then combined to develop potential remedial alternatives for the site. The alternatives discussed below were selected for detailed analysis and subjected to evaluation under nine NCP criteria. Three remedial alternatives were evaluated.

9.1 Description of Remedy Components

Each of the three alternatives is briefly described below. More detailed information about each of the alternatives can be found in the FS Report.

Alternative A: No Action[13]

(1) *Description of Alternative*: Under this alternative, no further remediation would occur within OU 3. Naturally-occurring processes would continue, however no monitoring would be conducted to assess the effectiveness of these processes or the overall condition of OU 3 over time. Evaluation of the No Action alternative is required by the NCP and provides a baseline against which the other potential remedial alternatives are evaluated.

(2) *Treatment Technologies and Materials Addressed*: There is no treatment component associated with this remedy.

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12 An example of a technology type is "sediment removal" and an example process option within that technology type is "mechanical dredging." Selection of a particular process option as representative was done to streamline the development of potential remedial alternatives. A process option not selected as representative still could be considered during remedial design if its technology type is part of the selected remedial alternative.

13 The NCP recommends developing a "no action" alternative. However, circumstances at OU 3 are such that a "no further action" alternative was developed in the FS. ROC has entered into an enforceable AOC requiring the operation and maintenance of the existing sediment control structures in Feeder Creek discussed in Sections 2.3 and 4.1. ROC has been maintaining the structures for more than a decade and wanted the FS to reflect its intended continued compliance with the AOC.

(3) *Containment Component*: There is no containment component associated with this remedy. However, the existing sediment control structures in drainage ditches at the plant and in Feeder Creek would remain, although they would not be maintained (e.g., fabric barriers would not be replaced as they wear out, built up sediment would not be removed from the structures).

(4) *Costs*: There would be no cost for this alternative.[14]

Alternative B

(1) *Description of Alternative*:

- MFLBC Sediment – MFLBC sediment would be remediated by monitored natural recovery (MNR). MNR involves leaving contaminated sediment in place and relying on naturally occurring processes to reduce the bioavailability or toxicity of the pollutants over time. A variety of natural recovery processes, including physical, biological, and chemical, can occur that reduce the risk to receptors from sediment contamination. While physical processes do not directly change the chemical nature of contaminants, biological and chemical processes do. Instead, physical processes reduce the chance of migration or bioavailability. Examples of physical processes include erosion, dispersion, dilution, and deposition of clean sediment over contaminated areas. Biological processes involve the facilitation of chemical change by microorganisms that live in the sediment (often referred to as biodegradation). Chemical processes involve a geochemical change that can reduce the bioavailability of certain contaminants. Within the MFLBC sediment, it is likely that physical processes would dominate the natural recovery mechanisms.

  Long-term monitoring of the system would be conducted until remedial goals are attained. To assess the effectiveness of MNR, fish samples would be composited within the targeted area (RM 31 to RM 37.6) and analyzed for mirex and percent lipids. It is anticipated that 2 to 3 species would be collected at each river mile, and analyzed as fillets, and approximately 50% of the samples would also be analyzed for whole body concentrations. In addition to fish, sediment samples would also be collected at each location, and analyzed for mirex, total organic carbon, and grain size distribution. In addition to the 6 river miles where sediment mirex concentrations exceed the remediation goal, natural recovery monitoring would also include additional upstream and downstream locations. The detailed monitoring program would be developed following a PDI.

- MFLBC Floodplain Soil – Contaminated soil would be excavated with conventional equipment and transported for consolidation with OU 2 contaminated soils at the Nease facility. Following consolidation, the soils would be capped and covered as called for in the OU 2 ROD. Following excavation of the contaminated soil, the floodplain areas would be

14 In order for ROC to comply with the AOC requiring maintenance of the existing sediment control structures, the FS included an estimated $360,000 in net present worth costs for maintaining the existing sediment control structures in Feeder Creek for 30 years. These costs were developed for the "no further action" alternative to estimate the cost of compliance, and do not apply to the "no action" alternative presented herein.

restored using clean fill that is able to support vegetation. This alternative provides for targeted removal of floodplain soils where mirex concentrations exceed the remediation goal. Based on current information, floodplain soils between about RM 35.4 to RM 34.8, and near RM 33.3 and RM 32.9 exceed the remediation goal. These areas are about 6.5 acres, with an estimated in-place volume of 5,300 cubic yards of contaminated soil. The targeted approach would be designed so as to minimize unacceptable damage to valuable riparian habitat while attaining the remediation goal. The extent of areas to be removed would be determined as part of the PDI. Backfill will be placed as necessary to maintain proper surface water management and avoid erosion.

- Feeder Creek Sediment – Contaminated sediments in Feeder Creek would be removed and residuals (if any) covered to mitigate potential future releases of mirex into the MFLBC. Excavated sediments would be consolidated with OU 2 soils on-site and contained. It is anticipated that sediment will be removed to a 2-foot depth along the entire creek, unless coarse material or bedrock is encountered first. The volume of sediment to be removed is estimated to be 2,600 cubic yards. Water flow from Feeder Creek would be redirected during remediation activities. This would most likely be achieved by temporarily pumping water around the removal area. It is anticipated that the entire channel would be excavated, a geotextile would be placed, and rip-rap substrate would be placed on top. However, in the event that removal of 2-feet eliminates all mirex contamination a cover may not be necessary. The detailed design will follow the PDI and determine the most cost-effective combination of removal and cover to mitigate future mirex releases and preserve the surface water management function of the creek.

(2) *Treatment Technologies and Materials Addressed*: There is no treatment component associated with this remedy. Treatment has not been considered because there are no feasible, cost-effective, in-situ or ex-situ treatment technologies for mirex, due to mirex's resistance to both chemical and biological breakdown and because the levels of mirex in the Site's sediments and floodplain soils are low and widely dispersed.

(3) *Containment Component*: There is a containment component associated with this remedy for the floodplain soils and sediments that would be consolidated with OU 2 contaminated soils. As selected in the ROD for OU 2, at least 11 acres of the former plant site will be contained using a cap comprised of an impermeable membrane and soil, or soil only.[15] The remedial design for OU 2 is currently being completed, and the additional soil and sediment from OU 3 can easily be incorporated under the cap. The primary basis for the OU 2 cover is to prevent contact with residual mirex contamination, particularly for ecological receptors. Mirex levels in surface soil of OU 2 are much higher than the levels found in OU 3, and thus use of the OU 2 cap for OU 3 contaminated soils and sediment is not expected to affect the effectiveness or require modification of the OU 2 remedy.

(4) *Costs*: The estimated present worth of this alternative is $2,180,000. This estimate is based on construction costs for soil and sediment removal over several months to about a year, and a

15 PDI information for OU 2 indicates that the capped area will be larger than anticipated in the OU 2 ROD.

30-year period of MNR. The estimate uses a discount rate of 5% for all present worth calculations. The total estimated cost is provided in 2008 dollars.

Alternative C

(1) *Description of Alternative*:

- MFLBC Sediment – This alternative includes targeted removal of MFLBC sediment to meet the remediation goal. Sediment removal by dredging or dry excavation would be conducted in more highly contaminated areas within the reach between approximately RM 31 and RM 37.6. A targeted removal approach would be developed to achieve the SWAC-based remediation goal while minimizing short-term impacts to aquatic and riparian habitats. The estimated fine-grained sediment body volume to be removed is approximately 4,300 cubic yards. The PDI would include further delineation of sediment bodies for removal. This alternative also includes the option of using post-removal backfilling in some areas to achieve the sediment SWAC-based remediation goal, if residual mirex levels are too high and additional removal is not practical.

  Sediment remediation would occur starting upstream and working downstream. To access the sediment in the MLFBC, staging areas would likely be required along the MFLBC. Floodplain areas requiring remediation may be used for this purpose, where possible, to minimize the number of disturbed floodplain areas; however, it may also be necessary to perform clearing/grubbing of vegetation in the floodplain and construction of temporary access roads in other areas so that equipment can be placed along the stream for dredging. It is anticipated that dredged sediment will be loaded into trucks/tankers and transported to the former Nease facility for dewatering, rather than setting up temporary dewatering facilities along the creek. After dewatering, the dry sediment would be consolidated with OU 2 contaminated soils within the Nease facility, and capped and covered as called for in the OU 2 ROD. A long-term fish monitoring program would be conducted to assess the effectiveness of sediment dredging.

- MFLBC Floodplain Soil – Contaminated floodplain soils would be remediated identically to the approach in Alternative B.

- Feeder Creek Sediment – Contaminated sediments in Feeder Creek would be remediated identically to the approach in Alternative B.

(2) *Treatment Technologies and Materials Addressed*: Similar to Alternative B, there is no treatment component associated with this remedy.

(3) *Containment Component*: As described above in Alternative B, there is a containment component associated with this remedy for the floodplain soils and sediments that will be consolidated with OU 2 contaminated soils.

(4) *Costs*: The estimated present worth of this alternative is $3,770,000. This estimate is based on construction costs for soil and sediment removal over about a year, and scheduled fish monitoring periodically over a 30-year period. The estimate uses a discount rate of 5% for all present worth calculations. The total estimated cost is provided in 2008 dollars.

9.2 Common Elements and Distinguishing Features of Each Alternative

Table 9 summarizes the common elements and distinguishing features of the major remedy components for each of the three remedial alternatives.[16]

Alternative	MFLBC Sediment	MFLBC Floodplain Soil	Feeder Creek Sediment	Cost
Alternative A	No action	No action	No action	none
Alternative B	MNR	Targeted removal to meet remediation goal	Remove all sediment	$2,180,000
Alternative C	Targeted removal to meet remediation goal	Targeted removal to meet remediation goal	Remove all sediment	$3,770,000

Table 9: Summary of Major Remedy Components for Each Alternative

Both of the active remedial alternatives, B and C, share some additional common elements. These common elements include remedial action components, as well as PDI activities. The common elements are summarized below and described in more detail in the FS.

9.2.1 Common Remedial Elements

No Remediation for Portions of the MFLBC

Based on the ecological and human health-based remediation goal of 0.5 mg/kg mirex in sediment and the sediment data, there are no known locations downstream of RM 31 or upstream of RM 37.6 where unacceptable risks from sediment exist. Similarly, based on the ecological and human health-based remediation goal of 1.0 mg/kg mirex in floodplain soil and the most recent floodplain data in 2006, there are no known locations downstream of RM 31 or upstream of RM 37.6 where unacceptable risks from floodplain soil exist. Therefore, both active remedial alternatives focus on remediation in and along the reach from RM 37.6 to RM 31. Both alternatives include no remediation for the rest of the sediment and floodplain soil in and along the MFLBC (although fish sampling may occur both up- and downstream).

Sediment Control Structures on Feeder Creek

Both of the active alternatives will include removal of the existing sediment control structures on Feeder Creek. These were constructed as an interim measure to mitigate the release of mirex-

16 Pertaining to MFLBC sediments, the FS was prepared in accordance with U.S. EPA's "Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites" (2002) and "Contaminated Sediment Remediation Guidance for Hazardous Waste Sites" (2005). As such, capping was considered as a remedial alternative, but was eliminated due to the size and depth of the creek.

contaminated sediment into the MFLBC. The active alternatives address the Feeder Creek to MFLBC pathway. Therefore, the existing sediment control structures on Feeder Creek would no longer be necessary.

Transport and Disposal of Removed Sediment/Soil
Both of the active alternatives include removal of floodplain soil and/or sediment, which will be transported for consolidation with OU 2 contaminated soil at the Site (on the former Nease manufacturing property beneath the planned OU 2 low permeability cap).

Former Nease Facility Surface Water Management
The selected remedy for OU 2 requires surface water management at the former Nease Manufacturing Site. It is important to ensure that erosion of site soils cannot re-contaminate Feeder Creek and the MFLBC. As part of the OU 2 remedy, soil covers will be placed on all areas that exceed the OU 2 ecological surface soil remediation goal of 1 mg/kg. These covers will mitigate the future release of unacceptable levels of mirex into the creek system. The consolidated OU 3 materials will be placed in areas to be covered and graded to integrate with the surface water management plan.

Construction/Performance Monitoring
Construction and performance monitoring are required for demonstrating the compliance of any implemented remedy with the remedial goals. Construction monitoring will be used to assess acute risks to the community, ecology, and workers that may occur as a result of implementing the remedy. Performance monitoring will be used post-remediation to assess whether short- and long-term risk reduction goals will be met by the implemented remedy. Both active alternatives will require a combination of construction and performance monitoring.

9.2.2 Pre-Design Investigation (PDI)

Each of the active remedial alternatives would require a PDI. It is anticipated that the OU 3 PDI will include the following activities (the complete, final scope will be developed through an Agency approved PDI Work Plan):

MFLBC Sediment/Fish

- Detailed mapping of fine-grained sediment bodies in the targeted remediation area. The sediment mapping will be used in the detailed design of sediment remediation.

- Sediment sampling for mirex and total organic carbon analysis. This assessment may include the collection of sediment pore water for analysis of mirex to determine whether BAFs can be better correlated with pore water concentrations. Sediment sampling for mirex analysis will provide a baseline for assessing whether remedial goals are met. Sediment sampling will likely target fine-grained sediments because mirex is more likely to adhere to these sediments. Discrete sampling will likely be performed to determine whether there are "hot-spots" where targeted remediation can be conducted to efficiently achieve the remediation goal. *In addition to surface sampling, depth-discrete sampling will be conducted to evaluate* buried mirex contamination that needs to be addressed as part of the remedy.

- Fish sampling for mirex and percent lipid analysis. Fish analyses would include both whole body and fillet samples to provide a baseline sampling event consistent with the anticipated long-term fish monitoring program discussed in Section 9.2.3, below.

MFLBC Floodplain Soil

- Physical characterization of areas targeted for removal. Physical assessments may include assessing surface water drainage patterns to determine whether excavating and/or backfilling floodplain soils can be conducted without adversely affecting surface water drainage.

- Chemical characterization of areas targeted for removal. This assessment will include mirex and total organic carbon analyses. Discrete sampling will likely be performed to determine whether there are "hot-spots" where targeted remediation can be conducted to efficiently achieve the remediation goal.

Floodplain/Wetlands

An assessment of the 100-year floodplain and the presence/absence of wetlands in areas where remediation may be conducted will be included in the PDI to provide data for design.

9.2.3 Operation, Monitoring and Maintenance

The remediation goals for MFLBC sediment and floodplain soil, and the complete removal of contaminated sediment from Feeder Creek will allow for unrestricted use and unlimited access for those media once the goals are met. There will be no operation or maintenance required for the sediments or floodplain soils. However, soils and sediments will be consolidated with contaminated soils from OU 2 and contained on site. Operation, monitoring and maintenance of the consolidated materials will be as required for soils in the OU 2 ROD.

Both alternatives would include post-construction monitoring:

Surface Water Sampling

Mirex levels in surface water in Feeder Creek and MFLBC will be measured at least once after the post-construction recovery period.

Long-Term Fish Monitoring Program

Ohio EPA proposed a long-term sampling plan for the MFLBC that is included as Appendix K in the FS. The plan calls for sampling of fish for mirex after a post-construction recovery period, allowing the ecological system time to begin to recover from construction activities. The frequency of fish sampling will be flexible and will be identified in the remedial design based on the results of the baseline monitoring and first post-remediation monitoring event. Alternative B would have a more intensive long-term monitoring program.

9.2.4 Institutional Controls

The remediation goals for MFLBC sediment and floodplain soil, and the complete removal of contaminated sediment from Feeder Creek will allow for unrestricted use and unlimited access

for those media once the goals are met. Current risk from direct contact with floodplain soils and MFLBC sediment is at or below U.S. EPA's acceptable risk range. Therefore, no institutional controls are required for Feeder Creek or MFLBC sediments or floodplain soils. However, soils and sediments will be consolidated with contaminated soils from OU 2 and contained on site. Institutional control for the consolidated materials will be as required for soils in the OU 2 ROD.

As discussed in Section 2.2.2, there is currently a fish consumption advisory that recommends consuming no more than one meal per month of carp between Allen Road and State Route 14 in Millville, a distance of about 12 river miles downstream of the Nease facility. It is anticipated that the results of fish tissue monitoring will be used to re-assess the need for a sport fishing advisory based on mirex.

9.3 Expected Outcomes of Each Alternative

Alternative A, which includes no active remediation measures, would not achieve protectiveness in the foreseeable future. Alternatives B and C are both expected to be protective, attain ARARs, and achieve the RAOs and remediation goals for the operable unit. Neither Alternative B nor C requires long-term land-use restrictions on Feeder Creek or MFLBC sediment or floodplain soil. Alternative B relies on natural processes to address mirex contamination in MFLBC sediments. While it is difficult to predict the time to attain the sediment goals using MNR, it is anticipated that Alternative B will take much longer than Alternative C. Both active remedial alternatives will require a PDI, and each requires about the same time to complete physical construction (several months to about one year). Both Alternatives B and C leave Feeder Creek and MFLBC sediments and floodplains available for unrestricted use and unlimited exposure. It is anticipated that the sport fish consumption advisory due to mirex may be further relaxed or lifted at the completion of the remedial action, and this is expected to be faster for Alternative C.

9.4 Preferred Alternative

The preferred alternative described in the Proposed Plan for OU 3 of the Nease Site was Alternative C. The estimated cost of the preferred alternative is $3,770,000.

10.0 Summary of Comparative Analysis of Alternatives

This section explains the U.S. EPA's rationale for selecting the preferred alternative. The U.S. EPA has developed nine criteria to evaluate remedial alternatives to ensure that important considerations are factored into remedy-selection decisions. These criteria are derived from the statutory requirements of Section 121 of CERCLA, the NCP, as well as other technical and policy considerations that have proven to be important when selecting remedial alternatives. When selecting a remedy for a site, U.S. EPA conducts a detailed analysis of the remedial alternatives consisting of an assessment of the individual alternatives against each of the nine evaluation criteria and a comparative analysis focusing upon the relative performance of each alternative against those criteria.

The nine evaluation criteria are described below.

Threshold Criteria
The two most important criteria are statutory requirements that must be satisfied by any alternative in order for it to be eligible for selection.

1. Overall protection of human health and environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls or institutional controls.

2. Compliance with ARARs addresses whether or not a remedy will meet all of the **A**pplicable or **R**elevant and **A**ppropriate **R**equirements of other Federal and State environmental statutes and/or provide grounds for invoking a waiver.

Primary Balancing Criteria
Five primary balancing criteria are used to identify major trade-offs between remedial alternatives. These trade-offs are ultimately balanced to identify the preferred alternative and to select the final remedy.

3. Long-term effectiveness and permanence refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

4. Reduction of toxicity, mobility, or volume through treatment addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility or volume of the hazardous substances as their principal element. This preference is satisfied when treatment is used to reduce the principal threats at the site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.

5. Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction of the remedy until cleanup levels are achieved. This criterion also considers the effectiveness of mitigation measures and time until protection is achieved through attainment of the RAOs.

6. Implementability addresses the technical and administrative feasibility of a remedy from design through construction, including the availability of services and materials needed to implement a particular option and coordination with other governmental entities.

7. Cost includes estimated capital costs, annual operation and maintenance costs (assuming a 30-year time period), and net present value of capital and operation and maintenance costs, including long-term monitoring.

Modifying Criteria
These criteria may not be considered fully until after the formal public comment period on the Proposed Plan and RI/FS Report are complete.

8. State Acceptance considers whether the State support agency concurs with the selected remedy for the site.

9. Community Acceptance addresses the public's general response to the remedial alternatives and the preferred alternative presented in the Proposed Plan. This ROD includes a responsiveness summary that summarizes the public's comments and U.S. EPA's response to those comments. The responsiveness summary is included as Appendix A.

The full text of the detailed analysis of the three remedial alternatives against the nine evaluation criteria (including both the individual analysis and the comparative analysis) is contained in the FS Report for OU 3 which is included in the Administrative Record for the Site. Because the two Modifying Criteria cannot be fully evaluated until public comment is received, they were not evaluated in the FS. The responsiveness summary of this ROD contains a more detailed discussion of public comments received. This section of the ROD summarizes the highlights of the comparative analysis.

10.1 Overall Protection of Human Health and the Environment

Under the current use scenarios, all remedial alternatives for OU 3, including Alternative A: No Action, provide protection of human health. However, Alternative A: No Action does not provide current protection of ecological receptors, nor does it address potential future human health or ecological risks.

Alternatives B and C will both provide future protection of human health and the environment. However, the timeframe to achieve protection is expected to be longer for Alternative B than Alternative C. The greatest certainty of timely protection of human health and the environment is provided by Alternative C because the remediation goals and RAOs for both sediment and floodplain soil will be met more quickly, while using a targeted approach to minimize environmental disruption. Differences between alternatives are discussed more fully below in Sections 10.3 through 10.7.

10.2 Compliance with ARARs

Alternatives B and C are expected to comply with action-specific and location-specific ARARs, and include monitoring to demonstrate compliance. There are no chemical-specific ARARS or TBCs that apply to mirex contamination in soils or sediments. Ohio EPA has promulgated water quality criteria for surface water in the State of Ohio within the Ohio River drainage basin (including the MFLBC) (OAC 3745-1-34) including a value of 0.00011 ug/L for mirex in surface water in the Ohio River Basin based on human health considerations including drink and nondrink exposures. For the selected remedy, these criteria may be ARARs for Feeder Creek and

the MFLBC if there are discharges to these water bodies as a result of the response action. Since no active remedial measures would take place under Alternative A, no additional action-specific or location-specific ARARs apply.

10.3 Long-Term Effectiveness and Permanence

Alternative C will have the highest long-term effectiveness and permanence because the highest levels of mirex contamination will have been removed from each component of the system and safely contained under a clean cover, after consolidation with the OU 2 soils. Effectiveness and permanence will be assured by a long-term operation, monitoring and maintenance program, as well as by the institutional controls required in the OU 2 ROD. Alternative B provides a greater long-term effectiveness for floodplain soil and Feeder Creek sediment than Alternative A because active remediation will be conducted. Alternative C contains the same features as Alternative B for Feeder Creek and the floodplain soils, and also the added effectiveness and permanence of sediment removal from the MFLBC. While MNR of the MFLBC sediments is expected to be protective in the long-term, there is a greater risk that events (such as a major storm) could disrupt the natural recovery process and decrease the long-term effectiveness and permanence for Alternative B.

Alternative A leaves all contaminated media in place within the operable unit with no active remedial measures. While the EA assessed that the risks to human health were acceptable under the current use scenarios, Alternative A does not provide current protection of ecological receptors, nor does it address potential future human health or ecological risks. The remediation goals and RAOs may eventually be achieved through naturally-occurring processes for the MFLBC sediment, but no monitoring would be conducted to assess the progress of recovery or the overall condition of the Site over time. It is less certain that naturally-occurring processes will allow the floodplain soils to reach the soil remediation goals and meet the RAOs. Considering the persistence of mirex in the environment, an unacceptably long period of time would be required until protection would be achieved.

10.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

None of the three alternatives includes active treatment of contaminated materials; therefore, there is no reduction in toxicity, mobility, or volume through treatment for any alternative. The reduction of exposures (and associated toxicity) to mirex-contaminated OU 3 media is highest for Alternative C since it provides for removal of the most contaminated and bioavailable mirex-contaminated media from the system and safe containment of the materials. Alternative A provides the least reduction in exposure since no remediation will occur. Exposure reductions are not associated with treatment *per se,* as feasible treatment methods are not available.

10.5 Short-Term Effectiveness

Alternative A will result in the least short-term adverse impacts, as no additional action will be taken. Alternative C will result in the highest degree of short-term impacts, including disruption of aquatic and riparian habitats. Due to the resistance of mirex to degradation, the time frame for

remediation will be longest for Alternative A, and will be longer for Alternative B than for Alternative C. Because Alternative C includes the removal of mirex to meet the remediation goals from all three impacted areas (MFLBC sediment and floodplain and Feeder Creek sediment), it will provide the shortest overall remediation time frame. Construction of both Alternatives B and C is expected to be complete within several months to about a year. Implementation of appropriate health and safety practices should protect both remediation workers and the community from unacceptable exposure during construction of all alternatives.

10.6 Implementability

All three alternatives are technically implementable since the technologies and skills are readily available. Alternative A is the easiest to implement, as no further action is needed. Alternative C is the most difficult to implement due to potential difficulties accessing some portions of the floodplain and the MFLBC for soil and/or sediment removal. The monitoring for all alternatives can be readily performed.

10.7 Cost

Cost includes estimated capital costs and annual operation and maintenance costs (assuming a 30-year time period). Present worth cost represents the total cost of an alternative over time in terms of today's dollar value. In accordance with U.S. EPA guidance, cost estimates developed for the FS are expected to be accurate within a range of +50 to -30 percent.

Detailed cost estimates for each of the three alternatives are presented in the FS Report. The estimated present worth costs to implement the potential remedial alternatives at OU 3 of the Nease Site are as follows:

- Alternative A: no cost
- Alternative B: $2,180,000
- Alternative C: $3,770,000

The cost differences between Alternatives B and C are based on the costs of actively managing the MFLBC sediment in Alternative C versus MNR in Alternative B.

10.8 State Agency Acceptance

The Nease Site RI/FS investigations were conducted under a tri-party order with Ohio EPA, U.S. EPA, and ROC. Ohio EPA has worked cooperatively with U.S. EPA in the RI/FS process, and state concurrence with the ROD is anticipated. Any correspondence from the State regarding concurrence with the selected remedies will be added to the Administrative Record.

10.9 Community Acceptance

During the public comment period on the Proposed Plan, the community expressed some concerns, as well as support for or opposition to the proposed remedy for OU 3 of the Nease Site.

Most commenters generally supported cleanup of OU 3 and were pleased that the problem is being addressed. As discussed in the Responsiveness Summary found as Appendix A to this ROD, public concerns focused on: remedy options; health concerns; cleanup goals; timeliness of the clean up; floodplain property owner concerns; remedy implementation; oversight of the current work; and miscellaneous comments.

11.0 Principal Threat Wastes

The NCP establishes an expectation that U.S. EPA will use treatment to address principal threats posed by a site wherever practicable. The term "principal threat" refers to source materials that are considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. Conversely, source materials that generally can be reliably contained and that would present only a low risk in the event of exposure are not a principal threat waste.

The soil and sediment in OU 3 of the Nease Site comprises low toxicity source material. Under current scenarios there is no unacceptable human health risk. The mirex concentrations are not greatly above risk levels for ecological receptors or potential future human exposures. Mirex is relatively immobile in air or groundwater, generally will remain sorbed to soil or sediment particles, and does not dissolve into surface water. Therefore, no principal threat wastes were identified for OU 3 of the Nease Site.

Because no principal threat wastes occur in OU 3 media, this ROD does not formulate treatment alternatives that will address the principal threats. There is no treatment component associated with the low toxicity source material (soil and sediment) for any of the remedial alternatives because there are no feasible, cost-effective, in-situ or ex-situ treatment technologies for mirex, due to mirex's resistance to both chemical and biological breakdown and because the levels of mirex in the Site's sediments and floodplain soils are low and widely dispersed.

