

**EPA Superfund
Record of Decision:**

**MRI CORP (TAMPA)
EPA ID: FLD088787585
OU 01
TAMPA, FL
12/22/1999**

RECORD OF DECISION
DECLARATION

SITE NAME AND LOCATION

MRI Corporation NPL Site
Tampa, Florida
FLD 088 787 585

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Site noted above. The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this Site.

The State of Florida, as represented by the Florida Department of Environmental Protection (FDEP), has been the support agency during the Remedial Investigation (RI) and Feasibility Study (FS) process for the MRI Corporation Site. In accordance with 40 CFR 300.430, FDEP, as the support agency, has provided input during the RI/FS process. The staff of FDEP agrees with the general approach to soil remediation, but has not agreed with the cleanup levels. FDEP will be provided a second opportunity to indicate if they accept the remedy, including cleanup levels, after the completion of the groundwater and leachability studies planned as part of the remedial design.

ASSESSMENT OF THE SITE

Unacceptable risk associated with this Site is due to the potential ingestion or dermal contact with contaminated soil as well as potential future consumption of groundwater containing contaminants above either federal or State of Florida primary groundwater standards. Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This remedy addresses the main threats posed by the contaminants at this Site which is human exposure to contaminated soil/sediment (Operable Unit One). Cleanup of the contaminated soil to health based levels will also reduce leaching of contaminants to groundwater. The cleanup levels will be further evaluated during the Remedial Design to ensure consistency with later actions for groundwater (Operable Unit Two) and to ensure protectiveness of environmental receptors.

The major components of the remedy include:

- ! Excavation of approximately 7,400 cubic yards of metals contaminated soil and sediment
- ! Screening of excavated material to remove debris.
- ! Solidification/stabilization of the excavated material.
- ! Disposal of solidified material on-site.
- ! Capping of solidified material.
- ! Deed restrictions to prohibit residential use of the Site, to protect integrity of cap, and to prohibit use of shallow groundwater as drinking water at the Site.
- ! Long term maintenance of solidified material as well as long term groundwater monitoring.
- ! Additional groundwater monitoring and evaluation as a basis for future groundwater actions. This will include evaluation of the soil cleanup levels to ensure consistency with cleanup actions to be selected for Operable Unit Two (groundwater).

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this Site.

This remedy will allow unlimited industrial/commercial future use of the Site, but will not allow residential use. Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

ROD Data Certification

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

- ! Chemicals of concern (COCs) and their respective concentrations
- ! Baseline risk represented by the COCs
- ! Cleanup levels established for COCs and the basis for the levels
- ! Current and future land and groundwater assumptions used in the baseline risk assessment and the ROD
- ! Land and groundwater use that will be available at the Site as a result of the Selected Remedy
- ! Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected.
- ! Decisive factors that led to selecting the remedy.



Richard D. Green, Director
Waste Management Division

22 DEC 99
Date

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THE DECISION SUMMARY

1.0 SITE LOCATION AND DESCRIPTION

The CERCLIS identification number for this Site is FLD08878758.

The MRI Corporation Site (Site) is located at 9220 Stannum Street in Tampa, Florida. The site, approximately 11.7 acres in size, is situated in an industrial area near the intersection of the U. S. Route 301 and Stannum Street which is about 0.5 mile north of Florida State Road 60 (See Figure 1 - Site Location). The site is bordered by industrial/commercial properties to the northwest, west, and south. Orchards and grazing pasture are located to the north and east of the site.

The nearest single residence is approximately 0.75 mile northwest of the site along Leslie Road. The nearest school is 1.7 miles to the northwest of the site. Approximately 50,000 people reside within a 4-mile radius of the site.

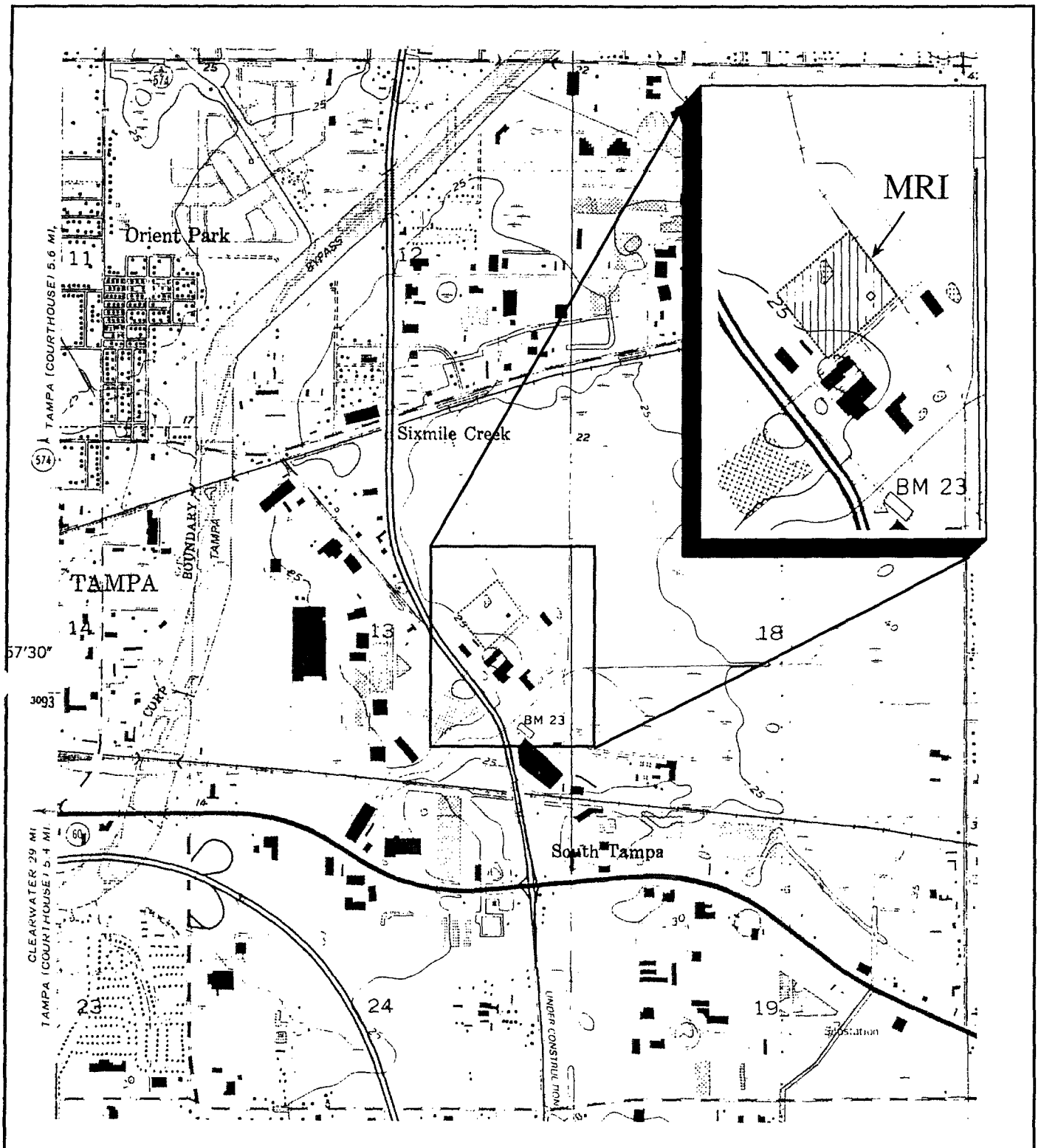
The site is rectangular in shape and is encircled by chain link fencing. A ditch and railroad embankment parallel the eastern boundary. The site is now vacant but was formerly used as a detinning/steel recycling facility. The only remaining building onsite is the shell of a machine shop on the site's southeastern corner. All other buildings have been demolished to grade and removed; only floor slabs remain. The property has been graded level with a gentle relief toward the north of approximately 3 feet. There are drainage ditches along all sides of the Site and there are two small ponds located onsite. Surface water runoff from this area of Tampa could eventually reach the Tampa Bypass Canal which is located about a mile west of the Site.

The fund-lead RI/FS was conducted by EPA.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

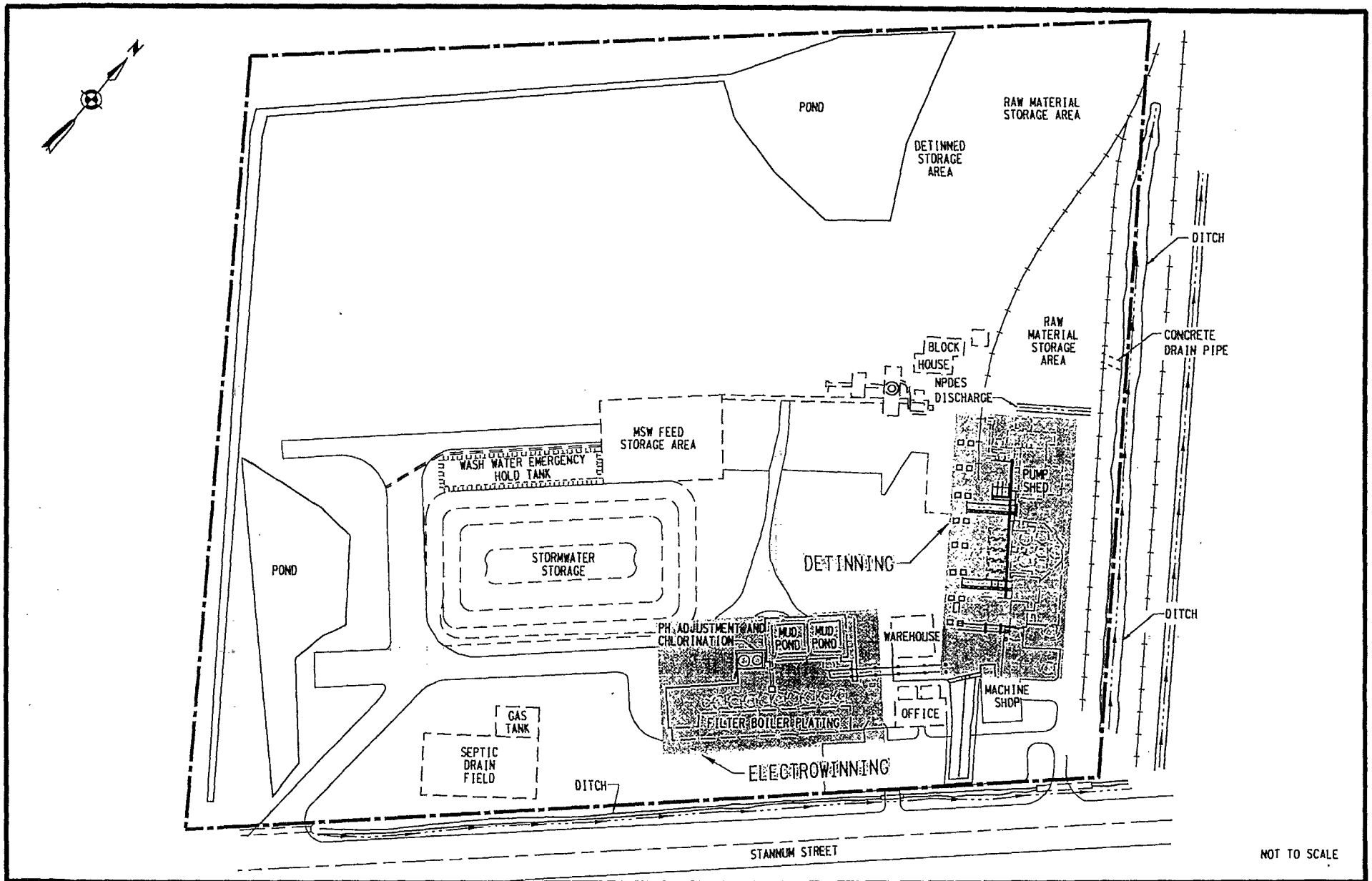
The site began operations around 1961 as a detinning/steel recycling facility. In approximately 1975, electroplating capabilities were added and in late 1979 or early 1980, a municipal solid waste recycling operation was put into service. The detinning area consisted of detinning tanks, rinse tanks, a crane system, and supporting utilities. The rinse tanks were partially confined by curbs with sumps provided for collecting spilled rinsewater, which was sent back to the rinse tank for reuse. The tin electroplating area included the tin plating and casting building, metal precipitation tanks, and a wastewater treatment area consisting of two holding ponds, a filter building, and a neutralization system (See Figure 2 - Site Layout).

Related facilities included a, small machinery shop, laboratory, and several scrap and process solids storage areas. Two petroleum underground storage tanks (USTs) were onsite during plant operations. The UST behind the machine shop, which had contained gasoline, was removed in



Source: Modified from USGS Quadrangle: Brandon, Florida

Figure 1
MRI Site Location



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Figure 2
MRI Site Layout
Prior to Decommissioning

the early 1980s; testing reportedly conducted at closure found no associated problems. The other UST was a fuel oil tank behind the plating area; it was used to fuel the boilers for a short period before it was removed when the facility switched to natural gas. Two aboveground petroleum tanks also were onsite during plant operation. One was constructed to replace the gasoline UST and was situated in the southwest corner of the property on a pad with a 3-ft containment wall. A diesel “field tank” was kept in the northeast production areas to fuel machinery and equipment.

The detinning process began in the early 1960s and was the plant’s primary function for over ten years. Scrap metal (recycled cans and metal trimmings from can manufacturers) brought to the site by rail and truck was stored predominantly in the northern corner of the site, at times on both sides of the railroad spur. Tin and other coatings were chemically removed from the raw material when it was placed in a heated alkaline bath. After 3.5 to 4 hours, the drums of detinned scrap were removed, drained, and batch-washed to reduce the alkaline content and recover “dragged out” detinning solutions. The washed drums were then unloaded and spray-washed. Water used in the final spray-washing procedure was contained and used as solution makeup for the batch washing procedure. The batch-washing water was in turn used for solution makeup for the detinning process. The detinned scrap was pressed into 500- to 600-lb bales that were ultimately shipped offsite (usually by rail) and sold as scrap steel.

The tin-bearing alkaline solutions were pumped from the detinning tanks through a leaf pressure filter and the solids (including the tin) were filtered out, producing sodium stannate cake. Prior to 1975, this filter cake represented MRI’s final product. It was placed in 55-gal drums, sealed, and transported offsite for final processing.

The electrowinning capabilities added to the facility in approximately 1975 allowed for onsite processing of the sodium stannate. The sodium stannate was put into a slurry tank and redissolved, then transported via overhead pipe to the plating system, reheated, agitated, and treated with sodium sulfide flakes to precipitate lead and various other impurities as metal sulfides. When the solution settled, it produced a clarified alkaline solution and the precipitated metal sulfides, or “black muds.” The tin-containing alkaline solution was circulated through plating vats for tin removal (electrowinned). Tin recovered from the electrowinning process was melted and cast into 100-lb ingots for shipment. The muds were washed with clean water to remove excess caustics and nitrate and allowed to resettle. This wash water was decanted to a storage tank to be used as solution makeup for the electrowinning vats.

Prior to 1979, the black muds were pumped into and dried in the settling ponds just north of the electrowinning facility. Use of the drying ponds stopped sometime around 1979 with the installation of a rotary vacuum filter. Initially, dried mud was stored on heavy plastic liners near the western property line until the volume was sufficient to warrant contacting a buyer. Ground storage of the muds was also reportedly observed just north of the drying ponds in 1977. An aerial photograph taken in 1980 shows evidence of surface staining in the vicinity of both of these areas. At some point a curbed concrete pad was constructed to store the muds.

The plating solution was neutralized with sulfuric acid to a pH of 7 to 8, and then allowed to settle in a cone bottom tank. A carbonated process was used in earlier years; a sodium hypochlorite step was employed in the early 1980s to remove unbound cyanides. The precipitate from this process was mixed and processed with the muds. The supernatant was pumped to final

settling and discharge ponds. After final settling the (treated) plating solution was mixed with non-contact cooling water in an approximate 1:50 ratio. The plating solution was then discharged into the unnamed ditch east of the site until sometime around late 1985, when it was directed to the city of Tampa's publicly owned treatment works. It was reported that in 1978 approximately 5,000 gal/week of spent plating solution was discharged to the ditch; the discharge rate listed on a 1982 wastewater discharge permit application was 10,000 gal/week.

In late 1979 or early 1980, a municipal solid waste (MSW) operation was put into service. The system consisted of conveyors, a shredder, dust collection system (bag house and cyclone) magnets, a prewash system, de-aluminizing/detinning, and rinse systems. Scrap metal for recycling was trucked from can manufacturers and municipal recycling programs throughout Florida. The MSW scrap was typically stored in an area toward the center of the site north of the two mud ponds on a concrete pad. When this area was full, however, it was stored in the northwest section of the site. When this area was also full, MSW scrap was stored in the southwest section of the site.

Though not initially part of the MSW operation, bimetal cans were processed with MSW once that system became operational. The cans came in by rail. During MRI's early years, these cans were only rarely processed separately to ship to copper mining industries. The cans were reportedly stored along the fence line in the northeastern corner of the site between the railroad spur and the pond area and then south as required. In 1977, bimetal can storage was also noted in an area approximately 150 ft west of the mud ponds.

Prior to 1980, control/treatment of stormwater runoff associated with facility operations and storage areas was minimal or nonexistent. After this time, however, a collection system and underground conduit were reportedly installed to collect all rainwater and/or solution spills in the detinning, plating, and MSW process areas. The water was directed to a pumping station and pumped into a large, double-lined retention pond north of the mud ponds for storage. Water in this pond was used as solution makeup for the various processes. When required, it was treated (neutralized) and discharged via the ditch (and to the Tampa Treatment Works during the last 2 years of site operation).

The facility was cited in 1984 for elevated metals and cyanide in the NPDES discharge. MRI Corporation ceased operations at the Site in 1986. A Screening Site Inspection was conducted by an EPA contractor in 1989. Contaminants detected in soil samples included chromium, lead, zinc, and cyanide. Contaminants detected in groundwater samples included chromium, lead, sodium, and cyanide.

In 1992, EPA collected additional soil samples. The results were comparable to those noted in the previous investigation. The Site was proposed for the NPL on June 15, 1996 and finalized on the NPL on December 23, 1996.

Special notice letters for the RI/FS were mailed in September 1996 to the current owner, its parent corporation, and two former owner/operators of the site (these PRPs were identified through EPA's initial PRP search efforts). The former owner/operators denied their liability. The MRI Corporation indicated that it did not have the resources to conduct the RI/FS. In May 1997, MRI's parent company, Proler International, indicated an interest in doing a portion of the work,

but their offer was not sufficient and EPA continued with a fund lead RI/FS.

In April 1998, Proler International sampled groundwater monitoring wells installed by EPA. The sampling was performed pursuant to an Administrative Order on Consent that addressed only that round of groundwater sampling.

3.0 COMMUNITY PARTICIPATION

EPA conducted community interviews during December 1997 and finalized the Community Relations Plan in May 1998. The area surrounding the site is industrial/commercial so the interviews were conducted with nearby business owners/managers. The interviewees expressed an interest in remaining on the mailing list. Otherwise, there was little community interest expressed regarding this Site.

EPA contacted the Hillsborough County Planning Commission (HCPC) in April 1999 to confirm the planned future use of the Site and adjoining property. According to the HCPC, the land use designation for the area is Light Industrial Planned which does not allow for residential use.

EPA issued a Remedial Investigation Fact Sheet in June 1999 which also asked citizens to call EPA if they would be interested in attending a public meeting for the Proposed Plan. In addition, a newspaper article appeared in the Tampa Tribune after the fact sheet was released. No one called to express an interest in a meeting. The only phone calls received were from several vendors interested in potential work associated with the Site.