12.0 Selected Remedy

This section describes the selected remedy and provides U.S. EPA's reasoning behind its selection. Alternatives can change or be modified if new information is made available to U.S. EPA through further investigation or research. An appropriate range of alternatives was developed, based upon the initial screening of technologies, the potential for contaminants to impact the environment, and site-specific RAOs and goals.

12.1 Identification of the Selected Remedy and Summary of the Rationale for its Selection

Based on the analysis of the nine criteria conducted in the FS Report and summarized in Section 10 of this ROD, the selected remedy for OU 3 of the Nease Chemical Site is Alternative C. This alternative represents the best balance of overall protectiveness, compliance with ARARs, long-term effectiveness and permanence, costs, and other criteria, including State and community acceptance.

12.2 Description of the Selected Remedy

A summary of the selected remedy, Alternative C is provided below:

(1) *Description of Alternative*:

- MFLBC Sediment – The selected alternative includes removal of MFLBC sediment. A targeted removal approach will be developed to achieve the SWAC-based remediation goal while minimizing short-term deleterious impacts to aquatic and riparian habitats.
    - Sediment remediation will be conducted in the MFLBC reach between approximately RM 31 and RM 37.6. Based on sediment sampling results, there are three primary sections where removal likely will be necessary: RM 31 to RM 32.3; RM 32.8 to RM 35.8; and RM 36.3 to RM 36.9. The estimated fine-grained sediment body volume within these reaches is approximately 4,300 cubic yards. The PDI will include further delineation of sediment bodies for targeted removal to ensure the SWAC-based remediation goal is met.

    - To access the sediment in the MLFBC, staging areas will likely be required along the MFLBC. Floodplain areas requiring remediation may be used for this purpose, where possible, to minimize the number of disturbed floodplain areas; however, it also may be necessary to perform clearing/grubbing of vegetation in the floodplain and construction of temporary access roads in other areas so that equipment can be placed along the stream for dredging.

    - The FS cost estimates assume that mechanical dredging/removal will be the most practical approach (e.g. using a backhoe from the creek banks), although hydraulic removal via vacuum truck (or similar) may be more cost-effective in some areas. Mechanical dredging operations will likely include the installation of sheet pile coffer dams (or similar) to isolate and dewater sediment bodies to reduce the amount of sediment dewatering subsequently required. Sediment remediation will occur starting upstream and working downstream to allow for re-capture of sediment particles that become resuspended as a result of disturbance. Construction monitoring for dredging may include measuring downgradient transport of resuspended particles (e.g. by using real-time turbidity meters).

    - It is anticipated that dredged sediment will be loaded into trucks/tankers and transported to the former Nease facility for dewatering, rather than setting up temporary dewatering facilities along the creek. This approach will lead to less disturbance of the floodplain since it will allow for smaller staging areas along the MFLBC. It is anticipated that dewatering will be conducted using Geotubes® (or a similar approach) which have been shown to produce water free of particulates. If it is determined during detailed design of this technology that treatment of the residual water is necessary, it will likely involve additional filtration and, possibly, adsorption using activated carbon. The existing on-Site treatment plant may be considered for

this treatment process (it is part of the selected remedy for water treatment in OU 2), or a separate facility may be constructed depending upon various factors such as cost and feasibility. The details of any required treatment would be developed as part of the remedial design.

- The ideal time for conducting sediment removal is when surface water flow rates are low. Based on data collected by USGS on Little Beaver Creek at East Liverpool, discharge rates in this watershed are highest from January to May and are lowest from June to October. It is anticipated that construction of this alternative can be accomplished within one construction season between June and October. Assuming that mechanical removal is used for dredging, the volume of water removed with sediment will be minimized (compared to hydraulic methods). It is expected that about 20 truck trips per day may be required to transport sediment from MFLBC to the former Nease facility for dewatering throughout the construction period. After dewatering, the dry sediment will be consolidated with OU 2 contaminated soils within the Nease facility, and capped and covered as called for in the OU 2 ROD.

- This alternative also includes the option of using post-removal backfilling in some areas to achieve the sediment SWAC-based remediation goal, if residual mirex levels are too high and additional removal is not practical. Post remediation sediment sampling will be conducted to confirm attainment of the remediation goal.

- A long-term fish monitoring program will be conducted to assess the effectiveness of sediment dredging.

- MFLBC Floodplain Soil – Contaminated soil will be excavated with conventional equipment. A targeted removal approach will be developed to achieve the remediation goal while minimizing short-term deleterious impacts to riparian habitats.
  - Floodplain soil remediation will be conducted in the river mile reach between approximately RM 31 and RM 37.6. Based on current floodplain soil sampling results, there are three primary sections where removal likely will be necessary: between about RM 35.4 to RM 34.8; near RM 33.3; and near RM 32.9. These areas comprise about 6.5 acres, with an estimated in-place volume of 5,300 cubic yards of contaminated soil. The PDI will include further delineation the extent of floodplain areas to be removed to ensure the remediation goal is met.

  - To access the contaminated floodplains along the MLFBC, legal access will be required of property owners. It may be necessary to perform clearing/grubbing of vegetation in the floodplain and construction of temporary access roads in other areas so that equipment can be moved into the areas requiring excavation.

  - Soil removal would use conventional equipment. Construction monitoring for a soil excavation would likely include dust control and monitoring. Following excavation of the contaminated soil, the area will be restored using clean fill that is able to

support vegetation. Backfill will be placed as necessary to maintain proper surface water management and avoid erosion.

- Removed floodplain soil will also be transported to the former Nease facility in a similar manner (e.g., small trucks). It is expected that floodplain soil and sediment removal will be conducted simultaneously and can both be completed within the same construction period. At the Nease facility, floodplain soils will be consolidated with OU 2 contaminated soils. Following consolidation, the soils will be capped and covered as called for in the OU 2 ROD.

- Feeder Creek Sediment – Contaminated sediments in Feeder Creek would be removed and residuals (if any) covered to mitigate potential future releases of mirex into the MFLBC. Excavated sediments would be consolidated with OU 2 soils on-site and contained. It is anticipated that sediment will be removed to a 2-foot depth along the entire creek, unless coarse material or bedrock is encountered first. The volume of contaminated sediment is estimated to be 2,600 cubic yards. Water flow from Feeder Creek will be redirected during remediation activities, most likely by temporarily pumping water around the removal area. It is anticipated that the entire channel would be excavated, a geotextile would be placed, and rip-rap substrate will be placed on top. However, it is anticipated that a 2-foot excavation depth may eliminate all mirex contamination. In that case, a cover may not be necessary or the design may be modified for erosion control purposes. The detailed design will follow the PDI and determine the most effective combination of removal and cover to mitigate future mirex releases and preserve the surface water management function.

- The common elements discussed in Section 9.2 (common remedial elements; PDI; and long-term monitoring) will be included as components of the remedy. It is anticipated that OU 3 will not require institutional controls upon completion of the remedy. However, soils and sediments will be consolidated with contaminated soils from OU 2 and contained on site. Operation, monitoring and maintenance and institutional control of the consolidated materials will be as are required for soils in the OU 2 ROD.

12.3 Summary of the Estimated Remedy Costs and Time Required for Implementation

The estimated cost of the selected remedy for OU 3 of the Nease Site is $3,770,000. The physical construction of the remedy is estimated to take approximately several months to about one year to complete. Post-construction monitoring of surface water and fish will occur on a schedule established during remedial design. A summary of costs for the OU 3 cleanup is shown in Table 10, while a detailed estimate of the costs is provided in Table 11.

12.4 Expected Outcomes of the Selected Remedy

The selected remedy for OU 3 of the Nease Site, Alternatives C, will quickly achieve the remediation goals and RAOs for OU 3. The selected remedy will be protective and is expected to attain ARARs. It is anticipated that the selected remedy will not leave contaminated materials in place above the remediation goals in soil and sediment at the Site, and does not require long

term land-use restrictions on these media. MFLBC floodplain soil and sediment and Feeder Creek of OU 3 will be available for unrestricted use and unlimited exposure at the completion of the remedial action, and institutional controls will not be required.

The selected remedy requires a PDI to more fully delineate conditions within the target response area and to establish design parameters to ensure attainment of the remediation goals while minimizing short-term deleterious impacts to aquatic and riparian habitats. After the physical construction period (estimated to be from several months to about one year), there will be immediate risk reductions to ecological receptors by mitigating contact with mirex in soil and sediment. Feeder Creek will no longer be a potential source of contamination to the MFLBC. The MFLBC sediments will no longer be a potential source of further floodplain contamination at unacceptable levels. Should the dairy farmers return cattle to the floodplain, uptake of mirex (if any) is expected to be below acceptable risk-based levels. However, U.S. EPA and Ohio EPA intend to work with the farmers and ROC to protect the floodplain habitat, possibly by encouraging the continued exclusion of cattle. Additionally, once the MFLBC begins to recover, there should be reductions of bioaccumulation of mirex in biota, and risk reductions for consumers of those biota. U.S. EPA anticipates that the selected remedy may allow the sport fish consumption advisory due to mirex to be further relaxed or lifted.

The actions to remediate OU 3 that will result from this ROD are compatible with the ROD previously issued for OU 2 (soils, groundwater, and source areas at the facility), signed in September 2005. This ROD is the second of two planned RODs for the Nease Chemical Site. The selected remedies specified in this ROD and the OU 2 ROD will serve as the final actions for the entire Site.

13.0 Statutory Determinations

Under CERCLA Section 121 and the NCP, remedies selected for Superfund sites are required to be protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a waiver is justified), be cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the toxicity, mobility or volume of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the selected remedy for OU 3 of the Nease Chemical Site meets these statutory requirements.

13.1 Protection of Human Health and the Environment

The current and potential future risks at OU 3 of the Nease Site are primarily due to the potential presence of mirex in floodplain soils and sediment. The mirex in the floodplain soils and sediment can bioaccumulate in fish and/or beef and milk, causing potential risks for consumers. Implementation of the selected remedy will be protective of human health and the environment through the removal of contaminated soils and sediments above the remediation goals, and safe long-term containment of the material. The OU-specific RAOs and remediation goals were

developed to protect current and future receptors that are potentially at risk from contaminants at OU 3. The selected remedy will meet the RAOs and the remediation goals. Feeder Creek and the sediments and floodplains of the MFLBC will be available for unrestricted use and unlimited exposure at the completion of the remedial action.

13.2 Compliance with ARARs

Section 121(d) of CERCLA requires that Superfund remedial actions meet ARARs. A brief discussion of the primary ARARs is provided below. In addition to ARARs, non-enforceable guidelines, criteria, and standards may be useful in designing the selected remedy. As described previously in Section 8.2 of this ROD, these guidelines, criteria and standards are known as TBCs. The selected remedy will comply with the ARARs for the Site. ARARs for the selected remedy, Alternative C are shown in Table 8.

The selected remedy involves disturbing surficial materials in floodplain areas of the MFLBC. These activities can be conducted in a manner that will comply with the substantive requirements of location and action-specific ARARs including local and State Erosion and Sediment Control ARARs, ambient air quality standards for particulates during remediation, and protection of wetlands and floodplains. Similarly removal of sediment from Feeder Creek and the MFLBC triggers Ohio Water Quality Criteria that are related to dredging, filling, obstructing or altering waters of the state.

With respect to OU 3 media, there are no chemical-specific ARARS or TBCs that apply to mirex contamination in soils or sediments. U.S. EPA has not promulgated any sediment criteria, nor has published a soil screening level for mirex. In addition, Ohio EPA has not published any standards or guidance for mirex in soil or sediment. Ohio EPA has promulgated water quality criteria for surface water in the State of Ohio within the Ohio River drainage basin (including the MFLBC) (OAC 3745-1-34) including a value of 0.00011 ug/L for mirex in surface water in the Ohio River Basin based on human health considerations including drink and nondrink exposures. For the selected remedy, these criteria may be ARARs for Feeder Creek and the MFLBC if there are discharges to these water bodies as a result of the response action. In addition, U.S. EPA have unpromulgated Water Quality Criteria to give guidance to states for setting water quality criteria. For mirex, U.S. EPA has recommended a chronic continuous concentration of 0.001 ug/L, based on the protection of aquatic life, and is a TBC for OU 3.

To the extent not otherwise listed in the ARAR and TBC table for this ROD, the OU 2 ROD addresses ARARs and TBCs for capping soil contamination on-site, and consolidation of the OU 3 contaminated soils and sediments with the OU 2 contaminated soils prior to capping, as called for by this ROD, will not interfere with the overall selected remedy complying with ARARs applicable to OU 2 as well as OU 3.

Specific requirements needed to comply with the ARARs will be included with the detailed remedial design, including a wetlands assessment and floodplain evaluation. Engineering controls and monitoring will be used to assure that the final remedy complies with the substantive requirements of ARARs. While there are several location and action-specific

ARARs and TBCs that will be addressed during remedial design, none are anticipated to be problematic and compliance with these requirements is expected.

13.3 Cost Effectiveness

U.S. EPA has determined that the selected remedy for the OU 3 at the Nease Chemical Site is cost effective and represents a reasonable value for the money to be spent. A cost-effective remedy in the Superfund program is one whose costs are proportional to its overall effectiveness. The overall effectiveness of the potential remedial alternatives for OU 3 was evaluated in the FS by considering the following three criteria: long-term effectiveness and permanence; reduction in toxicity, mobility and volume through treatment; and short-term effectiveness. The overall effectiveness was then compared to cost to determine whether an alternative is cost effective. Of the remedial alternatives evaluated for this OU, Alternative C (the selected remedy) provides the highest degree of overall effectiveness. Although Alternative B costs about $1.6 million less, it has a far greater degree of uncertainty regarding long-term effectiveness and permanence because of uncertainties related to the natural processes of the MNR for the MFLBC sediments.

13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

U.S. EPA has determined that the selected remedy, Alternative C, represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at OU 3 of the Nease Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, U.S. EPA has determined that the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

As discussed in Section 10 of this ROD, the selected remedy (Alternative C) provides the highest degree of long-term effectiveness and represents a more permanent solution than other alternatives for OU 3 of the Nease Site. None of the alternatives uses treatment to reduce toxicity, mobility, or volume. However, the selected remedy provides the greatest reduction in toxicity by removing bioavailable mirex from the ecosystem and the greatest reduction in mobility by containing the most highly contaminated floodplain soils and sediments. While the selected alternative will have greater short-term effects from construction in the MFLBC, the targeted removal approach will minimize short-term deleterious impacts to aquatic and riparian habitats while reaching the remediation goals and attaining RAOs significantly faster. During comment on the FS, the Ohio EPA indicated that it preferred an active approach to remediation of the MFLBC sediments rather than MNR.

The selected remedy addresses risks by removing more highly contaminated floodplain soils and sediments from the ecosystem and safely containing them at the old manufacturing plant. For this OU, removal, consolidation with OU 2 material, and containment are found to provide the best balance of tradeoffs, because there are no feasible, cost-effective, treatment technologies for

mirex. Long-term effectiveness will be achieved through applying the engineering controls; operation, monitoring and maintenance; and institutional controls required by the OU 2 ROD.

13.5 Preference for Treatment as a Principal Element

As discussed in Section 11 of this ROD, no principal threat wastes were identified for OU 3. Because no principal threat wastes occur in OU 3 media, this ROD cannot formulate treatment alternatives that will address the principal threats. Additionally, there is no practicable treatment component associated with the floodplain soil and sediment for the selected alternative because there are no feasible, cost-effective, in-situ or ex-situ treatment technologies for mirex.

However, for the Site as a whole, principal threat wastes include the highly contaminated sludge and fill in two of the former waste ponds and DNAPL in groundwater. The selected OU 2 remedy provides treatment of these principal threat wastes through the use of treatment technologies. Thus, the statutory preference for remedies that employ treatment as a principal element is satisfied for the Nease Chemical Site as a whole.

The selected remedy does not call for off-site disposal of untreated wastes, thereby meeting the CERCLA bias against off-site disposal of untreated wastes.

13.6 Five-Year Review Requirements

The NCP requires that the remedial action be reviewed no less often than every five years if the remedial action results in hazardous substances, pollutants or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure. The selected remedy for OU 3 will result in hazardous substances, pollutants, or contaminants remaining in Feeder Creek and MFLBC sediments and floodplain soils at levels that allow for unlimited use and unrestricted exposure at the completion of the remedial action. However, the OU 3 soils and sediments that will be consolidated on-site with the OU 2 soils are anticipated to contain mirex at levels that do not allow for unlimited use and unrestricted exposure at the completion of the remedial action, and will require a statutory review.

Additionally, the previously selected remedy for OU 2 will result in hazardous substances, pollutants, or contaminants remaining on some portions of OU 2 above levels that allow for unlimited use and unrestricted exposure at the completion of the remedial action. Because the remedies at the Nease Site will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of the first remedial action to ensure that the remedies are, or will be, protective of human health and the environment.

It is not certain how quickly after completion of the MFLBC sediment remediation mirex levels will be reduced in fish. Therefore, the long-term fish monitoring will be considered for at least two five-year reviews.

14.0 Documentation of Significant Changes

The Proposed Plan for OU 3 of the Nease Site was released for public comment on July 8, 2008, and the public comment period ran from July 14 through August 13, 2008. The Proposed Plan identified Alternative C (targeted removal of MFLBC sediment, excavation and backfilling of floodplain surface soil and removal of Feeder Creek sediment), as the preferred alternative for OU 3. U.S. EPA reviewed all written and verbal comments submitted during the public comment period and determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

TABLES

TABLE 1: Threatened, Endangered, and Rare Species Occurrences Along MFLBC

Common Name	Scientific Name	Ohio Status	USGS Quadrangle	Number of Records	Last Sighting
PLANTS					
Mountain-fringe	*Adlumia fungosa*	T	West Point East Liverpool North	2 10	10/85 9/85
Shale barren pussy-toes	*Antennaria virginica*	T	East Liverpool North	5	6/86
Lyre-leaf rock-cress	*Arabis lyrata*	P	East Liverpool North	2	6/86
Swamp jack-in-the-pulpit	*Arisaema stewardsonii*	P	Lisbon East Liverpool North	1 2	6/84 6/84
Pale straw sedge	*Carex albolutescens*	E	Lisbon	1	7/89
Necklace sedge	*Carexprojecta*	T	Lisbon	1	6/84
Reflexed sedge	*Carex retroflexa var. retroflexa*	T	East Liverpool North	1	5/83
Straw sedge	*Carew straminea*	T	Lisbon	1	7/89
Beaked sedge	*Carex utriculata*	P	Lisbon	1	7/89
American chestnut	*Castanea dentata*	P	West Point	1	11/82
Speckled wood lily	*Clintonia umbellulata*	P	West Point East Liverpool North	1 3	7/84 7/84
Spotted coral-root	*Corallorhiza maculata*	P	Lisbon	1	8/64
Tennessee bladder fern	*Cystopteris tennesseenis*	P	East Liverpool North	1	8/84
Crinkled hairgrass	*Deschampsiaflexuosa*	T	Salem	1	6/67
Prairie tick-trefoil	*Desmodium illinoense*	E	Lisbon	1	8/60
Tall manna-grass	*Glyceria grandis*	P	Lisbon	1	7/83
Oak fern	*Gymnocarpium dryopteris*	T	East Liverpool North	5	6/86
American water-pennywort	*Hydrocotyle americana*	P	East Liverpool North	8	7/86
Southern woodrush	*Luzula bulbosa*	T	Lisbon East Liverpool North	1 1	6/67 5/83
Catberry	*Nemopanthus mucronatus*	P	Lisbon	1	7/89
Bicknell's panic-grass	*Panicum bicknellii*	T	East Liverpool North	1	8/84
Long beech-fern	*Phegopteris connectilis*	P	Lisbon	1	6/60

Common Name	Scientific Name	Ohio Status	USGS Quadrangle	Number of Records	Last Sighting
			East Liverpool North	1	6/86
Tubercled rein-orchid	*Platanthera flava*	P	Lisbon	1	7/60
Large round-leaved orchid	*Platanthera orbiculata*	P	West Point	2	7/84
Bowman's root	*Porteranthus trifoliatus*	P	West Point East Liverpool North	2 1	6/86 6/60
Black willow	*Salix nigra*	SC	Lisbon	1	1/89
BIRDS					
Sharp-shinned hawk	*Accipiter striates*	S	Salem	1	7/83
American bittern	*Botaurus lentiginosus*	E	Damacus	1	6/88
Sora	*Porzana carolina*	S	Salem Lisbon	1 1	5/88 6/86
Virginia rail	*Rallus limicola*	S	Salem Lisbon	1 1	8/87 6/85
Winter wren	*Troglodytes troglodytes*	E	East Liverpool North	1	6/92
Canada warbler	*Wilsonia canadensis*	E	East Liverpool North	1	6/92
REPTILES AND AMPHIBIANS					
Hellbender	*Cryptobranchus alleganiensis*	E	West Point	3	7/88
OTHER ORGANISMS					
Wavy-rayed lampmussel	*Lampsilisfasiola*	S	West Point East Liverpool North	1 1	8/87 8/87
VEGETATIVE COMMUNITIES					
Hemlock-white-pine-hardwood forest		RS	West Point	1	9/88
Oak-maple forest		LS	East Liverpool North	1	9/88

E - Ohio Endangered; T - Ohio Threatened; S - Ohio Special Interest; P - Ohio Potentially Threatened; LS - Locally Significant; RS – Regionally Significant; SC - State co-champion

TABLE 2: Summary of Contaminants of Concern Measured for the RI[1]

Media	COC	Range ug/l – water ug/kg – solids	Frequency of Detection	Exposure point concentration (ug/kg or ug/l)
On-Facility Surface Water	Mirex	2.92E-01	1/2	3.62E-01
	Photomirex	1.51E-02	1/2	1.51E-02
On-Facility Sediment	Mirex	1.15E+02 – 1.29E+05	23/23	7.13E+03
	Photomirex	5.73E+01 – 5.30E+02	3/23	1.95E+02
Off-Facility Surface Water	Mirex	3.04E-02 – 6.36E-02	2/2	6.36E-02
Off-Facility Sediment	Mirex	2.48E+01 – 1.14E+04	25/26	8.46E+03
	Photomirex	2.00E+00 – 2.05E+02	15/26	2.91E+01
MFLBC Soil	Mirex	7.19E-01 – 6.65E+03	115/136	1.31E+03
	Photomirex	3.00E-01 – 2.12E+02	67/133	2.84E+01
MFLBC Upstream Sediment	Mirex	4.26E+00 – 2.82E+03	48/55	5.19E+02
	Photomirex	4.79E-01 – 7.38E+00	9/55	7.38E+00
MFLBC Upstream Fish	Mirex	2.20E+01 – 1.82E+03	15/15	1.27E+03
	Photomirex	1.39E+00 – 2.88E+01	12/15	1.73E+01
MFLBC Downstream Sediment	Mirex	6.30E+00 – 1.09E+01	3/13	1.09E+01
MFLBC Downstream Fish	Mirex	6.90E+00 – 6.70E+01	9/11	4.47E+01
	Photomirex	1.55E+00 – 3.12E+00	4/11	3.12E+00

[1] Other exposure media were considered in the human health risk assessment, including: game; beef; milk; and vegetables. These exposure media were not measured for the RI. To determine exposure point concentrations the following approaches were used:

- Game – values were based blood and fat samples from 22 opossum or raccoon taken by ODH in 1989. Mirex levels ranged from non-detect to 0.0089 mg/kg. No mirex was detected in 8/22 samples.
- Vegetables – values were modeled using soil levels and deposition of particulates and root uptake.
- Beef and milk – values were based on 29 samples of local upstream cattle taken by ODA between 1987 and 1990. Mirex levels ranged from non-detect to 1.75 mg/kg. Photomirex uptake was calculated as a ratio of the mirex values.

TABLE 3
SUMMARY OF CALCULATED RISKS FOR FUTURE USE SCENARIOS[1]
NEASE CHEMICAL SITE OU-3
SALEM, OHIO

Receptor	Media Analyzed	Contaminants Contributing Significant Risk	Exposure Pathways	Exposure Point Concentration (mg/kg)	Reasonable Maximum Exposure		Central Tendency	
					Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Future On-Facility Trespasser	On-Facility Surface Water	Mirex Photomirex	Ingestion	3.62E-01 1.51E-02	9.01E-10	6.65E-05	2.25E-10	1.66E-05
	On-Facility Surface Water	Mirex Photomirex	Dermal	3.62E-01 1.51E-02	3.92E-07	2.87E-02	6.28E-08	4.61E-03
	On-Facility Sediment	Mirex Photomirex	Ingestion	7.13E+00 1.95E-01	1.78E-08	1.31E-03	2.22E-09	1.64E-04
	On-Facility Sediment	Mirex Photomirex	Dermal	7.13E+00 1.95E-01	4.79E-08	3.54E-03	4.44E-09	3.27E-04
				Total:	4.59E-07	3.36E-02	6.97E-08	5.12E-03
Future On-Facility Industrial Worker	On-Facility Surface Water	Mirex Photomirex	Ingestion	3.62E-01 1.51E-02	1.01E-09	2.68E-05	2.12E-10	2.14E-05
	On-Facility Surface Water	Mirex Photomirex	Dermal	3.62E-01 1.51E-02	3.78E-08	9.99E-04	5.80E-09	5.81E-04
	On-Facility Surface Water	Mirex Photomirex	Inhalation	2.81E-08 1.25E-09	7.74E-12	2.08E-07	9.81E-13	9.98E-08
	On-Facility Sediment	Mirex Photomirex	Ingestion	7.13E+00 1.95E-01	3.30E-07	8.76E-03	4.36E-08	4.38E-03
	On-Facility Sediment	Mirex Photomirex	Dermal	7.13E+00 1.95E-01	4.36E-07	1.16E-02	8.37E-09	8.42E-04
				Total:	8.05E-07	2.13E-02	5.80E-08	5.82E-03
Future On-Facility Resident	On-Facility Surface Water	Mirex Photomirex	Ingestion	3.62E-01 1.51E-02	1.13E-08	2.50E-04	1.16E-09	8.56E-05
	On-Facility Surface Water	Mirex Photomirex	Dermal	3.62E-01 1.51E-02	1.22E-06	2.69E-02	5.81E-08	4.27E-03
	On-Facility Sediment	Mirex Photomirex	Ingestion	7.13E+00 1.95E-01	5.92E-07	4.58E-02	7.48E-08	7.85E-03
	On-Facility Sediment	Mirex Photomirex	Dermal	7.13E+00 1.95E-01	1.40E-07	3.09E-03	1.15E-08	8.48E-04
				Total:	1.96E-06	7.61E-02	1.46E-07	1.31E-02
Future Off-Facility Industrial Worker	Off-Facility Surface Water	Mirex	Ingestion	6.36E-02	1.77E-10	4.67E-06	3.73E-11	3.73E-06
	Off-Facility Surface Water	Mirex	Dermal	6.36E-02	6.64E-09	1.75E-04	1.02E-09	1.02E-04
	Off-Facility Surface Water	Mirex	Inhalation	4.94E-09	1.36E-12	3.63E-08	1.72E-13	1.74E-08
	Off-Facility Sediment	Mirex Photomirex	Ingestion	8.46E+00 2.91E-02	3.92E-07	1.03E-02	5.17E-08	5.17E-03
	Off-Facility Sediment	Mirex Photomirex	Dermal	8.46E+00 2.91E-02	5.17E-07	1.37E-02	9.92E-09	9.94E-04
				Total:	9.16E-07	2.42E-02	6.27E-08	6.27E-03

TABLE 3
SUMMARY OF CALCULATED RISKS FOR FUTURE USE SCENARIOS[1]
NEASE CHEMICAL SITE OU-3
SALEM, OHIO

Receptor	Media Analyzed	Contaminants Contributing Significant Risk	Exposure Pathways	Exposure Point Concentration (mg/kg)	Reasonable Maximum Exposure		Central Tendency	
					Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Future Off-Facility Resident	Off-Facility Game	Mirex Photomirex	Ingestion	3.53E-02 7.06E-04	3.13E-07	6.91E-03	1.13E-09	8.33E-05
	Off-Facility Beef	Mirex Photomirex	Ingestion	3.74E-01 7.49E-03	7.25E-05	1.61E+00	6.00E-06	4.41E-01
	Off-Facility Milk	Mirex Photomirex	Ingestion	1.57E-01 3.14E-03	3.11E-05	9.44E-01	2.60E-06	2.42E-01
	Off-Facility Fish	Mirex Photomirex	Ingestion	4.75E-01 1.11E-02	4.93E-05	2.04E+00	7.11E-06	6.48E-01
				Total:	1.53E-04	4.60E+00	1.57E-05	1.33E+00
Future MFLBC Recreational Visitor - Upstream	MFLBC - Upstream Soil	Mirex Photomirex	Ingestion	1.31E+00 2.84E-02	2.17E-07	1.68E-02	2.74E-08	2.87E-03
	MFLBC - Upstream Soil	Mirex Photomirex	Dermal	1.31E+00 2.84E-02	3.30E-08	7.29E-04	2.92E-09	2.16E-04
	MFLBC - Upstream Soil Dust	Mirex Photomirex	Inhalation	2.88E-10 6.28E-12	3.56E-12	7.93E-08	2.74E-13	2.04E-08
	MFLBC - Upstream Sediment	Mirex Photomirex	Ingestion	5.19E-01 7.38E-03	4.31E-08	3.33E-03	5.45E-09	5.70E-04
	MFLBC - Upstream Sediment	Mirex Photomirex	Dermal	5.19E-01 7.38E-03	1.02E-08	2.25E-04	8.38E-10	6.16E-05
	MFLBC - Upstream Fish	Mirex Photomirex	Ingestion	1.27E+00 1.73E-02	1.32E-04	5.44E+00	1.91E-05	1.74E+00
	MFLBC - Upstream Game	Mirex Photomirex	Ingestion	3.53E-02 7.06E-04	6.26E-08	1.38E-03	7.75E-11	5.71E-06
	MFLBC - Upstream Beef	Mirex Photomirex	Ingestion	3.74E-01 7.49E-03	1.45E-05	3.20E-01	4.11E-07	3.03E-02
	MFLBC - Upstream Milk	Mirex Photomirex	Ingestion	1.57E-01 3.14E-03	6.23E-06	1.89E-01	1.78E-07	1.66E-02
				Total:	1.53E-04	5.97E+00	1.97E-05	1.79E+00

TABLE 3
SUMMARY OF CALCULATED RISKS FOR FUTURE USE SCENARIOS[1]
NEASE CHEMICAL SITE OU-3
SALEM, OHIO

Receptor	Media Analyzed	Contaminants Contributing Significant Risk	Exposure Pathways	Exposure Point Concentration (mg/kg)	Reasonable Maximum Exposure		Central Tendency	
					Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Future MFLBC Resident - Upstream	MFLBC - Upstream Soil	Mirex Photomirex	Ingestion	1.31E+00 2.84E-02	1.08E-06	8.37E-02	3.99E-07	4.18E-02
	MFLBC - Upstream Soil	Mirex Photomirex	Dermal	1.31E+00 2.84E-02	1.65E-07	3.64E-03	4.26E-08	3.14E-03
	MFLBC - Upstream Soil Dust	Mirex Photomirex	Inhalation	2.88E-10 6.28E-12	1.78E-11	3.97E-07	4.00E-12	2.97E-07
	MFLBC - Upstream Sediment	Mirex Photomirex	Ingestion	5.19E-01 7.38E-03	4.31E-08	3.33E-03	5.45E-09	5.70E-04
	MFLBC - Upstream Sediment	Mirex Photomirex	Dermal	5.19E-01 7.38E-03	1.02E-08	2.25E-04	8.38E-10	6.16E-05
	MFLBC - Upstream Fish	Mirex Photomirex	Ingestion	1.27E+00 1.73E-02	1.32E-04	5.44E+00	1.91E-05	1.74E+00
	MFLBC - Upstream Game	Mirex Photomirex	Ingestion	3.53E-02 7.06E-04	3.13E-07	6.91E-03	1.13E-09	8.33E-05
	MFLBC - Upstream Beef	Mirex Photomirex	Ingestion	3.74E-01 7.49E-03	7.25E-05	1.61E+00	6.00E-06	4.41E-01
	MFLBC - Upstream Milk	Mirex Photomirex	Ingestion	1.57E-01 3.14E-03	3.11E-05	9.44E-01	2.60E-06	2.42E-01
	MFLBC - Upstream Aboveground Vegetables, Leafy	Mirex Photomirex	Ingestion	5.26E-03 1.36E-03	6.22E-08	1.43E-03	3.93E-09	3.00E-04
	MFLBC - Upstream Aboveground Vegetables, Non-Leafy	Mirex Photomirex	Ingestion	5.26E-03 1.36E-03	5.18E-08	1.19E-03	3.19E-09	2.44E-04
	MFLBC - Upstream Belowground Vegetables	Mirex Photomirex	Ingestion	9.76E-05 2.17E-05	3.43E-08	7.81E-04	2 00E-09	1.52E-04
				Total:	2.37E-04	8.09E+00	2.82E-05	2.47E+00

TABLE 3
SUMMARY OF CALCULATED RISKS FOR FUTURE USE SCENARIOS[1]
NEASE CHEMICAL SITE OU-3
SALEM, OHIO

Receptor	Media Analyzed	Contaminants Contributing Significant Risk	Exposure Pathways	Exposure Point Concentration (mg/kg)	Reasonable Maximum Exposure		Central Tendency	
					Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Future MFLBC Recreational Visitor - Downstream	MFLBC - Downstream Soil	Mirex Photomirex	Ingestion	1.31E+00 2.84E-02	2.17E-07	1.68E-02	2.74E-08	2 87E-03
	MFLBC - Downstream Soil	Mirex Photomirex	Dermal	1.31E+00 2.84E-02	3.30E-08	7.29E-04	2.92E-09	2.16E-04
	MFLBC - Downstream Soil Dust	Mirex Photomirex	Inhalation	2.88E-10 6.28E-12	3.56E-12	7.93E-08	2.74E-13	2.04E-08
	MFLBC - Downstream Sediment	Mirex	Ingestion	1.09E-02	9.04E-10	6.97E-05	1.14E-10	1.19E-05
	MFLBC - Downstream Sediment	Mirex	Dermal	1.09E-02	2.14E-10	4.70E-06	1.76E-11	1.29E-06
	MFLBC - Downstream Fish	Mirex Photomirex	Ingestion	4.47E-02 3.12E-03	4.63E-06	1.93E-01	6.71E-07	6.18E-02
	MFLBC - Downstream Game	Mirex Photomirex	Ingestion	3.53E-02 7.06E-04	6.26E-08	1.38E-03	7.75E-11	5.71E-06
	MFLBC - Downstream Beef	Mirex Photomirex	Ingestion	3.74E-01 7.49E-03	1.45E-05	3.20E-01	4.11E-07	3.03E-02
	MFLBC - Downstream Milk	Mirex Photomirex	Ingestion	1.57E-01 3.14E-03	6.23E-06	1.89E-01	1.78E-07	1.66E-02
				Total:	2.57E-05	7.21E-01	1.29E-06	1.12E-01

TABLE 3
SUMMARY OF CALCULATED RISKS FOR FUTURE USE SCENARIOS[1]
NEASE CHEMICAL SITE OU-3
SALEM, OHIO

Receptor	Media Analyzed	Contaminants Contributing Significant Risk	Exposure Pathways	Exposure Point Concentration (mg/kg)	Reasonable Maximum Exposure		Central Tendency	
					Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Future MFLBC Resident - Downstream	MFLBC - Downstream Soil	Mirex Photomirex	Ingestion	1.31E+00 2.84E-02	1.08E-06	8.37E-02	3.99E-07	4.18E-02
	MFLBC - Downstream Soil	Mirex Photomirex	Dermal	1.31E+00 2.84E-02	1.65E-07	3.64E-03	4.26E-08	3.14E-03
	MFLBC - Downstream Soil Dust	Mirex Photomirex	Inhalation	2.88E-10 6.28E-12	1.78E-11	3.97E-07	4.00E-12	2.97E-07
	MFLBC - Downstream Sediment	Mirex	Ingestion	1.09E-02	9.04E-10	6.97E-05	1.14E-10	1.19E-05
	MFLBC - Downstream Sediment	Mirex	Dermal	1.09E-02	2.14E-10	4.70E-06	1.76E-11	1.29E-06
	MFLBC - Downstream Fish	Mirex Photomirex	Ingestion	4.47E-02 3.12E-03	4.63E-06	1.93E-01	6.68E-07	6.15E-02
	MFLBC - Downstream Game	Mirex Photomirex	Ingestion	3.53E-02 7.06E-04	3.13E-07	6.91E-03	1.13E-09	8.33E-05
	MFLBC - Downstream Beef	Mirex Photomirex	Ingestion	3.74E-01 7.49E-03	7.25E-05	1.61E+00	6.00E-06	4.41E-01
	MFLBC - Downstream Milk	Mirex Photomirex	Ingestion	1.57E-01 3.14E-03	3.11E-05	9.44E-01	2.60E-06	2.42E-01
	MFLBC - Downstream Aboveground Vegetables, Leafy	Mirex Photomirex	Ingestion	5.26E-03 1.36E-03	6.22E-08	1.43E-03	3.93E-09	3.00E-04
	MFLBC - Downstream Aboveground Vegetables, Non-Leafy	Mirex Photomirex	Ingestion	5.26E-03 1.36E-03	5.18E-08	1.19E-03	3.19E-09	2.44E-04
	MFLBC - Downstream Belowground Vegetables	Mirex Photomirex	Ingestion	9.76E-05 2.17E-05	3.43E-08	7.81E-04	2.00E-09	1.52E-04
				Total:	1.10E-04	2.84E+00	9.72E-06	7.90E-01

1. Current use scenarios resulted in calculated risks within USEPA's acceptable risk criteria

Checked by BMC on 6/4/08

TABLE 5: Ecological Risk Assessment – Retained Chemicals

Chemical	Surface Water	Fish Tissue	Sediment	Floodplain Soil
Evaluated in the Exposure and Risk Characterization Portions of the Risk Assessment				
Anthracene			X	
Benzo(a)anthracene				X
Benzo(a)pyrene			X	X
Benzo(b)flouranthene				X
Benzo(k)flouranthene			X	X
Benzo(g,h,i)perylene			X	
Dibenzo(a,h)anthracene			X	
Flouranthene			X	
Indeno(1,2,3-cd)pyrene				X
Iron			X	
Kepone				X
4-Methylphenol			X	
Mirex		X	X	X
Phenanthrene			X	
Photomirex		X	X	X
Phenol			X	
Chemicals Addressed in the Uncertainty Section of the Risk Assessment				
Aroclor-1254		X		
Arsenic			X	
Aroclor-1260		X		
Benzo(b)flouranthene			X	
Benzoic acid		X		
Calcium			X	
Carbazole				X
Carbon disulfide		X		X
Dibenzofuran				X
Di-n-octylphthlate				X
Diphenyl sulfone	X		X	
Endrin		X	X	
Magnesium			X	
N-nitrosodiphenylamine		X		
Potassium			X	
Sodium			X	

Table 8
Potential Action and Location Specific ARARs
OU-3 Feasibility Study
Nease Site, Salem Ohio

Potential ARAR or TBC	ARAR	TBC	Retained Alternatives		
			Alternative A	Alternative B	Alternative C
State Action-Specific ARARs					
Ohio EPA Air Pollution Control					
ORC 3704.05 (A-I): Prohibitions Prohibits emission of an air contaminant in violation of ORC 3704 or any rules, permit, order or variance issued pursuant to that section of the ORC. Should be considered for virtually all sites.	x			x	x
OAC 3745-15-07 (A): Air Pollution Nuisances Prohibited Pertains to any site which causes, or may reasonably cause, air pollution nuisances. Consider for sites that will undergo excavation, demolition, cap installation, methane production, clearing and grubbing, water treatment, incineration.	x			x	x
OAC 3745-25-03: Emissions Control Action Programs Requires preparation for air pollution alerts, warnings and emergencies. Pertains to any site which is emitting or may emit air contaminants.	x			x	x
Ohio EPA Division of Surface Water					
OAC 3745-1 Water Quality Standards Pertains to discharges to surface water as a result of remediation and any on-site surface waters affected by site conditions.	x			x	x
OAC 3734-32-05: Water Quality Criteria (for Decision by the Director) Specifies substantive criteria for Section 401 Water Quality criteria for dredging, filling, obstructing or altering waters of the state.		x		x	X

Potential ARAR or TBC	ARAR	TBC	Retained Alternatives		
			Alternative A	Alternative B	Alternative C
Federal Action-Specific ARARs					
Federal requirements for National Pollution Discharge Elimination System (NPDES) discharges to surface water	x			x	x
Federal Location-Specific ARARs					
Federal Clean Water Act Section 404 Sets forth standards for discharge and actions in waters of the US including wetlands.	x			x	x
Fish and Wildlife Coordination Act (16 USC 661-666c) Requires Agency consultation for activities affecting waters of the US including wetlands that are subject to the provisions of the Federal CWA.	x			x	x
State Location-Specific ARARs					
OAC 3745-1-15 Water Use Designation for the Little Beaver Creek Drainage Basin Establishes surface water quality criteria and aquatic habitiat criteria that may be affected by remedial activities.	x			x	x
State and Federal Location-Specific ARARs					
Executive Orders on Floodplain Management and Wetlands Protection (CERCLA Floodplain and Wetlands Assessments-EO 11988 and 11990) Requires federal agencies to assess potential effects of remediation on surrounding wetlands and in the floodplain.		x		x	X
OAC 1501-15-1: Erosion and Sediment Control Establishes state standards to achieve a level of management and conservation practices which will control wind or water erosion of the soil and minimize the degradation of water resources by soil sediment in conjunction with land grading, excavating, filling, or other soil-disturbing activities on land used or being developed for non-farm commercial, industrial, residential, or other non-farm purposes, and establish criteria for determination of the acceptability of such management and conservation practices.	x			x	X

TABLE 10
COST ESTIMATE SUMMARY - ALTERNATIVE C (ALT. C)
NEASE CHEMICAL SITE OU-3
SALEM, OHIO

ACTIVITY	Initial Cost	PW of O&M
Alternative C		
Common Elements	$320,000	$0
RAO 1 & RAO 2 - MFLBC Sediment	$1,443,257	$248,250
RAO 3 & RAO 4 - MFLBC Floodplain Soil	$591,289	$0
RAO 5 - Feeder Creek	$145,066	$6,456
Subtotal	**$2,500,000**	**$260,000**
INITIAL COST TOTAL		**$2,500,000**
ENGINEERING DESIGN/CQA (15%)		**$380,000**
TOTAL PW OF O&M COST		**$260,000**
SUBTOTAL		**$3,140,000**
CONTINGENCY (20%)		**$630,000**
TOTAL NET PRESENT WORTH COST		**$3,770,000**

Notes:
Assume common earth can be used as backfill.
Based upon fuel prices of $3.96/gal for regular unleaded gas and $4.73/gal for diesel.
Geosynthetic prices have doubled in the last 12 months and cannot be reliably predicted.
These estimates are based on conceptual designs and will be subject to change based upon actual detailed engineering design and competitive bidding of construction services.

Table 11
Cost Estimate Details for Alternative C (Alt. C)
Nease Chemical Site OU-3
Salem, Ohio

Common Elements				
Activity	**Unit Costs**	**Units**	**Quantity**	**Estimated Cost**
Pre-Design Investigation/Baseline Sampling	$300,000	Lump Sum	1	$300,000
Secure Access Agreements (Legal)	$20,000	Lump Sum	1	$20,000
COMMON ELEMENTS TOTAL PRESENT WORTH				**$320,000**
Remedial Action Components to Address - RAO-1 & RAO-2 (MFLBC Sediment)				
Activity	**Unit Costs**	**Units**	**Quantity**	**Estimated Cost**
Initial Cost - Sediment Dredging				
Mobilization/Demobilization	$18,500	Station	20	$370,000
Liability Insurance, Payment and Performance Bonds (5% of Excavation Costs)	$50,422	Lump Sum	1	$50,422
Install and remove temporary sheet pile or coffer dam (or similar)	$30	sf	10,800	$324,000
Mechanical Excavation	$50	cy	4,300	$215,000
Processing/Handling/Dewatering	$35	cy	4,300	$150,500
Transportation to Staging Area	$8	cy	17,200	$137,600
Perimeter resuspension monitoring (real-time turbidity monitoring)	$400	day	40	$16,000
Backfilling (topsoil/loam + granular material, including hauling backfill to site)	$38.45	cy	4,300	$165,335
Confirmation sampling	$360	Sample	40	$14,400
RAO-1 TOTAL INITIAL COST				**$1,443,257**
Operation & Maintenance (O&M) (Sampling every 5 years)				
Fish Tissue Sample Analytical (including QA/QC)	$600	Sample	39	$23,400
Fish Tissue Sample Collection	$33,500	Lump Sum	1	$33,500
Data validation, analysis, and reporting	$20,000	Lump Sum	1	$20,000
RAO-1 & RAO-2 TOTAL ANNUAL O&M COST				**$15,380**
Long-term monitoring	30	Years		
Discount Rate	5	%		
RAO-1 & RAO-2 PRESENT WORTH OF ANNUAL O&M COST				**$248,250**
RAO-1 & RAO-2 TOTAL PRESENT WORTH				**$1,691,506**

Table 11
Cost Estimate Details for Alternative C (Alt. C)
Nease Chemical Site OU-3
Salem, Ohio

Remedial Action Components to Address - RAO-3 & RAO-4 (MFLBC Floodplain Soil)				
Activity	**Unit Costs**	**Units**	**Quantity**	**Estimated Cost**
Initial Cost - Floodplain Soil Removal				
Mobilization / Demobilization (10% of Excavation Costs)	$45,502	Lump Sum	1	$45,502
Surveying and Field Engineering (6% of Excavation Costs)	$27,301	Lump Sum	1	$27,301
Liability Insurance, Payment and Performance Bonds (5% of Excavation Costs)	$22,751	Lump Sum	1	$22,751
On-Site E&S Controls (4% of Excavation Costs)	$18,201	Lump Sum	1	$18,201
Health and Safety (4% of Excavation Costs)	$18,201	Lump Sum	1	$18,201
Clearing (ground preparation)	$0.20	sf	287,000	$57,400
16 oz/sy Non-woven geotextile	$0.17	sf	287,000	$48,790
Excavation and loading of soil	$7.80	cy	5,300	$41,340
Backfill (common earth)	$12.85	loose cy	6,360	$81,726
Haul backfill to site (from within 10 miles)	$16.10	loose cy	6,360	$102,396
Compact backfill	$2.21	cy	5,300	$11,713
Confirmation Sampling	$360	sample	12	$4,320
Revegetate	$2,500	acre	6.5	$16,250
Haul Soil to Nease Manufacturing Facility for Consolidation	$18	cy	5,300	$95,400
RAO-3 & RAO-4 TOTAL INITIAL COST				**$591,289**
RAO-3 & RAO-4 TOTAL PRESENT WORTH				**$591,289**

Table 11
Cost Estimate Details for Alternative C (Alt. C)
Nease Chemical Site OU-3
Salem, Ohio

Remedial Action Components to Address - RAO-5 (Feeder Creek)				
Activity	**Unit Costs**	**Units**	**Quantity**	**Estimated Cost**
Initial Cost - In-Situ Treatment				
Liability Insurance, Payment and Performance Bonds (5% of Excavation Costs)	$6,753	Lump Sum	1	$6,753
Redirect stream	$1,025	day	15	$15,375
Excavate stream sediments	$7.80	cy	2,600	$20,280
Transport sediment to Nease Manufacturing Facility for Consolidation	$3.45	lcy	3,380	$11,661
Channel lining - Rip-Rap and Geotextile	$22.50	sy	3,900	$87,750
Contractor Surveying and E&S Controls	$10,000	Lump Sum	1	$10,000
RAO-5 TOTAL INITIAL COST				**$145,066**
Annual Operation & Maintenance (O&M)				
Site Inspection and Maintenance	$2,000	Lump Sum	1	$2,000
RAO-5 TOTAL ANNUAL O&M COST				**$2,000**
Site Inspection and Maintenance	30	Years		$32,282
Discount Rate	5	%		
RAO-5 PRESENT WORTH OF ANNUAL O&M COST				**$6,456**
RAO-5 TOTAL PRESENT WORTH				**$151,522**

ESTIMATED TOTAL PRESENT WORTH FOR THIS ALTERNATIVE	**$2,760,000**

Notes: Assume common earth can be used as backfill.
Based upon fuel prices of $3.96/gal for regular unleaded gas and $4.73/gal for diesel.
Geosynthetic prices have doubled in the last 12 months and cannot be reliably predicted.
These estimates are based on conceptual designs and will be subject to change based upon actual detailed engineering design and competitive bidding of construction services.

FIGURES

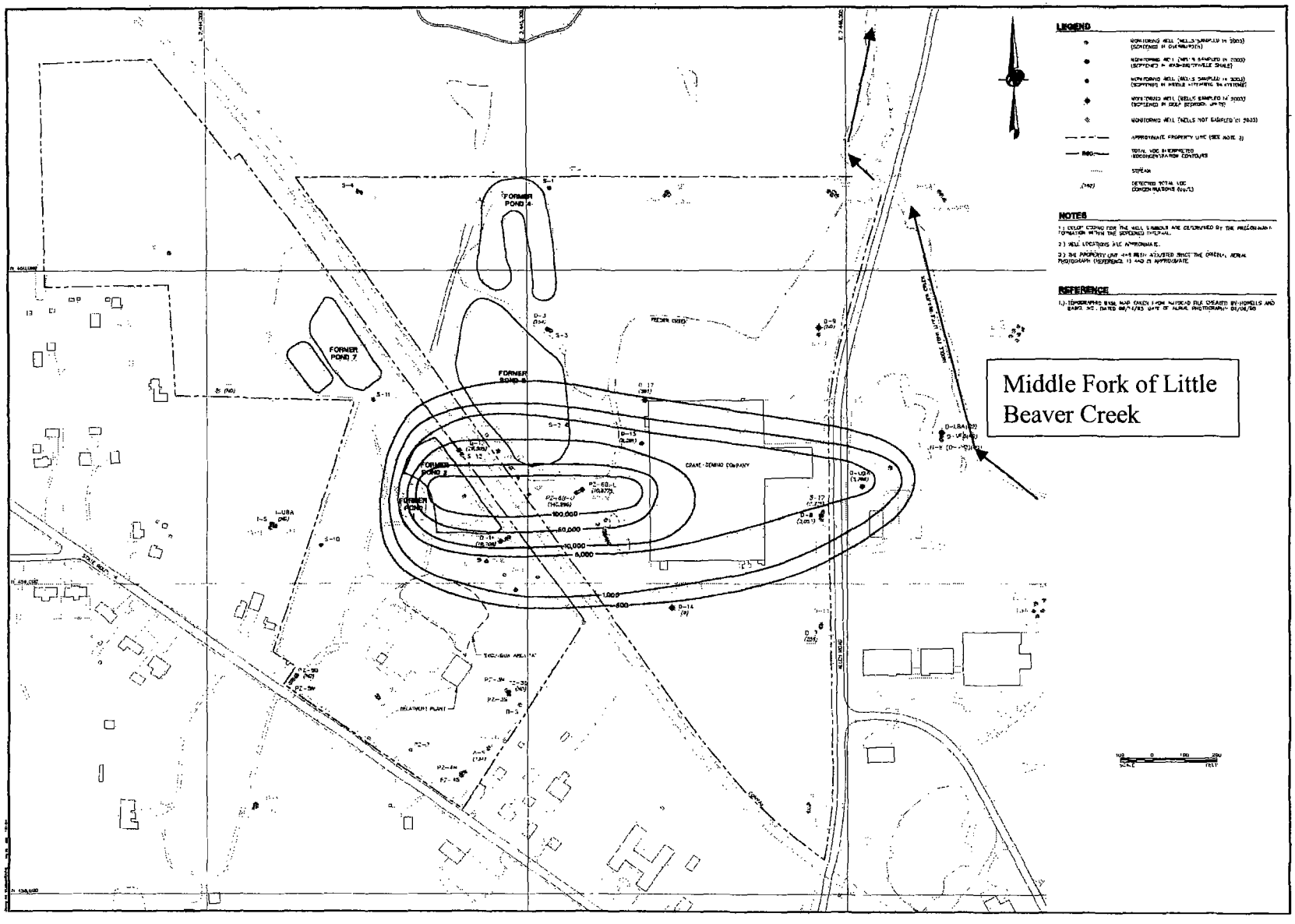
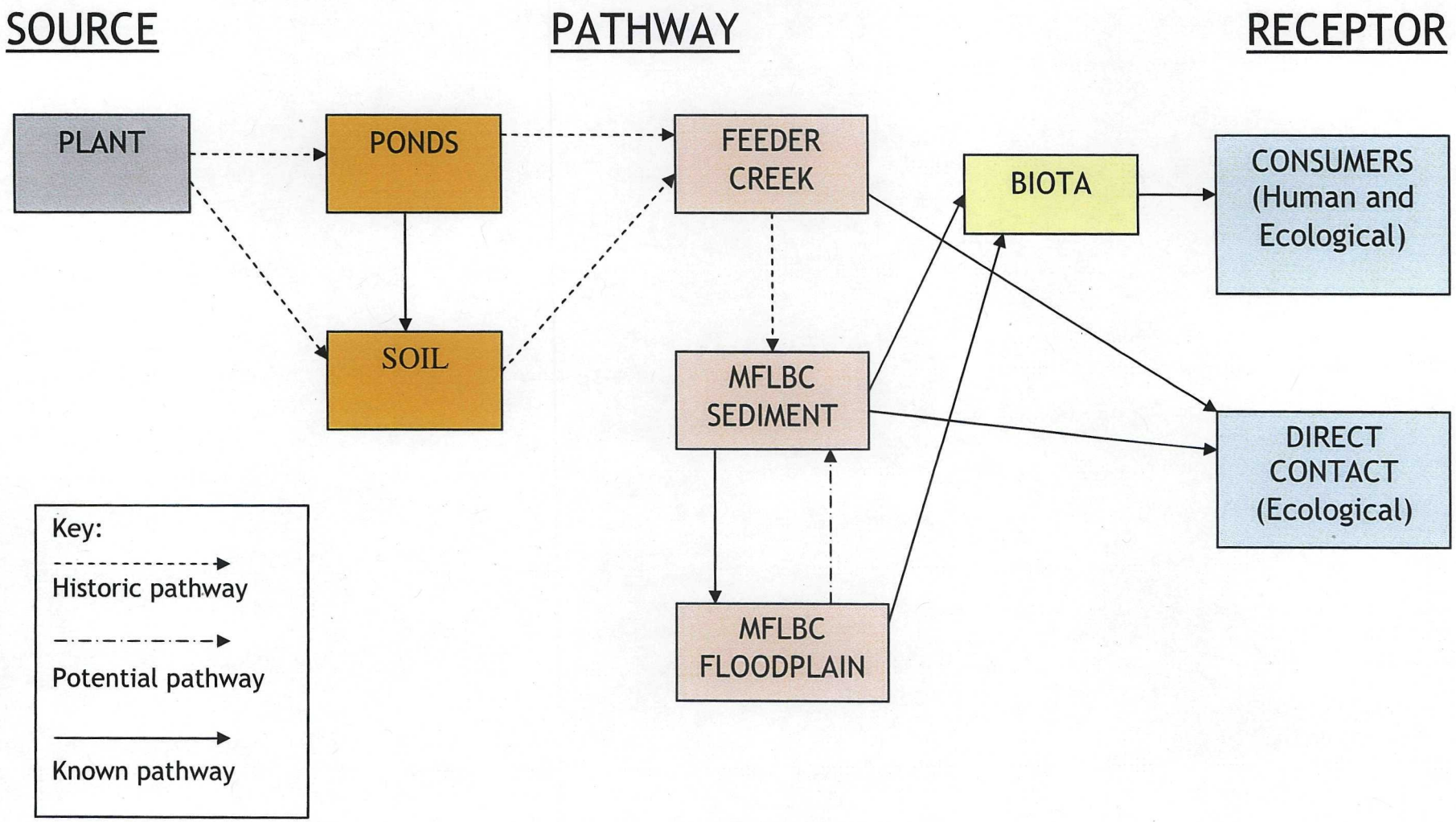