The Proposed Plan fact sheet was released on August 24, 1999. The initial 30-day comment period was held between August 25, 1999, and September 23, 1999 and was extended until October 23, 1999. The start of the public comment period was advertised in the Tampa Tribune on August 25, 1999.

The administrative record is located at the Brandon Regional Library, 619 Vonderburg Drive Brandon, FL 33511.

4.0 SCOPE AND ROLE OF ACTION

The planned actions for this Site address soil contamination, which will be referred to as Operable Unit One (OU1). The ROD further describes this remedy and is the first of two RODs anticipated for this Site. The second ROD will address groundwater contamination which will be referred to as OU2.

The remedy for OU1 will address the main threat which is the potential human exposure to soil and sediment contaminated with metals, primarily lead. Reducing contaminant concentrations in soil will also improve the quality of surface water and groundwater at the Site. The ROD will be implemented pursuant to the remedial authorities of CERCLA.

5.0 SUMMARY OF SITE CHARACTERISTICS

The site, approximately 11.7 acres in size, is now vacant but was formerly used as a detinning/steel recycling facility. The only remaining building onsite is the shell of a machine shop on the site's southeastern corner. All other buildings have been demolished to grade and removed; only floor slabs remain.

5.1 Geology

In general, soils at the site are poorly drained as a result of the site's topography and vegetation. Soil borings at the MRI site indicate that the surface soils consist of fine- to medium-grained sands, silts, and clays with varying amount of gravel, plastic, and metal debris. Previous construction and demolition activities resulted in a surficial layer of disturbed soil and backfill material over much of the site. The disturbed material ranges in thickness from 2.0 to 6.5 ft; the thickest intervals occur in the central and northeast portions of the site. The similarity between disturbed and native material made differentiation difficult. Underlying the disturbed material is fine- to medium-grained sand and silty sand that grades to a marine clay with depth. The marine clay extends to the uppermost semiconsolidated bedrock unit.

The primary geologic units underlying the MRI site in descending order are undifferentiated terrace deposits, the Hawthorn Group, the Suwannee Limestone, the Ocala Limestone, and the Avon Park Formation.

Ten-foot-thick clay beds underlie the terrace deposits. These clay beds, known as the Hawthorn Formation, are confining layers for the underlying Floridan; however, some leakage is known to occur in this clay layer. Previous investigations have determined that the Hawthorn has been breached by the Tampa Bypass Canal and numerous sinkholes, resulting in an interconnected aquifer system.

The Hawthorn Group underlies the Tampa area, gently dipping to the southwest and consisting of carbonate sediments intermixed with increasing amounts of siliclastic sediments. Beneath the MRI site, the Hawthorn Group is represented by the Arcadia Formation, which consists of undifferentiated sands and clays grading to a marine clay and the Tampa Member limestone. The Tampa Member of the Arcadia Formation is predominantly composed of limestone with subordinate dolostone, quartz sands, and clays (Scott 1988).

Site-specific geological information was obtained during drilling of soil borings and monitoring wells at the site. The geology is relatively uniform with the exception of the area just south of the large pond in the northern portion of the site.

The initial borehole (10S) in this area indicated a broken discontinuous layer of marine clay very different than that found across the site. At a second borehole (10D), drilled and sampled approximately 5 ft to the south of the original, the marine clay was absent. The borehole was sampled to approximately 40 ft bgs where the fractured limestone of the Tampa member was present.

The limestone was encountered just below the marine clay layer at various shallow borehole

locations. The absence of the marine clay and depth of the Tampa limestone indicate possible sinkholes in this area. There is a relatively deep depression in the top of the clay between soil boring SB-02 and monitoring well 8S, as well as a minor depression at soil boring SB-06. A previous investigation in the process area of the site by Pittsburgh Testing Laboratory (1980) indicated the presence of 3.5-ft cavities at the top of the limestone in boreholes B-1 and B-5, which are near soil boring SB-06. These observations suggest the presence of one or more cover collapse sinkholes on the site.

5.2 Hydrogeology

Three major aquifer systems have been identified in the Tampa area: the surficial, intermediate, and Floridan aquifers. The intermediate aquifer system is not present in the site area and is replaced by an intermediate confining unit.

The surficial aquifer system in the MRI area extends from the surface to the intermediate confining unit and is composed of undifferentiated terrace deposits and Hawthorn Group sands. Groundwater is typically encountered within 2.0 ft bgs across the MRI site. The surficial system is unconfined except in localized areas where clay layers create semiconfined conditions (SWFWMD 1988). The base of the surficial aquifer is the contact with the clay layers in the Hawthorn Group or the top of the Tampa Member limestone where the clay layer is absent. Site-specific measurements indicate that the surficial aquifer ranges in thickness from 4.5 to 23 ft. Recharge of the surficial aquifer is primarily through surface water infiltration due to rain events. Groundwater discharge in the surficial aquifer principally occurs through seepage into area creeks, rivers, and canals. The surficial aquifer consists of clastic deposits of medium- to fine-grained, well-sorted, quartz sand; silty sand; and clay.

The surficial aquifer is used to a limited extent in Hillsborough County. Small volumes of water are drawn for domestic use, lawn irrigation, or stock watering. Most wells that tap the surficial aquifer yield less than 25 gpm. Generally the water contained in the near-surface sands and clays is not available in desirable quality or quantity and thus is not an important source of water supply in the county (Menke et al. 1961).

The Floridan Aquifer in Hillsborough County is described as a single hydrologic unit with two distinct water-bearing zones that are separated by low-permeability beds which act as semiconfining layers and retard the vertical movement of water. The upper zone or Upper Floridan Aquifer consists of the Tampa member of the Arcadia Formation, the Suwanee and Ocala Formations, and the upper part of the Avon Park Formation. The lower zone or Lower Floridan aquifer consists of permeable limestone and dolomitic rock in the Oldsmar and Cedar Keys Formations. Because of its great depth and poor water quality in the Tampa area, the Lower Floridan Aquifer is not used for water supply (Trommer 1993). Recharge to the Floridan Aquifer occurs primarily in areas where the aquifer is exposed at the surface by infiltration of precipitation. Recharge to the Floridan Aquifer in the site area is very low (less than 2 in. per year) to nonexistent (SWFWMD 1988).

A regional potentiometric surface of the Floridan Aquifer suggests that flow in the Floridan is generally toward the southwest in the site area. The hydraulic gradient in the vicinity of the site is 0.003. Using the regional hydraulic properties and this hydraulic gradient, the average linear

groundwater velocity in the Floridan is estimated to range from 0.6 to 1.6 ft/day or 219 to 584 ft/year.

Only a small portion of the population within a 4-mile radius of the MRI site obtains potable water from private wells; municipal water distribution covers most of the area of concern. Private wells range in depth from 50 to 200 ft, with the closest well located approximately 1.25 miles to the northeast of the site.

Municipal water within a 3-mile radius is supplied by the City of Tampa, Hillsborough County, Seaboard Utilities, and USA Utilities. The Tampa Water Department and Hillsborough County System obtain potable water from the Brandon Wellfield, located greater than 4 miles to the east of the MRI site. The water from these wells is mixed and serves a population of about 76,000. Seaboard obtains water from four wells located approximately 1.5 miles southwest of the site. These wells are about 300 ft deep and serve about 8,000 people in the area. USA Utilities obtains water from two wells about 300 ft deep located about 3 miles north of the site and serves 3,500 people.

During the MRI investigation, slug tests were performed in selected site monitoring wells to determine the horizontal hydraulic conductivity of the surficial aquifer. Test results were interpreted using the Bouwer and Rice (1976) method and the AQTESOLV program (Duffield 1996). The hydraulic conductivity determined from these tests range from 0.25 to 24.7 ft/day, with a geometric mean of 4.1 ft/day. The results correspond to the typical hydraulic conductivity values as described by Boutwell et al. (1985) for fine-grained sand and silt. No hydrogeologic tests were performed on the Floridan Aquifer during the investigation.

The vertical hydraulic conductivity of the confining layer at the site was not measured. Published data from Walton (1988) indicate that an aquitard comprised of clay with some sand and gravel would have a representative vertical hydraulic conductivity of 0.01 ft/day.

Effective porosity measurements were not made on site-specific samples of the surficial or the Floridan Aquifer. Boutwell et al. (1985) indicates that specific yield can be used as an approximation of the effective porosity. In an unconfined aquifer, such as the surficial aquifer, the storage coefficient is equal to the specific yield. Thus, using the storage coefficient described above, an estimated effective porosity for the surficial aquifer is 0.2. No information is available for the confining layer; however, considering the lithology of the unit, Boutwell et al. (1985) suggests use of 0.05 for the effective porosity of clay.

As part of the MRI investigation, groundwater samples were analyzed for major cations (calcium, magnesium, sodium, and potassium) and major anions (bicarbonate, carbonate, sulfate, and chloride).

The geochemical results suggest groundwater at the site is sodium-bicarbonate for areas influenced by site operations and calcium-bicarbonate in other areas. A noteworthy aspect of the data distribution is a comparison of analytical results for 10S and 10D—the distinct geochemical difference between the two adjacent wells suggests the presence of a vertical barrier for downward movement of groundwater. Also, the head difference between the shallow and deeper well ranges from 0.95 to 1.11 ft, indicating an upward flow direction from the deeper portion of

the aquifer.

The direction and rate of groundwater flow in the surficial aquifer were determined from water levels collected from the monitoring wells installed in November 1997 and April 1998. In general, the local groundwater flow direction is to the northeast. The resultant average linear velocity ranges from 55 to 110 ft/year.

During the investigation, a deep monitoring well was installed to monitor groundwater conditions at depth in an area where the soil boring investigation showed the impermeable marine clay layer to be absent.

5.3 Surface Water Hydrology

The MRI site is well vegetated and poorly drained. The property has been graded level with a gentle relief toward the north of approximately 3 feet. Small, scattered topographic depressions tend to pond during rains. The collected water then evaporates or infiltrates the sandy soils.

There was insufficient precipitation during the RI field investigation to observe any map-specific surface runoff patterns firsthand. However, based on surveyed surface elevations, the likely flow direction is to the north/northeast.

Most runoff on the site presumably does not proceed far before ponding, and subsequent evaporation or infiltration occurs. However, site features and contaminant sampling results indicate that some runoff does leave the site. The prominent overland drainage features include an onsite ditch running along the southwest and northwest sides of the site that drains through a ponded area and then northward off the site. Runoff then empties into a ditch bordering the railroad bed just east of the site. This ditch is hydraulically connected to a second, parallel ditch on the opposite side of the railroad bed via a partially blocked concrete drain pipe. Contaminated runoff migrating into the railroad ditch closest to the site therefore eventually migrates to the second railroad ditch. It is important to note that the drainage ditches associated with the Site are not connected with a stormwater pond located on property just north of the Site.

Both railroad ditches slope slightly to the north, eventually discharging into the Tampa Bypass Canal approximately 1 mile west of the site. Although runoff is expected to flow predominantly northward, the slope is so slight there is likely some southward backwashing in the ditches when the water depth rises during heavy rains. None of the drainages are in contact with any city sewer or other man-made storm water catchments.

Six-Mile Creek, located approximately 1 mile west of the site, was modified in the late 1960s to form the Tampa Bypass Canal to divert floodwaters from the Hillsborough River. The Tampa Bypass Canal extends approximately 14 miles from the Lower Hillsborough Flood Detention Area to its discharge point into McKay Bay, part of the Hillsborough Bay system. The canal partially penetrates the Floridan Aquifer and acts as a sink for groundwater flow. However, localized groundwater flow patterns and the geologic composition of the site suggest that the canal is not in direct hydrologic contact with the surficial aquifer at the MRI site.

Both Six-Mile Creek and Tampa Bypass Canal water bodies are within the Class 3 category for

water quality criteria, which is classified for recreation use and propagation and maintenance of a healthy, well-balanced population of fish and wildlife. Six-Mile Creek and Palm Creek (both components of the Tampa Bypass Canal) have had nutrient, bacterial, and dissolved oxygen problems. Historic pollution and nonpoint runoff enters this small system and flows through a heavily developed portion of Tampa that has been extensively ditched, channeled, and walled.

5.4 Soil Contamination

The RI fieldwork was conducted in two phases between November 1997 and April 1998. The first phase included soil, sediment, and groundwater sampling, primarily on-site. The second phase, conducted in April 1998, focused on offsite sediment and groundwater sampling.

The first effort for the RI was a geophysical investigation conducted between November 6 and 17, 1997. Survey transect Lines were established on 20-ft centers. This effort was conducted to determine the presence of buried metallic debris and layer continuity of the clayey sediments underlying the site

The site-wide soils investigation involved collecting 23 soil samples from areas within the fenced boundary of the MRI site and 3 offsite surface soil samples and installing and sampling 7 onsite and 2 offsite soil borings. Sampling locations were based upon a variety of factors including previous sampling data, results from the geophysical survey, historical aerial photography, etc. Surface soil samples were collected across the entire property while the subsurface soil samples were focused in areas of previous site operations. Soil samples were analyzed for metals plus cyanide. Approximately 20 percent of the samples were also analyzed for extractable organics (base/neutral/acid extractables [BNAEs], pesticides, and polychlorinated biphenyls [PCBs]).

The distributions of concentrations are fairly consistent from metal to metal, indicating a high degree of commingling. The highest concentrations are generally found in the northern corner of the site where raw and detinned scrap was stored. The second-highest concentrations are in the vicinity of the detinning and electrowinning areas and in the central portion of the site where metal was stockpiled for the municipal recycling operation.

Mid-range concentration levels of several metals were detected near ponding areas midway along the northwestern perimeter of the site, and lower levels were detected near the western edge and southern corner of the site. Contamination in these areas may be a result of several mechanisms including:

- storm water runoff from the municipal recycling operations area
- storm water runoff associated with intermittently present scrap storage areas in the western and southern site corners

The distribution and magnitude of the onsite metals contamination support the hypothesis that the site currently contains no well-defined sources but rather several widespread, poorly defined areas of contamination resulting from its varied operational practices and configurations. It is evident, however, that the western and southwestern portions of the site are less contaminated than the eastern and northern areas; only iron and aluminum were detected at concentrations exceeding screening levels on the western side.

Nine subsurface soil borings were advanced using hollow-stem augers. Seven onsite borings (SB01 through SB07) and two offsite reference background borings (SB08 and SB09) were advanced. A total of 40 samples were collected from the soil borings. The depth of sample collection ranged from 2 to 22 ft bgs. Similar to surface soil results, all identified analytes of concern were present at elevated concentrations, with lead, iron, aluminum, manganese, chromium, sodium, and zinc most commonly detected. These metals were most frequently elevated in the vadose zone samples (1 to 4 ft bgs). The concentrations and distribution were similar to conditions in the surface soils. As is the case for surface soils, concentrations were highest in samples from the northeastern side of the site, around the pond on the northern side of the site, and the area immediately northwest of the municipal recycling scrap storage area.

In most areas, the elevated metals concentrations within the shallow subsurface soils probably result from a combination of mechanisms. Although downward migration from the contaminated sandy surface soils is likely ongoing, the presence of debris in much of the vadose zone illustrates a history of burial, backfilling, and grading activities resulting in a mixture of disturbed contaminated soils.

Results from samples collected below the water table indicate that, to a lesser extent, onsite soils in the saturated zone above the clay layer contain elevated concentrations of various metals. Iron, lead, manganese, zinc, and sodium were most frequently detected. Lead and sodium were detected at above-reference concentrations in approximately 90 percent of the samples. Iron, manganese, and zinc were elevated in approximately two-thirds of the samples, and aluminum was elevated in approximately one-third. Arsenic was detected least frequently.

The highest concentrations were found in samples taken from soil borings SB-03, SB-05, and SB01. In SB-03, adjacent to the detinning operation and detinned scrap storage area, both lead and iron were detected at concentrations exceeding screening levels in the 6- to 8-ft interval, and lead was also detected at 190 mg/kg in the 12- to 14-ft interval. Located centrally between the mud ponds, detinning area, and electrowinning area, SB-05 yielded lead concentrations of 190 mg/kg from the 6- to 8-ft interval.

Though generally less contaminated than the vadose zone, the results of the subsurface RI sampling show that contaminants have migrated into the saturated soils. Using lead as an indicator, it is apparent that the migration has reached the clay layer in the vicinity of the processing and scrap storage areas. The clay presumably attenuates downward migration to the underlying Floridan Aquifer. The only evidence of a break in the continuity of the clay layer onsite is in the vicinity of monitoring well 10D. However, water samples from this 39-ft-deep well do not indicate the presence of contamination.

Test pits were dug with a backhoe at locations suggested from previous investigations to contain possible buried material. The geophysical survey provided information on anomalies that might reveal possible areas for investigation. Test pits were dug as either a 3-ft wide trench (the width of the backhoe bucket) or a wider pit, depending on the material investigated. Samples were collected from representative soil layers that might contain debris or contaminants. A total of 17 samples were collected from 11 test pits. Four samples were collected specifically for TCLP analysis; none of those samples failed the TCLP criteria.

Accumulations of buried metallic debris are highest where the contour gradient is the greatest. Based on the contour map, buried metallic debris was detected under more than 50 percent of the site survey area, concentrated in the northern and eastern portions. Very little debris was indicated in the southern portion of the site. Observations made during the trenching activities support the findings that debris is concentrated in the eastern and northern portions of the site. The metal debris was generally found at depths of 1 to 2.5 ft.

TABLE 1: CONTAMINANTS OF POTENTIAL CONCERN IN SURFACE SOIL

CONTAMINANT	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)
Aluminum	32/32	855 - 28,000
Antimony	9/32	16 - 790
Arsenic	12/32	2.5 - 24
Cadmium	13/32	1 - 25
Chromium	28/32	7.9 - 230
Copper	15/32	2.7 - 10,000
Iron	32/32	1,100 - 400,000
Lead	32/32	8.8 - 4,600
Manganese	31/32	8.4 - 1,900
Mercury	17/32	0.14 - 37
Nickel	11/32	11 - 240
Vanadium	17/32	12 - 130
Zinc	32/32	5.7 - 40,000

TABLE 2: CONTAMINANTS OF POTENTIAL CONCERN IN SUB-SURFACE SOIL

CONTAMINANT	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)
Arsenic	2/15	2.3 - 13.0
Iron	15/15	820 - 250,000

TABLE 2: CONTAMINANTS OF POTENTIAL CONCERN IN SUB-SURFACE SOIL

Lead	15/15	12 - 2,500
Mercury	9/15	0.11 - 120

5.5 Groundwater Contamination

Ten monitoring wells were installed to depths ranging from 6 to 30 ft below ground surface (bgs) using a power auger. Wells were generally located according to their representativeness of site boundary limits and/or based on findings from the geophysical survey and shallow soil borings. No permanent monitoring wells were located offsite.

Most wells were completed at shallow depths (less than 20 ft bgs). Several attempts were made to install monitoring well EPA-6S; however, no water entered the boring within approximately 7 hours following initial drilling and the decision was made to abandon the well. A pair of wells consisting of a shallow well completed at 12.5 ft bgs and a deep well completed at 38.6 ft bgs were located near the northern pond. This area contained a discontinuity in the clayey layer.

Six temporary piezometers were installed with hand augers to depth of the clay layer during the sampling in April 1998. Depths to top of clay ranged from 4.5 to 9.5 ft bgs. Three piezometers were placed at onsite locations and three at offsite locations.

Onsite piezometers were installed to provide additional information on groundwater flow, particularly along the eastern portion of the site where previous attempts to install a monitoring well were futile. Additional piezometers were located along the fence adjacent to the pond in the northern corner of the Site and in the middle of the site east of monitoring well EPA-5S.

Two piezometers were installed northeast of the site across from the railroad track and drainage ditch to provide information on whether groundwater metal contamination has migrated offsite. Another offsite piezometer was installed at the southern boundary to provide background information for groundwater parameters.

All groundwater samples from monitoring wells were field screened for alkalinity, hydrogen sulfide, and total chloride when turbidity was below 100 NTUs. Laboratory analyses were performed for anions/cations, organics, and inorganics.

Two rounds of water level measurements were obtained during the investigation. These measurements were collected during December 1997 and April 1998. In most cases, the greatest concentrations of contaminants were found at monitoring wells 1S, 5S, 7S, and 10S and piezometers P1, P2, and P5. This compares well with findings of surface and subsurface soil contamination discussed and reflects the probable migration of contaminants within the soil to the groundwater, especially within the shallow vadose zone. In general, groundwater is

less contaminated in wells located in the south and southwest portions of the site.

Offsite migration of contamination is reflected in the groundwater results at piezometer P5. Concentrations of lead, arsenic, chromium, iron, and aluminum are listed above the RBCs but are generally half the values reported for well 7S, which is the well nearest the site boundary and most immediately upgradient. With the exception of arsenic at P4, offsite contamination was not observed from the analytical results of offsite piezometers P4 and P6. It is apparent from these results that a plume of contaminated groundwater emanating from the central and northern storage areas onsite has migrated beyond the site boundary in a northeastern direction, the direction of the shallow groundwater flow. Of the metals previously mentioned, arsenic, chromium, and lead are the contaminants most relevant for determining present and future risk.

While iron, aluminum, manganese, and sodium naturally occur in the shallow aquifer, the concentrations are elevated relative to background. The elevated concentrations reflect the operations conducted onsite, such as the use of caustic soda, and the presence of metallic debris in the soil and are also reflected in the results of the soil investigation.

Throughout the site, a marine clay layer defines a relatively impermeable barrier between the surficial aquifer and the deeper Floridan Aquifer; the absence of this clay component from the soil boring at deep well 10D suggests a possible pathway for migration of contaminants to the deeper aquifer system. However, comparison of analytical results for the well pair 10S and 10D indicated that metals concentrations were elevated in the shallow aquifer but were not elevated in the deeper well. This discrete separation of hydrologic units is further supported by the head difference measured between the shallow and deep wells, which varies approximately 1 ft, indicating an upward flow direction for the deeper portion of the aquifer. The upward movement of the groundwater apparently prevents the vertical migration of contaminants from the surficial aquifer and minimizes the potential for downward migration into the Floridan.

The analytical results of the 1997 groundwater sampling program were compared with results of groundwater samples collected from the same wells during April 1998 by representatives of the MRI Corporation (CH2M-Hill 1998). The comparison reflects similar findings of contaminants of concern, especially for lead, arsenic, aluminum, chromium, and cyanide, in their distribution patterns and levels of concentration. Observation of the sampling procedures indicate that the relative turbidity of the water was comparable during both sampling periods.

TABLE 3: CONTAMINANTS OF POTENTIAL CONCERN IN GROUNDWATER		
CONTAMINANT	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (ug/l)
Chloroform	1/1	2.0

TABLE 3: CONTAMINANTS OF POTENTIAL CONCERN IN GROUNDWATER		
Dieldrin	1/1	0.018
Aluminum	12/14	1,600 - 110,000
Arsenic	9/14	11 - 69
Barium	12/14	32 - 1,300
Chromium	12/14	10 - 290
Copper	12/14	2 - 185
Cyanide	6/10	18 - 260
Iron	13/14	1,200 - 53,000
Lead	12/14	4 - 380
Manganese	14/14	21 - 520
Mercury	2/14	0.340 - 0.800
Nickel	4/14	42 - 100
Selenium	6/14	4 - 61
Sodium	14/14	11,000 - 1,600,000
Thallium	1/11	9
Vanadium	11/14	7 - 420

5.6 Surface Water and Sediment Contamination

The objective of the surface water and sediment investigation was to determine whether surface water runoff or seepage from beneath the site was transporting contaminants into surrounding surface waters.

Three surface water and sediment samples were collected from onsite locations—two from the drainage areas along the southwest and northwest borders and one from the pond area. Seven surface water and sediment samples were collected from offsite location—one from a ponded area that receives drainage from the northern part of the site, two from drainage areas adjacent to the northeast property fence, and four from a drainage area parallel to the fence but north of the railroad tracks. These two drainage areas are connected by a small 6-in. drainage pipe under the railroad tracks; however, the culvert appears to be blocked with sediment on the south side of the tracks. In addition, five sediment samples were collected from offsite locations during April 1998. Two of these samples were collected from the ditch on either side of the railroad track approximately 300 ft north of the site. Two other

samples were collected from the ditch that flows under Stannum Street to the southeast at distances of approximately 250 ft and 900 ft. A fifth sample was collected from the drainage ditch along Stannum Street at the southern boundary of the site.

Surface water samples were analyzed for total metals plus cyanide; two samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and total metals plus cyanide. All sediment samples were analyzed for total metals; two samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and total metals plus cyanide.

Surface water samples were collected from ten locations, seven of which were within the offsite ditch paralleling the eastern side of the site. The remaining locations were onsite in a perimeter drainage ditch and the pond area in the northern corner.

At the time of sample collection, there had been no appreciable rainfall for over two weeks. The pond and ditches on and adjacent to the site represent topographic low points for the area; therefore, the sampling conditions might best be termed "no flow" rather than "base flow." Water movement under these conditions would be limited to evaporation and downward percolation. Thus, the surface water results better identify metal solubilities and potential risks associated with the collection areas under these conditions than actual migration of contaminants via this pathway under storm flow conditions.

Iron, lead, manganese, and zinc levels were highest in samples from the offsite ditch and from the pond in the northern portion of the site. Chromium and vanadium were detected regularly but at very low levels. Ten samples were collected, and RBCs were exceeded at eight locations for iron, four locations for manganese, two locations for lead, and one location each for arsenic and mercury.

Iron concentrations exceeded RBCs in all onsite samples and all but one offsite sample; this may be a result of widespread occurrence of iron at elevated concentrations in the onsite surface soils. The maximum lead concentration (210 ug/L) and the only mercury concentration (0.22 ug/L) were detected offsite north at SW-07. Manganese concentrations were slightly elevated offsite north and northeast in the ditch adjacent to the detinning area. Overall, the surface water results are consistent with the surface soil contamination, i.e., locations receiving runoff from the northern corner and eastern areas of the site contain the highest concentrations of site-related contaminants.

Sediment samples were collected from ten locations during RI sampling performed in November 1997. Collocated with the surface water sampling, seven of the locations were within the offsite ditch paralleling the eastern side of the site. The remaining locations were onsite in a perimeter drainage ditch and in the pond area in the northern corner of the site. Results from the November sampling indicated a need to collect additional samples from the ditches paralleling the railroad track to determine the extent of contaminant migration. To this end, four samples were collected further from the site in April 1998.

Concentration variations indicate that sediments in the offsite ditch and the pond area in the northern portion of the site have been affected by site activities. In addition, the less ubiquitous metals mercury, antimony, and cadmium were detected mainly in these areas.

Concentrations of essentially all of the analytes of concern were highest in samples 07, 10, 11,

and 12. Locations 10 (onsite) and 07 (off-site) are in a pond area adjacent to the northern corner of the site known to have been contaminated via operations and scrap metal storage. These locations are above the ditch elevation by about 2 ft and therefore receive only site runoff. Downgradient from location 10, sediments at location 07 contained the highest concentrations of iron (35,000 mg/kg), aluminum (35,000 mg/kg), mercury (3.2 mg/kg), antimony (110 mg/kg), and zinc (2,900 mg/kg).

Locations 11 and 12 are approximately 260 ft north of the site in the drainage ditches along either side of the railroad bed. Given the current topography, these locations are downgradient of the drainage ditches adjacent to the site and the pond. At location 11, concentrations of lead (3,000 mg/kg), chromium (130 mg/kg), and total mercury (3.2 mg/kg) were as high as or higher than at any other locations. A review of current and historical land use in the vicinity of these locations indicated no viable sources for the contamination other than migration from the MRI site. Furthermore, these results demonstrate that efforts to bound the extent of site-related sediment contamination within the ditch were unsuccessful.

The data indicate that metals concentrations in ditch sediments north of the site are higher than those immediately adjacent to the site where the facility discharged its process wastes. Regardless of whether this was historically the case, surface runoff quality and quantity may explain this current circumstance. Overland surface water flow over most areas of the site is minimal during average rains due to the site topography and sandy soils. However, runoff is likely a much more active migration pathway within the ditch and pond areas due to the site gradient and minimal infiltration resulting from the lower-porosity muds and detritus in these areas.

Soil contamination in the vicinity of the eastern site boundary (adjacent to the ditch) is more likely to migrate downward into groundwater rather than move eastward into the ditch or northwestward to the pond area via surface flow. This would result in minimal input to the pond and ditch areas from the contaminated soils along the eastern boundary. Because the ditch slopes slightly to the north, contamination currently within the ditch adjacent to the eastern boundary may decrease over time as precipitation induces contaminant migration further north or percolation downward.

By contrast, metals in the northern pond sediments are much more likely to continue to move northward offsite in response to precipitation events. Once in the ditch, migration continues north and crosses over to the second ditch via a conduit north of the site. The sampling results at locations 11 and 12 support this scenario. The pond area contains high concentrations of metals resulting from its use and proximity to a former scrap storage area. It is therefore likely serving as an active source for the northward migration of metals in the drainage ditch during even moderate precipitation events. Figure 3 shows the approximate extent of soil/sediment and groundwater contamination.

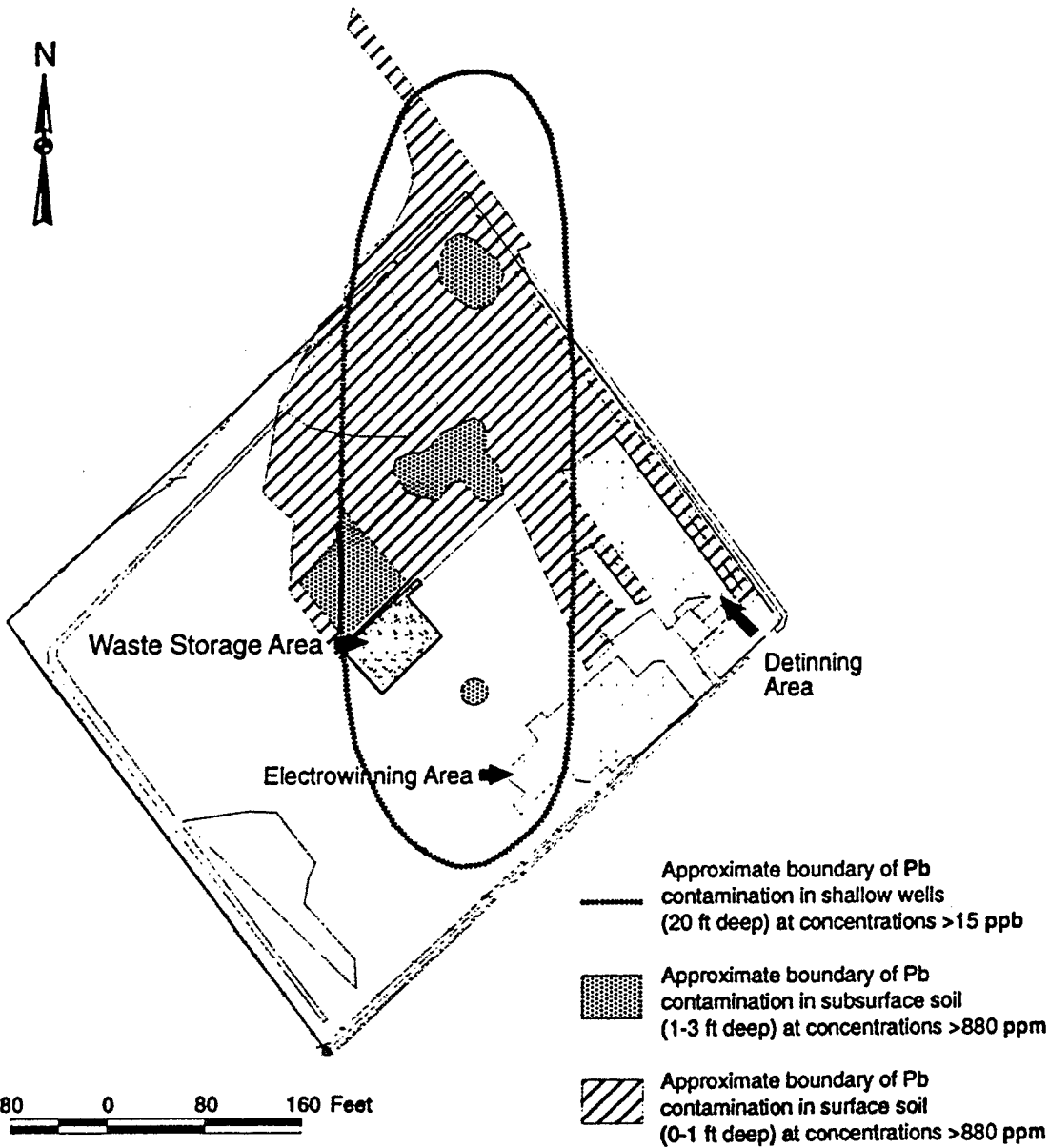
TABLE 4: CONTAMINANTS OF POTENTIAL CONCERN IN SEDIMENT

CONTAMINANT	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)
Benzo(a)pyrene	1/1	0.143

TABLE 4: CONTAMINANTS OF POTENTIAL CONCERN IN SEDIMENT		
Aluminum	15/15	1,700 - 35,000
Antimony	3/15	6.1 - 110
Arsenic	7/15	3.5 - 20
Cadmium	7/15	1.6 - 15
Chromium	15/15	8 - 130
Iron	15/15	1,500 - 35,000
Lead	15/15	33 - 3,300
Manganese	13/15	17 - 440
Mercury	5/15	0.230 - 3.20
Vanadium	13/15	5.4 - 58
Zinc	15/15	40 - 2,900

TABLE 5: CONTAMINANTS OF POTENTIAL CONCERN IN SURFACE WATER		
CONTAMINANT	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (ug/l)
Arsenic	1/10	14
Iron	9/10	620 - 5,200
Lead	10/10	7 - 210
Manganese	10/10	18 - 140
Mercury	1/10	0.220
Sodium	10/10	16,000 - 210,000

Figure 3 Extent of Contamination



6.0 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The site is not currently in use. The site is bordered by industrial/commercial properties to the northwest, west, and south. Orchards and grazing pasture are located to the north and east of the site.

EPA contacted the Hillsborough County Planning Commission (HCPC) in April 1999 to confirm the planned future use of the Site and adjoining property. According to the HCPC, the land use designation for the area is Light Industrial Planned which does not allow for residential use.

Groundwater at the site occurs in the surficial unconfined aquifer (terrace deposits) and the underlying Floridan Aquifer. In the vicinity of the site, the sand, clay, and shell terrace deposits average a thickness of 25 ft. The site is in an area of recharge for the Floridan Aquifer, and depth to groundwater is about 2 feet. The surficial aquifer is currently classified as Class II (potential source of drinking water) by EPA and as Class G-II (potable water use) by the Florida Department of Environmental Protection (FDEP). However, the surficial aquifer is not currently used as a drinking water source in the area of the Site.

7.0 SUMMARY OF SITE RISKS

CERCLA directs EPA to conduct a baseline risk assessment to determine whether a Superfund Site poses a current or potential threat to human health and the environment in the absence of any remedial action. The baseline risk assessment provides the basis for taking action and indicates the exposure pathways that need to be addressed by the remedial action. This section of the ROD reports the results of the baseline risk assessment conducted for this Site.

The foundation of the conceptual site model is that surface and subsurface soil are contaminated with metals. The surface soils could be subject to ingestion or direct contact by humans or animals. Surface water runoff can be contaminated with metals and deposit the metals in ditch sediments. Surface and subsurface soil can release metals to the shallow groundwater. Humans could possibly ingest contaminated groundwater in the future. Animals and plants could possibly experience direct contact or ingestion of contaminated soil or surface water. There is also the potential for metals to bioaccumulate up the foodchain to birds and animals.

7.1 Contaminants of Concern

The chemicals measured in the various environmental media during the RI were included in this discussion of the site risks if the results of the risk assessment indicated that a contaminant might pose a significant current or future risk or contribute to a cumulative risk which is significant. The contaminants of concern are a subset of the contaminants of potential concern listed in Tables 1-5. The criteria for a significant risk was a carcinogenic risk level above the acceptable risk range, i. e., 1×10^{-4} to 1×10^{-6} , or a hazard quotient (HQ) greater than 1.0 (unity). See tables 6-8 for the contaminants of concern in each medium.

TABLE 6: CONTAMINANTS OF CONCERN IN SURFACE SOIL		
CONTAMINANT	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)
Lead	32/32	8.8 - 4,600

TABLE 7: CONTAMINANTS OF CONCERN IN SURFACE SOIL		
CONTAMINANT	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)
Lead	15/15	12 - 2,500
Mercury	9/15	0.11 - 120

TABLE 8: CONTAMINANTS OF CONCERN IN GROUNDWATER		
CONTAMINANT	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (ug/l)
Aluminum	12/14	1,600 - 110,000
Arsenic	9/14	11 - 69
Lead	12/14	4 - 380
Sodium	14/14	11,000 - 1,600,000

7.2 Exposure Assessment

Whether a chemical is actually a concern to human health and the environment depends upon the likelihood of exposure, i.e. whether the exposure pathway is currently complete or could be complete in the future. A complete exposure pathway (a sequence of events leading to contact with a chemical) is defined by the following four elements:

- ! A source and mechanism of release from the source,
- ! A transport medium (e.g., surface water, air) and mechanisms of migration through the medium,
- ! The presence or potential presence of a receptor at the exposure point, and
- ! A route of exposure (ingestion, inhalation, dermal absorption).

An evaluation was undertaken of all potential exposure pathways which could connect chemical sources at the Site with potential receptors. All possible pathways were first hypothesized and evaluated for completeness using the above criteria. The current pathways represent exposure pathways which could exist under current Site conditions while the future pathways represent exposure pathways which could exist, in the future, if the current exposure conditions change. Exposure by each of these pathways was mathematically modeled using generally conservative assumptions. Residential exposures were evaluated in

the BRA. However, given the current land use and future land planning, residential use of the Site is not realistically anticipated and will not be discussed further in this ROD.

TABLE 9: POTENTIAL EXPOSURE PATHWAYS			
Media	Scenario	Receptor	Exposure Pathways
Groundwater	Future	Adult Worker	Ingestion
Surface Soil	Current	Teenage Trespasser	Ingestion & Dermal Contact
	Future	Teenage Trespasser & Adult Worker	Ingestion & Dermal Contact
Subsurface Soil	Future	Adult Construction Worker	Ingestion & Dermal Contact
Sediment	Current, Future	Teenage Trespasser	Ingestion & Dermal Contact

The exposure point concentrations (EPCs) for each of the chemicals of concern and the exposure assumptions for each pathway with an unacceptable risk or hazard were used to estimate the chronic daily intakes for the potentially complete pathways (the exposure assumptions for the pathways of concern can be found in Appendix B). The EPCs are summarized below for those contaminants and exposure pathways that were found to present a significant potential risk. The baseline risk assessment is based on the reasonable maximum exposure (RME) that may be encountered during the various Site use scenarios. The RME concentrations are either the calculated 95% Upper Confidence Limit of the arithmetic mean or the maximum concentration detected during sampling. The intent of the RME is to estimate a conservative exposure case (i.e., well above the average case) that is still within the range of possible exposures. If the calculated UCL exceeded the maximum level measured at the Site, then the maximum concentration detected was used to represent the reasonable maximum concentration. The chronic daily intakes were then used in conjunction with cancer slope factors and noncarcinogenic reference doses to evaluate risk. Sodium was included as a contaminant of concern in groundwater at the request of the State of Florida.