Figure 3 Bedrock Groundwater Contamination

Figure 4: Conceptual Site Model for Operable Unit 3



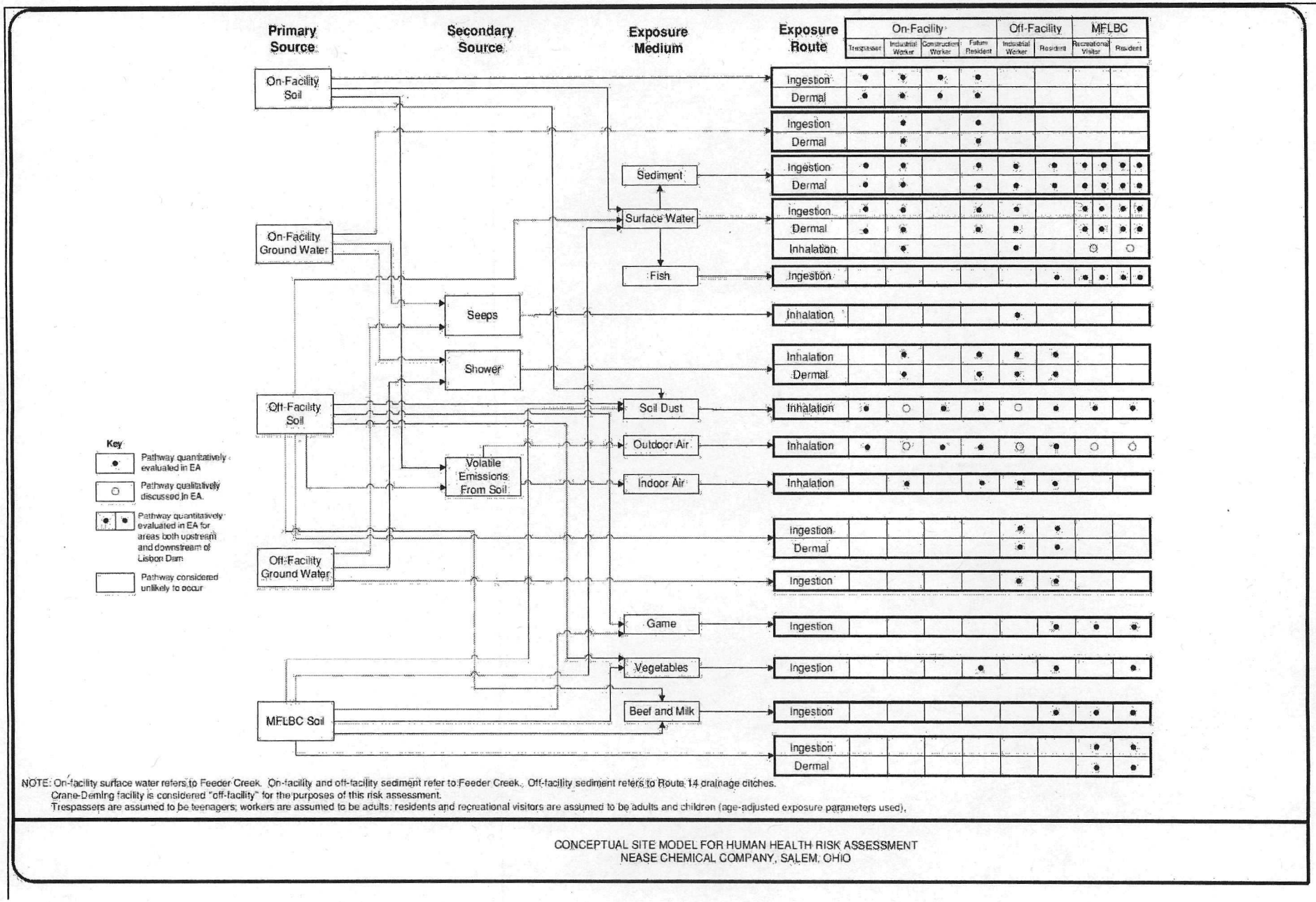
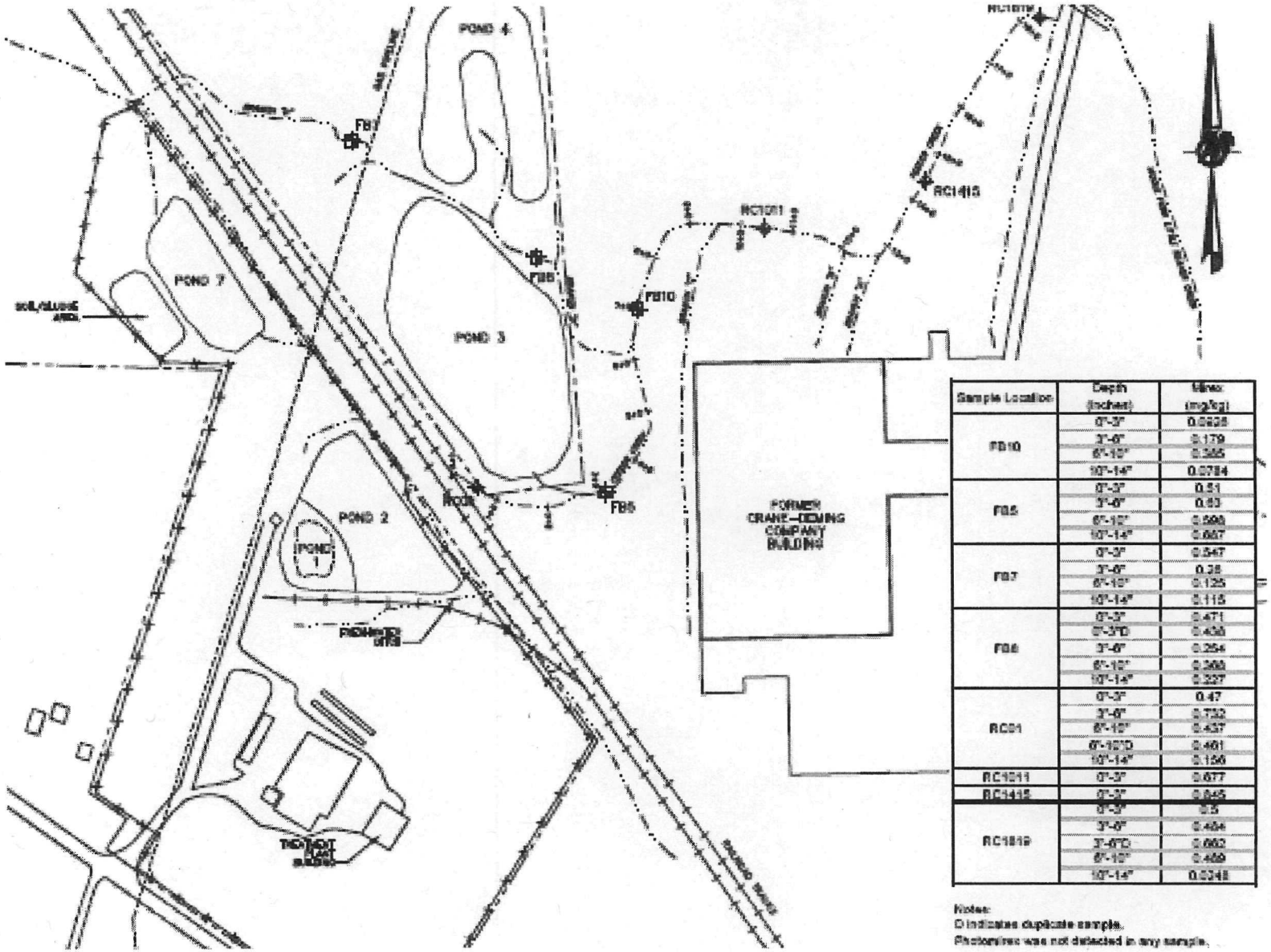


Figure 5: Conceptual Site Model for Human Health Risk Assessment, Nease Chemical Company, Salem, Ohio



Sample Location	Depth (inches)	Mirex (mg/kg)
FB10	0"-3"	0.0928
	3"-6"	0.179
	6"-10"	0.365
	10"-14"	0.0784
FB5	0"-3"	0.51
	3"-6"	0.63
	6"-10"	0.595
	10"-14"	0.667
FB7	0"-3"	0.547
	3"-6"	0.38
	6"-10"	0.125
	10"-14"	0.115
FB8	0"-3"	0.471
	0"-3"D	0.438
	3"-6"	0.254
	6"-10"	0.368
	10"-14"	0.237
RC01	0"-3"	0.47
	3"-6"	0.732
	6"-10"	0.437
	6"-10"D	0.461
	10"-14"	0.156
RC1011	0"-3"	0.677
RC1415	0"-3"	0.645
RC1819	0"-3"	0.5
	3"-6"	0.484
	3"-6"D	0.662
	6"-10"	0.469
	10"-14"	0.0348

Notes:
D indicates duplicate sample.
Photomirex was not detected in any sample.

Figure 6: Feeder Creek

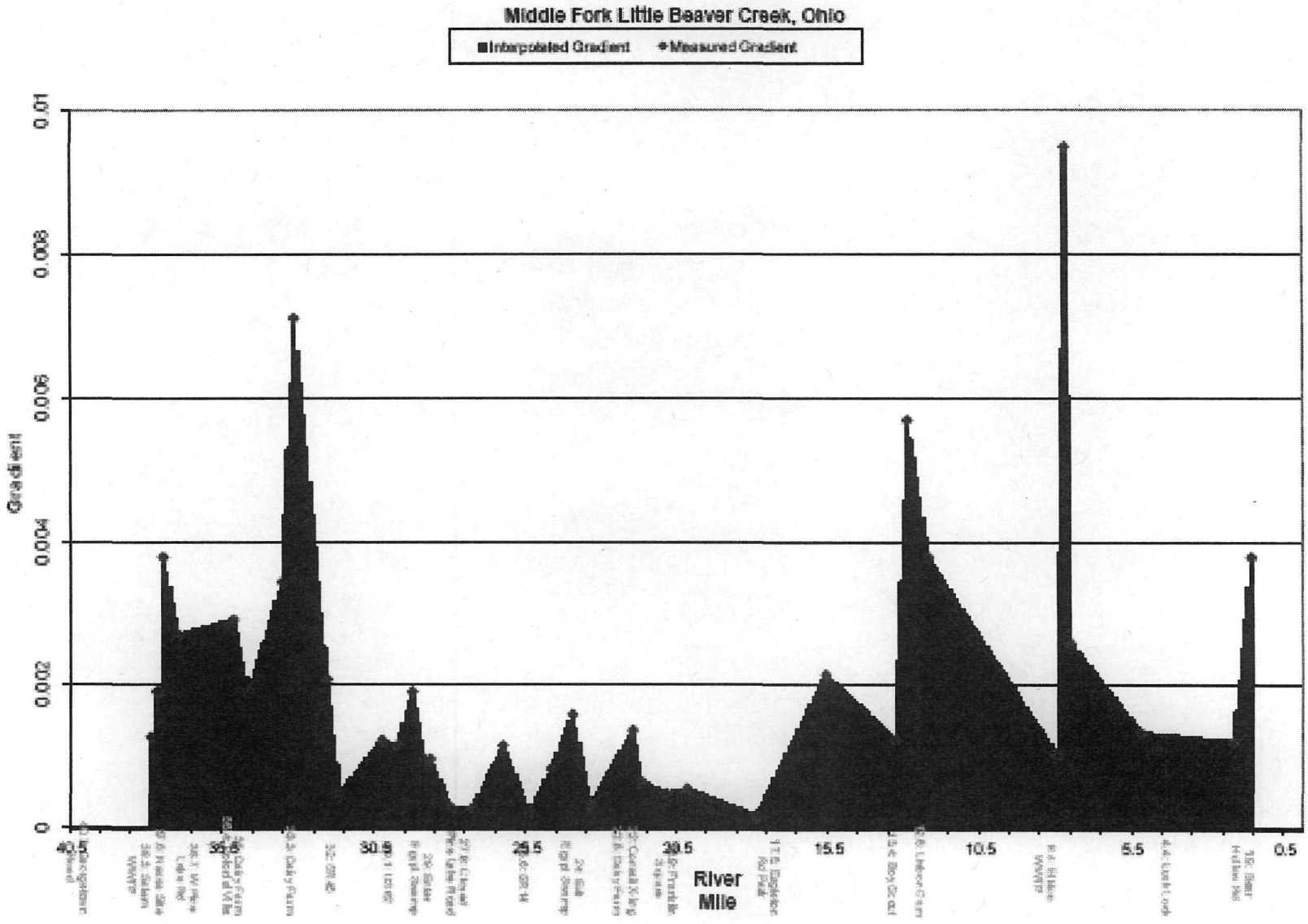


Figure 7: MFLBC Stream Gradients by River Mile

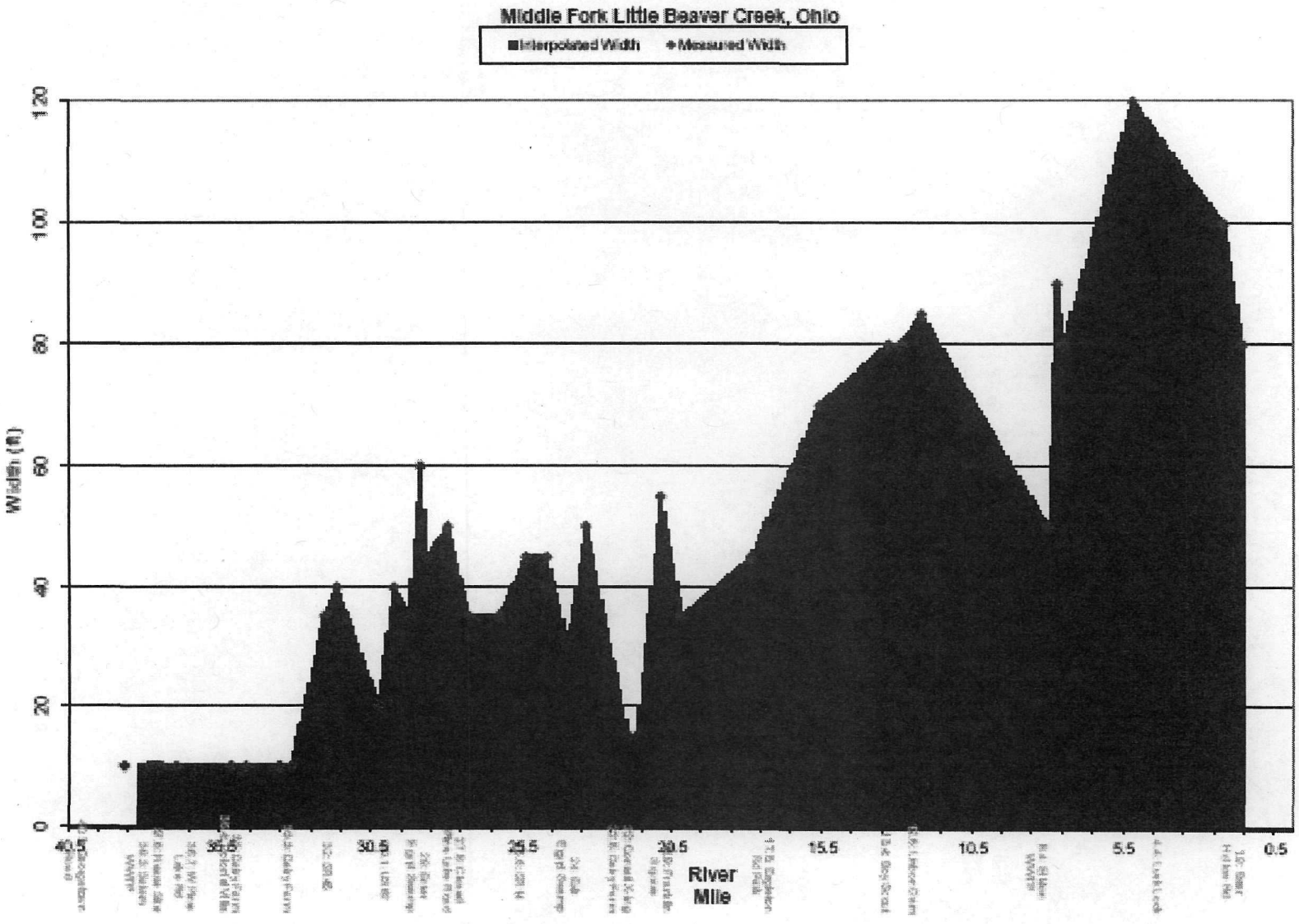


Figure 8: MFLBC Stream Widths by River Mile

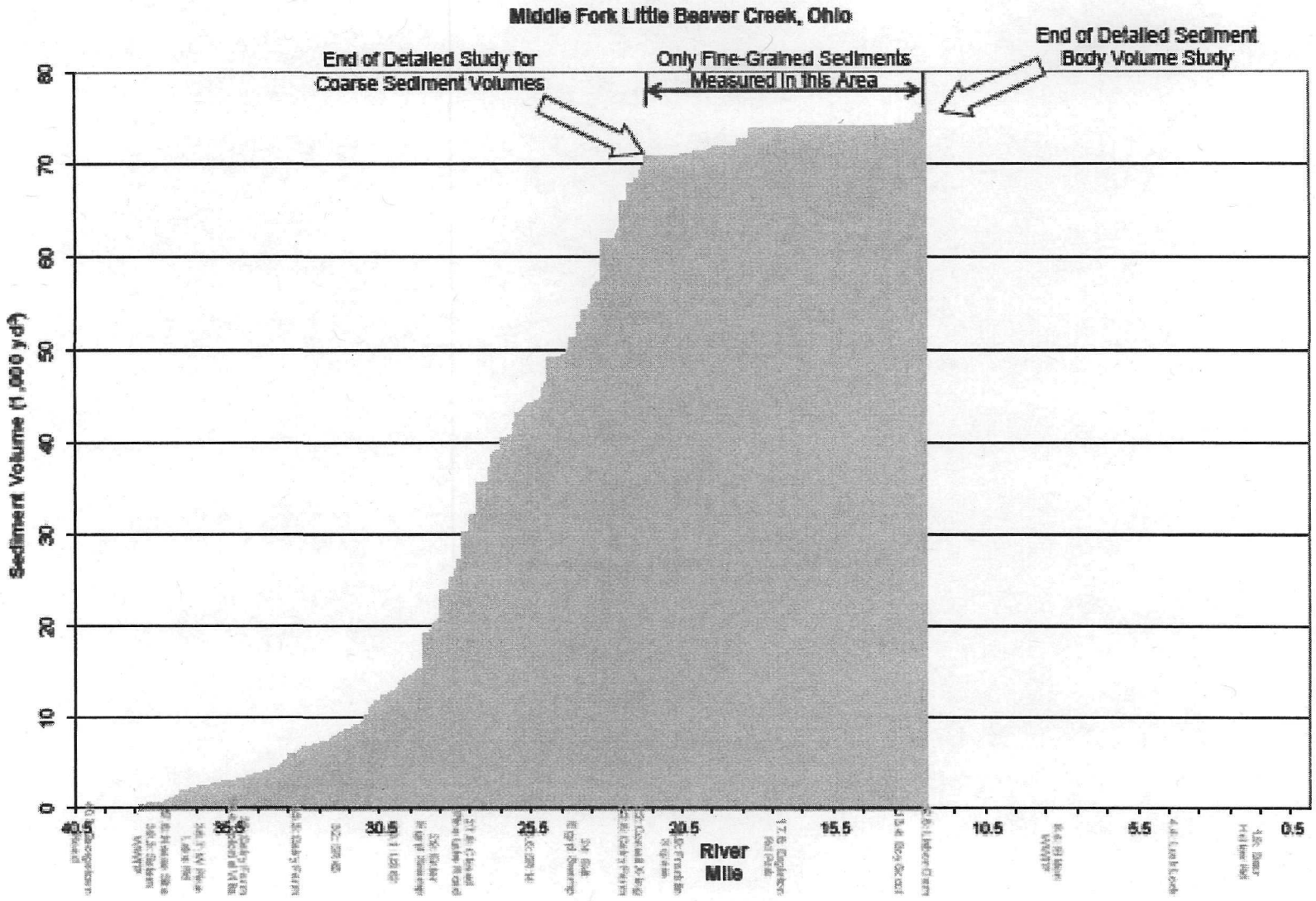


Figure 9: MFLBC Cumulative Sediment Volume by River Mile

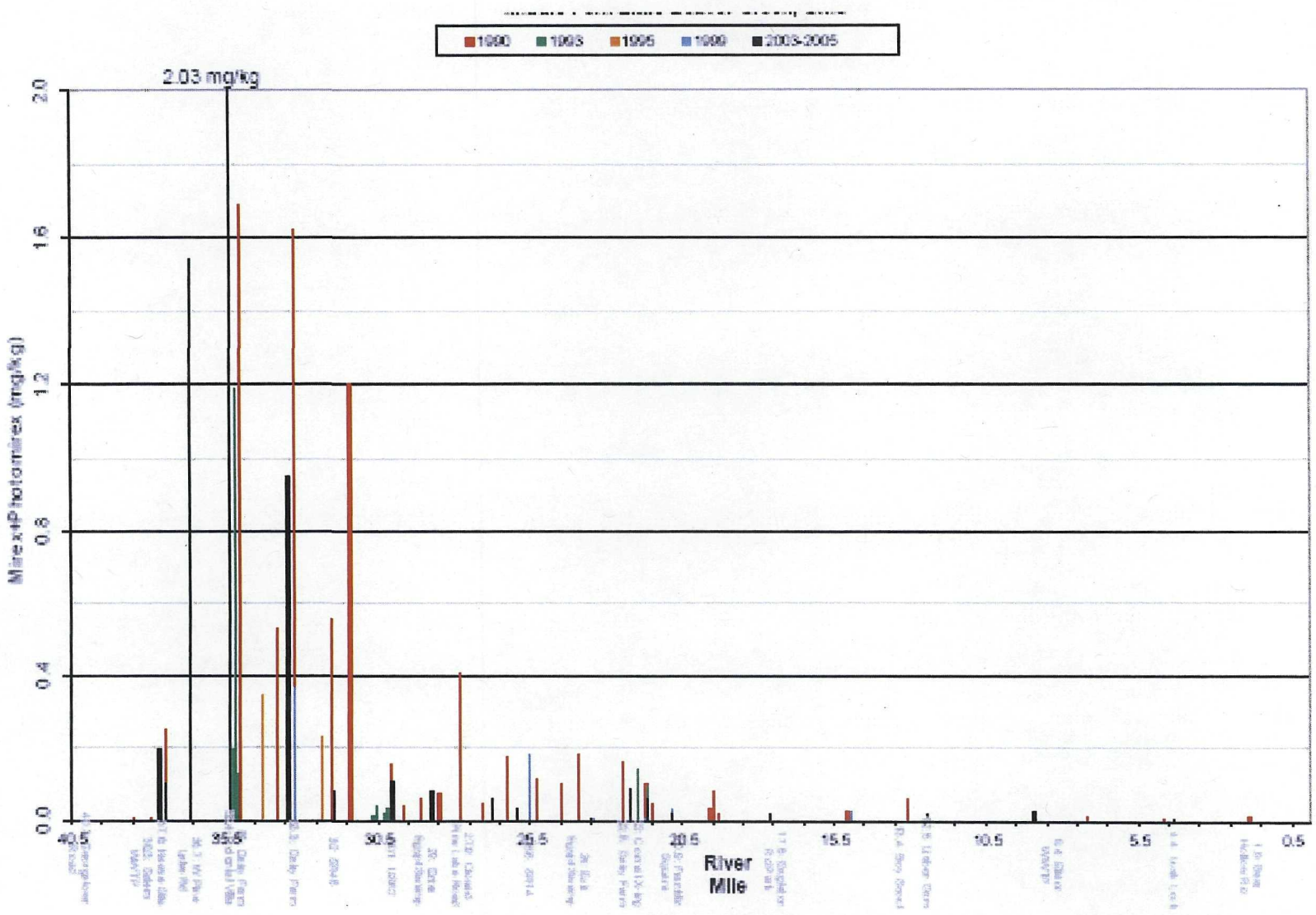


Figure 10: MFLBC Sediment Mirex Results by River Mile

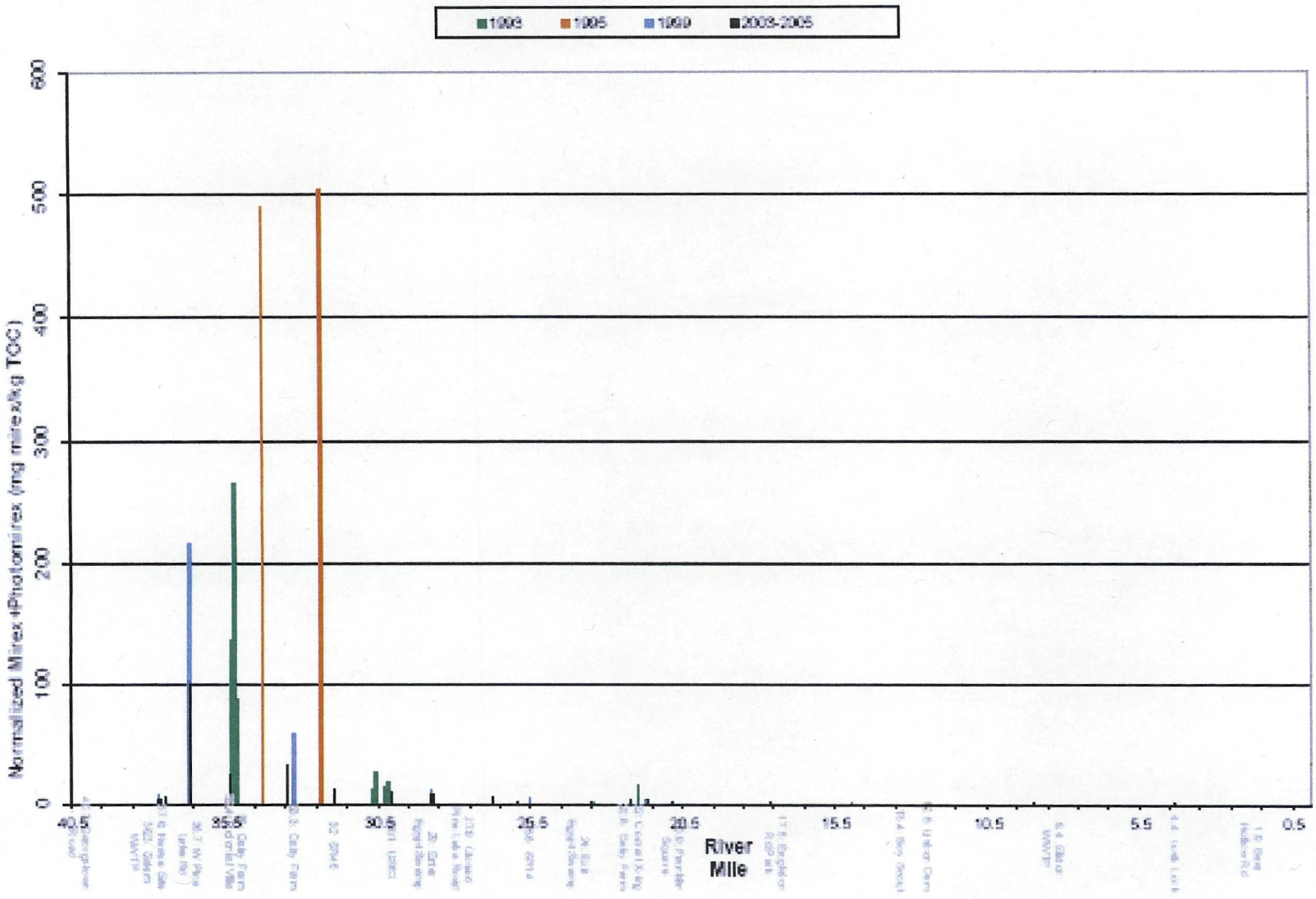


Figure 11: MFLBC Sediment Mirex Results Normalized for Total Organic Carbon by River Mile