TABLE 10: EXPOSURE POINT CONCENTRATIONS IN SURFACE SOIL		
CONTAMINANT	EPC Value (mg/kg)	Max. or 95% UCL

TABLE 10:EXPOSURE POINT CONCENTRATIONS IN SURFACE SOIL		
Lead	3,040	95% UCL

TABLE 11:EXPOSURE POINT CONCENTRATIONS IN SUB-SURFACE SOIL (2-4 ft bgs)		
CONTAMINANT	EPC Value (mg/kg)	Max. or 95% UCL
Lead	2,500	Max.
Mercury	120	Max.

TABLE 12:EXPOSURE POINT CONCENTRATIONS IN GROUNDWATER		
CONTAMINANT	EPC Value (ug/l)	Max. or 95% UCL
Aluminum	110,000	Max.
Arsenic	69	Max.
Iron	53,000	Max.
Lead	380	Max.
Sodium	1,600,000	Max.

7.3 Toxicity Assessment

Toxicity values are used in conjunction with the results of the exposure assessment to characterize Site risk. EPA has developed critical toxicity values for carcinogens and noncarcinogens. Cancer slope factors (CSFs) have been developed for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs, which are expressed in units of (mg/kg/day)⁻¹, are multiplied by the estimated intake of a potential carcinogen, in mg/kg/day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term “upper bound” reflects the conservative estimate of the risks calculated from the CSF. Use of this conservative approach makes underestimation of the actual cancer risk highly unlikely. CSFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg/day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media can be compared to the RfD. RfDs are derived from human epidemiological studies or animal

studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Quantitative dose-response data were compiled from EPA's Integrated Risk Information System (IRIS), Health Effects Assessment Summary Tables (HEAST), and National Center for Environmental Assessment (NCEA). Toxicity criteria were available for all COPCs except lead. There is no reference dose for lead so the risk characterization, was developed by using EPA approved methods for estimating blood lead levels. The method used for the adult worker is found in the "Technical Review Workgroup for Lead Recommendations for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil." The calculations for lead soil levels can be found in Appendix B along with the non-cancer toxicity data and cancer toxicity data.

7.4 Risk Characterization

Human health risks are characterized for potential carcinogenic and noncarcinogenic effects by combining exposure and toxicity information. Excessive lifetime cancer risks are determined by multiplying the estimated daily intake level with the CSF. These risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper boundary, an individual has a one in one million additional (above their normal risk) chance of developing cancer as a result of Site-related exposure to a carcinogen over a 70-year lifetime under the assumed specific exposure conditions at a Site.

EPA considers individual excess cancer risks in the range of 1×10^{-4} to 1×10^{-6} as protective; however the 1×10^{-6} risk level is generally used as the point of departure for setting cleanup levels at Superfund sites. EPA's definition of acceptable risk is found in 40 CFR 300.430 (e)(2). The point of departure risk level of 1×10^{-6} expresses EPA's preference for remedial actions that result in risks at the more protective end of the risk range. The health-based risk levels for the Site in its current condition are shown in Table 13.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminants's reference dose). A HQ which exceeds unity (1) indicates that the daily intake from a scenario exceeds the chemical's reference dose. By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. An HI which exceeds unity indicates that there may be a concern for potential health effects resulting from the cumulative exposure to multiple contaminants within a single medium or across media. The HIs for the Site are shown in Table 13.

Using the results of the human exposure assessment and the toxicity information, potential human health risks for each COPC and selected exposure pathway were evaluated. Upper bound excess lifetime cancer risks for carcinogenic chemicals and hazard quotients and hazard index values for noncarcinogenic chemicals were estimated. The upper-bound lifetime excess cancer risks derived in this report can be compared to EPA's target risk range for health protectiveness at Superfund sites of 1×10^{-6} to 1×10^{-4} . In addition, the noncarcinogenic

hazard indices can be compared to a value of 1 since hazard indices greater than 1 indicate a potential for adverse health effects.

The risk characterization results showed unacceptable risks (i.e., upper-bound excess lifetime cancer risks exceeding the upper limit of EPA’s target risk range for health protectiveness at Superfund sites [1×10^{-4}] and/or non-cancer hazard indexes (HIs) greater than one) in groundwater due to arsenic. However, it should be noted that exposures to groundwater at the MRI site are not likely to occur because water is supplied to the area by a municipality, and consumption of the aesthetically poor surficial aquifer groundwater would be highly unlikely.

Total cancer risk estimates based on exposures to surface soil, subsurface soil, surface water, and/or sediment by industrial workers, construction workers, and trespassers at the MRI site were at the low end of, or below, EPA’s target risk range for health protectiveness. The HI associated with exposures to contaminants (not including lead) in soil was 2.8.

Based on the methods for assessing risks associated with adult exposures to lead in soil, potential future exposure by an adult industrial worker could result in unacceptable blood lead levels. It was calculated that a soil cleanup level of 880 mg/kg for lead would be protective of the industrial worker. The calculations are found in Appendix A of the Feasibility Study.

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

TABLE 13: RISK SUMMARY * FOR CURRENT AND FUTURE USE			
Receptor	Pathway	Noncarcinogenic Risk (Hazard Index)	Carcinogenic Risk
Future Adult Construction Worker	Ingestion of Soil Mercury	1.9	
	Dermal Contact with Soil Mercury	0.9	
	TOTAL:	2.8	
Future Adult Worker	Ingestion of Groundwater Aluminum	1.1	3.6x10 ⁻⁴
	Arsenic	2.3	
	Iron	1.7	
	TOTAL:	5.1	

*NOTE: Lead is a significant contamination of concern. However, there is no reference dose for lead. The risk characterization for lead was developed using EPA approved methods for estimating blood lead levels, instead of calculating a HI. Therefore, the risk associated with exposure to lead is not presented here, but can be found in Appendix B of this ROD. The risk characterization is based upon the “Technical Review Workgroup for Lead Recommendations for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil”

7.5 Environmental Risk

A qualitative risk assessment was conducted to determine if contaminants present in site soils, sediment and surface water could potentially impact flora and fauna in the area. However, this risks assessment did not include toxicity testing. Analytical results from the contaminated media were compared with published screening values for ecological effects.

As for the HHRA, the first of the ERA was to summarize the analytical data collected during the RI at the MRI site. Surface soil, sediment, and surface water data were summarized for evaluation in the ERA. Subsurface soil and groundwater data were not evaluated in the ERA because these media are considered inaccessible to ecological resources. COPCs were selected from these media for quantitative evaluation by comparing the maximum detected concentrations of chemicals in these media to Dutch Soil Cleanup Levels (Netherlands 1996) and EPA Region IV ecologically-based screening level concentrations for surface water and sediment (EPA 1995). All compounds detected at concentrations above these screening levels were selected as COPCs and further evaluated in the ERA.

Based in part on the conservative nature of the screening values, a number of organic and inorganic chemicals were identified as COPCs. The organic chemicals identified as COPCs consisted of primarily pesticides and PCBs in soil and pesticides, PCBs, and PAHs in sediment. No organic COPCs were identified in surface water. The pesticides and PAHs are not thought to be associated with site operations. The majority of inorganic chemicals detected in soil, sediment, and surface water were identified as COPCs.

An exposure assessment was performed to identify ecological resources that could be adversely affected by onsite chemicals. Based on consideration of the COPCs, potential chemical exposure pathways, and ecological resources present onsite, the potential for adverse effects was evaluated in the ERA for the following receptors: terrestrial plants, soil invertebrates, vermiferous wildlife (represented by robins and shrews), aquatic-feeding terrestrial wildlife (represented by raccoon), and aquatic life.

Consistent with current guidance, maximum detected chemical concentrations were conservatively used to estimate and/or model exposure concentrations for all of the above receptors. The mean concentration of the COPCs was used in addition to the maximum concentration in surface water because of the transient nature of this medium and the mobility of many aquatic species.

The ecological toxicity assessment was performed to identify numerical toxicity values with which to assess the exposure of the ecological resources identified for evaluation. With the exception of Federal Ambient Water Quality Criteria, very few toxicity criteria have been developed for the evaluation of adverse effects to terrestrial and aquatic species. Accordingly,

the open scientific literature was reviewed to identify applicable screening values for the receptors of concern.

Results of the ecological exposure assessment and the toxicity data were considered together to determine whether there is the potential for adverse effects to ecological resources. Results of this comparison indicated there is the potential for adverse effects to both terrestrial plants and earthworms from exposure to a number of inorganic chemicals in surface soil. Sample locations EPASB041 and EPASS03 appear to be hot spots, and risks to terrestrial plants and earthworms are likely localized around these sample locations.

The results of the conservative screening-level food chain analyses indicate the potential for adverse effects to robins and shrews from the presence of organic and inorganic COPCs in soil and to raccoon from the presence of organic and inorganic COPCs in sediment. When interpreting the results of the terrestrial wildlife models, however, it should be recognized that there are numerous conservative assumptions. These conservative assumptions, which are consistent with current EPA guidance, are likely to overestimate risk.

The results of the sediment analyses suggest there is potential for a number of inorganic and organic COPCs in sediment to adversely affect benthic organisms, while the results of the surface water analyses indicate the potential for a number of inorganic COPCs in surface water to adversely affect aquatic life. It should be noted, however, many of the surface water bodies where samples were collected are intermittent in nature and could not support aquatic life year-round. For instance, sample locations EPA8 and EPA9 were dry during a site visit in June 1997 and during fieldwork in April 1998, while all offsite sample locations were dry or damp in April 1998. As a result, persistent populations of aquatic organisms are not expected in many of the aquatic habitats associated with the MRI site, and adverse effects at many locations, if occurring, would be limited to opportunistic species capable of withstanding periods of dryness. Furthermore, surface water and sediment data from additional background locations would be helpful to more conclusively determine if any of the COPCs potentially causing risks were within background levels, in which case risks for onsite species are likely to have been overestimated by the model.

Formal ecological surveys were not conducted at the MRI Site. However, observations were made during a site visit in June 1997 and during field sampling activities in November and December 1997 and April 1998. In general, the eastern, central, and southern portions of the site consist of open field areas with scattered concrete, gravel, and rocks intermingled with plants. Many of these open areas were disturbed by past site activities. The central sections of the western and northern sections also consist of open field areas. However, the western and northern boundary areas consist of small forested areas. Much of the 11-acre site is vegetated with broom sedge, particularly in the open field areas and adjacent to existing concrete structures.

Birds were the most common animals observed during field activities at the site. Field sparrows, bluejays, migrating warblers, little blue heron, snowy egret, several hawks (including red-shouldered), turkey vultures, loggerhead shrike, snipe, red-winged blackbird, red-shouldered hawk, killdeer, crows and whip-poor-will were all observed. The only mammals observed included numerous marsh rabbits. Tracks of raccoons were common. Although no amphibians were noted, many species are expected to use the pond areas at the site. Reptiles observed included alligator snapping turtles and black or rat snake. A few mosquitofish were observed in the ponded water near the eastern boundary of the site and in

the drainage ditches adjacent to the railroad tracks to the east of the site.

The U.S. Fish and Wildlife Service and the Florida Game and Fresh Water Fish Commission(1998) were contacted to identify species of special concern at or near the Site. Many of the endangered species in Hillsborough County are found in marine habitats (e.g., West Indian manatee, green sea turtle leatherback sea turtle, loggerhead sea turtle, and gulf sturgeon), which precludes their occurring at the MRI Site. The remaining species are also unlikely to occur at the site given its disturbed nature and lack of adequate habitat for these species.

The National Audubon Society visited the perimeter of the MRI Site in November, 1998. The Audubon members noted that red-tailed hawks may be using the MRI Site to roost as a pair was observed in a cypress on the north side of the site. Secondly, a sunset census and an early morning census at the storinwater detention pond just offsite indicated a variety of birds. In particular, Florida sandhill cranes, which are threatened, were using the offsite pond for a night roost. Other species of special concern observed included snowy egret, tricolored heron, and white ibis. Other birds observed were egrets, ibis, ducks, etc.

The site cleanup, based on protection of human health, will address contaminated soil and sediment. Cleanup of the contaminated soil and sediment will reduce the potential risks to ecological receptors at the Site. However, it will be necessary to further evaluate the potential ecological risks associated with this Site as part of the RD/RA. At a minimum, this task will involve comparing the anticipated or measured residual contaminant concentrations in soil with ecological screening values.

7.6 Uncertainties

At all stages of the risk assessment, conservative estimates and assumptions were made so as not to underestimate potential risk. Nevertheless, uncertainties and limitations are inherent in the risk assessment process.

The estimates of exposure point concentrations of the chemicals of concern probably overstate actual concentrations to which individuals would hypothetically be exposed and therefore, the health risk estimates are very conservative. In addition, no attenuation of the chemicals was considered; however, this may reduce concentrations of chemicals over time.

The assumed exposure pathways evaluated in the risk assessment are conservative in nature and may overstate the actual risk posed by this Site.

Summing risks or hazard indices for multiple contaminants ignores the possibility of synergistic or antagonistic activities in the metabolism of the contaminants.

The ecological risk assessment did not include toxicity testing (bioassays) for surface water or sediment.

Surface water and sediment data from additional background locations would be helpful to more conclusively determine if any of the COPCs potentially causing risks were within background levels, in which case risks for onsite species are likely to have been overestimated by the model.

8.0 REMEDIAION OBJECTIVES

EPA developed a range of alternatives to address the contamination at the Site. The alternatives were based upon the following remedial action objectives:

- ! Prevent ingestion of and dermal contact with contaminated soil and sediment;
- ! Prevent further migration of contaminants to the groundwater.

EPA then developed specific remedial goals to meet these objectives. The risk assessment identified the remedial goals relative to direct contact or ingestion of soil. The soil cleanup alternatives were based upon on a remedial goal for lead in soil of 880 mg/kg. Lead was used as an “indicator chemical” for the purpose of estimating the amount of soil to be cleaned up. Lead is more toxic than the other metals. In addition, lead and the other metals are usually found in the same areas. The volume of material to be remediated has been estimated at approximately 7400 cubic yards.

Other contaminants do not pose a significant threat to human health through soil exposure, but do contribute to groundwater contamination. The cleanup of soil to the levels listed below in Table 14 will reduce the impact to groundwater. However, it may be appropriate to review and modify the cleanup levels or develop additional cleanup levels to ensure that the source of groundwater contamination has been addressed to the maximum extent practical and to be consistent with actions proposed for Operable Unit Two.

The cleanup levels for the protection of human health are based upon continued industrial use of the Site. According to the Hillsborough County Planning Commission, the designation for the area at and around the Site is Light Industrial Planned which does not allow for residential use.

The surficial aquifer is currently classified as Class II by EPA and as Class G-II (potential source of drinking water) by the Florida Department of Environmental Protection (FDEP). However, the surficial aquifer is not currently used as a drinking water source in the area of the Site.

TABLE 14: Remedial Goals for Soil/Sediment Contaminants	
Contaminant	Goal (mg/kg)
Lead	880 ¹
Mercury	43 ¹
¹ Risk based goal Additional evaluation will be performed during the design phase to confirm the effectiveness of the proposed remedy relative to the protection of groundwater. If necessary, the cleanup levels will be modified, or additional goals developed, to ensure consistency with any future groundwater actions.	

9.0 DESCRIPTION OF ALTERNATIVES

The analysis presented below reflects the fundamental components of the various alternatives considered feasible for this Site.

ALTERNATIVE S-1: NO ACTION FOR SOIL

The *National Contingency Plan (NCP)* requires the consideration of a no action alternative

as a basis for comparison to other alternatives. Under the no action alternative, the site is left “as is” and no funds are expended for monitoring, control, or cleanup of the Site. This no-action alternative would also apply to groundwater. There are no costs associated with this alternative.

ALTERNATIVE S-2: EXCAVATION, DISPOSAL & CONTAINMENT

Alternative S-2 involves excavation of contaminated soil and sediment from isolated areas of significant concentrations at depths below the surface (or deep source “hot spots”) and from selected areas where significant concentrations are limited to the surface soil (two feet below ground surface). Excavated material would be loaded and transported to an offsite disposal facility.. Capping alone may not be as effective on these deep hot spots.

Containment of the remaining contaminated soil and sediment would be accomplished by capping, which would reduce the potential for exposure to contaminated soils and and infiltration of water. This alternative would use existing concrete and asphalt in addition to the construction of a simple cap over consolidated materials. This alternative also includes institutional controls and monitoring to evaluate long-term performance of the alternative.

The containment portion of the cleanup would address two areas: (1) drainage areas, including the north pond and the ditches northwest of the site; and (2) the former detinning and waste storage areas

The main tasks for the drainage areas would include the following:

- Further sampling to define the extent of contaminated soil
- Excavate the contaminated surface sediment and soil.
- Transport the contaminated soil offsite for disposal.
- Backfill, regrade, and revegetate the area.

The main tasks for the detinning and waste storage areas would include:

- Excavate and remove any soil with high levels of contaminants (“hot spots”).(i.e., 3-8 ft range, approximately 225 cu yd).
- Backfill the excavated hot spots with clean soil.
- Cap the remaining contaminated areas with a layer of clay or clay/bentonite (1 foot thick) and a one-half foot layer of top soil.
- Deed restrictions to preclude residential use of the site and preclude use of shallow groundwater at the site for drinking water.
- Periodic groundwater monitoring to gauge the effectiveness of the soil cleanup relative to groundwater quality.

Following cap construction, institutional controls including deed restrictions on future site uses, and fence installation would be initiated.

ARARs for this alternative would apply to excavation and disposal of contaminated soil, reclamation of the areas of excavation, and monitoring activities. Requirements such as RCRA land disposal restrictions, and RCRA manifesting and record keeping, may apply if new data indicates that the contaminated soil should be considered a characteristic hazardous waste. However, the information collected during the RI indicates that the contaminated media is not a characteristic hazardous waste.

Consolidation and capping of untreated material at the MRI site is expected to reduce the infiltration of water and subsequent leaching of contaminants into the groundwater. Capping is a commonly implemented and effective alternative for contaminated soils and waste left in place. The cap is also expected to effectively provide long-term isolation of the material from human receptors. A properly graded and compacted low-permeability clay liner would be an effective means of reducing infiltration. A clay liner is very durable and has “self-healing” properties should settlement occur. Alternate asphalt and concrete pavement caps installed as an integral part of site redevelopment would also be adequate as long as the system is not compromised by additional site modifications in the future. A significant drawback to capping is that future site use and development is made more complicated. Subgrade work such as installation or modification of buried utilities or building foundations would have to take into account deed restrictions limiting access and activities.

It is anticipated that the actual design and construction of the alternative would take approximately one year. Deed restrictions could be developed concurrently.

The present-worth cost for the containment alternative is approximately \$1,674,838. This includes capital costs of \$1,494,063 and yearly O&M costs of \$11,760. The costs were estimated calculated for a 30-year period using a five percent discount rate.

ALTERNATIVE S-3: Solidification/stabilization

Alternative S-3 for remediation of soils and debris involves excavation and solidification/stabilization of soils. The alternative includes institutional controls, monitoring, and O&M to ensure long-term protectiveness and performance of the alternative. The institutional controls for Alternative S-3 are the same as proposed in Alternative S-2. The basic components for this remedy are outlined below:

- Further sampling to define the extent of contaminated soil.
- Perform, treatability studies on soil samples to determine the most effective stabilizing agent and mix design.
- Excavate contaminated soil and sediment from off-site and on-site locations.
- Consolidate excavated material on-site; screen excavated material to remove any recyclable metal items.
- Solidify the excavated material.
- Collect verification samples from excavated areas and from the solidified wastes to verify that the cleanup goals and performance standards have been met.

- Backfill the onsite and offsite areas with clean fill, grade the fill, and revegetate the disturbed portions of the Site as necessary.

It is anticipated that it would take about a year to complete the sampling and analysis, and design work for Alternative S-3. Actual implementation (mobilization, excavation, treatment, backfilling, capping, and demobilization) is expected to take another year.

Implementation of Alternative S-3 would leave treated residuals onsite. The solidification/stabilization process does not destroy the contaminants but does reduce contaminant mobility. Immobilization is accomplished by chemically and/or physically binding the contaminants to the matrix materials. By grading the surface and then placing a topsoil and vegetation layer on the surface, rainwater infiltration and groundwater recharge through the waste would be reduced.

Treatment of contaminated soils would be performed using conventional construction equipment. Treatability study testing would be necessary to select appropriate stabilizing agents and identify appropriate admixtures.

As part of the solidification/stabilization estimate, it is assumed that the 400 yd³ of contaminated sediment/soils from the offsite drainage way would be excavated; another 1840 yd³ of contaminated soil would be excavated from the deep source areas to a depth of approximately 4 ft; the remainder of the soil would be excavated to a depth of two feet. Conventional construction equipment would be used to implement the excavation and solidification/stabilization processes.

The present-worth cost for the solidification/stabilization alternative is approximately \$2,292,521. This includes capital costs of \$2,111,747 and yearly O&M costs of \$11,760. The costs were estimated calculated for a 30-year period using a five percent discount rate.

The solidification/stabilization treatment processes would be completed on-site and the treated material would remain onsite under a soil and vegetative cover. The alternative would also include requirements for long term maintenance and monitoring of the solidified material.

ALTERNATIVE S-4: OFFSITE DISPOSAL

Alternative S-4 includes sampling and analysis to delineate contamination boundaries (vertical and horizontal), excavation, handling, loading, shipping and disposal of contaminated soils, verification sampling, backfilling of excavations with imported fill, and revegetating the site. While most contamination is located within the top two feet, there are some limited areas of deeper contamination. One particular area consists of approximately 225 yd³ of contaminated soil, deeper than 2 feet, identified in the Metal Waste Storage Areas. This may require collection and treatment of groundwater that is encountered during excavation.

It is anticipated that it would take less than one year for the design of Alternative S-4 and for contractor procurement. Waste processing (including mobilization, excavation, backfilling, and demobilization) is also expected to take less than one year.

Offsite disposal is a reliable method to eliminate contamination from the site. Excavation, material handling, loading, transport, and disposal of the contaminated soils would be performed using conventional construction equipment; there is no question as to its technical feasibility.

The cost estimate for Alternative S-4 assumes that all contaminated soil that exceeds the

remediation goals is excavated, dewatered, loaded, transported offsite, and disposed of at a permitted disposal facility. All excavated areas would be backfilled with clean soil and revegetated (as necessary).

The present-worth cost for Alternative S-4 is approximately \$3,403,747. This includes capital costs of \$3,315,205 and yearly O&M costs of \$5,760. The costs were estimated calculated for a 30-year period using a five percent discount rate.

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives are evaluated against one another by using the following nine criteria:

- ! Overall protection of human health and the environment.
- ! Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).
- ! Long term effectiveness and permanence.
- ! Reduction of toxicity, mobility, or volume through treatment.
- ! Short term effectiveness.
- ! Implementability.
- ! Costs.
- ! State Acceptance.
- ! Community Acceptance.

The NCP categorized the nine criteria into three groups:

- (1) Threshold criteria: the first two criteria, overall protection of human health and the environment and compliance with ARARs (or invoking a waiver), are the minimum criteria that must be met in order for an alternative to be eligible for selection
- (2) Primary balancing criteria: the next five criteria are considered primary balancing criteria and are used to weigh major trade-offs among alternative cleanup methods
- (3) Modifying criteria: state and community acceptance are modifying criteria that are formally taken into account after public comment is received on the proposed plan. Community acceptance is addressed in the responsiveness summary of the ROD.

Overall Protection of Human Health and Environment

Alternative S-1 (No Action) would not provide protection of human health or the environment. Contaminants would not be isolated from the people that use the Site and may continue to leach into the groundwater. Alternative S-2 (Containment) would isolate the contaminants through capping, but protectiveness depends upon long-term maintenance of the cap.

Alternative S-3 (Solidification/stabilization) provides an additional level of protectiveness over

Alternative S-2 by treating the waste prior to onsite disposal but is also dependent on long-term maintenance. The solidification/stabilization alternative also requires periodic upkeep of the cap to maintain protectiveness. Alternative S-4 (Offsite Disposal) also provides a high level of protection because all soil contamination above health-based levels would be removed from the site.

Compliance with ARARs

Neither RCRA listed nor characteristic hazardous waste exists at the MRI site. Under RCRA, Land Disposal Restrictions may be applicable if samples of contaminated material fail TCLP analysis and if the response action constitutes placement. Alternatives S-2, S-3, and S-4 would be designed and implemented to meet all other ARARs. The no-action alternative (S-1) would not comply with groundwater MCLs anticipated for Operable Unit Two.

Long-Term Effectiveness and Permanence

The highest degree of permanence and the lowest level of residual risk are associated with Alternative S-4 (Offsite Disposal), which involves removal of all soil contamination above health-based levels. Alternative S-3 is also effective and permanent, but the permanence is somewhat dependent upon long term monitoring and maintenance for the cap and solidified material. Alternative S-3 provides a higher level of permanence than Alternative S-2, where no soil treatment is employed and residual risk levels are higher. The no-action alternative is not considered to be either effective or permanent in addressing risks from the site.

Reduction of Toxicity, Mobility, or Volume

The no-action alternative (S-1) would not affect the toxicity, mobility, or volume of contaminated soils or wastes at the MRI site.

Alternative S-2 (Containment) achieves a reduction in mobility (but not in toxicity or volume) by isolating the contamination under a cap. Capping would reduce the percolation of rainfall through the soil, thus reducing the migration of contaminants from soil to groundwater. Alternative S-3 (Solidification/stabilization) achieves an even greater reduction in mobility through binding of contaminants in a matrix highly resistant to leaching. The solidified material would then be capped on-site. A drawback to solidification/stabilization is an expected increase of approximately 15% in the volume of stabilized material remaining onsite. Alternative S-4 (Offsite Disposal) achieves the greatest reduction in mobility; however, volume and toxicity remain unchanged, as the waste is moved from one location (onsite) to another (an offsite landfill).

Short-Term Effectiveness

Alternative S- 1 (No Action), involving no onsite remediation activities, would result in no additional risks to the community or workers beyond those currently associated with this site. All other soil remediation alternatives (S-2, S-3, and S-4) involve excavation and processing of contaminated material. Differences in the short-term effectiveness of these more aggressive soil remediation alternatives are not significant; potential impacts to the community, site workers, and the environment can be minimized through proper use of engineering controls,

monitoring, and appropriate health and safety procedures.

Because Alternative S-2 (Containment) entails the excavation/handling of a smaller volume of contaminated material, it would be less likely to have an adverse impact to the community and/or workers.

Time required to achieve protectiveness has been estimated to be less than 1 year, once construction had started, for Alternatives S-2, S-3, and S-4.

Implementability

Alternative S-1 (No Action) is the most easily implemented because it entails no remedial design or construction activities. Alternative S-2 (Containment) would require the preparation of a design, deed restrictions, and a long-term O&M plan. Treatability studies would be necessary for Alternative S-3 (Onsite Solidification/stabilization) to determine the most effective stabilizing agents and delivery systems. Alternative S-3 (Onsite Solidification/stabilization) would also require a design, deed restrictions, and a long-term O&M plan. Alternative S-4 (Offsite Disposal) involves excavation and transportation of soil that exceeds health-based criteria to a RCRA disposal facility. After the soil has been excavated, the site would need to be backfilled and graded.

Costs

A summary of the present worth, capital, and O&M costs for each of the alternatives is presented in Table 6. Alternative S-1 is least expensive, while Alternative S-4 is the most expensive.

Community Acceptance

Based on the lack of responses from the general public, the community is not opposed to the selected remedy. The PRPs have provided their rationale for a more limited alternative that they labeled alternative S-5. EPA's responses to their concerns can be found in the responsiveness summary.

State Acceptance

In accordance with 40 CFR 300.430, FDEP, as the support agency, has provided input during the RI/FS process. The staff of FDEP agrees with the general approach to soil remediation, but has not agreed with the cleanup levels. FDEP will be provided a second opportunity to indicate if they accept the remedy, including cleanup levels, after the completion of the groundwater and leachability studies planned as part of the remedial design.

11.0 SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, EPA has selected Alternative S-3, as modified, as the remedy for this Site. The modification changes the solidification process from in-situ to ex-situ. The comparative analysis is not significantly impacted by the modifications included in the selected remedy. The basic components of the remedy include excavation and

solidification/stabilization of the contaminated material, on-site disposal and capping of the solidified material, deed restrictions and long term maintenance and monitoring. Groundwater monitoring and evaluation is also necessary to ensure the effectiveness of the soil cleanup levels relative to a reduction in leaching of contaminants to groundwater.

At the conclusion of the remedy, the potential hazard index associated with exposure to soil or sediment will be less than or equal to 1.0. EPA considers these hazard levels to be protective of human health and the environment and are based on an EPA approved site specific risk assessment. The total present worth cost of the selected, remedy, Alternative S-3, as modified, is estimated at \$2,130,111.

A. Description of Remedy

The selected remedy is more fully described as follows:

- Additional soil and sediment sampling to confirm extent of contamination.
- Treatability studies to establish the most effective solidification/stabilization reagents.
- Excavation of contaminated soil and sediment from off-site and on-site locations.
- Consolidation on-site of excavated soil and sediment; screening of excavated soil to remove metal debris.
- Ex-situ solidification/stabilization of the excavated material.
- Verification sampling from excavated areas and from the stabilized wastes to verify that the cleanup goals and performance standards have been met.
- Backfilling the onsite and offsite areas with clean fill, grading and revegetating the disturbed portions of the Site as necessary.
- Capping of the solidified material with soil and vegetation.
- Deed restrictions to preserve the integrity of the solidified material, prohibit residential use of the Site, and prohibit the consumption of shallow groundwater at the Site until groundwater is addressed by the action selected for OU 2.
- Long term maintenance and monitoring of the remedy.
- Additional groundwater monitoring and evaluation.

The main areas to be excavated include, but are not limited to, the former operation areas on-site, a small on-site pond located near the northeast corner of the Site, and drainage areas near the northeast corner of the Site and extending offsite in a northern direction. The estimated volume of contaminated soil is approximately 7,400 cubic yards.

The cleanup levels (880 ppm for lead and 43 ppm for mercury) were calculated based upon protection of an on-site industrial worker and/or construction worker. The soil cleanup is also expected to reduce impacts to groundwater and reduce potential risks to ecological receptors. However, additional evaluation relative to these concerns will be necessary during the remedial design. At a minimum, this task will involve: 1) collecting additional groundwater data to confirm if elevated metals concentrations are due to turbidity, further defining the

extent of the shallow groundwater contamination, and installing at least two additional monitoring wells in the Floridan aquifer to evaluate the extent of potential contamination in the deeper aquifer; 2) sampling and analysis to determine the concentrations of site related contaminants that may leach from soil to groundwater; 3) comparing the anticipated and measured residual contaminant concentrations in soil with ecological screening values.

The performance standards for the solidified material include:

unconfined compressive strength:	>50 pounds/square inch
permeability:	< 1×10^{-6} cm/sec
leachability index (Modified ANS 16.1):	< 1×10^{-12} cm/sec
SPLP extract:	lead < 100 ug/l
TCLP extract:	lead < 5.0 mg/l (confirmation that the solidified material is not a hazardous waste)

The leachability index will not be used as a pass/fail criteria during the remediation; it is a goal for the treatability study. Leachability index results from samples of the treated material will be used to guide long term monitoring.

The SPLP standard is based upon ensuring that leachate from the solidified mass does not cause the lead concentrations in groundwater to exceed 15 ug/l beyond the nearest edge of the site property. This standard may be revised during the RD after consideration of site specific factors such as the site hydrology, permeability of the solidified material, presence and type of cover over the solidified material, and distance from the solidified material to the point of interest on the site boundary.

The solidified material shall be capped. The specific cap design is best determined during the RD and must address these factors:

- long term stability and integrity of the solidified material
- leachability performance of the solidified material
- anticipated future use of the Site.

The remedy also includes institutional controls. These controls shall be deed restrictions, implemented by the Site owners, to preserve the integrity of the solidified material and cap and limit future use of the Site to industrial or commercial uses. The restrictions shall also prohibit the use of on-site contaminated groundwater as a source of drinking water.

Long term maintenance and monitoring of the remedy shall include site inspections, maintenance of the cover and solidified material, and annual groundwater monitoring.

Groundwater sampling and analysis shall include the parameters listed in the table below. The monitoring requirements apply to both the additional groundwater evaluation described above as well as long term monitoring for OU1.

Contaminant	Minimum Reporting Level (ug/l)
Aluminum	50
Arsenic	50
Chromium	100
Cyanide	200
Iron	300
Lead	15
Manganese	50
Nickel	100
Sodium	160,000
Vanadium	49

The remedy may change somewhat as a result of the remedial design and construction processes. Changes to the remedy will be documented appropriately, including entries in the administrative record, depending upon the significance of any such changes.

B. Summary of the Estimated Remedy Costs

CONSTRUCTION ITEMS	QUAN- TITY	UNITS	UNIT PRICE	RAW COSTS	COST FAC- TOR	TOTAL COSTS
Remedial Design Investigation						
Soil sampling to delineate contamination	32	crew-hrs	\$150.00	\$4,800	1	\$4,800
Analyze soil samples (60 in field)	20	hours	\$200.00	\$4,020	1	\$4,020
Analyze soil samples (10 in lab)	10	each	\$350.00	\$3,500	1	\$3,500
Contaminated soil profile, TCLP	10	each	\$350.00	\$3,500	1	\$3,500
Evaluate soil lab data	40	hours	\$150.00	\$6,000	1	\$6,000

Treatability Study	1	each	\$20,000.00	\$20,000	1	\$20,000
Mobilization and site preparation						
Contractor mob. & equipment procurement	1	lot	\$15,000.00	\$15,000	1	\$15,000
Install power supply for trailers	1	lot	\$5,000.00	\$5,000	1	\$5,000
Clear and grub site	4	acre	\$3,000.00	\$12,000	1.05	\$12,600
Construct decon pad and sump	40	crew-hrs	\$150.00	\$6,000	1.05	\$6,300
Mobilize track excavator, front end loader	1	lot	\$1,000.00	\$1,000	1	\$1,000
Tractor truck, 1 ea for onsite roll-off transport	2	month	\$1,000.00	\$2,000	1	\$2,000
Treatment						
Remove perimeter fencing (north corner)	600	lin ft	\$1.20	\$720	1	\$720.00
Construct soil staging area	100	cu yd	\$200.00	\$20,000	1	\$20,000
Excavate contaminated soils	7400	cu yd	\$8.78	\$64,972	1.41	\$91,610.00
Place contaminated soil in staging area	7400	cu yd	\$1.51	\$11,174.00	1.41	\$15,755.00
Backfill excavated areas with fill	7400	cu yd	\$7.43	\$54,982.00	1	\$54,982.00
Mobilize screening equipment	1	lot	\$1,000.00	\$1,000.00	1	\$1,000.00
Screen excavated soil	5675	cu yd	\$5.00	\$28,375.00	1	\$28,375.00
Transport recovered metals for off-site recycling	284	cu yd	\$1.75	\$497.00	1	\$497.00
Solidify and place excavated material	7400	cy	\$64.20	\$475,080.00	1	\$475,080.00
Verification sampling	1	lot	\$25,000.00	\$25,000.00	1	\$25,000.00
Decon, dispose of soil staging area	40	crew-hrs	\$300.00	\$12,000.00	1	\$12,000.00
Place topsoil, grade & revegetate	2	acre	\$8,000.00	\$16,000.00	1	\$16,000.00
Replace perimeter fence along north corner	600	lin ft	\$20.00	\$12,000.00	1	\$12,000.00
Site Distributables						
Officer trailer rental, utilities	6	month	\$1,000.00	\$6,000.00	1	\$6,000.00

RA contractor non-manual personnel	6000	hours	\$60.00	\$360,000.00	1	\$360,000.00
Site vehicle rental	6	month	\$600.00	\$3,600.00	1	\$3,600.00
Air monitoring	6	month	\$1,000.00	\$6,000.00	1	\$6,000.00
PPE	6	month	\$1,000.00	\$6,000.00	1	\$6,000.00
Capital costs subtotal						\$1,218,339
Contingencies and oversight						
H&S (5%)						\$60,916
Construction (30%)						365,501
Oversight (5%)						60,916
Support Costs						
Design and procurement (10%)						121,833
Permitting and legal (5%)						60,916
Services during construction (5%)						60,916
Total Capital Costs						\$1,949,337
Operation and Maintenance						
Annual Cap inspections	6,000	each	6,000			6,000
5 year reviews	0.2	Lot	28,800			\$5,760
Total O&M costs/year						\$11,760
Total O&M costs: 30 years	5.0% interest, 30 years present worth costs factor: 15.372					\$180,774
TOTAL COSTS INCLUDING O&M:						\$2,130,111
NOTE: All cost information presented here is an estimate with an accuracy of +50 to -30%. The estimate will be refined as the remedy is designed and implemented. Estimates assume a 5% discount rate. Volume of material to be screened does not include sediment; scrap metal not stored in ditch or pond.						

C. Expected Outcomes of Selected Remedy

The purpose of this action is to control risks posed by direct contact and ingestion of contaminated soil and sediment. The remedy will also reduce the migration of contaminants from soil into groundwater.

The Site will be available for industrial/commercial use after the cleanup is complete. It is expected that it will take about two years for design and implementation of this remedy. Future residential use of the site will be precluded by the deed restrictions. In addition, deed restrictions will be used to prevent consumption of the shallow groundwater on-site. The

shallow groundwater is considered by the State of Florida to be a potential source of drinking water. It is worth noting that the shallow groundwater at or adjacent to the Site is not currently used for drinking water.

An added benefit of the remedy is an expected reduction in contaminant leaching from soil to groundwater. A final decision regarding any particular remedial action for groundwater will be made as part of Operable Unit Two.

TABLE 17 : Cleanup levels for Chemicals of Concern			
Media: Soil and sediment			
Available use: Future Industrial/commercial			
Controls to Ensure Restricted Use: Deed restrictions implemented by property owner			
Chemicals of Concern	Cleanup Level	Basis for Cleanup Level	Risk at Cleanup level
Lead	880 mg/kg	risk assessment	10 ug/dl ¹
Mercury	43 mg/kg	risk assessment	Hazard index = 1
¹ There is no reference dose for lead so the risk characterization was developed by using EPA approved methods for estimating blood lead levels. The method used for the adult worker is found in the "Technical Review Workgroup for Lead: Recommendations for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil." The value of 10 ug/dl represents the goal for blood lead level in adults subject to exposure to lead.			

12.0 STATUTORY DETERMINATIONS

EPA has determined that the selected remedy will satisfy the statutory determinations of Section 121 of CERCLA. The remedy will be protective of human health and the environment, will comply with ARARs, will be cost effective, and will use permanent solutions and alternative treatment technologies to the maximum extent practicable.