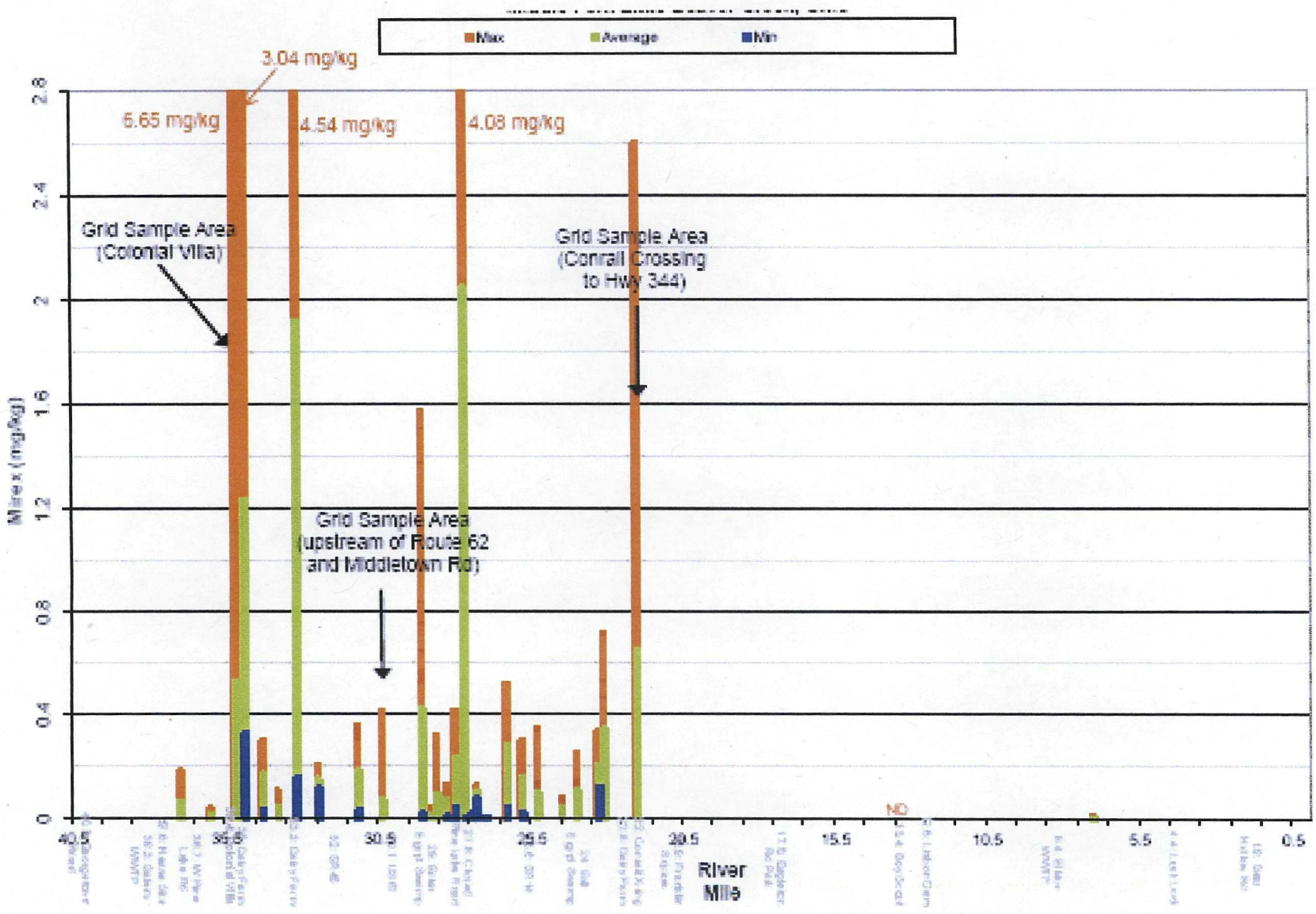


Figure 12: MFLBC Floodplain Soil Mirex Results through 2005 by River Mile

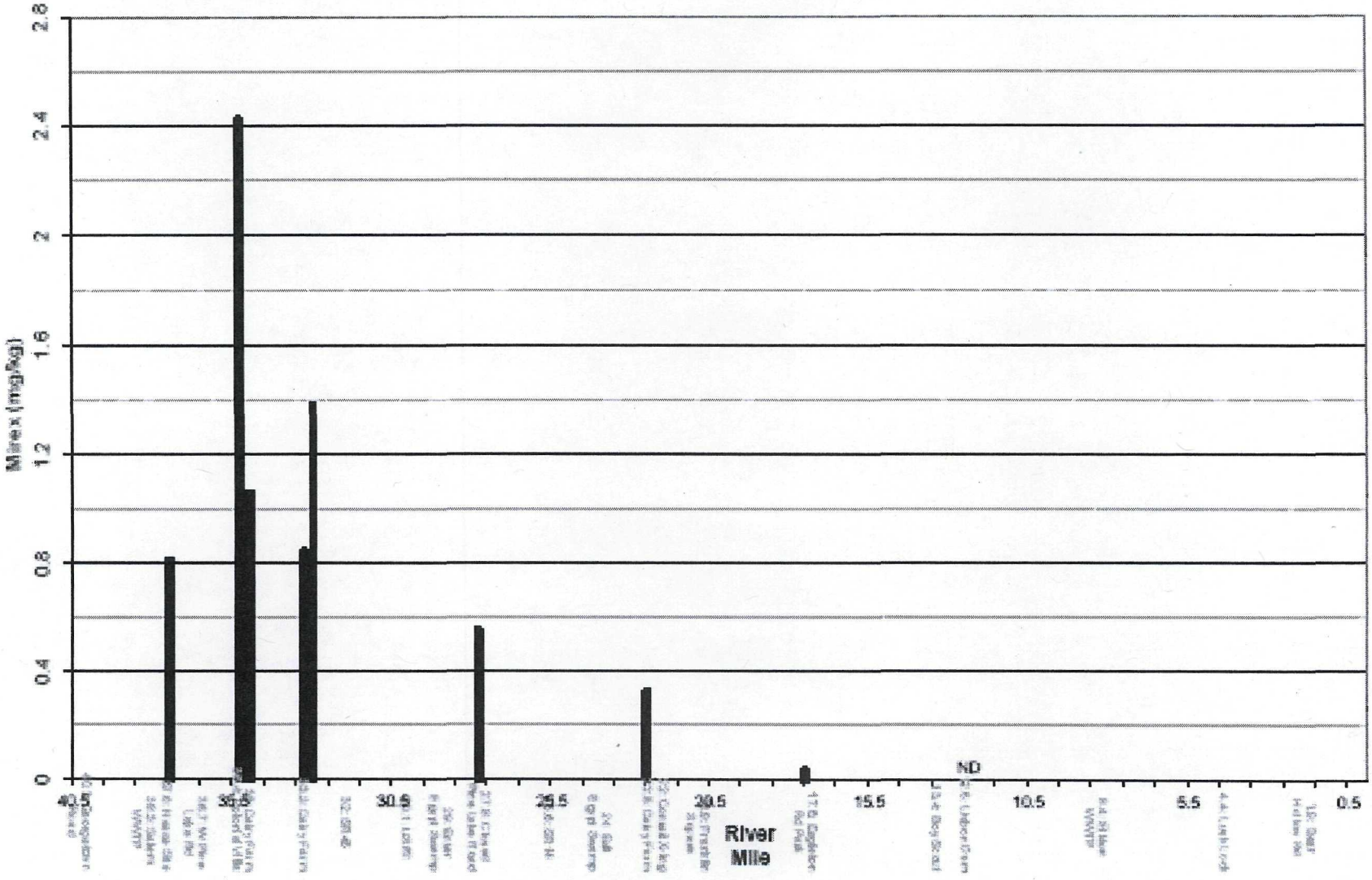


Figure 13: MFLBC Floodplain Soil Results in 2006 by River Mile

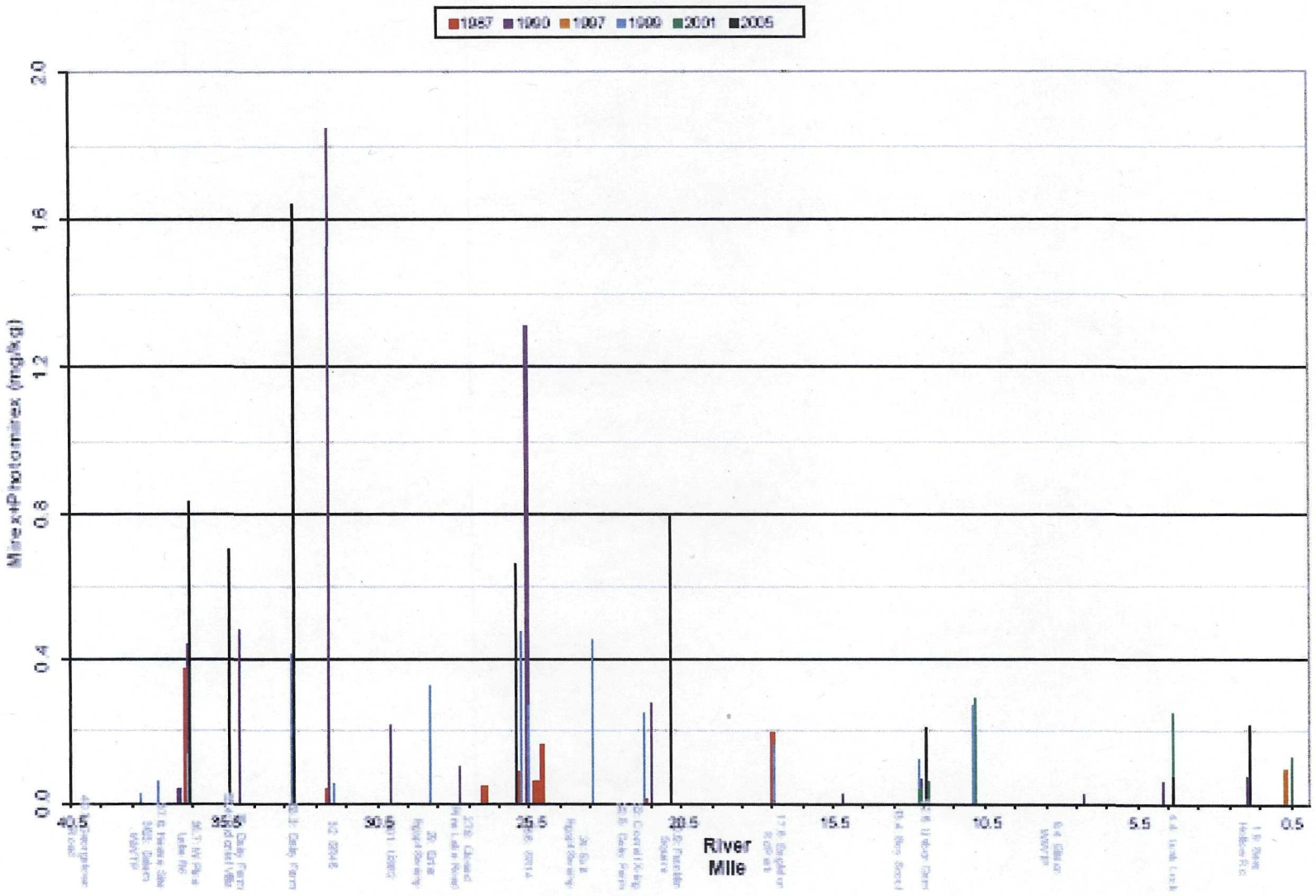


Figure 14: MFLBC Fish Fillet Mirex Results by River Mile

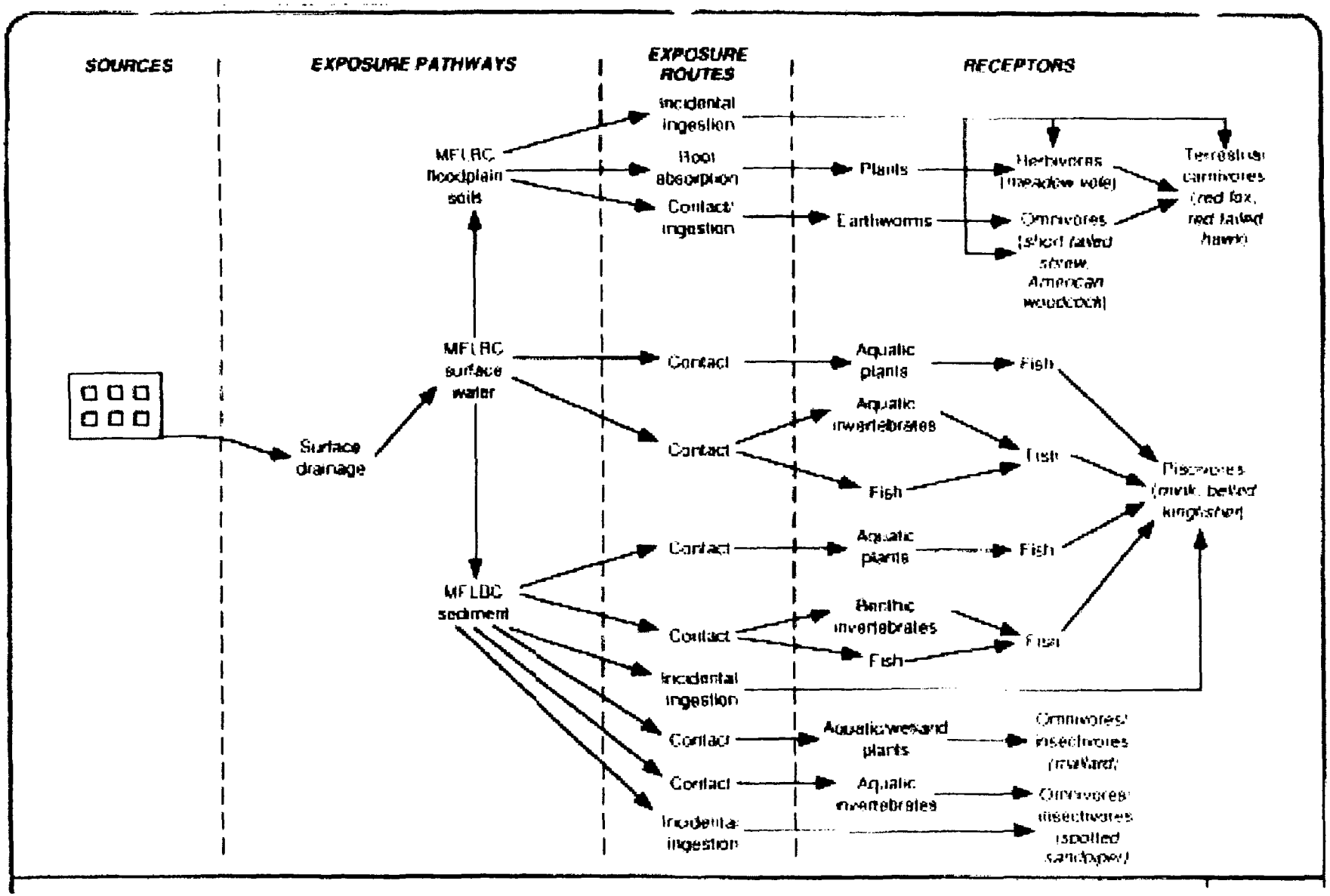


Figure 15: Conceptual Site Model for the MFLBC Ecological Risk Assessment

APPENDIX A

Responsiveness Summary

APPENDIX A – RESPONSIVENESS SUMMARY

Nease Chemical Site, Operable Unit Three

This Responsiveness Summary provides both a summary of the public comments U.S. EPA received regarding the Proposed Plan for Operable Unit 3 (OU 3) of the Nease Chemical Site and U.S. EPA's responses to those comments. The Proposed Plan was released to the public on July 9, 2008, and the public comment period ran from July 14, through August 13, 2008. Ohio EPA provided support and input on the Proposed Plan. U.S. EPA held a public meeting regarding the Proposed Plan on July 31, 2008, at the Salem Public Library in Salem, Ohio. Ohio EPA participated in the public meeting, assisted in responding to questions, and provided support at the meeting.

U.S. EPA received written comments (via regular and electronic mail) and verbal comments (at the public meeting) during the public comment period. In total, U.S. EPA received comments from approximately 12 different people. Copies of all the comments received (including the verbal comments reflected in the transcript of the public meeting) are included in the Administrative Record for the Site.

U.S. EPA also received email comments dated August 12, 2008, submitted on behalf of Rutgers Organics Corporation (ROC), the Site owner. ROC acquired the assets of Nease Chemical Company in 1977, including the non-operational Salem facility. Since 1982, ROC has conducted the work at the Site, with Ohio EPA and U.S. EPA oversight. ROC and its consultant, Golder Associates, attended the public meeting and assisted in responding to technical questions, as well as questions about ROC's future responsibilities. A summary of ROC's comments and U.S. EPA's responses is included below.

This Responsiveness Summary does not repeat verbatim each individual comment. Rather, the comments are summarized and grouped by the type of issue raised. The comments fell within several different categories: remedy options; health concerns; cleanup goals; timeliness of the clean up; floodplain property owner concerns; remedy implementation; oversight of the current work; and miscellaneous comments. U.S. EPA carefully considered all comments prior to selection of the final remedy for OU 3 documented in this Record of Decision (ROD). The remainder of this Responsiveness Summary contains a summary of the comments U.S. EPA received and U.S. EPA's responses to those comments, grouped by category.

I. COMMENTS ON REMEDY OPTIONS

A. Support For The Proposed Remedy

1. Most commenters generally supported cleanup of OU 3 and were pleased that the problem is being addressed. However, the commenters varied in the degree to which they supported U.S. EPA's proposed alternative:

a. ROC expressed support for the proposed remedy for the Site (Alternative C: removal of Feeder Creek sediment; targeted removal of floodplain soils from along the Middle Fork of Little Beaver Creek (MFLBC); and targeted removal of MFLBC sediment). ROC's comment in the August 12, 2008, email states "ROC is supportive of EPA's proposed plan and while, as EPA has noted, there are no current risks to people living near or playing in Middle Fork Little Beaver Creek, ROC believes that EPA's plan is appropriate to provide long-term protection of human health and the environment."

b. Several other commenters expressed support for the proposed cleanup of Feeder Creek and the MFLBC, but they opposed the proposal to consolidate the material with OU 2 soils at the plant site, as discussed in comment 2 below.

c. Two other commenters expressed support for the proposed remedy for the Site (Alternative C), stating that they believed that the reduction in risk outweigh the costs.

U.S. EPA acknowledges these comments.

B. Comments on On-Site Consolidation

2. Eight of the twelve commenters objected to the proposal to bring the excavated sediment and floodplain soil back to the former Nease facility, where it would be consolidated with the contaminated soils in OU 2 and capped. Many of these commenters are people who own homes near the Nease facility. There were a number of concerns raised:

a. Health effects – Several commenters were concerned that the placement of mirex contaminated sediments and soil back on the facility could cause adverse health effects for the people living near the Site. There were particular concerns for children.

The health effects and health studies related to mirex and the Site are discussed more fully in response to comment 6, below and in the ROD. The levels of mirex found in OU 3 soil and sediment do not pose an unacceptable risk from direct contact, and would not pose an unacceptable risk from direct contact at any other location. The contaminated soil and sediment from OU 3 will be brought back to the facility and placed with other contaminated soil. All contaminated soil will be covered with an engineered barrier cover, including clean soil at the surface. The cover will prevent any accidental contact with OU 3 materials consolidated on-site. Without exposure, there will be no risks from the materials.

b. Several commenters felt that this approach would create problem in the future because the contamination would leach to groundwater or runoff to adjacent properties.

U.S. EPA's does not believe that the on-site management of mirex contaminated soil and sediment will create future problems from leaching or runoff. After evaluating the nine criteria, including long-term effectiveness, U.S. EPA selected a remedy for OU 2 which requires on-site management of mirex contaminated soil. The OU 2 remedy requires an engineered barrier cover (including clean soil at the surface) over mirex contaminated areas; inspection, operation and

maintenance of the cover; five-year reviews to ensure that the remedy remains protective; and institutional controls that will prevent breaching of the cover. The remedy also requires management of surface water to prevent erosion and runoff.

After hearing concerns at the public meeting, ROC's engineering consultant submitted comments stating:

> "The engineering design of modern isolation covers is such that concern that contaminated soils will wash off the site in the future is not warranted. Covers of the type envisioned under OU-2 have been in use for decades at modern landfills and their performance is well documented. EPA will also require regular inspection and maintenance of the covers into the future to ensure proper performance." and
>
> "Mirex is effectively insoluble in water and so concerns for leaching are unfounded. Previous monitoring in the floodplain has shown no evidence of leaching. Given that the soils have not leached in their current location, and they will not be mixed with other contaminated materials, they will not leach at the Nease site in the future. Furthermore, the isolation cover at the Nease site will be of a low permeability design over much of the area so as to limit infiltration of rainwater that could (theoretically) cause leaching. Finally, groundwater at the Nease site is to be cleaned up (for contaminants other than mirex) and will be monitored in the future to ensure that leaching is not occurring."

The OU 3 materials will be consolidated with the soil at the facility already to be addressed by the OU 2 remedy, and covered. Based on the requirements of the OU 2 selected remedy and the nature of mirex, U.S. EPA believes that there is no threat of unacceptable leaching or runoff of the consolidated OU 3 soil and sediment.

> *c. Two commenter were concerned because they felt that this approach would allow the Nease Site to become a dump for waste from other areas. They worried that more toxic materials would be brought in and disposed at the Site.*

The Superfund law provides for remedial decisions that allow for on-site disposal. However, in order to take waste materials from off-site, the facility would require a permit to operate as a disposal facility. There is no intention of operating the Nease Site as a disposal facility, and waste will not be brought from off-site. The contaminated soils and sediments in Feeder Creek and the MFLBC are considered part of the Nease Site.

> *d. Several commenters were concerned because they felt that their property values would be lowered.*

U.S. EPA has no information on property values in the area surrounding the Site. There are a number of factors that affect property values that are unrelated to the Superfund Site, including the current economy and the local housing market. However, U.S. EPA believes that the actions taken to date and that will be taken in the future to clean up the Nease Site should have a positive effect on property values.

e. One commenter felt that the extra soil and sediment would result in a "mountain of waste" at the Site.

U.S. EPA's selected alternative is estimated to involve the removal of approximately 12,200 cubic yards of soil and sediment from the Middle Fork Little Beaver Creek and its floodplain. This volume will not substantially change the topography of the Nease facility. After hearing concerns at the public meeting, ROC's engineering consultant submitted a comment stating:

> "The former pond areas at the site are currently low basins, which must, in any case, be filled in order to facilitate the management of surface water at the site. The OU-3 materials will assist in this regard and can be placed at the site without creating any visible mound of soil, less still a "mountain." Even if the low areas did not require filling, the estimated quantity of OU-3 soils is such that were they spread out over the area that is to be covered under OU-2 they would only amount to a thickness of about 6-inches."

U.S. EPA believes that the additional soil and sediment volume from OU 3 that will be consolidated at the Site can be managed in a safe an unobtrusive manner.

f. One commenter was concerned that the mirex-containing waste on Site could be a Homeland Security threat. She felt that access to the Site was not secure and that mirex is a very dangerous chemical.

The mirex that is found at the Nease Site is dispersed at low levels through the contaminated sediment and soils. It is not found as a pure product or in formulations that contain high levels. The health effects and health studies related to mirex and the Site are discussed more fully in response to comment 6, below and in the ROD. The levels of mirex found in OU 3 soil and sediment do not pose an unacceptable human health risk from direct contact. In the unlikely event that security was breached and someone was to remove the contaminated soil, it would not pose an unacceptable risk from direct contact at any other location. Additionally, mirex at the levels found at the Nease Site is not explosive, flammable, or reactive, so would not be a threat.

g. One commenter felt that all of the contaminated soils and material from the Site, as well as the materials from OU 3 should be removed from the Site.

U.S. EPA issued a Proposed Plan for OU 2 of the Nease Chemical Site and took comments on the proposal before selecting the final remedy for OU 2 on September 29, 2005. The Proposed Plan was released to the public on May 23, 2005, and the public comment period ran from June 1, through July 8, 2005. U.S. EPA held a public meeting regarding the Proposed Plan for OU 2 on June 22, 2005, at the Salem Public Library in Salem, Ohio. The proposed and selected remedy for OU 2 called for leaving mirex contaminated soil in place at the Site, covered by an engineered barrier (among other remedial responses). No comments objecting to this aspect of the OU 2 remedy were received during the public comment period for OU 2. No new

information has been presented that indicates that the remedy will not be protective. Therefore, U.S. EPA will not consider removing all contaminated soils and material from the Site.