12.1 Protection of Human Health and The Environment

The remedy will eliminate potential risks to industrial workers from exposure to contaminated soil and sediment. The potential risks are eliminated because the soil above the selected cleanup levels will be solidified and capped to prevent exposure to the contaminated soil.

The remedy will eliminate potential risks to industrial workers from exposure to

contaminated groundwater. The potential risks are eliminated by deed restrictions that will prohibit the use of contaminated groundwater as a source of drinking water. Also, future groundwater contamination will be reduced because the volume of the source, contaminated soil, will be reduced. A final remedy for groundwater will be documented in Operable Unit Two.

The resulting exposure levels will be reduced to ARAR levels or to within EPA’s generally acceptable risk range of 10⁻⁴ to 10⁻⁶ for carcinogens and below the HI of 1 for non-carcinogens.

The remedy will reduce potential risks to small mammals and birds from exposure to contaminated soil and sediment. The potential risks are reduced because the more highly contaminated soil and sediment will be solidified and capped to prevent exposure to the ecological receptors. Further environmental risk assessment will be performed to ensure that the cleanup levels will be sufficiently protective of ecological receptors.

12.2 Compliance with ARARs

The selected remedy will comply with the Federal ARARs and State ARARs listed in the table below.

TABLE 18 : ARARS		
LOCATION SPECIFIC		
	Citation	Location/Description
A	•Florida Administrative Code 62-524 and Florida Statute 373.309	Area of known contamination. Regulatory clearance required to use potable water wells in area of known contamination.
CHEMICAL-SPECIFIC		
RESOURCE RECOVERY AND CONSERVATION ACT		
R & A	40 CFR Part 261 - Determination of characteristic hazardous waste.	Solidified material to be tested for TCLP to ensure that it is not a characteristic hazardous waste.
CLEAN AIR ACT		

CHEMICAL-SPECIFIC		
R & A	40 CFR Part 50 - National Ambient Air Quality FAC 62-204 Florida Air Emission Standards	Lead is one of the criteria pollutants with a primary NAAQS. Monitoring may be required during soil disturbance; the expected corrective actions would include dust suppression, etc.
A = APPLICABLE REQUIREMENTS WHICH WERE PROMULGATED UNDER FEDERAL LAW TO SPECIFICALLY ADDRESS A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION LOCATION OR OTHER CIRCUMSTANCE AT THE SITE.		
R & A = RELEVANT AND APPROPRIATE REQUIREMENTS WHICH WHILE THEY ARE NOT "APPLICABLE TO A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION, LOCATION, OR OTHER CIRCUMSTANCE AT THE SITE, ADDRESS PROBLEMS OR SITUATIONS SUFFICIENTLY SIMILAR TO THOSE ENCOUNTERED AT THE SITE THAT THEIR USE IS WELL SUITED TO THE SITE.		

12.3 Cost-Effectiveness

In EPA's judgement, the selected remedy is cost effective and represents a reasonable value for the money to be spent. The following definition was used in making this determination: "A remedy shall be cost effective if its costs are proportional to its overall effectiveness." (40 CFR 300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination: long term effectiveness and permanence, reduction in toxicity, mobility, and volume through treatment, and short term effectiveness. Overall effectiveness was then compared to costs to determined cost effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represent a reasonable value for the money to be spent.

There were various trade-offs between the alternatives that relate to their overall effectiveness and thus, their cost effectiveness. Alternatives 2 and 3 will require long term maintenance of either a cap or a solidified mass in order to ensure long term effectiveness. There will be little long term maintenance required for Alternative 4. Alternatives 2 and 4 are considered lower in reduction of toxicity, mobility, and volume through treatment because those alternatives do not include treatment. Alternative 3 includes treatment but the treatment will increase the total volume of material left at the Site. The three alternatives are similar in short term effectiveness, except that Alternative 4 does involve significant truck traffic to haul the material off-site.

12.4 Use of Permanent Solutions and Treatment Technologies

This remedy will be a permanent solution for the Site in that all contaminated soil and sediment above the cleanup goals will solidified and capped, thus preventing direct exposure to or leaching of contaminants. Solidification/stabilization is a common treatment method for metals contaminated soil at Superfund sites. It will be a permanent remedy, particularly with appropriate deed restrictions to preserve the integrity of the solidified material.

12.5 Preference for Treatment as a Principal Element

The preference for treatment is satisfied because the contaminated material will be treated via solidification/stabilization.

13.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The remedy described in this Record of Decision has been changed as a result of comments received during the public comment period. The selected remedy is Alternative S-3 (on-site solidification/stabilization) as opposed to Alternative S-4 (off-site disposal) which was the preferred alternative described in the Proposed Plan. Given the currently available information, EPA determined that there was not sufficient justification for the added expense of off-site disposal, given that on-site remedies have been successfully implemented at other similar sites. Solidification/stabilization has been used frequently at other Superfund sites and will prevent direct contact with or ingestion of the contaminated soil at the Site. In addition, solidification/stabilization of the contaminated soil will reduce or prevent any potential leaching of contaminants into the groundwater.

Also, antimony and iron were deleted from the list of contaminants of concern (COCs) in Table 6. This is based on the uncertainty information provided in Attachment A - Section 6.1.6 (pages 6-50 thru 6-55) of the final RI report. The uncertainty section discusses the fact that the baseline risk assessment (BRA) used incorrect dermal absorption factors for both contaminants. The correct dermal absorption factors were used in Table A- 1 thru A-5 in Attachment A which show that neither contaminant should be considered COCs for the site in surface soils. Also, Attachment A - Section 6.1.1.4 (pages 6-54 and 6-55) discusses the significant uncertainties associated with the use of the provisional reference dose for iron.

Iron was removed from the list of COCs in Table 7. Attachment A - Section 6.1.1.4 (pages 6-54 and 6-55) discusses the significant uncertainties associated with the use of the provisional reference dose for iron. The uncertainties are significant enough that iron was eliminated as a COC.

APPENDIX A: RESPONSIVENESS SUMMARY

The comments received during the comment period can be categorized as to their sources - the general public, the PRPs, and the Florida Department of Environmental Protection. The comments and EPA's responses are presented below.

General Public

1. The remedy selected for the Site should specifically address the delineation and remediation of groundwater and soil contamination on adjacent property that is located north and east of the Site.

RESPONSE: Additional groundwater sampling is necessary before recommending a particular groundwater remedy for this Site. The additional groundwater monitoring data shall be reviewed within the framework of CERCLA to determine if active groundwater remediation is warranted. A final decision regarding groundwater remediation will be addressed as Operable Unit Two for this Site.

The writer provided additional groundwater, soil and sediment data for off-site locations adjacent to the Site. EPA will consider the additional groundwater data when making its final decision for groundwater as part of Operable Unit Two. EPA reviewed the additional soil and sediment data and has determined that the soil concentrations do not exceed screening levels in an industrial setting as would be applicable for the properties adjacent to the Site. In addition, the sediment concentrations do not exceed EPA Region 4 sediment screening values. Therefore, the additional soil and sediment data does not indicate the need to expand the scope of the planned soil cleanup for the MRI Corp. Site.

PRPs

1. The RI may not have accurately defined the contaminants of potential concern in groundwater, or the distribution thereof. The turbidity of the groundwater may have resulted in the overestimation of concentrations of metals; the detected metals may be naturally occurring and could have precipitated from soil particles after the water samples were preserved with an acid prior to analysis.

RESPONSE: Groundwater samples have been collected by at least four different organizations during at least four different occasions between 1989 and 1998. Site related contaminants were detected at elevated concentrations in each sampling event.

Nevertheless, EPA concedes that there appears to be a correlation between turbidity and contaminant concentrations in groundwater samples collected during the RI. Additional groundwater monitoring is necessary as part of future actions at the Site. The sampling should be conducted so as to minimize any impacts from turbidity in the groundwater samples.

2. The RI does not define the relationship between the metals present in site soils and any

metals that may be present in groundwater.

RESPONSE: EPA agrees. Additional analysis is necessary, beginning with the groundwater sampling discussed in the previous comment. If representative groundwater samples continue to contain site contaminants, then it will be necessary to derive the relationship between metals in site soils and site groundwater through either calculations or analytical tests.

3. A proper fate and transport analysis is needed to ensure that the RA implemented at the Site meets the objectives of the FS. In the absence of such an analysis, the proposed soil remedy may not be appropriate.

RESPONSE: The fate and transport analysis will be revised, as necessary, based upon the results of the additional groundwater studies discussed above. However, EPA feels that it is appropriate to proceed with the proposed soil remedy. The proposed soil remedy is based upon preventing direct contact with the contaminated solid media. Anticipated related benefits include improvement in surface water and groundwater quality at the Site.

The additional groundwater studies discussed above can be performed as the first step in the design of this remedy. The scope of the soil action can be modified, as necessary, based upon the results of the groundwater studies. Given the distribution of contaminants in soil, an increase or decrease in the volume of soil to be remediated is not expected to change the cost estimate outside of the -30 to +50 percent range established in the NCP. Thus, there is little to be gained by delaying the Record of Decision and the associated special notice procedures.

4. The risk assessment is inconsistent with certain findings of the RI/FS, particularly the potential consumption of groundwater from the surficial aquifer.

RESPONSE: The cleanup described in this Record of Decision is based upon preventing direct contact with or ingestion of contaminated soil. The risk assessment did evaluate the potential risk associated with a worker consuming contaminated groundwater from a well that could be installed at the Site. This may indeed be a conservative assumption, given that shallow groundwater at or adjacent to the Site is not currently used for drinking water. However, FDEP does consider the shallow aquifer to be a potential source of drinking water.

5. Residual metal recovery should be included as part of remedial activities at the Site.

RESPONSE: The separation of debris from contaminated soil is a common step in the remediation of contaminated soils. This task should be included in the remedial design or the remedial action work plans. The site owner, whose business includes metal recycling, has

provided an estimate of the costs for on-site metal segregation and recycling. The cost estimate ranged from \$110,682 to \$216, 627 depending upon the volume of soil and debris that has to be screened. These costs are based upon performance as a stand alone task; the costs are significantly reduced when integrated with the overall soil cleanup.

6. The remedy must make a distinction between principal threat wastes , and low level wastes. Furthermore, containment remedies are the only viable options for low level wastes.

RESPONSE: According to “A Guide to Principal Threat and Low Level Threat Wastes” (EPA-OSWER Guidance 9380.3-06FS, November 1991), the principal threat/low level threat waste concept is not a mandatory waste classification requirement. The guidance notes that there may be some situations where site wastes will not be readily classifiable as either a principal or low level threat waste, and thus no general expectations on how best manage these source materials of moderate toxicity and mobility will necessarily apply. The contaminated soil at the Site meets one of the criteria for a principal threat wastes, namely contaminant mobility. Lead and other metals are present at elevated levels in soil at the Site and are apparently mobile due to their presence at elevated levels in surface water, in soil/sediment along surface water flow paths, and in the underlying shallow groundwater. Yet, the concentrations in soil, while elevated, are within one order of magnitude of the cleanup level and could be described as moderate levels of contamination.

7. We suggest a new alternative, S-5, and have provided our evaluation relative to the nine criteria.

RESPONSE: The newly suggested alternative S-5 is somewhat similar to alternative S-4. The common items include excavation and off-site disposal of lead contaminated soil and sediment, and deed restrictions. The differences include the appropriate cleanup levels of site contaminants(including lead), capping of “residual” excavated material, and recovery of recyclable materials from the excavated soil. As mentioned before, EPA has selected alternative S-3, on-site solidification.

A fundamental component of the suggested alternative S-5 is a soil cleanup level for lead of 1400 mg/kg. The context for this cleanup level was not site specific health based considerations, but was based on references to several other sites with varying cleanup levels for lead. These other sites include the Dutch Boy Site in Illinois and the 62nd Street Dump in Tampa (which is approximately one and a half miles west of the MRI Site). The lead cleanup levels for these sites were 1400 mg/kg and 224 mg/kg, respectively.

EPA did develop a lead cleanup level of 880 mg/kg for the protection of human health assuming future industrial use of the Site. The cleanup level was developed based upon the “Technical Review Workgroup for Lead Recommendations for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil.”

EPA envisions additional evaluation and a second decision document for groundwater contamination. EPA acknowledged in the Proposed Plan and in this ROD that the soil cleanup levels may have to be adjusted to ensure that the soil cleanup is sufficient to prevent future leaching of metals in soil to groundwater. If these adjustments result in a significant increase in the volume of soil to be remediated, then an Explanation of Significant Differences will be prepared. EPA also acknowledged that further study of the groundwater quality is necessary, particularly the relationship between turbidity and contaminant concentrations in groundwater.

8. Capping and appropriate deed restrictions can provide the same level of protectiveness as deeper excavation. EPA has put undue weight on the presumed risk reduction benefits to be achieved from deep excavation.

RESPONSE: EPA feels that it is appropriate to include cleanup goals for subsurface soil in order to protect the future construction worker. As can be seen in Section 7.4 of the ROD, the future adult construction worker could face a noncarcinogenic risk associated with exposure to mercury as denoted by HI of 2.8. A hazard index greater than 1 indicate a potential for adverse health effects. However, the mercury contaminated soil is apparently very localized as evidenced by the fact of 56 subsurface soil samples, only one exceeds the calculated cleanup level for mercury. As a result, excavation to this depth for mercury will have a negligible impact on the scope and costs of this action.

9. Suggested alternative S-5 would meet all ARARs and will provide exactly the same long-term effectiveness and permanence as EPA's preferred alternative.

RESPONSE: Given that alternative S-5 is presented as a complete remedy for the Site (no separate operable unit for groundwater), it would have to include groundwater monitoring in order to evaluate if groundwater ARARs were satisfied. EPA's selected remedy will be designed to be consistent with future groundwater actions at the Site.

The selected remedy includes both solidification and capping of contaminated soil. Thus, there is an added degree of effectiveness and permanence for the selected remedy when compared to the suggested alternative S-5.

10. It is unlikely that institutional controls/deed restrictions will fail. The NCP provides that EPA should rely on institutional controls for wastes that pose a relatively low long-term threat (40 CFR 300.430(a)(1)(iii)(B)).

RESPONSE: According to the NCP, EPA shall consider the use of engineering controls for low threat wastes when developing appropriate remedial alternatives. EPA did consider engineering controls, particularly capping, in the FS and Proposed Plan (see alternative S-2). Deed restrictions can be effective but do depend upon the site owner, developer, or other local entity to inform EPA that post-remediation site activities are actually occurring. Deed restrictions and capping are included as part of the selected remedy.

11. EPA's preferred alternative S-4 involves off-site disposal where EPA has no specific

control of future land use. Alternative S-5 does have provisions to control future land use for the wastes left in place under the cap.

RESPONSE: EPA has selected alternative S-3, instead of alternative S-4, as the soil remedy for this Site. The selected remedy includes on-site disposal of solidified soil, capping and deed restrictions governing use of the Site and protecting the cap.

12. Alternative S-5 achieves reduction in toxicity, mobility, and volume of contaminated soil. EPA's preferred alternative does not reduce toxicity or volume, and may not reduce the mobility of the soil contaminants.

RESPONSE: EPA has selected alternative S-3. The separation of soil and debris during the remedial action will reduce the volume of material requiring treatment. Solidification and capping will reduce the mobility of the contaminants.

13. EPA has raised concerns about whether it could effectively design the containment remedy and then implement the required deed restrictions and long term O&M plan. EPA has included these items as an integral part of remedies across the country. The Florida Department of Environment Protection has agreed with such remedies, notably the Sixty Second Street (62nd Street) Dump Site located in Tampa, Florida.

RESPONSE: EPA agrees that containment and deed restrictions have been implemented as integral parts of other remedies and has included capping and deed restrictions as part of the selected remedy for this Site. However, EPA determined that treatment via solidification was also necessary. A similar remedy was selected for the nearby Sixty Second Street Dump Site, located approximately 1.5 miles west of the MRI Site. Metals are contaminants of concern at both sites; soil and surficial groundwater were also contaminated with metals at both sites. The completed cleanup at 62nd Street included:

- stabilization/solidification of the contaminated soil;
- a cap, across the entire site, consisting of a two foot thick layer of soil on top of an impermeable liner;
- a slurry wall, connected to the confining layer, around the entire perimeter of the Site. The slurry wall has a hydraulic permeability of 10^{-7} .

EPA has not made a final decision regarding remedial actions for groundwater. Such a decision will be made as part of Operable Unit Two.

14. Alternative S-5 achieves equivalent protection of human health and the environment at a cost substantially less than EPA's preferred alternative. Lead concentrations would be reduced by a range of 47 to 72 percent by alternative S-5.

RESPONSE: EPA welcomes the submittal of detailed cost estimates to support the assertion of substantial cost reductions for alternative S-5. In the meantime, it is safe to assume that if less conservative cleanup levels are used and a smaller volume of contaminated soil is remediated, then the costs of the cleanup would be reduced.

15. EPA was too conservative in selecting the exposure assumptions in the adult lead model and should have used less conservative values for the geometric standard deviation (GSD), the baseline blood lead concentration, and the gastrointestinal absorption factor.

RESPONSE: The values selected for the GSD and the baseline blood lead concentration are within the range of proposed values in the model and are at the more conservative end. Since it is difficult to predict who the future potentially exposed population will be, the values selected in the BRA represent a reasonable maximum exposure (RME). EPA typically makes its decisions based on RME assumptions, therefore the values used in the BRA are acceptable.

The value in the BRA used for the gastrointestinal absorption factor is the same as the default value proposed in the model by EPA Lead Technical Review Workgroup. The Workgroup considered all of the information available on this issue before proposing the gastrointestinal absorption factor provided in the model. Therefore, the value used in the BRA is acceptable and reasonable for this site.

16. EPA proposes that all soil above the lead cleanup level of 880 mg/kg will be remediated. This would result in a maximum residual lead concentration of 880 mg/kg and a 95th percent upper confidence limit of the arithmetic mean that is substantially below 880 mg/kg. The residual risk at the site would then be more protective than necessary. EPA should instead consider using “the distribution of residual lead concentrations in near-surface soil so that the average residual concentration of lead within the exposure unit is 880 mg/kg.”

RESPONSE: EPA will further evaluate this issue prior to or during the Remedial Design phase. The comment warrants further attention because the adult lead model that was used to determine the remedial goal uses the average concentration in determining what lead levels are acceptable in surface soils. Also, EPA has a workgroup that is writing guidance on this subject and it is hoped that the guidance will be finalized before the remedial design is complete.

It should be mentioned that the protection of groundwater from the leaching of lead in soils at the MRI site is still being evaluated. When the cleanup value for lead in soils protective of groundwater is determined, it may also effect the “not-to-exceed” cleanup level used for the site.

FDEP

1. We are not opposed to the use of operable units for soil and groundwater, We also agree that excavation and off-site disposal appears to be the most effective approach to soil remediation. Our primary objections are that the soil cleanup criteria do not include all appropriate contaminants of concern nor do they adequately incorporate leachability considerations.

RESPONSE: The chemicals measured in the various environmental media were considered contaminants of concern if the results of the risk assessment indicated that a contaminant might pose a significant current or future risk or contribute to a cumulative risk which is significant. The criteria for a significant risk was a carcinogenic risk level above the acceptable risk range, i.e., 1×10^{-4} to 1×10^{-6} , or a hazard quotient (HQ) greater than 1.0 (unity). The acceptable risk range is established in the NCP (FR 300.430 (e)(2)(i)(A)(2)). The contaminants of concern are further discussed in Section 7, Summary of Site Risks, and Section 13, Documentation of Significant Changes. Section 13 describes how antimony and iron were deleted as contaminants of concern in soil. Incorrect dermal absorption factors were used for these contaminants; the correct factors and calculations are shown in Tables A-1 through A-5 of Baseline Risk Assessment. Also, page 6-54 and 6-55 discuss the significant uncertainties associated with the provisional reference dose for iron.

EPA noted in the Proposed Plan and this ROD that the cleanup levels for contaminants in soil will be reviewed to consider the potential for leaching into groundwater. The cleanup levels will be reviewed during the RD/RA and revised, if necessary, to ensure that the soil cleanup is consistent with any planned groundwater actions at the Site. While cleanup levels may be revised or established for several contaminants, it is expected that the cleanup for lead will tend to encompass a large majority of the areas to be remediated. Furthermore, given the distribution of contaminants, reducing the lead cleanup level below 880 mg/kg is not expected to significantly increase the volume of soil to be addressed. Any modified cleanup levels must take into account site specific factors including additional groundwater sampling to ensure that groundwater contaminant concentrations are indeed representative of Site conditions.

FDEP provided a table of suggested cleanup levels, (soil cleanup target levels or SCTLs) that included values for industrial exposure and leachability. However, according to a memo dated September 22, 1999, from John Rudell, Director of the FDEP Waste Management Division, SCTLs may not be imposed by the agency as rule, standards, or to deny permits, with certain exceptions. The SCTLs are applicable only to sites addressed pursuant to a brownfield site rehabilitation agreement, the petroleum contamination site cleanup program, the dry-cleaning solvent cleanup program, or the soil treatment facilities program. The suggested values are not considered ARARs so they were not included as cleanup levels for this Site.

FDEP also provided a table of groundwater cleanup target levels for chemicals of concern at this Site. This ROD does not include a final remedy for groundwater so it is not appropriate to establish groundwater cleanup levels at this time.

EPA and FDEP have discussed changing the selected remedy from alternative S-4 to alternative S-3. The staff of FDEP has indicated a willingness to accept solidification (alternative S-3) as long as the solidification was performed ex-situ.

2. Cleanup goals for sediments should be identified in the ROD on the basis of the Probable Effects Level (PEL) for the contaminants of concern. The criteria would apply to the on-site wetland. Soil criteria would apply to the ditch since surface water is observed only during storm events. EPA has proposed removing the top 1 foot of sediment in the pond. Confirmatory sampling should be used to determine that these criteria have been met following

the removal.

RESPONSE:

The onsite pond is not listed as a wetland on the available National Wetland Inventory map (Brandon quadrangle) nor does it appear to meet the definition of waters of the United States. Nevertheless, given that the pond may be attractive to ecological receptors who may be exposed to contaminated sediment, EPA proposes to remove the upper foot of sediment to lin-fit any potential exposure. The excavated area would then be backfilled with clean fill. In such a case, it is not necessary to perform confirmatory sampling on the sediment that would be located beneath the clean fill. Also, PELs are screening values and are not cleanup values; thus it would not be appropriate to include them as sediment cleanup criteria in this Record of Decision.

APPENDIX B: RISK ASSESSMENT INFORMATION

-Exposure Assumptions

(NOTE: The reference to using a 1% dermal absorption factor for inorganics should be 0.1% based on Region 4 guidance. This information can be found in the uncertainty section provided in Attachment A - Section 6.1.6 (pages 6-50 thru 6-55) of the final remedial investigation. The uncertainty section discusses the fact that the baseline risk assessment (BRA) used incorrect dermal absorption factors for inorganic contaminants with the exception of arsenic. The corrected calculations using Region 4 dermal absorption factors can be found in Table A-1 thru A-5 in Attachment A.).

-Non-cancer toxicity data

-Cancer toxicity data

TABLE 6-3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
MRI

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site-wide - Tap Water

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Log-Transformed Data (1)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Chloroform	µg/L	2.0	N/A	2.0	J	µg/L	2.0	Max	W-Test (2)	N/A	N/A	N/A
Dieldrin	µg/L	0.018	N/A	0.0180	NJ	µg/L	0.018	Max	W-Test (2)	N/A	N/A	N/A
Aluminum	µg/L	36,000	35,800,000	110,000	J	µg/L	110,000	Max	W-Test (3)	N/A	N/A	N/A
Arsenic	µg/L	23.4	95.5	69.0	J	µg/L	69.0	Max	W-Test (3)	N/A	N/A	N/A
Barium	µg/L	216	931	1,300	J	µg/L	931	95% UCL-T	W-Test (4)	N/A	N/A	N/A
Chromium	µg/L	79.3	1,930	290	J	µg/L	290	Max	W-Test (3)	N/A	N/A	N/A
Copper	µg/L	53.9	278	185	(J/J)*	µg/L	185	Max	W-Test (3)	N/A	N/A	N/A
Cyanide	µg/L	74.2	1.18	260	J	µg/L	260	Max	W-Test (3)	N/A	N/A	N/A
Iron	µg/L	14,300	101,000	53,000	J	µg/L	53,000	Max	W-Test (3)	N/A	N/A	N/A
Lead	µg/L	86.6	2,010	380	(J/J)*	µg/L	380	Max	W-Test (3)	N/A	N/A	N/A
Manganese	µg/L	132	290	520	J	µg/L	290	95% UCL-T	W-Test (4)	N/A	N/A	N/A
Mercury	µg/L	0.130	0.205	0.800	J	µg/L	0.205	95% UCL-T	W-Test (4)	N/A	N/A	N/A
Nickel	µg/L	25.5	166	100	J	µg/L	100	Max	W-Test (3)	N/A	N/A	N/A
Selenium	µg/L	9.68	30.2	61.0	J	µg/L	30.2	95% UCL-T	W-Test (4)	N/A	N/A	N/A
Thallium	µg/L	2.18	2.96	9.0	J	µg/L	2.96	95% UCL-T	W-Test (4)	N/A	N/A	N/A
Vanadium	µg/L	122	1,390	420	J	µg/L	420	Max	W-Test (3)	N/A	N/A	N/A

Statistics: Maximum Detected Value (Max); 95% UCL of Log-transformed Data (95% UCL-T); 95% UCL of Log-transformed Data (95% UCL-N).

- (1) In accordance with USEPA Region IV guidance (USEPA, 1995b) the 95% UCL-T, rather than the 95% UCL-N is presented.
- (2) Too few samples were available to calculate a 95% UCL-T, thus the maximum detected concentration was used as the EPC.
- (3) The 95% UCL-T exceeds the maximum detected concentration, therefore, the maximum concentration is used as the EPC.
- (4) The maximum detected concentration exceeds the 95% UCL-T, therefore, the 95% UCL-T was used as the EPC.

N/A = Not Applicable.

* = The qualifier(s) shown are associated with either multiple samples with the same minimum/maximum concentration or with minimum/maximum concentrations that were calculated by averaging duplicate samples.

Data Qualifiers:

J = Value is estimated.

N = Tentative identification. Considered present.

TABLE 6-3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
MRI

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Site-wide - Soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Log-Transformed Data (1)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Aluminum	mg/kg	8,540	12,000	28,000		mg/kg	12,000	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Antimony	mg/kg	38.6	41.4	790	J	mg/kg	41.4	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Arsenic	mg/kg	2.63	3.76	18.5		mg/kg	3.76	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Cadmium	mg/kg	3.73	5.88	25.0	J	mg/kg	5.88	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Chromium	mg/kg	47.0	72.1	230		mg/kg	72.1	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Copper	mg/kg	636	2,290	10,000	J	mg/kg	2,290	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Iron	mg/kg	50,200	89,600	400,000		mg/kg	89,600	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Lead	mg/kg	712	3,040	4,600		mg/kg	3,040	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Manganese	mg/kg	310	955	1,900	J	mg/kg	955	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Mercury	mg/kg	2.08	4.52	37.0		mg/kg	4.52	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Nickel	mg/kg	25.3	40.5	240	JN	mg/kg	40.5	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Vanadium	mg/kg	20.7	31.0	130		mg/kg	31.0	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Zinc	mg/kg	1,820	3,450	40,000	J	mg/kg	3,450	95% UCL-T	W-Test (2)	N/A	N/A	N/A

Statistics: 95% UCL of Log-transformed Data (95% UCL-T); 95% UCL of Log-transformed Data (95% UCL-N).

(1) In accordance with USEPA Region IV guidance (USEPA, 1995b) the 95% UCL-T, rather than the 95% UCL-N is presented.

(2) The maximum detected concentration exceeds the 95% UCL-T, therefore, the 95% UCL-T was used as the EPC.

N/A = Not Applicable.

Data Qualifiers:

J = Value is estimated.

N = Tentative identification. Considered present.

TABLE 6-3.4
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
MRI

Scenario Timeframe: Current/Future Medium: Surface Soil Exposure Medium: Surface Soil Exposure Point: Previous Operations Area - Soil
--

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Log-Transformed Data (1)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Aluminum	mg/kg	8,290	16,400	25,000		mg/kg	16,400	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Antimony	mg/kg	70.9	208	790	J	mg/kg	208	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Arsenic	mg/kg	4.14	9.41	18.5		mg/kg	9.41	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Cadmium	mg/kg	6.67	37.1	25.0	J	mg/kg	25.0	Max	W-Test (3)	N/A	N/A	N/A
Chromium	mg/kg	58.2	138.0	230		mg/kg	138	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Copper	mg/kg	1,260	35,600	10,000	J	mg/kg	10,000	Max	W-Test (3)	N/A	N/A	N/A
Iron	mg/kg	92,700	348,000	400,000		mg/kg	348,000	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Lead	mg/kg	1,070	3,240	4,600		mg/kg	3,240	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Manganese	mg/kg	499	2,020	1,900	J	mg/kg	1,900	Max	W-Test (3)	N/A	N/A	N/A
Mercury	mg/kg	3.99	77.80	37.0		mg/kg	37.0	Max	W-Test (3)	N/A	N/A	N/A
Nickel	mg/kg	46.6	331.0	240	JN	mg/kg	240	Max	W-Test (3)	N/A	N/A	N/A
Vanadium	mg/kg	32.2	65.3	130		mg/kg	65.3	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Zinc	mg/kg	3,420	14,100	40,000	J	mg/kg	14,100	95% UCL-T	W-Test (2)	N/A	N/A	N/A

Statistics: 95% UCL of Log-transformed Data (5% UCL-T); Maximum Detected Value (Max); 95% UCL of Log-transformed Data (95% UCL-N).

(1) In accordance with USEPA Region IV guidance (USEPA, 1995b) the 95% UCL-T, rather than the 95% UCL-N is presented.

(2) The maximum detected concentration exceeds the 95% UCL-T, therefore, the 95% UCL-T was used as the EPC.

(3) The 95% UCL-T exceeds the maximum detected concentration, therefore, the maximum concentration is used as the EPC.

N/A = Not Applicable.

Data Qualifiers:

J = Value is estimated.

N = Tentative identification. Considered present.

TABLE 6-3.6
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
MRI

Scenario Timeframe: Future Medium: Subsurface Soil Exposure Medium: Subsurface Soil Exposure Point: Site-wide (2-4 ft bgs) - Soil
--

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Log-Transformed Data (1)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/kg	1.78	3.20	13.0		mg/kg	3.20	95% UCL-T	W-Test (2)	N/A	N/A	N/A
Iron	mg/kg	39,200	361,000	250,000		mg/kg	250,000	Max	W-Test (3)	N/A	N/A	N/A
Lead	mg/kg	598	4,550	2,500		mg/kg	2,500	Max	W-Test (3)	N/A	N/A	N/A
Mercury	mg/kg	11.2	1,800	120		mg/kg	120	Max	W-Test (3)	N/A	N/A	N/A

Statistics: 95% UCL of Log-transformed Data (95% UCL-T); Maximum Detected Value (Max); 95% UCL of Log-transformed Data (95% UCL-N).

- (1) In accordance with USEPA Region IV guidance (USEPA, 1995b) the 95% UCL-T, rather than the 95% UCL-N is presented.
 - (2) The maximum detected concentration exceeds the 95% UCL-T, therefore, the 95% UCL-T was used as the EPC.
 - (3) The 95% UCL-T exceeds the maximum detected concentration, therefore, the maximum concentration is used as the EPC.
- N/A = Not Applicable.

TABLE 6-4.1
VALUES USED FOR DAILY INTAKE CALCULATIONS
MRI SITE

Scenario Timeframe:	Current
Medium:	Surface Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site-wide Soil
Receptor Population:	Trespasser/Visitor
Receptor Age:	Adolescents (Teens)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	See Table 6-3.2	See Table 6-3.2	---	---	Potential (Lifetime) Average Daily Dose [(L)ADD _{po}] (mg/kg-day) = <u>CS x IR-S x EF x ED x CF1</u> BW x AT
	IR-S	Ingestion Rate of Soil	mg/day	100	USEPA, 1191a	---	---	
	EF	Exposure Frequency	days/year	45	(1)	---	---	
	ED	Exposure Duration	years	10	USEPA, 1995a	---	---	
	CF1	Conversion Factor 1	kg/mg	1x10 ⁻⁶	---	---	---	
	BW	Body Weight	kg	45	USEPA, 1995a	---	---	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, 1991a	---	---	
Dermal Absorption	CS	Chemical Concentration in Soil	mg/kg	See Table 6-3.2	See Table 6-3.2	---	---	Internal (Lifetime) Average Daily Dose [(L)ADD _{in}] (mg/kg-day) = <u>CS x SSAF x DABS x SA x EF x ED x CF1</u> BW x AT
	SSAF	Soil to Skin Adherence Factor	mg/cm ² -day	1	USEPA, 1995a	---	---	
	DABS	Dermal Absorption Factor (Solid)	unitless	(2)	USEPA, 1995d	---	---	
	SA	Skin Surface Area Available for Contact	cm ²	3,600 (3)	USEPA, 1985	---	---	
	EF	Exposure Frequency	days/year	45	(1)	---	---	
	ED	Exposure Duration	years	10	USEPA, 1995a	---	---	
	CF1	Conversion Factor 1	kg/mg	1x10 ⁻⁶	---	---	---	
	BW	Body Weight	kg	45	USEPA, 1995a	---	---	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---	
AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, 1991a	---	---		

(1) The exposure frequency was based on best professional judgement.

(2) Dermal absorption factors of 3.2% for arsenic (Wester et al., 1993) and 1% for all other inorganics (Ryan et al., 1987) were used.

(3) Value derived from data presented in USEPA (1985), averaging across gender and age. It is assumed that hands, 1/2 arms, and 1/2 legs are exposed to surface soil.

TABLE 6-4.3
VALUES USED FOR DAILY INTAKE CALCULATIONS
MRI SITE

Scenario Timeframe:	Current
Medium:	Surface Soil
Exposure Medium:	Surface Soil
Exposure Point:	Previous Operations Area Soil
Receptor Population:	Trespasser/Visitor
Receptor Age:	Adolescents (Teens)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Units	RME Rationale Reference	CT Value	CT Rationale/Reference	Intake Equation/Model Name
Ingestion	CS	Chemical Concentration Soil	mg/kg	See Table 6-3.6	See Table 6-3.6	---	---	Potential (Lifetime) Average Daily Dose [(L)ADD _{pot}] (mg/kg-day) = <u>CS x IR-S x EF x ED x CF1</u> BW x AT
	IR-S	Ingestion Rate Soil	mg/day	100	USEPA, 1991a	---	---	
	EF	Exposure Frequency	days/year	45	(1)	---	---	
	ED	Exposure Duration	years	10	USEPA, 1995a	---	---	
	CF1	Conversion Factor 1	kg/mg	1x10 ⁻⁶	---	---	---	
	BW	Body Weight	kg	45	USEPA, 1995a	---	---	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, 1991a	---	---	
Dermal Absorption	CS	Chemical Concentration in Soil	mg/kg	See Table 6-3.6	See Table 6-3.6	---	---	Internal (Lifetime) Average Daily Dose [(L)ADD _{int}] (mg/kg-day) = <u>CS x SSAF x DABS x SA x EF x ED x CF1</u> BW x AT
	SSAF	Soil to Skin Adherence Factor	mg/cm ² -day	1	USEPA, 1995a	---	---	
	DABS	Dermal Absorption Factor (Solid)	--	(2)	USEPA, 1995d	---	---	
	SA	Skin Surface Area Available for Contact	cm ²	3,600 (3)	USEPA, 1985	---	---	
	EF	Exposure Frequency	days/year	45	(1)	---	---	
	ED	Exposure Duration	years	10	USEPA, 1995a	---	---	
	CF1	Conversion Factor 1	kg/mg	1x10 ⁻⁶	---	---	---	
	BW	Body Weight	kg	45	USEPA, 1995a	---	---	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---	
AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, 1991a	---	---		

(1) The exposure duration time was based on best professional judgement.

(2) Dermal absorption factors of 3.2% for arsenic (Wester et al., 1993) and 1% for all other inorganics (Ryan et al., 1987) were used.

(3) Value derived from data presented in USEPA (1985), averaging across gender and age. It is assumed that hands, 1/2 arms, and 1/2 legs are exposed to surface soil.

TABLE 6-4.6
VALUES USED FOR DAILY INTAKE CALCULATIONS
MRI SITE

Scenario Timeframe:	Current
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site-Wide Sediment
Receptor Population:	Trespasser/Visitor
Receptor Age:	Adolescents (Teens)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	CT Value	CT Rationale/Reference	Intake Equation/Model Name
Ingestion	CS	Chemical Concentration in Sediment	mg/kg	See Table 6-3.13	See Table 6-3.13	---	---	Potential (Lifetime) Average Daily Dose [(L)ADD _{po}] (mg/kg-day) = $\frac{CS \times IR-S \times EF \times ED \times CF1}{BW \times AT}$
	IR-S	Ingestion Rate of Sediment	mg/day	100	USEPA, 1991a	---	---	
	EF	Exposure Frequency	days/year	45	(1)	---	---	
	ED	Exposure Duration	years	10	USEPA, 1995a	---	---	
	CF1	Conversion Factor 1	kg/mg	1x10 ⁻⁶	---	---	---	
	BW	Body Weight	kg	45	USEPA, 1995a	---	---	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, 1991a	---	---	
Dermal Absorption	CS	Chemical Concentration in Sediment	mg/kg	See Table 6-3.13	See Table 6-3.13	---	---	Internal (Lifetime) Average Daily Dose [(L)ADD _{in}] (mg/kg-day) = $\frac{CS \times SSAF \times DABS \times SA \times EF \times ED \times CF1}{BW \times AT}$
	SSAF	Soil to Skin Adherence Factor	mg/cm ² -day	1	USEPA, 1995a	---	---	
	DABS	Dermal Absorption Factor (Solid)	--	(2)	USEPA, 1995d	---	---	
	SA	Skin Surface Area Available for Contact	cm ²	3,600 (3)	USEPA, 1985	---	---	
	EF	Exposure Frequency	days/year	45	(1)	---	---	
	ED	Exposure Duration	years	10	USEPA, 1995a	---	---	
	CF1	Conversion Factor 1	kg/mg	1x10 ⁻⁶	---	---	---	
	BW	Body Weight	kg	45	USEPA, 1995a	---	---	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---	
AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, 1991a	---	---		

(1) The exposure duration time was based on best professional judgement.

(2) Dermal absorption factors of 3.2% for arsenic (Western et al., 1993) and 1% for all other inorganics (Ryan et al., 1987) were used.

(3) Value derived from data presented in USEPa (1985), averaging across gender and age. It is assumed that hands, 1/2 arms, and 1/2 legs are exposed to sediment.