3. Two other commenters expressed support for the proposal to consolidate materials on-site, and explicitly stated that they felt on-site consolidation and long-term management was the best option to protect the waste for the long-term.

U.S. EPA acknowledges these comments.

4. As noted in comment 2 above, ROC's consultant, Golder Associates submitted comments to try to address concerns expressed at the public meeting regarding on-site consolidation and management of OU3 waste. The comments expanded on some information in the FS and supported that on-site management of the materials can be conducted safely and effectively.

U.S. EPA acknowledges these comments.

C. Other Preferred Options

5. Three commenters expressed a preference for other remedial alternatives.

a. Two people preferred Alternative B because they felt that monitored natural recovery (MNR) of the MFLBC sediments would be preferable to dredging or removal of the sediments. One commenter felt that nature would take care of the problem. The other sent extensive analysis:

> *"In my opinion, the dredging should not be done. The certainty of stream habitat destruction on a short term basis far outweighs the risk of leaving the stream to recover by natural processes. There does not seem to be much risk now to people from contamination within the stream. This seems due to the long time since initial spread of contamination, to natural sedimentation processes, and to the fact that sediments have not been actively leaving the site since early work there. USEPA and OEPA have stated that there is not at this point any risk to people from stream contact, and any risk of exposure to mirex from consuming fish is already surpassed by the state-wide hazard due to mercury contamination. Further, the consumption ban from mirex is now restricted to carp from a rather small area of the stream. These rather unpalatable fish do not seem to me to be worth the certain disruption of habitat from dredging. The issue of risk from resuspension of contaminated sediments during dredging should also be considered. In addition, dredging will result under the best of circumstances in several years of recovery for the stream system, further increasing the risk of sediment movement and habitat loss. Even if that sediment is not contaminated with mirex, the sediment itself has a serious potential for stream degradation downstream."*

The commenter who sent the extensive analysis has grappled with many of the same concerns that U.S. EPA and Ohio EPA considered in identifying the preferred alternative. Monitored Natural Recovery was included in Alternative B to address sediments in the MFLBC for many of the reasons discussed by the commenter. Both U.S. EPA and Ohio EPA recognize the importance of the MFLBC habitat, and both agencies are concerned with short-term effects that will result from sediment removal. This is why the approach to removal in the selected alternative, Alternative C is "targeted removal." The targeted approach is intended to meet the cleanup goal, while minimizing destruction of valuable habitat. In choosing between MNR and targeted removal, the agencies were concerned with mirex's high resistance to degradation and persistence in nature. The selected alternative will meet the cleanup goals most quickly and reliably. Also, removal of the most highly contaminated materials provides greater long-term effectiveness and permanence.

In regard to specific concerns about resuspension and further sediment erosion from the destabilized area, U.S. EPA believes that these issues can be addressed by considering the concerns during design of the remedy and careful construction practices. The removal may be conducted "in the dry" – after water has been excluded from a stream segment to prevent resuspension. Alternatively, triggers can be established for dredging that require work practice changes based on performance measures. Once the target sediments are removed, additional erosion can be prevented by armoring or other construction practices, if needed.

b. One commenter preferred Alternative A, No Further Action, because he felt that there were no risks from the Site warranting cleanup and that the problem had solved itself.

As summarized in Section 7 of the Decision Summary of this ROD, an assessment was conducted to evaluate actual and potential risks to human health and the environment from contaminants at the Site. The risk assessment followed U.S. EPA guidance in evaluating Site conditions. Based on the findings of the risk assessment, a response action at OU 3 of the Nease Chemical Site is warranted because there are potential ecological risks and potential future human health risks. Alternative A, No Further Action, would not be protective, and therefore cannot be selected. The response action selected in this ROD is necessary to protect the public health or welfare or the environment from the actual or threatened releases of hazardous substances into the environment.

II. HEALTH CONCERNS

6. A few people made comments related to potential health issues and the risks associated with the contamination at the Site. Concerns included the toxic effects of mirex (including cancer) and its ability to build up in exposed populations.

A human health risk assessment was conducted for the Site, and is extensively documented in the *Endangerment Assessment for the Nease Chemical Company Salem, Ohio Site* (EA), completed in 2004. This risk assessment evaluated the potential risks that could result to people from exposure to the contaminants at the Site under current use scenarios and potential future use scenarios, assuming that no cleanup takes place. The risk assessment uses protective

assumptions in evaluating potential risks. The risk assessment considered the toxic effects of mirex in evaluating the cancer and non-cancer risks to potentially exposed individuals, and U.S. EPA conducted a toxicity reassessment as part of the study.

The results of the human health risk assessment are discussed in Section 7 of this ROD. In summary, none of the current use scenario exposure pathways (for either OU 2 or OU 3) resulted in potential risks exceeding U.S. EPA's acceptable risk range. For OU 3, the highest estimated risks are associated with potential future consumption of fish containing mirex and beef and/or milk from animals assumed to have access to the MFLBC. U.S. EPA has determined that the human health risk assessment has documented a basis for a response action at OU 3 of the Nease Site. However, the human health basis for action is due to potential future exposures, not current exposures.

Three previous public health assessments have been conducted at the Nease Site: a 1990 assessment conducted by the Ohio Department of Health (ODH); a 1996 assessment conducted by ODH in cooperation with the federal Agency for Toxic Substances and Disease Registry (ATSDR); and a 1997 assessment issued by ATSDR. These assessments are discussed in the EA and summarized in Section 2 of this ROD. The assessments probed into potential exposure and deliberately tried to target people most likely to have been exposed to mirex. Very few individuals had detectable mirex in their blood (despite the biased approach to sampling the most likely persons exposed). In the 1996 assessment, ODH recommended that further health studies of the general population were not needed, based on examination of potential exposure pathways and actual measured levels of mirex in blood. The 1997 assessment concluded that "contamination of MFLBC (associated with the Nease Chemical site) represents a public health hazard, because of past exposure and the possibility of future exposures." The results of the risk assessment are consistent with ATSDR's conclusion regarding potential future exposure (the baseline human health risk assessment looked at current and potential future risks, but not past exposures).

III. CLEANUP GOALS

7. ROC commented on the remediation goals:

> *"The current status of the Middle Fork Little Beaver Creek (MFLBC) as a high quality natural resource (a point emphasized by the Ohio Department of Natural Resources at the public meeting) has an important bearing on how the cleanup plan proposed by EPA should be implemented. Studies by Ohio EPA and ODNR show that MFLBC is a very high quality stream that supports a healthy aquatic community, and the natural condition of the floodplain riparian area is an important part of this system. The preliminary remediation goals for sediment and soil established in the Feasibility Study have been expressed as ranges, and their application will require appropriate balancing of the extent of soil/sediment removal to reduce mirex levels against the unavoidable damage to the ecosystem that will result from removal. A clean-up based on the conservative end of the PRG ranges will inevitably cause more damage to the ecology (at least in the short term) with no attendant benefit in terms of long-term risk reduction. As discussed in the*

Feasibility Study, ROC believes, based on multiple lines of evidence, that a mirex PRG of 1.0 mg/kg is an appropriate goal for floodplain soil, consistent with the PRG established by EPA for OU-2 soils. Similarly, ROC believes that a mirex PRG of 0.75 mg/kg is appropriate for sediment. In both cases, attainment of these goals should be based on area-weighted average values (over at least one acre and one river mile for soil and sediment, respectively) and remedy implementation should minimize collateral damage to terrestrial and aquatic habitats."

Both U.S. EPA and Ohio EPA agree that the MFLBC is high quality stream that supports a healthy aquatic community, and the natural condition of the floodplain riparian area is an important part of this system. Because of this, Alternatives B and C in the FS and the selected remedy in this ROD (Alternative C) use a "targeted removal" approach, intended to meet the remediation goals, while minimizing destruction of valuable habitat. The findings of a pre-design investigation (PDI) will be used for both MFLBC sediments and floodplain soils to further refine the areas requiring removal. The remedial design will consider the quality of habitat and the PDI data in establishing the specific areas to be removed.

In regard to the remediation goal for MFLBC floodplain soils, this ROD selects 1.0 mg/kg of mirex as the remediation goal for floodplain soils based on the desired risk reduction endpoints, using multiple lines of evidence, and considering uncertainties. This level will assure no material adverse ecological effect on the identified receptor populations and will ensure that cattle exposed to floodplain soil will not accumulate mirex at unacceptable levels. This level is also consistent with the remediation goal for soil in OU 2, which was selected to be protective of ecological receptors and potential human exposures. As discussed in this ROD, it is intended that the remediation goal is assessed as an average of surface soil values over the exposure unit, likely to be one acre.

In regard to the remediation goal for MFLBC sediment, ROC has recommended 0.75 mg/kg of mirex based on preliminary remediation goals (PRGs) established in the FS. In this ROD, U.S. EPA selects a sediment remediation goal of 0.5 mg/kg of mirex, based on the desired risk reduction endpoints, using multiple lines of evidence, and considering uncertainties. However, because portions of the MFLBC are high quality habitat, in certain cases, based on the PDI data and habitat quality, the remediation goal may be modified in remedial design to be as high as 0.75 mg/kg for those stretches. The remediation goal will prevent additional mirex contamination of the floodplain from MFLBC sediment and, over time will assure no material adverse effects from fish consumption due to mirex uptake. U.S. EPA recognizes that ROC's recommendation is within the range of protective PRGs. However, an important objective for Ohio EPA is that the remediation should clean up mirex-contaminated sediment such that the surface water resource can, at the end of the post-construction recovery period, achieve "fishable" goals. In addition to the FS, U.S. EPA considered information submitted by Ohio EPA in an email with attachments, dated September 8, 2008, in selecting the sediment remediation goal for OU 3. This document is in the Administrative Record. Analysis done by Ohio EPA indicated that a lower remediation goal within the PRG range was likely to achieve this objective more quickly. As discussed in this ROD, it is intended that the remediation goal is assessed by using a surface weighted average concentration, likely over a one mile reach.

IV. TIMELINESS OF THE CLEAN UP

8. Two people commented that the Site should have been cleaned up years ago, since the problem has been acknowledged for decades.

U.S. EPA acknowledges that studies at the Nease Chemical Site have taken longer than at many other Superfund Sites. In hindsight, there may have been opportunities to improve the schedule, however, there were circumstances at the Nease Site that added substantial time to the studies, including: the complexity of the Site; uniqueness of some of the key chemicals of concern (mirex, photomirex and kepone); and the need for a toxicity reassessment for those chemicals. Because mirex is the main contaminant of concern in OU 3, it was imperative to work through these issues. At this point, U.S. EPA believes that these issues are resolved, and that the Site will progress rapidly towards completion of cleanup.

Additionally, because contamination on the old Nease facility was the source of mirex to the MFLBC, work on the source had to precede work on the creeks and floodplains to avoid potential recontamination. The cleanup actions in the selected remedy for OU 2 will constitute source control actions for OU 3. As discussed in U.S. EPA's Directive 9285.6-08: Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites (February 12, 2002), it is important to control sources early. While some of the interim response actions have controlled Site runoff and mitigated releases to the MFLBC, those actions were not a permanent solution to control the source.

V. FLOODPLAIN PROPERTY OWNER CONCERNS

9. Two commenters own or manage property where the floodplain will require cleanup and had concerns specific to their property.

> *a. Dairy Farmer – One of the farmers whose property will need floodplain cleanup sent in several comments specific to their property. They requested to be contacted in person at their property during planning to walk the creek and floodplain and point out areas of concern. Additionally, they currently exclude their cattle from the floodplain with fencing, but might like to use the area for grazing in the future. They asked what would happen if mirex shows up in their milk after cleanup and expressed concerns with the ODH's response to any mirex in the milk from their farm.*

In regard to the request to be contacted in person, this will be done during the planning for the PDI, as well as at other times as needed to keep the property owner informed of plans and progress.

In regard to the questions and concerns about potentially using the floodplain for cattle grazing in the future and the consequences if mirex were to be detected in milk after the cleanup is complete, this is somewhat complicated. The approach to cleanup under the Superfund law is to reduce risks to levels that are considered "acceptable." As discussed in Section 8.1.1 of this

ROD, the remediation goal for floodplain soils is based on risk ranges to protect both ecological receptors and human consumers of beef and/or milk from cattle exposed to mirex while grazing. The remediation goal has not been set to ensure that there will never be any detection of mirex in beef or milk, but to ensure that uptake of mirex into grazing cattle, if it occurs, will be at levels that are protective under the Superfund law. The remediation goal is based on conservative assumptions, and uses a weight-of-evidence approach. However, as discussed in Appendix J of the Feasibility Study, there are very few studies of mirex uptake to cattle and there are uncertainties with the studies. Additionally, the Food and Drug Administration (FDA) used to have an action level of 0.1 mg/kg of mirex in beef and milk fat. There is no longer an FDA action level for mirex in beef and milk fat. The remediation goal for floodplain soil is expected to result in levels in beef and milk below the former action level. It is not clear what ODH's response would be if mirex were detected at very low levels in the milk of cattle grazing in the MFLBC floodplains in the future. U.S. EPA and Ohio EPA will work with the property owner during and after completion of the remedy to discuss the post-construction options for land use in the floodplains.

> *b. Colonial Villa – A manager from Colonial Villa, an estate of mobile homes with 300 – 400 residents, sent in comments specific to the Colonial Villa property. He stated that they had removed a playground and swimming pool because of concerns with mirex in the floodplain, and would like to have the area available again for recreational purposes. He supported the proposed cleanup plan.*

The floodplain soils adjacent to the Colonial Villa estate will be cleaned up as part of the remedy selected in this ROD. The floodplain soil cleanup goal will allow for unrestricted use and unlimited access. Upon completion of the cleanup, the area can be used for recreation and any other purposes that are allowed in floodplains. As a clarifying note, the floodplains near Colonial Villa have relatively high mirex levels compared to other areas in the MFLBC. The playground and pool were removed as a precautionary measure by Colonial Villa. The EA subsequently concluded that there was no unacceptable risk to recreational users of the MFLBC from floodplain soils or creek sediments. However, cleanup of the floodplain in this area is warranted to protect ecological receptors and to prevent potential unacceptable bioaccumulation.

VI. COMMENTS ON REMEDY IMPLEMENTATION

10. One commenter expressed concerns that the sediments and floodplain soils should be managed during drying and storing to ensure that there are no releases of contaminants to the air or into the water table.

Adverse effects of remediation are considered in the short-term effectiveness criterion discussed in this ROD. The remedy will be implemented in a manner that prevents unacceptable releases of contaminants. Typically, a remedial design will include mitigation measures such as an impermeable drying pad and collection sump to collect water coming from the sediments and soils. Also it is typical to have construction monitoring plans and contingency plans to assess and correct any potential effects from construction and implementation of the remedy. U.S. EPA intends that this remedy will be implemented in a safe and protective manner.

11. One commenter stated that because of the dynamic nature of the MFLBC, the floodplain areas can change over time. She recommended that sampling be conducted immediately prior to floodplain excavation to ensure that the appropriate areas are remediated.

U.S. EPA agrees with this comment. The remedy selected in this ROD requires a Pre-design Investigation to further delineate specific areas that will be removed to meet the remediation goal. The Pre-design Investigation is very important because both U.S. EPA and Ohio EPA recognize that the habitat along areas of the MFLBC is a valuable natural resource. The data from the Pre-design Investigation will be used to target areas to be removed, while preserving as much habitat as possible.

12. The Northeast Ohio Scenic River Manager from the Ohio Department of Natural Resources spoke extensively about the beauty and special value of the MFLBC, and made a number of suggestions on cleanup implementation:

> *a. He commented that because the MFLBC is such an important river at both the state and federal level, the project should be conducted by an experienced engineering firm.*

U.S. EPA expects that ROC will conduct the cleanup work required by this ROD. ROC will need to submit the credentials of the engineers and other consultants that will perform the work for U.S. EPA's approval. This will ensure that competent entities are performing the work.

> *b. He commented on the provisions of the plan that allow for the placement of backfill, expressing concerns that the backfill would not be consolidated and armored like natural sediment, and could contribute to a solids and/or turbidity problem downstream.*

U.S. EPA recognizes that backfill has different properties than naturally occurring sediment. If backfill is used, the remedial design will include provisions to ensure that it does not become significantly eroded and a surface water problem downstream. Some of these provisions might include specification of the grain size range required, placement methods, and others.

> *c. He expressed concerns that resuspension of mirex-contaminated sediment could be a problem and recommended that sediment be removed "in the dry."*

U.S. EPA recognizes that resuspension and downstream transport of contaminated sediment is a short-term effect that must be limited. The Feasibility Study provides that MFLBC sediment may be removed by dredging or "in the dry" – after water has been excluded from a stream segment. The final method will be established in the remedial design, after pre-design investigations have provided more information on the best method. Whatever method is selected, provisions to control resuspension and downstream transport will be part of the design considerations.

> *d. He commented that because mirex is a contaminant that tends to stick to the sediment particles rather than move into the water, it is important to manage particles during the*

dewatering of contaminated sediments. He recommended the use of mesh bags, such as were used at other projects in Ohio.

Recognizing that dewatering of contaminated sediment is an important aspect of waste management, the Feasibility Study includes process options to address sediment dewatering. The process options include the use of geotextile tubes, such as Geotubes® or similar. The final method will be established in the remedial design, after pre-design investigations have provided more information on the best method. Whatever method is selected, design provisions will require the management of particulates in water removed from the sediment.

VII. OVERSIGHT OF THE CURRENT WORK

13. One commenter expressed concern with the current work, especially that ROC is allowed to conduct the work. He felt that U.S. EPA and Ohio EPA's were not adequately "policing" the current work. He commented that the appearance of the Site needs to be cleaned up. Finally, he stated that trucks come and go early in the morning without oversight, and was concerned that more waste has been found on the Site.

U.S. EPA's policy is "enforcement first" – U.S. EPA has a strong commitment to have potentially responsible parties (PRPs) conduct the Remedial Investigation / Feasibility Study (RI/FS) wherever appropriate. This policy promotes the "polluter pays" principle and helps conserve the resources of the Hazardous Substance Response Trust Fund (Fund) for sites where no viable responsible parties exist. U.S. EPA's experience has shown that, with adequate oversight, PRPs can perform acceptable RI/FSs. Detailed and thorough work plans are required of ROC and approved by U.S. EPA and Ohio EPA. These plans ensure an adequate RI/FS by setting forth work and deliverable requirements, specifying procedures and relevant guidance documents, and establishing oversight expectations. U.S. EPA also has the ability to seek penalties under the settlement agreements with ROC, and this provides incentives for ROC to meet the requirements of the work plans. Moreover, U.S. EPA and Ohio EPA retain their rights to conduct all or a portion of the work if the ROC's work may cause an endangerment to human health or the environment or does not meet the terms and conditions of the agreement.

In regard to the appearance of the Site, the Superfund program requires remedies that address actual or potential risks, but does not require beautification of the Site. However, the selected remedy for OU 2 calls for leaving mirex contaminated soil in place at the Site, covered by an engineered barrier (among other remedial responses). To construct the cover, vegetation will be cleared and the Site will be graded to manage surface water flow. After construction, the cover will be vegetated and routine maintenance will occur. Completion of the OU 2 remedy should result in a Site that looks neater and better maintained.

In regard to the comment about truck traffic in the night, ROC and Ohio EPA explained the incident at the public meeting. There is an active groundwater treatment system capturing contaminated groundwater. Once or twice a month ROC has arranged to have some of the contaminated groundwater removed by truck to an off-site treatment facility. On one occasion, the trucker who was to pick up the load arrived at the Site early and slept in his truck until he

could pick up the load of water in the morning. Ohio EPA inspected the incident and was satisfied that waste handling was legal. ROC has directed the truck company not to allow the drivers to arrive at the Site in the night.

VIII. MISCELLANEOUS COMMENTS

14. One commenter expressed disappointment that few local government officials attended the public meeting. She hoped that they were well informed.

U.S. EPA produces a Community Involvement Plan for each Superfund site. Among other objectives, this plan provides details about how to involve effected communities in Site decision-making. For OU 3, factsheets were mailed to over 4,000 recipients, including local officials. Information was available on the Nease website. A press release was issued and local media covered the information. U.S. EPA and Ohio EPA met with the Columbiana County Health Department to discuss the proposed cleanup on July 31, 2008.

15. One commenter asked about the plans for long-term monitoring of groundwater wells on neighboring properties and what would be done about wells that are contaminated.

Groundwater contamination is being addressed by the remedial responses selected for OU 2. The selected OU 2 remedy is currently being designed and will be constructed and implemented by ROC. As part of the Pre-Design Investigation for OU 2, neighbors located downgradient of the groundwater plumes were approached to determine if they were using groundwater from wells that might be contaminated, and if so, the wells were sampled. The OU 2 remedy requires a long-term monitoring program and control over use of contaminated groundwater, but specific details of which wells will be monitored and the frequency of monitoring have yet to be determined. The final remedial design will specify how monitoring and institutional controls will be conducted.

APPENDIX B

Administrative Record Index

AR

U.S. EPA ADMINISTRATIVE RECORD
REMEDIAL ACTION
NEASE CHEMICAL COMPANY
SALEM, COLUMBIANA COUNTY, OHIO
ORIGINAL
06/26/95

DOC#	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	00/00/00	U.S. EPA		Procedures for Pesticide/PCB Determination in Fish	4
2	10/01/73	Court of Common Pleas; Columbiana County, Ohio	Litigants	Consent Judgement	6
3	12/18/80	Freese, R., Ecology and Environment, Inc.	U.S. EPA File	Off-Site Inspection Report	13
4	06/11/81	Mount, L., Ruetgers-Nease Chemical Company, Inc.	U.S. EPA	Notification of Hazardous Waste Site	3
5	10/06/82	U.S. EPA		NPL Quality Assurance Summary Sheet	3
6	10/26/82	Ecology and Environment, Inc.	U.S. EPA	Report: Air Sampling at Nease Chemical	14
7	11/09/82	U.S. EPA		HRS Scoring Package	21
8	02/02/83	Lunsford, M., Ecology and Environment, Inc.	U.S. EPA File	Preliminary Assessment	6
9	05/12/83	Ecology and Environment, Inc.	U.S. EPA	Technical Direction Document Acknowledgement of Completion re: Air Sampling at Nease Chemical w/Attached TDDs and FIT Services Request Form	6
10	07/00/83	U.S. EPA		NPL Conditions at Listing in December 1982 and Status as of July 1983	1
11	00/00/84	World Health Organization		Publication: Environmental Health Criteria #14 - Mirex	37
12	08/03/84	Jones, G., Centers for Disease Control / USPHS / USDHHS	Fabinski, L., U.S. EPA	Memorandum re: CDC's Review of (1) Health Threats by Contamination of Sediments, Soils, and Groundwater by VOCs, Mirex, and Methoxychlor and (2) Acceptable Levels of Contaminants	5
13	08/00/87	U.S. EPA	Public	Guidance: Health Effects Assessment for Mirex (EPA/600/22)	48

DOC#	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
14	09/03/87	Foard, S., Ruetgers-Nease Chemical Company, Inc.	Bicknell, D., U.S. EPA; Beals, R., Ohio EPA	Letter re: Aquatic Survey of Middle Fork of Little Beaver Creek	3
15	09/15/87	Constantelos, B., U.S. EPA	Foard, S., Ruetgers-Nease Chemical Company, Inc.	Letter re: Special Notice of Potential Liability (UNSISNED)	3
16	10/16/87	U.S. EPA		Sampling Plan Outline: October 13-16, 1987 Collection of Fish and Sediments	4
17	01/27/88	U.S. EPA	Respondent	Administrative Order by Consent re: RI/FS	45
18	03/28/88	Constantelos, B., U.S. EPA	Adamkus, V., U.S. EPA	Action Memorandum: Authorization for Funding of PRP RI/FS Oversight Activities	3
19	11/00/88	Jacobs Engineering Group Inc.	U.S. EPA	Final Community Relations Plan	30
20	01/06/89	Black & Veatch	U.S. EPA	Summary Report of the Fall 1987 U.S. EPA Fish and Sediment Sampling Survey of the Middle Fork of Little Beaver Creek	16
21	02/03/89	Bicknell, D., U.S. EPA; and MacMillan, S., Ohio EPA	Foard, S., Ruetgers-Nease Chemical Company, Inc.; et al.	Letter re: Additional Work for the RI/FS w/Attachments	7
22	07/28/89	Black & Veatch	U.S. EPA	Quality Assurance Project Plan: RI/FS Oversight	137
23	02/28/90	Ruetgers-Nease Chemical Company, Inc.	U.S. EPA/Ohio EPA	RI/FS Volume 1: Work Plan (Revision 4)	122
24	02/28/90	Ruetgers-Nease Chemical Company, Inc.	U.S. EPA/Ohio EPA	RI/FS Volume 2: Qualilty Assurance Project Plan (Revison 4)	230
25	02/28/90	Ruetgers-Nease Chemical Company, Inc.	U.S. EPA/Ohio EPA	RI/FS Volume 3: Site Specific Sampling Plan (Revison 4)	324
26	02/28/90	Ruetgers-Nease Chemical Company, Inc.	U.S. EPA/Ohio EPA	RI/FS Volume 4: Health and Safety Plan (Revision 4)	143

DOC#	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
27	10/04/90	Ohio Department of Health	U.S. EPA/Ohio EPA	Report: Assessment of Exposure to Mirex Associated with the Nease Chemical Company Superfund Site (Final)	46
28	11/26/90	Shelley, T. and Mortensen, B.; Ohio Department of Health	Blumberg, A., U.S. EPA	Letter re: Wildlife Sample Results w/Attachments	6
29	05/09/94	U.S. EPA/OSWER	U.S. EPA	Considering Wetlands at CERCLA Sites (OSWER Directive 9280.0-03; EPA/540/R-94/019; PB94-963242)	45
30	10/00/94	Golder Associates Inc.	U.S. EPA	Supplemental Well Closure Plan: Production Wells P1, P2, and P3 (Revision 1) w/Response to Comments Document	302

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COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

DOC NO	VOL	TITLE	DATE	AUTHORS	STATUS	PAGES	TIER	ATTACHMENTS	OSWER/EPA NUMBER
0000	1	INDEX TO COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS	05/01/89	- OWPE - PRC-ENVIRONMENTAL MANAGEMENT, INC	Final	8		1) DATA ELEMENT DEFINITIONS 2) ORGANIZATIONAL ABBREVIATIONS AND ACRONYMS IDENTIFIED IN INDEX	
**		Pre-Remedial							
0001	1	EXPANDED SITE INSPECTION TRANSITIONAL GUIDANCE FOR FY-88	10/01/87	- OERR	Final	74	2		OSWER #9345.1-02
0002	1	PRELIMINARY ASSESSMENT GUIDANCE FISCAL YEAR 1988	01/01/88	- OERR/ASCD	Final	83	2		OSWER #9345.0-01
**		Removal Action							
1000	1	CERCLA REMOVAL ACTIONS AT METHANE RELEASE SITES	01/23/86	- LONGEST, H.L. /OERR	Final	2	2		OSWER #9360.0-8
1001	1	COSTS OF REMEDIAL RESPONSE ACTIONS AT UNCONTROLLED HAZARDOUS WASTE SITES	01/01/81	- RISKEL, H.L., ET AL /SCS ENGINEERS - ALBRECHT, O.W. /HERL	Final	164	1		
1002	1	EMERGENCY RESPONSE PROCEDURES FOR CONTROL OF HAZARDOUS SUBSTANCE RELEASES	01/01/83	- MELVOLD, R.W. /ROCKWELL INTERNATIONAL - MCCARTHY, L.T. /HERL	Final	23	1		EPA 600/8-84-011
1003	1	ENVIRONMENTAL REVIEW REQUIREMENTS FOR REMOVAL ACTIONS	04/13/87	- OERR/ERD	Final	6	2		OSWER #9318.0-05
1004	1	GUIDANCE ON IMPLEMENTATION OF THE "CONTRIBUTE TO REMEDIAL PERFORMANCE" PROVISION	04/06/87	- OSWER	Final	6	2		OSWER #9360.0-11
1008	2	GUIDANCE ON NON-NPL REMOVAL ACTIONS INVOLVING NATIONALLY SIGNIFICANT OR PRECEDENT SETTING ISSUES	04/03/89	- LONGEST, H.L. /OERR	Final	9	2	1) REQUEST FOR CONCURRENCE	OSWER #9360.0-19
1005	1	INFORMATION ON DRINKING WATER ACTION LEVELS	04/19/88	- FIELDS, JR., T /OSWER/ERD	Final	17	2	1) MEMO: RELEASES FROM LAWFULLY APPLIED PESTICIDES 2) MEMO: EDB CONTAMINATION 3) GUIDANCE FOR ETHYLENE DIBROMIDE IN DRINKING H2O	
1006	1	SUPERFUND REMOVAL PROCEDURES, REVISION #3	02/01/88	- OSWER/OERR	Final	365	1		OSWER #9360.0-03B
1007	1	THE ROLE OF EXPEDITED RESPONSE ACTIONS UNDER SARA	04/21/87	- LONGEST, H.L. /OERR	Final	3	2		OSWER #9360.0-15
4002	26	INTERIM FINAL GUIDANCE ON REMOVAL ACTION LEVELS AT CONTAMINATED DRINKING WATER SITES (Secondary Reference)	10/06/87	- OSWER/OERR	Final	9	2		OSWER #9345.1-11
6001	32	REMOVAL COST MANAGEMENT MANUAL (Secondary Reference)	04/01/88	- OSWER/OERR	Final	170	1		OSWER #9360.0-02B

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COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

DOC NO	VOL	Title	Date	Authors	Status	Pages	Tier	Attachments	OSWER/EPA Number
**		RI/FS - General							
2000	2	CASE STUDIES 1-23 REMEDIAL RESPONSE AT HAZARDOUS WASTE SITES	03/01/84	- ORD/OEET/HERL - OSWER/OERR	Final	830	1		EPA 540/2-84/002B
2001	3	EPA GUIDE FOR MINIMIZING THE ADVERSE ENVIRONMENTAL EFFECTS OF CLEANUP OF UNCONTROLLED HAZARDOUS-WASTE SITES	06/01/85	- ENVIRONMENTAL RESEARCH LABORATORY	Final	250	2		EPA/600/8-85/008
2002	3	GUIDANCE FOR CONDUCTING REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES UNDER CERCLA	10/01/88	- OSWER/OERR	Final	390	1		OSWER #9355.3-01
2003	3	JOINT CORPS/EPA GUIDANCE	06/24/83	- OERR/PAS	Final	42	2		OSWER #9295.2-02
2004	4	MODELING REMEDIAL ACTIONS AT UNCONTROLLED HAZARDOUS WASTE SITES (VOL. I-IV)	04/01/85	- BOURWELL, S.H. ET AL./ANDERSON-NICOLS AND CO - OSWER/OERR - AMON, D.C AND BORNWELL, JR., T.O./HERL	Final	350	1		OSWER #9355.0-08
2005	4	POLICY ON FLOOD PLAINS AND WETLAND ASSESSMENTS FOR CERCLA ACTIONS	08/01/85	- HIDEMAN, JR., W.N./OERR - LUCERO, C./OWPE	Final	9	2		OSWER #9280.0-02
2006	4	REMEDIAL RESPONSE AT HAZARDOUS WASTE SITES SUMMARY REPORT	03/01/84	- ORD/HERL	Final	95	1		EPA 540/2-84/002A
2007	4	REVISED PROCEDURES FOR IMPLEMENTING OFF-SITE RESPONSE ACTIONS	11/13/87	- PORTER, J.W./OSWER	Final	20	2		OSWER #9834.11
2008	4	RI/FS IMPROVEMENTS	07/23/87	- LONGEST, H.L./OERR	Final	11	2	1) RI/FS IMPROVEMENTS	OSWER #9355.0-30
2009	4	RI/FS IMPROVEMENTS FOLLOW-UP	04/25/88	- LONGEST, H.L./OERR	Final	16	2	1) RI/FS IMPROVEMENTS FOLLOW-UP 2) REMEDIAL INFORMATION TRANSFER ACTIVITIES	OSWER #9355.3-05
2010	4	SUPERFUND FEDERAL-LEAD REMEDIAL PROJECT MANAGEMENT HANDBOOK	12/01/86	- OERR	Draft	179	1		OSWER #9355.1-1
2011	5	SUPERFUND REMEDIAL DESIGN AND REMEDIAL ACTION GUIDANCE	06/01/86	- OERR	Final	100	1		OSWER #9355.0-4A
2012	5	SUPERFUND STATE-LEAD REMEDIAL PROJECT MANAGEMENT HANDBOOK	12/01/86	- OERR	Final	120	1		OSWER #9355.2-1
**		RI/FS - RI Data Quality/Site & Waste Assessment							
2100	5	A COMPENDIUM OF SUPERFUND FIELD OPERATIONS METHODS	12/01/87	- OERR - OWPE	Final	550	1		OSWER #9355.0-14
2101	6	DATA QUALITY OBJECTIVES FOR REMEDIAL RESPONSE ACTIVITIES: DEVELOPMENT PROCESS	03/01/87	- CDM FEDERAL PROGRAMS CORP - OERR/OWPE	Final	150	1		OSWER #9355.0-7B

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2102	6	DATA QUALITY OBJECTIVES FOR REMEDIAL RESPONSE ACTIVITIES EXAMPLE SCENARIO: RI/FS ACTIVITIES AT A SITE W/ CONTAMINATED SOILS AND GROUNDWATER	03/01/87	- CDM FEDERAL PROGRAMS CORP - OUWR/ORPE	Final	120	1		OSWER #9355.0-7B
2103	6	DESIGN AND DEVELOPMENT OF HAZARDOUS WASTE REACTIVITY TESTING PROTOCOL	02/01/84	- WOLBACH, C.D., ET AL./ACUREX CORP - BARKLEY, N./MERL	Final	150	1		EPA-600/2-84-057
2104	6	FIELD SCREENING FOR ORGANIC CONTAMINANTS IN SAMPLES FROM HAZARDOUS WASTE SITES	04/02/86	- HOFFMAN, H.K., ET AL./ANUS CORP. - CARTER, A./MICHIGAN DEPT OF NATURAL RESOURCES - THOMAS, T./EPA	Final	11	2	1) MEMO FIELD SCREENING FOR ORGANIC CONTAMINANTS	
2105	6	FIELD SCREENING METHODS CATALOG: USER'S GUIDE	09/01/88	- OSWER/OSWD	Final	90	1		EPA/540/2-88/005
2106	6	FIELD STANDARD OPERATING PROCEDURES MANUAL #4-SITE ENTRY	01/01/85	- OSWER/ERSD	Final	29	2		OSWER #9285.2-01
2107	7	FIELD STANDARD OPERATING PROCEDURES MANUAL #6-WORK ZONES	04/01/85	- OSWER/ERSD	Final	19	2		OSWER #9285.2-04
2108	7	FIELD STANDARD OPERATING PROCEDURES MANUAL #8 AIR SURVEILLANCE	01/01/85	- OSWER/ERSD	Final	24	2		OSWER #9285.2-03
2109	7	FIELD STANDARD OPERATING PROCEDURES MANUAL #9-SITE SAFETY PLAN	04/01/85	- OSWER/ERSD	Final	26	2	1) SAMPLE SITE SAFETY PLAN AND OSHA SAFETY PLAN 2) EMERGENCY OPERATION CENTERS REAL TIME MONITOR 3) RESPONSE SAFETY CHECK-OFF SHEET	OSWER #9285.2-05
2110	7	GEOPHYSICAL METHODS FOR LOCATING ABANDONED WELLS	07/01/84	- FRISCHKNECHT, L.M., ET AL./U.S. GEOLOGICAL SURVEY - VANEE, J.J./EMSL	Final	211	1		EPA-600/4-84-065
2111	7	GEOPHYSICAL TECHNIQUES FOR SENSING BURIED WASTES AND WASTE MIGRATION	06/01/84	- BENSON, R.C., ET AL./TECHNOS, INC. - VANEE, J.J./EMSL	Final	236	1		EPA-600/7-84/064
2112	8	GUIDELINES AND SPECIFICATIONS FOR PREPARING QUALITY ASSURANCE PROGRAM DOCUMENTATION	06/01/87	- OWP/QUALITY ASSURANCE MANAGEMENT STAFF	Final	31	2	1) MEMO GUIDANCE ON PREPARING QAPP'S DATED 6/10/87	
2113	8	LABORATORY DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING INORGANICS ANALYSES	07/01/88	- EPA DATA REVIEW WORK GROUP - BLEYLER, R./VIAR AND CO./SAMPLE MGMT OFFICE - HSWD	Draft	20	2		
2114	8	LABORATORY DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING ORGANICS ANALYSES	02/01/88	- BLEYLER, R./VIAR AND CO./SAMPLE MGMT OFFICE - EPA DATA REVIEW WORKGROUP - HSWD	Draft	45	2		

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2115	8	PRACTICAL GUIDE FOR GROUND-WATER SAMPLING	09/01/85	- BARCELONA, M J., ET AL./ILLINOIS ST WATER SURVEY - SCALF, M R./ORD/ERL	Final	175	1		EPA/600/2-85/104
2116	8	SEDIMENT SAMPLING QUALITY ASSURANCE USER'S GUIDE	07/01/85	- BARTH, D S. & STARKS, T S /UNIV OF NEV, LAS VEGAS - BROWN, K W /EARD	Final	120	1		EPA/600/4-85/048
2117	8	SOIL SAMPLING QUALITY ASSURANCE USER'S GUIDE	05/01/84	- BARTH, D S. & MASON, B J /U OF NEVADA, LAS VEGAS - BROWN, K /ORD/EARD	Final	104	1		EPA 600/4-84/043
2118	9+	TEST METHODS FOR EVALUATING SOLID WASTE, LABORATORY MANUAL PHYSICAL/CHEMICAL METHODS, THIRD EDITION (VOLUMES IA, IB, IC, AND II)	11/01/86	- OSWER	Final	3000	1		
2119	11	USER'S GUIDE TO THE CONTRACT LABORATORY PROGRAM	12/01/88	- OSWR/OLP SAMPLE MANAGEMENT OFFICE	Final	220	2		OSWER 89240 0-1
**		RI/FS - Land Disposal Facility Technology							
2200	12	COVERS FOR UNCONTROLLED HAZARDOUS WASTE SITES	09/01/85	- MCANENY, C C , ET AL /U S COE/WES - HOUTHOOFD, J M /HWERL	Final	475	2		EPA/540/2-85/002
2201	13	DESIGN, CONSTRUCTION, AND EVALUATION OF CLAY LINERS FOR WASTE MANAGEMENT FACILITIES	11/01/88	- COLDMAN, J L , ET AL /ALIS - ROULIER, M H /RREL	Final	500	2		EPA/530/SW-86/007F
2202	13	EVALUATING COVER SYSTEMS FOR SOLID AND HAZARDOUS WASTE	09/01/82	- LUTTON, R J./U S A COE/WES - LANDRETH, R E /MERL	Final	58	2		OSWER 89476 00-1
2203	13	GUIDANCE MANUAL FOR MINIMIZING POLLUTION FROM WASTE DISPOSAL SITES	08/01/78	- TOLMAN, A L , ET AL./A.W MARTIN ASSOCIATES, INC - SANNING, D E /MERL	Final	83	1		EPA-600/2-78-142
2204	13	LAND DISPOSAL RESTRICTIONS	08/11/87	- LONDEST, H.L./OSWR - ELCERO, G./OWPE	Final	23	2	1) SUMMARY OF MAJOR LDR PROVISIONS AND CALIFORNIA LIST PROHIBITIONS 2) OTHER ATTACHS CITED ARE AVAILABLE IN	

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2205	14	LINING OF WASTE CONTAINMENT AND OTHER IMPOUNDMENT FACILITIES	09/01/88	- MATRECON, INC - LANDRETH, R /ORD/RISK REDUCTION ENGINEERING LAB	Final	950	2		
2206	15	LINING OF WASTE IMPOUNDMENT AND DISPOSAL FACILITIES	03/01/83	- LANDRETH, R /MERL	Final	480	2		OSWER #9480 00 4
2207	15	PROCEDURES FOR MODELING FLOW THROUGH CLAY LINERS TO DETERMINE REQUIRED LINER THICKNESS	01/01/84	- OSW	Draft	145	2		OSWER #9480 00 10
2208	15	RCRA GUIDANCE DOCUMENT LANDFILL DESIGN LINER SYSTEMS AND FINAL COVER	07/01/82	- EPA	Draft	30	2		
2209	15	SETTLEMENT AND COVER SUBSIDENCE OF HAZARDOUS WASTE LANDFILLS: PROJECT SUMMARY	05/01/85	- MURPHY, W.L. - GILBERT, P.A.	Final	4	2		EPA-600/S2-85 035
2210	15	SUPPLEMENTARY GUIDANCE ON DETERMINING LINER/LEACHATE COLLECTION SYSTEM COMPATIBILITY	08/07/86	- NEDDLE, B.R./PERMITS AND STATE PROGRAMS DIV	Final	60	2	1) ANALYSIS AND FINGERPRINTING OF UNEXPOSED & EXPOSED POLYMERIC MEMBRANE LINERS MATRECON, INC 2) SEC 3019 EXPOSURE INFO AND RISK ASSESSMENTS	OSWER #9480 00 13
2211	15	TECHNICAL GUIDANCE DOCUMENT CONSTRUCTION QUALITY ASSURANCE FOR HAZARDOUS WASTE LAND DISPOSAL FACILITIES	10/01/86	- FERRMANN, J G /HWERL/LAND POLLUTION CONTROL DIV - OSWER	Final	88	2		OSWER #9472 003
2212	15	TREATMENT OF REACTIVE WASTES AT HAZARDOUS WASTE LANDFILLS PROJECT SUMMARY	01/01/84	- SCHEIBLE, D. ET AL /ARTHUR D LITTLE, INC - LANDRETH, R /MERL	Final	4	2		EPA/600/S2 83/118
3000	25	APPLICABILITY OF THE HSWA MINIMUM TECHNICAL REQUIREMENTS RESPECTING LINERS AND LEACHATE COLLECTION SYSTEMS (Secondary Reference)	04/01/85	- SKINNER, J /OSW	Final	3	2		OSWER #9480 01(85)
**		RI/FS - Other Technologies							
3300	16	A COMPENDIUM OF TECHNOLOGIES USED IN THE TREATMENT OF HAZARDOUS WASTES	09/01/87	- ORD/CERI	Final	49	2		EPA/625/8 87/014

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2301	16	CARBON ADSORPTION ISOTHERMS FOR TOXIC ORGANICS	04/01/80	- COBBS, R A /MERL - COHEN, J M /MERL	FINAL	321	2		EPA/600/8-80-023
2302	17	ENGINEERING HANDBOOK FOR HAZARDOUS WASTE INCINERATION	09/01/81	- BONNER T A , ET AL /MONSANTO RESEARCH CORP. - OBERACKER, D A /OTEET	FINAL	445	2		OSWER 9480 00 5
2303	17	EPA GUIDE FOR IDENTIFYING CLEANUP ALTERNATIVES AT HAZARDOUS WASTE SITES AND SPILLS BIOLOGICAL TREATMENT	—	- PACIFIC NORTHWEST LABORATORY - RAINERE, L C./CORVALLIS ENVIRONMENTAL RESEARCH LAB	FINAL	120	2		EPA-600/1-83-063
2304	17	EPA GUIDE FOR INFECTIOUS WASTE MANAGEMENT	05/01/86	- OSWER/ORM	FINAL	75	2		OSWER 9410 00 2
2305	17	GUIDANCE DOCUMENT FOR CLEANUP OF SURFACE IMPOUNDMENT SITES	06/01/86	- COM/WOODWARD-CLYDE/RDV F WESTON - BARTH, E /OSWER	FINAL	39	1		OSWER 9380 0 06
2306	17	GUIDANCE DOCUMENT FOR CLEANUP OF SURFACE TANK AND DRUM SITES	05/30/85	- COM/WOODWARD-CLYDE/RDV F WESTON/C C JOHNSON - BARTH, E AND BIXLER, B /OSWER	FINAL	135	1		OSWER 9380 0 03
2307	18	HANDBOOK FOR EVALUATING REMEDIAL ACTION TECHNOLOGY PLANS	08/01/83	- BRENFELD, J AND BASS, J /ARTHUR D LITTLE INC - PARREN, H R /MERL	FINAL	439	1		EPA-600/2-83-076
2308	18	HANDBOOK FOR STABILIZATION/SOLIDIFICATION OF HAZARDOUS WASTE	06/01/86	- CULLINANE JR , M J ET AL /U S CE/WES - HOUTMOOFD, J M /ORD/MERL	FINAL	135	1		EPA/540/2-86-001
2309	19	HANDBOOK REMEDIAL ACTION AT WASTE DISPOSAL SITES (REVISED)	10/01/85	- ORD/MERL - OSWER/OERR	FINAL	560	1		EPA/625/6-85/006
2310	20	LEACHATE PLUME MANAGEMENT	11/01/85	- REPO, E AND KUES, C /GRB ASSOCIATES - BARKLEY, W /EPA	FINAL	590	1		EPA/540/2-85/004
2311	20	MOBILE TREATMENT TECHNOLOGIES FOR SUPERFUND WASTES	09/01/86	- CAMP, DRESSER, AND MCKEE INC - CALER, L D./ARSD	FINAL	130	1		EPA/540/2-86-003
2312	21	PRACTICAL GUIDE-TRIAL BURNS FOR HAZARDOUS WASTE INCINERATORS	04/01/86	- CORMAN, P., ET AL /MIDWEST RESEARCH INSTITUTE - OBERACKER, D A /MERL	FINAL	63	2		EPA/600/2-86/050
2313	21	PRACTICAL GUIDE-TRIAL BURNS FOR HAZARDOUS WASTE INCINERATORS, PROJECT SUMMARY	07/01/86	- CORMAN, P , ET AL /MIDWEST RESEARCH INSTITUTE - OBERACKER, D A /MERL	FINAL	2	1		EPA/600/S2-86/050

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2314	21	PROHIBITION ON THE PLACEMENT OF BULK LIQUID HAZARDOUS WASTE IN LANDFILLS-STATUTORY INTERPRETIVE GUIDANCE	06/11/86	- OSWER/OSW	Final	35	1	1) MEMO RE SAME SUBJECT FROM WILLIAMS, M E /OSW	OSWER #9487 00-2A
2315	21	REVIEW OF IN-PLACE TREATMENT TECHNIQUES FOR CONTAMINATED SURFACE SOILS-VOL 2: BACKGROUND INFORMATION FOR IN-SITU TREATMENT	11/01/84	- SIMS, R C , ET AL /JRB ASSOCIATES - BARKLEY, N. /MERL	Final	350	1		EPA-540/2-84-003b
2316	21	REVIEW OF IN-PLACE TREATMENT TECHNIQUES FOR CONTAMINATED SURFACE SOILS-VOL. 1 TECHNICAL EVALUATION	09/19/84	- OSWER/OERR - ORD/MERL	Final	165	1		EPA/540/2-84-003a
2317	22	SLURRY TRENCH CONSTRUCTION FOR POLLUTION MIGRATION CONTROL	02/01/84	- OERR - ORD/MERL	Final	220	1		EPA/540/2-84-001
2318	22	SYSTEMS TO ACCELERATE IN SITU STABILIZATION OF WASTE DEPOSITS	09/01/86	- MALLAIER, M , ET AL /ENVIROSPHERE CO. - CALIGE, W.A-MERL	Final	285	1		EPA 540/2-86/002
2319	22	TECHNOLOGY SCREENING GUIDE FOR TREATMENT OF CERCLA SOILS AND SLUDGES	09/01/88	- OSWER/OERR	Final	130	1		EPA 540/2-88/004
2320	22	TREATMENT TECHNOLOGY BRIEFS ALTERNATIVES TO HAZARDOUS WASTE LANDFILLS	07/01/86	- MERL	Final	35	2		EPA/600/8-86/017
**		RI/FS - Ground-Water Monitoring & Protection							
2400	23	CRITERIA FOR IDENTIFYING AREAS OF VULNERABLE HYDROGEOLOGY UNDER RCRA STATUTORY INTERPRETIVE GUIDANCE	07/01/86	- OSWER/OSW	Final	950	2		OSWER #9472 00-2A
2401	24	FINAL RCRA COMPREHENSIVE GROUND-WATER MONITORING EVALUATION (GME) GUIDANCE DOCUMENT	12/19/86	- LUCERO, C A./OWPE	Final	55	2	1) RELATIONSHIP OF TECHNICAL INADEQUACIES TO GROUND-WATER PERFORMANCE STANDARDS	OSWER #9950 2
2402	24	GROUND-WATER MONITORING AT CLEAN-CLOSING SURFACE IMPOUNDMENT AND WASTE PILE UNITS	03/31/88	- HORTER, J W /OSWER	Final	3	2		OSWER #9476 00 14
2403	24	GROUND-WATER PROTECTION STRATEGY	08/01/84	- OFFICE OF GROUND-WATER PROTECTION	Final	65	2		EPA/440/6-84-002
2404	24	GUIDELINES FOR GROUND-WATER CLASSIFICATION UNDER THE EPA GROUND-WATER PROTECTION STRATEGY	12/01/86	- OFFICE OF GROUND-WATER PROTECTION	Draft	600	2		
2405	24	OPERATION AND MAINTENANCE INSPECTION GUIDE (RCRA GROUND-WATER MONITORING SYSTEMS)	03/30/88	- OSWER/OWPE/RCRA ENFORCEMENT DIVISION	Final	50	2	1) TRANSMITTAL MEMO RE SAME SUBJECT	OSWER #9950-3

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2406	24	PROTOCOL FOR GROUND-WATER EVALUATIONS	09/01/86	- HAZARDOUS WASTE GROUND WATER TASK FORCE	Final	200	2		OSWER #9080 0-1
2407	25	RCRA GROUND-WATER MONITORING TECHNICAL ENFORCEMENT GUIDANCE DOCUMENT(TEGD)	09/01/86	- EPA	Final	270	2		OSWER #9950 1
2408	25	RCRA GROUND-WATER MONITORING TECHNICAL ENFORCEMENT GUIDANCE DOCUMENT, TEGD: EXECUTIVE SUMMARY	07/01/87	- LUCERO, G A /OWPE	Final	8	1		OSWER #9950 1-a
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3000	25	APPLICABILITY OF THE HSWA MINIMUM TECHNICAL REQUIREMENTS RESPECTING LINERS AND LEACHATE COLLECTION SYSTEMS	04/01/85	- SKINNER, J /OSW	Final	3	2		OSWER #9480 01(85)
3001	25	CERCLA COMPLIANCE WITH OTHER ENVIRONMENTAL STATUTES	10/02/85	- PORTER, J W /OSWER	Final	19	1	1) POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	OSWER #9234 0-2
3002	25	CERCLA COMPLIANCE WITH OTHER LAWS MANUAL	08/08/88	- OSWR	Draft	245	2		OSWER #9234 1-01
3003	25	EPA'S IMPLEMENTATION OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986	05/21/87	- THOMAS, L M /EPA	Final	4	2		
3004	25	GUIDANCE MANUAL ON THE RCRA REGULATION OF RECYCLED HAZARDOUS WASTES	03/01/86	- INDUSTRIAL ECONOMICS, INC - OSW	Final	350	2		OSWER #9441 00 2
3005	25	INTERIM RCRA/CERCLA GUIDANCE ON NON-CONTIGUOUS SITES AND ON-SITE MANAGEMENT OF WASTE AND TREATMENT RESIDUE	03/27/86	- PORTER, J W /OSWER	Final	8	2	1) COMBINING HAZARDOUS WASTE SITES FOR REM ACTION	OSWER #9347 0-1
2400	23	CRITERIA FOR IDENTIFYING AREAS OF VULNERABLE HYDROGEOLOGY UNDER RCRA: STATUTORY INTERPRETIVE GUIDANCE (Secondary Reference)	07/01/86	- OSWER/OSW	Final	950	2		OSWER #9472 00 2A
2401	24	FINAL RCRA COMPREHENSIVE GROUND-WATER MONITORING EVALUATION (GME) GUIDANCE DOCUMENT (Secondary Reference)	12/19/86	- LUCERO, G A /OWPE	Final	55	2	1) RELATIONSHIP OF TECHNICAL INADEQUACIES TO GROUND-WATER PERFORMANCE STANDARDS	OSWER #9950 2
2405	24	OPERATION AND MAINTENANCE INSPECTION GUIDE (RCRA GROUND-WATER MONITORING SYSTEMS) (Secondary Reference)	03/30/88	- OSWER/OWPE/RCRA ENFORCEMENT DIVISION	Final	50	2	1) TRANSMITTAL MEMO RE SAME SUBJECT	OSWER #9950-3
2407	25	RCRA GROUND-WATER MONITORING TECHNICAL ENFORCEMENT GUIDANCE DOCUMENT(TEGD) (Secondary Reference)	09/01/86	- EPA	Final	270	2		OSWER #9950 1
2408	25	RCRA GROUND-WATER MONITORING TECHNICAL ENFORCEMENT GUIDANCE DOCUMENT, TEGD: EXECUTIVE SUMMARY (Secondary Reference)	07/01/87	- LUCERO, G A /OWPE	Final	8	1		OSWER #9950 1-a

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9001	32	RCRA/CERCLA DECISIONS MADE ON REMEDY SELECTION (Secondary Reference)	06/24/85	- KILPATRICK, M /COMPLIANCE BRANCH, OWM	Final	3	2		
**		Water Quality							
4000	26	ALTERNATE CONCENTRATION LIMIT GUIDANCE PART 1, ACL POLICY AND INFORMATION REQUIREMENTS	07/01/87	- OSW/WMD	Final	124	2		OSWER #9481.00-6C
4001	26	GUIDANCE DOCUMENT FOR PROVIDING ALTERNATE WATER SUPPLIES	02/01/88	- OERR	Final	64	2		OSWER #9355.3-03
4002	26	INTERIM FINAL GUIDANCE ON REMOVAL ACTION LEVELS AT CONTAMINATED DRINKING WATER SITES	10/06/87	- OSWER/OERR	Final	9	2		OSWER #9360.1-01
4003	26	QUALITY CRITERIA FOR WATER 1986	05/01/87	- OFFICE OF WATER REGULATIONS AND STANDARDS	Final	375	2		EPA/440/5-86-001
7301	16	CARBON ADSORPTION ISOTHERMS FOR TOXIC ORGANICS (Secondary Reference)	04/01/80	- DOBBS, R A /MERL - COHEN, J M /MERL	Final	371	2		EPA/600/8-80-023
1005	1	INFORMATION ON DRINKING WATER ACTION LEVELS (Secondary Reference)	04/19/88	- FIELDS, JR , T /OSWER/ERD	Final	17	2	1) MEMO RELEASES FROM LAWFULLY APPLIED PESTICIDES 2) MEMO DBCP CONTAMINATION 3) GUIDANCE FOR ETHYLENE DIBROMIDE IN DRINKING H2O	
**		Risk Assessment							
5000	27	ATSDR HEALTH ASSESSMENTS ON NPL SITES	06/16/86	- DEPT OF HEALTH AND HUMAN SERVICES/ATSDR	Draft	14	2		
5001	27	CHEMICAL, PHYSICAL & BIOLOGICAL PROPERTIES OF COMPOUNDS PRESENT AT HAZARDOUS WASTE SITES	09/27/85	- CLEMENT ASSOCIATES, INC	Final	320	2		OSWER #9850.3
5002	27	FINAL GUIDANCE FOR THE COORDINATION OF ATSDR HEALTH ASSESSMENT ACTIVITIES WITH THE SUPERFUND REMEDIAL PROCESS	05/14/87	- PORTER, J W /OSWER/OERR - ATSDR	Final	22	2	1) SAME TITLE, DATED 4/22/87	OSWER #9285.4-02
5003	27	GUIDELINES FOR CARCINOGEN RISK ASSESSMENT (FEDERAL REGISTER, SEPTEMBER 24, 1986, p 33992)	09/24/86	- EPA	Final	13	2		

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5005	27	GUIDELINES FOR HEALTH ASSESSMENT OF SUSPECT DEVELOPMENTAL TOXICANTS (FEDERAL REGISTER, SEPTEMBER 24, 1986, p. 34028)	09/24/86	- EPA	Final	14	2		
5006	27	GUIDELINES FOR MUTAGENICITY RISK ASSESSMENT (FEDERAL REGISTER, SEPTEMBER, 24, p 34006)	09/24/86	- EPA	Final	8	2		
5007	27	GUIDELINES FOR THE HEALTH RISK ASSESSMENT OF CHEMICAL MIXTURES (FEDERAL REGISTER, SEPTEMBER 24, 1986, p. 34014)	09/24/86	- EPA	Final	13	2		
5008	28+	HEALTH EFFECTS ASSESSMENT DOCUMENTS (56 CHEMICAL PROFILES) VOL 28: ACETONE, ARSENIC, ASBESTOS, BARIUM, BENZO(A)PYRENE, CADMIUM, CARBON TETRACHLORIDE, CHLOROBENZENE, CHLORDANE, CHLOROFORM, COAL TARS, COPPER, CRESOLS, CYANIDE, DDT, 1,1-DICHLOROETHANE, 1,2-DICHLOROETHANE, VOL 29: 1,1-DICHLOROETHYLENE, 1,2-DICHLOROETHYLENE, CIS-1,2-DICHLOROETHYLENE, ETHYLBENZENE, GLYCOL ETHERS, HEXACHLOROBENZENE, HEXACHLOROBUTADIENE, HEXACHLOROCYCLOPENTADIENE, HEXAVALENT CHROMIUM, IRON (AND COMPOUNDS), LEAD, LINDANE, MANGANESE (AND COMPOUNDS), MERCURY, METHYL ETHYL KETONE, METHYLENE CHLORIDE, NAPHTHALENE, NICKEL, PENTACHLOROPHENOL, PHENOL, PHENANTHRENE, VOL 30 POLYCHLORINATED BIPHENYLS (PCBS), POLYCYCLIC AROMATIC HYDROCARBONS (PAHS), PYRENE, SELENIUM (AND COMPOUNDS), SODIUM CYANIDE, SULFURIC ACID, 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN, 1,1,2,2-TETRACHLOROETHANE, TETRACHLOROETHYLENE, TOLUENE, 1,1,2-TRICHLOROETHANE, 1,1,1-TRICHLOROETHANE, TRICHLOROETHYLENE, 2,4,5-TRICHLOROPHENOL, 2,4,6-TRICHLOROPHENOL, TRIVALENT CHROMIUM, VINYL CHLORIDE, XYLENE, ZINC (AND COMPOUNDS)	09/01/84	- ORD/OHEA/ECAO - OSWER/OERR	Final	1750	2		EPA/540/1-86/001-058
5009	31	INTEGRATED RISK INFORMATION SYSTEM (IRIS) [A COMPUTER-BASED HEALTH RISK INFORMATION SYSTEM AVAILABLE THROUGH E-MAIL--PROCEDURE ON ACCESS IS INCLUDED]	-	- OHEA	Final	-	2		

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COMPENDIUM OF CERCLA RESPONSE SELECTION GUIDANCE DOCUMENTS

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5010	31	INTERIM POLICY FOR ASSESSING RISKS OF "DIOXINS" OTHER THAN 2,3,7,8-TCDD	01/07/87	- THOMAS, L M /EPA	Final	50	2	1) INTERIM PROCEDURES FOR ESTIMATING RISKS ASSOCIATED WITH EXPOSURES TO MIXTURES. 10/86	
5011	31	PUBLIC HEALTH RISK EVALUATION DATABASE (PHRED) [USER'S MANUAL AND TWO DISKETTES CONTAINING THE DBASE III PLUS SYSTEM ARE INCLUDED]	09/16/88	- OERR/TOXICS INTEGRATION BRANCH	Final	-	2		
5012	31	ROLE OF ACUTE TOXICITY BIOASSAYS IN THE REMEDIAL ACTION PROCESS AT HAZARDOUS WASTE SITES	08/01/87	- ATHEY L A , ET AL /PACIFIC NORTHWEST LABORATORY - MILLER, W.E./CORVALLIS ENVIRONMENTAL RESEARCH LAB	Final	106	2		EPA/600/8-87/044
5013	31	SUPERFUND EXPOSURE ASSESSMENT MANUAL	04/01/88	- OERR	Final	160	1		OSWER #9285 5-1
5014	31	SUPERFUND PUBLIC HEALTH EVALUATION MANUAL	10/01/86	- OERR - OSWER	Final	500	1		OSWER #9285 4-1
5015	31	TOXICOLOGY HANDBOOK	08/01/85	- LIFE SYSTEMS, INC - TYBURSKI, T E /OHPE	Draft	126	2		OSWER #9850 2
8000	32	ENDANGERMENT ASSESSMENT GUIDANCE [Secondary Reference]	11/22/85	- PORTER, J W /OSWER	Final	11	2		OSWER #9850 0-1
**		Cost Analysis							
6000	32	REMEDIAL ACTION COSTING PROCEDURES MANUAL	10/01/87	- JRB ASSOCIATES/OLDM HILL - OHD/MERL - OSWER/OERR	Final	56	1		
6001	32	REMOVAL COST MANAGEMENT MANUAL	04/01/88	- OSWER/OERR	Final	170	1		OSWER #9360 0-02A
1003	1	ENVIRONMENTAL REVIEW REQUIREMENTS FOR REMOVAL ACTIONS [Secondary Reference]	04/13/87	- OERR/ERD	Final	6	2		OSWER #9318 0-05
**		Community Relations							
7000	32	COMMUNITY RELATIONS IN SUPERFUND A HANDBOOK (INTERIM VERSION)	06/01/88	- OERR	Final	188	2	1) CHAP 6 OF THE COM REL HANDBOOK 11/03/88	OSWER #9230 0 0B

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**		Enforcement							
8000	32	ENDANGERMENT ASSESSMENT GUIDANCE	11/22/85	- PORTER, J W /OSWER	Final	11	2		OSWER #9850 0-1
8001	32	INTERIM GUIDANCE ON POTENTIALLY RESPONSIBLE PARTY PARTICIPATION IN REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES	05/16/88	- PORTER, J W /OSWER	Final	37	2		OSWER #9835 1a
**		Selection of Remedy/Decision Documents							
9000	32	INTERIM GUIDANCE ON SUPERFUND SELECTION OF REMEDY	12/24/86	- PORTER, J W /OSWER	Final	10	2		OSWER #9355 0 19
9001	32	RURA/CERCLA DECISIONS MADE ON REMEDY SELECTION	06/24/83	- KILPATRICK, M /COMPLIANCE BRANCH, OWPE	Final	3	2		

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U.S. ENVIRONMENTAL PROTECTION AGENCY
REMEDIAL ACTION

ADMINISTRATIVE RECORD
FOR
NEASE CHEMICAL COMPANY SITE
SALEM, COLUMBIANA COUNTY, OHIO

UPDATE #1
AUGUST 17, 1998

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	04/05/91	Ruetgers-Nease Corporation	U.S. EPA	*Remedial Investigation Report: Volume 2 of 4 (Appendix A)* for the Nease Chemical Site	209
2	04/05/91	Ruetgers-Nease Corporation	U.S. EPA	*Remedial Investigation Report: Volume 3 of 4 (Appendices B-J)* for the Nease Chemical Site	600
3	04/05/91	Ruetgers-Nease Corporation	U.S. EPA	*Remedial Investigation Report: Volume 4 of 4 [1 of 2] (Appendix K: Laboratory Analytical Results)* for the Nease Chemical Site	743
4	04/05/91	Ruetgers-Nease Corporation	U.S. EPA	*Remedial Investigation Report: Volume 4 of 4 [2 of 2] (Appendix K: Laboratory Analytical Results)* for the Nease Chemical Site (Revision 1: July 6, 1993)	567
5	01/31/96	Ruetgers-Nease Corporation	U.S. EPA/ Ohio EPA	*Final Remedial Investigation Report: Volume 1 of 4* (Text, Tables, and Figures) for the Nease Chemical Site	499
6	01/31/96	Ruetgers-Nease Corporation	U.S. EPA/ Ohio EPA	*Final Remedial Investigation Report: Volume 1A of 4 (Plates)* for the Nease Chemical Site (Plates #1-16 May be Viewed at U.S. EPA Region 5)	4
7	02/00/96	U.S. EPA		*Revised Community Involvement Plan* for the Nease Chemical Site	38

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ADMINISTRATIVE RECORD
FOR
NEASE CHEMICAL SITE
SALEM, OHIO

UPDATE #2
SEPTEMBER 23, 2005

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	03/28/90	Blumberg, A., U.S. EPA & S. MacMillan, Ohio EPA	Foard, S., Ruetgers-Nease Chemical Company & W. Kennedy, Deckert, Price & Rhoads	Letter re: U.S. EPA/ Ohio EPA Approval of the Method Validation Study for the Nease Chemical Site	2
2	04/00/90	U.S. EPA	Public	Fact Sheet: "Environmental Investigation to Begin" at the Nease Chemical Site	6
3	04/05/91	Ruetgers-Nease Chemical Company, Inc.	U.S. EPA/ Ohio EPA	Appendices B-J of the RI Report for the Nease Chemical Site (Volume 3 of 4)	612
4	04/05/91	Ruetgers-Nease Chemical Company, Inc.	U.S. EPA/ Ohio EPA	Appendix K of RI Report (Laboratory Analytical Results) for the Nease Chemical Site (Volume 4 of 4)	736
5	07/00/92	U.S. EPA	Public	Fact Sheet: "Nease Chemical Superfund Site Update"	12
6	11/00/92	U.S. EPA	Public	Fact Sheet: "Mirex"	12
7	07/06/93	Ruetgers-Nease Chemical Company, Inc.	U.S. EPA/ Ohio EPA	Endangerment Assessment Report for the Nease Chemical Company Site (Appendix A to RI Report, Volume 2 of 4) [Revision 1 to April 5, 1991 Original Submittal)	673
8	07/06/93	Ruetgers-Nease Chemical Company, Inc.	U.S. EPA/ Ohio EPA	Appendix K of RI Report (Laboratory Analytical Results) for the Nease Chemical Site (Volume 4) [Volume 2 of 2 - Revision 1]	567

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
9	01/00/94	U.S. EPA	Public	Fact Sheet: "Nease Chemical Superfund Site Update"	8
10	01/00/94	U.S. EPA	Public	Fact Sheet: Correction to the "Nease Chemical Superfund Site Update"	2
11	08/18/94	Golder Associates Inc.	Ruetgers-Nease Corporation	Additional Remedial Investigation for the Middle Fork of Little Beaver Creek at the Nease Chemical Site (Volume 1 of 2: Text, Tables and Figures)	69
12	08/18/94	Golder Associates Inc.	Ruetgers-Nease Corporation	Additional Remedial Investigation for the Middle Fork of Little Beaver Creek at the Nease Chemical Site (Volume 2 of 2: Appendix A)	574
13	10/06/94	Golder Associates Inc.	Ruetgers-Nease Corporation	Supplemental Well Closure Plan for Production Wells P1, P2 and P3 at the Nease Chemical Site (Revision 1)	256
14	11/00/94	Ruetgers-Nease Corporation	U.S. EPA/ Ohio EPA	Insert Package for Volumes 1A, 3 and 4 of the Remedial Investigation Report for the Nease Chemical Site	135
15	02/16/95	Golder Associates Inc.	U.S. EPA/ Ohio EPA	Removal Action Work Plan Addendum for the Nease Chemical Site (Appendix C to Section 1, Volume 1 of the May 1994 Work Plan)	194
16	09/00/95	U.S. EPA	Public	Fact Sheet: "On-Site Treatment Underway" Modifications Complete at the Nease Chemical Superfund Site	4
17	03/00/96	U.S. EPA	Public	Fact Sheet: "Site Update" Progress To Date; Plans for 1996/1997 for the Nease Chemical Superfund Site	8

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
18	05/00/96	Ruetgers-Nease Corporation	U.S. EPA/ Ohio EPA	Remedial Investigation Report Volume 5 (Appendix N: Middle Fork of Little Beaver Creek - Binder 1 of 3)	223
19	05/00/96	Ruetgers-Nease Corporation	U.S. EPA/ Ohio EPA	Remedial Investigation Report Volume 5 (Appendix N: Middle Fork of Little Beaver Creek - Binder 2 of 3)	457
20	05/00/96	Ruetgers-Nease Corporation	U.S. EPA/ Ohio EPA	Remedial Investigation Report Volume 5 (Appendix N: Middle Fork of Little Beaver Creek - Binder 3 of 3)	403
21	11/00/96	U.S. EPA	Public	Fact Sheet: "Community Update" for the Nease Chemical Superfund Site	8
22	12/00/06	Ohio Department of Health	File	Final Report: An Assessment of Exposure to Mirex from the Ruetgers-Nease Superfund Site	29
23	02/06/97	Ohio Department of Health	File	Public Health Assessment Report for the Nease Chemical Site	71
24	08/04/98	Golder Associates Inc.	Rutgers Organics Corporation	Eastern Plume/DNAPL Investigation Report for the Nease Chemical Site	227
25	03/31/00	Golder Associates Inc.	Rutgers Organics Corporation	Impact Assessment Report for the Middle Fork of Little Beaver Creek in Mahoning and Columbiana Counties, OH	196
26	10/31/03	White, R. & P. Finn, Golder Associates	O'Grady, J., U.S. EPA	Letter: Operable Unit 2 Feasibility Study for the Nease Chemical Site	274
27	04/00/04	ENVIRON International Corporation	Rutgers Organics Corporation	Endangerment Assessment Report for the Nease Chemical Site	2407
28	08/30/04	Logan, M., U.S. EPA & J. Trocchio Ohio EPA	Domalski, R., Rutgers Organics Corporation	U.S. EPA/Ohio EPA Review and Approval of the Endangerment Assessment for the Nease Chemical Site	6

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29	12/00/04	U.S. EPA	Public	Fact Sheet: "Health Risks Studied; Cleanup Plan is Next Step" for the Nease Chemical Site	4
30	04/21/05	Logan, M., U.S. EPA & S. Abraham, Ohio EPA	Domalski, R., Rutgers Organics Corporation	Letter re: U.S. EPA/ Ohio EPA Approval of the Revised Feasibility Study for Operable Unit 2 of the Nease Chemical Site	9
31	05/11/05	Golder Associates Inc.	Rutgers Organics Corporation	Feasibility Study fo Operable Unit 2 at the Nease Chemical Company Site	414
32	05/28/05	Morning Journal (Lisbon, OH)	Public	Public Notice re: Announcement of June 22, 2005 U.S. EPA Public Meeting and Acceptance of Public Comments on the Feasibilty Study and Proposed Plan for the Nease Chemical Site	1
33	06/00/05	U.S. EPA	Public	Fact Sheet: "Cutting-Edge Techniques Proposed for Nease Cleanup"	8
34	06/22/05	Corsillo & Grandillo Court Reporters	U.S. EPA	Transcript of the June 22, 2005 Proposed Plan Public Meeting for the Nease Chemical Site	198
35	06/30/05	Finn, P., Golder Associates	Logan, M., U.S. EPA	Letter re: Rutgers Organics Comments on the Proposed Cleanup Plan for the Nease Chemical Site	3

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FOR
NEASE CHEMICAL SITE
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UPDATE #3
JULY 29, 2008
(SDMS ID: 299732)

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	03/00/00	Golder Associates, Inc.	Rutgers Organics Corporation	Middle Fork of Little Beaver Creek Mahoning and Columbiana Counties, Ohio Impact Assessment Report **(SDMS ID: 238537)**	196
2	12/17/02	Domalski, R., Rutgers Organics Corporation	Cranner, D., Columbiana County Commissioner	Letter re: Middle Fork of Little Beaver Creek - Sand Bank Removal **(SDMS ID: 299733)**	1
3	02/07/03	Finn, S., Golder Associates, Inc.	O'Grady, J., U.S. EPA & J. Trocchio, Ohio EPA	Letter re: Middle Fork of Little Beaver Creek Sand Bar Investigation Work Plan **(SDMS ID: 299734)**	2
4	06/18/03	O'Grady, J., U.S. EPA & J. Trocchio, Ohio EPA	Finn, S., Golder Associates, Inc.	Letter re: Agency Comments to Sediment Sampling for the Middle Fork of Little Beaver Creek Sand Bar Investigation Work Plan **(SDMS ID: 299735)**	1
5	09/26/03	Finn, S., Golder Associates, Inc.	O'Grade, J., U.S. EPA & J. Trocchio, Ohio EPA	Letter re: Results of Sediment Sampling for the Middle Fork of Little Beaver Creek Sand Bar Investigation Work Plan **(SDMS ID: 299736)**	2
6	08/30/04	Logan, M., U.S. EPA & J. Trocchio, Ohio EPA	Domalski, R., Rutgers Organics Corporation	Letter re: Approval of the Endangerment Assessment for the Nease Chemical Site w/Attachment **(SDMS ID: 238533)**	6
7	12/07/04	Finn, S., Golder Associates, Inc.	Abraham, S., Ohio EPA	Memorandum re: State Route 165 Drainage Ditches at the Middle Fork of Little Beaver Creek **(SDMS ID: 299737)**	3
8	05/12/05	Finn, S., Golder Associates, Inc.	Abraham, S., Ohio EPA	Memorandum re: Proposed Floodplain Soil Sampling at the Scout Camp Area, Lisbon, Ohio w/Attachments **(SDMS ID: 299738)**	7

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9	07/08/05	Finn, S., Golder Associates, Inc.	Abraham, S., Ohio EPA	Memorandum re: Floodplain Soil Sampling Results for the Scout Camp Area, Lisbon, Ohio w/Attachments **(SDMS ID: 299739)**	6
10	07/21/05	Finn, S. & A. Joslyn, Golder Associates, Inc.	Abraham, S., Ohio EPA	Memorandum re: Review of Direct Contact Advisory at the Middle Fork of Little Beaver Creek **(SDMS ID: 299740)**	16
11	09/19/05	Logan, M., U.S. EPA & S. Abraham, Ohio EPA	Frey, B., Ohio Dept. of Health	Letter re: Reassessment of Existing Direct Contact Advisory at the Middle Fork of Little Beaver Creek **(SDMS ID: 299741)**	2
12	10/06/05	Golder Associates, Inc	File	2005 Sediment, Surface Water, and Fish Tissue Sampling Draft Work Plan at the Middle Fork of Little Beaver Creek **(SDMS ID: 299742)**	8
13	08/00/06	Golder Associates, Inc.	Rutgers Organics Corporation	2006 Floodplain Soil Sampling Work Plan for the Middle Fork of Little Beaver Creek OU-3 **(SDMS ID: 299743)**	1
14	09/14/06	Logan, M., U.S. EPA & S. Abraham, Ohio EPA	Domalski, R., Rutgers Organics Corporation	Letter re: Additional Investigatory Work for Operable Unit 3 at the Nease Chemical Site **(SDMS ID: 299744)**	2
15	03/26/07	Chapman, J., U.S. EPA	Logan, M., U.S. EPA	Memorandum re: Bioaccumulation of Mirex in Fish, Preliminary Remedial Goals for Sediment, and the Horizontal Pattern of Sediment Mirex in the Middle Fork of Little Beaver Creek **(SDMS ID: 299745)**	28
16	11/07/07	Logan. M., U.S. EPA & S. Abraham. Ohio EPA	Addressees	Letter re: Transmittal of Floodplain Soil Sampling at the Nease Chemical Site w/Attachments **(SDMS ID: 299746)**	30

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17	01/23/08	Abraham, S., Ohio EPA & M. Logan, U.S. EPA	Domalski, R., Rutgers Organics Corporation	Letter re: Ohio EPA Comments on the Draft Nov. 2007 Interim Deliverable for the Feasibility Study for OU-3 of the Nease Chemical Site w/Attachments **(SDMS ID: 299747)**	15
18	02/28/08	Lehrman, J. & S. Finn, Golder Associates, Inc.	Logan, M., U.S. EPA	Memorandum re: Analytical Laboratories for Mirex Testing at the Nease Chemical Site **(SDMS ID: 299748)**	11
19	03/00/08	Golder Associates, Inc.	File	Responses to Agency Review Comments on the Draft Feasibility Study for OU-3 of the Nease Chemical Site **(SDMS ID: 299479)**	23
20	03/17/08	Logan, M., U.S. EPA	Domalski, R., Rutgers Organics Corporation	Letter re: Proposal to Use Additional Laboratory for Mirex Analysis at the Nease Chemical Site **(SDMS ID: 299750)**	1
21	05/01/08	Chapman, J., U.S. EPA	Logan, M., U.S. EPA	Memorandum re: Preliminary Remedial Goals for Soil Mirex Based on Beef and Milk from Cows in Floodplain Areas Downstream of the Nease Chemical Site **(SDMS ID: 299751)**	19
22	05/06/08	Abraham, S., Ohio EPA	Logan, M., U.S. EPA	Letter re: Ohio EPA Comments on the Nease Chemical Site OU-3 (March 2008) Feasibility Study **(SDMS ID: 299752)**	12
23	05/07/08	Logan, M., U.S. EPA & S. Abraham, Ohio EPA	Domalski, R., Rutgers Organics Corporation	Letter re: Transmittal of Agency Review Comments on Draft Feasibility Study for OU-3 of the Nease Chemical Site (Dated March 2008) **(SDMS ID:299753)**	16
24	06/06/08	Golder Associates, Inc.	Rutgers Organics Corporation	Feasibility Study for OU-3 (Revision 1) of the Nease Chemical Site **(SDMS ID: 299731)**	374

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25	06/30/08	Logan, M., U.S. EPA & S. Abraham, Ohio EPA	Domalski, R., Rutgers Organics Corporation	Letter re: Transmittal of Errata in the Feasibility Study for OU-3 of the Nease Chemical Site (Dated June 2008) **(SDMS ID: 299754)**	3
26	07/00/08	U.S. EPA	Public	Proposed Plan Fact Sheet: EPA Proposes Plan to Clean Up Two Creeks **(SDMS ID: 299755)**	8

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FOR
NEASE CHEMICAL SITE
SALEM, COLUMBIANA COUNTY, OHIO

UPDATE #4
SEPTEMBER 24, 2008

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	06/02/05	Finn, S., Golder Associates	Abraham, S. Ohio EPA	Memorandum re: Sampling Results from State Route 165 Drainage Ditches near the Middle fork of Beaver Creek w/Attachments	3
2	09/16/05	Golder Associates	Rutgers Organics Corporation	Middle Fork Little Beaver Creek River Mile Designation Maps for the Nease Chemical Site	4
3	09/29/05	U.S. EPA	Public	Record of Decision (ROD) for the Nease Chemical Site OU2	144
4	11/23/05	Koncelik, J., Ohio EPA	Karl, R., U.S. EPA	Letter re: Ohio EPA Concurs with U.S. EPA's Selected Remedy for OU2 of the Nease Site	2
5	09/00/06	U.S. EPA	Public	Technology Update #1: Nanotechnology	2
6	06/00/07	U.S. EPA	Public	Technology Update #2: Nanotechnology	2
7	11/00/07	Golder Associates	Rutgers Organics Corporation	Draft Interim Deliverable Feasibility Study for OU-3 at the Nease Chemical Company	116
8	12/12/07	Rutgers Organics Corporation	U.S. EPA	MFLBC Database Version 03 December, 2007 for the Nease Chemical Site	
9	07/00/08	Golder Associates	U.S. EPA	Responses to Agency Comments on the Draft Feasibility Study for Nease Chemical Company OU-3	23
10	07/14/08	Lloyd, K., Lloyd Dermatology & Laser Center	Pastor, S., U.S. EPA	Fax Transmission: Comments for the Proposed Cleanup Plan at the Nease Chemical Site w/Cover Sheet	2

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
11	07/31/08	Corsillo & Grandillo Court Reporters	U.S. EPA	July 31, 2008 Proposed Plan Public Meeting Transcript for the Nease Chemical Site w/Attached Presentation Materials	53
12	08/12/08	Finn, S., Golder Associates	U.S. EPA	Electronic Transmission re: Rutgers Organics Corporation Comments on the Proposed Cleanup Plan for the Nease Chemical Site OU3	2
13	08/13/08	Residents of Salem, Ohio	U.S. EPA	Electronic Transmissions: Four Resident Comments on the Proposed Plan for the Nease Chemical Site	6
14	08/13/08	Residents of Salem, Ohio	Pastor, S., U.S. EPA	Six U.S. EPA Comment Sheets on the Proposed Cleanup Plan for the Nease Chemical Site	12
15	08/18/08	Resident of Salem, Ohio	Pastor, S., U.S. EPA	Letter re: Resident Comments on the Proposed Cleanup Plan for the Nease Chemical Site	1
16	09/08/08	Abraham, S., Ohio EPA	Logan, M., U.S. EPA	Electronic Transmission re: Human Health Fish Fillet Targets at the Nease Chemical Site w/Attachments	9