TABLE 6-4.7
VALUES USED FOR DAILY INTAKE CALCULATIONS
MRI SITE

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Site-wide Tap Water
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	CT Value	CT Rationale/Reference	Intake Equation/Mode Name
Ingestion	CS	Chemical Concentration in Groundwater	µg/l	See Table 6-3.1	See Table 6-3.1	---	---	Potential (Lifetime) Average Daily Dose [(L)ADD _{pot}] (mg/kg-day) = $\frac{CW \times IR-S \times EF \times ED \times CF1}{BW \times AT}$
	IR-W	Ingestion Rate of Groundwater	liters/day	1	USEPA, 1995a	---	---	
	EF	Exposure Frequency	days/year	250	USEPA, 1995a	---	---	
	ED	Exposure Duration	years	25	USEPA, 1995a	---	---	
	CF1	Conversion Factor 1	mg/µg	1x10 ⁻³	---	---	---	
	BW	Body Weight	kg	70	USEPA, 1995a	---	---	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	USEPA, 1991a	---	---	

TABLE 6-4.8
VALUES USED FOR DAILY INTAKE CALCULATIONS
MRI SITE

Scenario Timeframe:	Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site-wide Soil
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	CT Value	CT Rationale/Reference	Intake Equation/Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	See Table 6-3.3	See Table 6-3.3	---	---	Potential (Lifetime) Average Daily Dose $[(L)ADD_{po}] \text{ (mg/kg-day)} =$ $\frac{CS \times IR-S \times EF \times ED \times CF1}{BW \times AT}$
	IR-S	Ingestion Rate of Soil	mg/day	50	USEPA, 1995a	---	---	
	EF	Exposure Frequency	days/year	250	USEPA, 1995a	---	---	
	ED	Exposure Duration	years	25	USEPA, 1995a	---	---	
	CF1	Conversion Factor 1	kg/mg	1×10^{-6}	---	---	---	
	BW	Body Weight	kg	70	USEPA, 1995a	---	---	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---	
AT-N	Averaging Time (Non-Cancer)	days	9,125	USEPA, 1991a	---	---		
Dermal Absorption	CS	Chemical Concentration in Soil	mg/kg	See Table 6-3.3	See Table 6-3.3	---	---	Internal (Lifetime) Average Daily Dose $[(L)ADD_{in}] \text{ (mg/kg-day)} =$ $\frac{CS \times SSAF \times DABS \times SA \times EF \times ED \times CF1}{BW \times AT}$
	SSAF	Soil to Skin Adherence Factor	mg/cm ² -day	1	USEPA, 1995a	---	---	
	DABS	Dermal Absorption Factor (Solid)	--	(1)	USEPA, 1995d	---	---	
	SA	Skin Surface Area Available for Contact	cm ²	3,500 (2)	USEPA, 1985	---	---	
	EF	Exposure Frequency	days/year	250	USEPA, 1995a	---	---	
	ED	Exposure Duration	years	25	USEPA, 1995a	---	---	
	CF1	Conversion Factor 1	kg/mg	1×10^{-6}	---	---	---	
	BW	Body Weight	kg	70	USEPA, 1995a	---	---	
AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---		
AT-N	Averaging Time (Non-Cancer)	days	9,125	USEPA, 1991a	---	---		

(1) Dermal absorption factors of 3.2% for arsenic (Wester et al., 1993) and 1% for all other inorganics (Ryan et al., 1987) were used.
(2) Value derived from data presented in USEPA (1985), averaging across gender and age. It is assumed that hands and arms are exposed to surface soil.

TABLE 6-4.10
VALUES USED FOR DAILY INTAKE CALCULATIONS
MRI SITE

Scenario Timeframe:	Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil
Exposure Point:	Previous Operations Area Soil
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	CT Value	CT Rationale/Reference	Intake Equation/Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	See Table 6-3.7	See Table 6-3.7	---	---	Potential (Lifetime) Average Daily Dose [(L)ADD _{po}] (mg/kg-day) = <u>CS x IR-S x EF x ED x CF1</u> BW x AT
	IR-S	Ingestion Rate of Soil	mg/day	50	USEPA, 1995a	---	---	
	EF	Exposure Frequency	days/year	250	USEPA, 1995a	---	---	
	ED	Exposure Duration	years	25	USEPA, 1995a	---	---	
	CF1	Conversion Factor 1	kg/mg	1x10 ⁻⁶	---	---	---	
	BW	Body Weight	kg	70	USEPA, 1995a	---	---	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---	
AT-N	Averaging Time (Non-Cancer)	days	9,125	USEPA, 1991a	---	---		
Dermal Absorption	CS	Chemical Concentration in Soil	mg/kg	See Table 6-3.7	See Table 6-3.7	---	---	Internal (Lifetime) Average Daily Dose [(L)ADD _{in}] (mg/kg-day) = <u>CS x SSAF x DABS x SA x EF x ED x CF1</u> BW x AT
	SSAF	Soil to Skin Adherence Factor	mg/cm ² -day	1	USEPA, 1995a	---	---	
	DABS	Dermal Absorption Factor (Solid)	--	(1)	USEPA, 1995d	---	---	
	SA	Skin Surface Area Available for Contact	cm ²	3,500 (2)	USEPA, 1985	---	---	
	EF	Exposure Frequency	days/year	250	USEPA, 1995a	---	---	
	ED	Exposure Duration	years	25	USEPA, 1995a	---	---	
	CF1	Conversion Factor 1	kg/mg	1x10 ⁻⁶	---	---	---	
	BW	Body Weight	kg	70	USEPA, 1995a	---	---	
AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---		
AT-N	Averaging Time (Non-Cancer)	days	9,125	USEPA, 1991a	---	---		

(1) Dermal absorption factors of 3.2% for arsenic (Wester et al., 1993) and 1% for all other inorganics (Ryan et al., 1987) were used.
(2) Value derived from data presented in EPA (1985), averaging across gender and age. It is assumed that hands and arms are exposed to surface soil.

TABLE 6-4.12
VALUES USED FOR DAILY INTAKE CALCULATIONS
MRI SITE

Scenario Timeframe:	Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site-wide Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CSB	Chemical Concentration in Subsurface Soil	mg/kg	See Table 6-3.10	See Table 6-3.10	---	---	Potential (Lifetime) Average Daily Dose [(L)ADD _{pot}] (mg/kg-day) = <u>CS x IR-S x EF x ED x CF1</u> BW x AT
	IR-S	Ingestion Rate of Subsurface Soil	mg/day	480	USEPA, 1995a	---	---	
	EF	Exposure Frequency	days/year	250	USEPA, 1995a	---	---	
	ED	Exposure Duration	years	1	(1)	---	---	
	CF1	Conversion Factor 1	kg/mg	1x10 ⁻⁶	---	---	---	
	BW	Body Weight	kg	70	USEPA, 1995a	---	---	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---	
AT-N	Averaging Time (Non-Cancer)	days	365	USEPA, 1991a	---	---		
Dermal Absorption	CSB	Chemical Concentration in Subsurface Soil	mg/kg	See Table 6-3.10	See Table 6-3.10	---	---	Internal (Lifetime) Average Daily Dose [(L)ADD _{in}] (mg/kg-day) = <u>CS x SSAF x DABS x SA x EF x ED x CF1</u> BW x AT
	SSAF	Soil to Skin Adherence Factor	mg/cm ² -day	1	USEPA, 1995a	---	---	
	DABS	Dermal Absorption Factor (Solid)	--	(2)	USEPA, 1995d	---	---	
	SA	Skin Surface Area Available for Contact	cm ²	3,500 (3)	USEPA, 1985	---	---	
	EF	Exposure Frequency	days/year	250	USEPA, 1995a	---	---	
	ED	Exposure Duration	years	1	(1)	---	---	
	CF1	Conversion Factor 1	kg/mg	1x10 ⁻⁶	---	---	---	
	BW	Body Weight	kg	70	USEPA, 1995a	---	---	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1991a	---	---	
AT-N	Averaging Time (Non-Cancer)	days	365	USEPA, 1991a	---	---		

(1) The exposure duration time was based on best professional judgement.

(2) Dermal absorption factors of 3.2% for arsenic (Wester et al., 1993) and 1% for all other inorganics (Ryan et al., 1987) were used.

(3) Value derived from data presented in USEPA (1985), averaging across gender and age. It is assumed that hands and arms are exposed to surface soil.

TABLE 6-5.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
MRI SITE

Chemical of Potential Concern	Chronic/ Subchronic (1)	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (2)	Adjusted Dermal RfD (3)	Units	Primary Target Organ	Combined Uncertainty Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (4) (MM/DD/YY)
Organics										
Benzo(a)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	Chronic	1E-02	mg/kg-day	100%	1.0E-02	mg/kg-day	Liver	1,000	IRIS	6/1/98:9/1/92
Dieldrin	Chronic	5E-05	mg/kg-day	100%	5.0E-05	mg/kg-day	Liver	100	IRIS	6/1/98:9/1/90
Inorganics										
Aluminum	Chronic	1E+00	mg/kg-day	27%	2.7E-01	mg/kg-day	Developmental Neurotoxicity	100	NCEA	8/26/96
Antimony	Chronic	4E-04	mg/kg-day	10%	4.0E-05	mg/kg-day	Blood chemistry	1,000	IRIS	6/1/98:2/1/91
Arsenic	Chronic	3E-04	mg/kg-day	100%	3.0E-04	mg/kg-day	Skin, Vascular Effects	3	IRIS	6/1/98:2/1/93
	Subchronic	3E-04	mg/kg-day	100%	3.0E-04	mg/kg-day	Skin, Vascular Effects	3	IRIS	6/1/98:2/1/93
Barium	Chronic	7E-02	mg/kg-day	100%	7.0E-02	mg/kg-day	Hypertension	3	IRIS	6/1/98:3/30/98
Cadmium (food)	Chronic	1E-03	mg/kg-day	2.5%	2.5E-05	mg/kg-day	Kidney	10	IRIS	6/1/98:2/1/94
Chromium (VI)	Chronic	5E-03	mg/kg-day	2%	1.0E-04	mg/kg-day	NOEL	500	IRIS	6/1/98:12/1/96
Copper	Chronic	4E-02	mg/kg-day	60%	2.4E-02	mg/kg-day	GI Irritation	1	HEAST	1997
Cyanide	Chronic	2E-02	mg/kg-day	47%	9.4E-03	mg/kg-day	<Body Weight, Thyroid, Myelin Degradation	500	IRIS	6/1/98:2/1/93
Iron	Chronic	3E-01	mg/kg-day	15%	4.5E-02	mg/kg-day	GI Irritation	1	NCEA	7/23/96
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	2.4E-02	mg/kg-day	100%	2.4E-02	mg/kg-day	CNS	3	IRIS	6/1/98:5/1/96
Mercury (inorganic)	Chronic	3E-04	mg/kg-day	15%	4.5E-05	mg/kg-day	Kidney	1,000	HEAST	Value withdrawn
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	Chronic	2E-02	mg/kg-day	10%	2.0E-03	mg/kg-day	<Body Weight	300	IRIS	6/1/98:12/1/96
Selenium	Chronic	5E-03	mg/kg-day	97%	4.9E-03	mg/kg-day	Selenosis	3	IRIS	6/1/98:9/1/91
Thallium (5)	Chronic	8E-05	mg/kg-day	100%	8.0E-05	mg/kg-day	Blood Chemistry	3,000	IRIS	6/1/98:9/1/90
Vanadium	Chronic	7E-03	mg/kg-day	3%	2.1E-04	mg/kg-day	NOAEL	100	HEAST	1997
Zinc	Chronic	3E-01	mg/kg-day	30%	9.0E-02	mg/kg-day	Blood Chemistry	3	IRIS	6/1/98:10/1/92

N/A = Not Available

(1) Subchronic toxicity criteria were compiled only for COPCs in subsurface soil in order to evaluate potential short-term exposures to future construction workers.

(2) As described in the text, adjustment factors were used to adjust oral toxicity criteria for use in the dermal pathway. All adjustment factors were obtained from ASTDR with the following exceptions: the values for arsenic, cadmium, and manganese were obtained from IRIS (USEPA, 1998c); the values for barium and mercury were obtained from NCEA (1993, 1992); the value for iron was obtained from Klaassen (1986).

(3) The equation used to derive the adjusted dermal RfD is presented in the text.

(4) For IRIS values, the date IRIS was searched and the date of the most recent review are provided.

For HEAST values, the date of HEAST is provided.

For NCEA values, the date of the article provided for NCEA is provided.

(5) The toxicity information for thallium salts was used.

HEAST = Health Effects Assessment Summary Tables (USEPA, 1997).

IRIS = Integrated Risk Information System (USEPA, 1998c).

NCEA = National Center for Environmental Assessment.

TABLE 6-5.2
NON-CANCER TOXICITY DATA – INHALATION
MRI SITE

Chemical of Potential Concern (1)	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (2)	Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (MM/DD/YY)
Organics									
Chloroform	Chronic	3E-04	mg/m ³	8.6E-05	mg/kg-day	N/A	N/A	EPA 1998	1998
Inorganics									
Chromium (VI)	Chronic	4E-07	mg/m ³	1.0E-07	mg/kg-day	N/A	N/A	EPA 1998	1998

N/A = Not Available

(1) Inhalation toxicity criteria were compiled for volatile organic compounds selected as COPCs in groundwater detected at concentrations above SSLs in soil.

(2) The equation used adjust the RfC to the adjusted inhalation RfD is: $RfC \times 20 \text{ m}^3/\text{day} \times 1/70 \text{ kg}$.

EPA 1998 = Toxicity criteria are NCEA values obtained from USEPA (1998b).

TABLE 6-6.1
 CANCER TOXICITY DATA -- ORAL/DERMAL
 MRI SITE

Chemical of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)
Organics							
Benzo(a)pyrene	7.3E+00	N/E	N/E	(mg/kg-day) ⁻¹	B2	IRIS	6/1/98:11/1/94
Chloroform	6.1E-03	100%	6.1E-03	(mg/kg-day) ⁻¹	B2	IRIS	6/1/98:3/1/91
Dieldrin	1.6E+01	100%	1.6E+01	(mg/kg-day) ⁻¹	B2	IRIS	6/1/98:7/1/93
Inorganics							
Aluminum	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	1.5E+00	100%	1.5E+00	(mg/kg-day) ⁻¹	A	IRIS	6/1/98:4/1/98
Barium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium (food)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (VI)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cyanide	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mercury (inorganic)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A = Not Available

N/E = Not Evaluated

IRIS = Integrated Risk Information System

(1) As described in the text, adjustment factors were used to adjust oral toxicity criteria for use in the dermal pathway. All adjustment factors were obtained from ASTDR with the following exceptions: the values for arsenic, cadmium, and manganese were obtained from IRIS (USEPA, 1998c); the values for barium and mercury were obtained from NCEA (1993, 1992); the value for iron was obtained from Klaassen (1986).

(2) For IRIS values, the date IRIS was searched and the date of the most recent review are provided.

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

TABLE 6-6.2
CANCER TOXICITY DATA -- INHALATION
MRI SITE

Chemical of Potential Concern (1)	Unit Risk	Units	Adjustment (2)	Inhalation Cancer Slope Factor	Units	Weight of Evident/ Cancer Guideline Description	Source	Date (3) (MM/DD/YY)
Organics Chloroform	2.30E-05	(ug/m ³) ⁻¹	3500	8.1E-02	(mg/kg-day) ⁻¹	B2	IRIS	6/1/98:3/1/91
Inorganics Chromium (VI)	1.20E-02	(ug/m ³) ⁻¹	3500	4.2E+01	(mg/kg-day) ⁻¹	A	IRIS	6/1/98:3/1/91

IRIS = Integrated Risk Information System

(1) Inhalation toxicity criteria were compiled for volatile organic compounds selected as COPCs in groundwater and compounds detected at concentrations above SSLs in soil.

(2) The equation used to adjust the unit risk to the inhalation cancer slope factor is: unit risk x 70 kg x 10³ µg/mg x 1/20 m³/day.

(3) For IRIS values, the date IRIS was searched and the date of the most recent review are provided.

EPA Group:

A - Human carcinogen

B1 - Probably human carcinogen - indicates that limited human data are available

B2 - Probably human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in human

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Assessing Risks Associated with NonResidential Adult Exposures to Lead
in Soil



CALCULATION COVER SHEET

PROJECT MRI Corporation	JOB NO. 20385-052	CALC NO. 052-001	SHEET 1
SUBJECT Assessing Risks Associated with Nonresidential Adult Exposures to Lead in Soil		DISCIPLINE Risk Assessment	

CALCULATION STATUS DESIGNATION	PRELIMINARY <input type="checkbox"/>	CONFIRMED <input checked="" type="checkbox"/>	SUPERSEDED <input type="checkbox"/>	VOIDED <input type="checkbox"/>
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COMPUTER PROGRAM/TYPE SCP YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	MAINFRAME <input type="checkbox"/>	PC <input type="checkbox"/>	PROGRAM NO.	VERSION/RELEASE NO.
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Abstract:

Prepared by Kevin Shaw *KShaw 6/3/99*
 Checked by Celeste Barry *CBarry 6/3/99*
 Reviewed by Nicke Ring *N.Ring 6/3/99*

No.	Reason for Revision	Total No. of Sheets	Last Sheet No.	By	Checked	Approved/ Accepted	Date
	<i>Original Issue</i>				<i>CB</i>		
Record of Revisions							



CALCULATION SHEET

PROJECT	EPA WA No. 52-4LOG
JOB NUMBER	20385 - 052
CALC NO.	052-001
SHEET NO.	2 of 5
SHEET REV	0

SUBJECT Assessing Risks Associated with NonResidential Adult Exposures to Lead in Soil
 BY K. Shaw DATE 4 June, 1999

Purpose: To Derive a Soil Lead Concentration Level that is Protective of Nonresidential Adults (Adult Industrial Exposure to Lead in Soil).

Reference Model: "Technical Review Workgroup for Lead (TRW) Recommendations for an Interim approach to Assessing Risks associated with Adult Exposures to Lead in Soil" and "Equations and Rationale for Default Values Assigned to Parameters in the Slope Factor Approach and Exposure Model for Assessing Risk Associated with Adult Exposures to Lead in Soil". (EPA, December 1996).

The recommended approach for derivation of a risk-based remediation goal (RBRG) to assess nonresidential adult risks utilizes a methodology that relates soil lead intake to blood lead concentrations in women of child-bearing age. What follows is a calculation for determination of allowable levels of lead in soil at a site with exposure to an adult industrial worker.

Source of Data Input: The basis for the calculation begins with the algorithm for blood lead concentration in women of child-bearing age:

(Equation 1)

$$PbB_{adult,central} = PbB_{adult,0} + \frac{PbS \cdot BKSF \cdot IR_s \cdot AF_s \cdot EF_s}{AT}$$

where:

$PbB_{adult,central}$ = Central estimate of blood lead concentrations (g/dL) in adults (i.e., women of child-bearing age) that have site exposures to soil lead at concentrations. PbS .

$PbB_{adult,0}$ = Typical blood lead concentration (g/dL) in adults (i.e., women of child-bearing age) in the absence of exposure to the site that is being assessed.

PbS = Soil lead concentration (g/g) (appropriate average concentration for individual).

$BKSF$ = Biokinetic slope factor relating (quasi-steady state) increase in typical adult blood lead concentration to average daily lead uptake (g/dL blood lead increase per g/day lead uptake).

IR_s = Intake rate of soil, including both outdoor soil and indoor soil-derived dust (g/day).



CALCULATION SHEET

PROJECT	EPA WA No. 52-4LOG
JOB NUMBER	20385 - 052
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SHEET REV	0

SUBJECT Assessing Risks Associated with NonResidential Adult Exposures to Lead in Soil
 BY K. Shaw DATE 4 June, 1999

AF_S = Absolute gastrointestinal absorption fraction for ingested lead in soil and lead in dust derived.

EF_S = Exposure frequency for contact with assessed soils and/or dust derived in part from these soils (days of exposure during the averaging period); may be taken as days per year for continuing, long term exposure.

AT = Averaging time; the total period during which soil contact may occur; 365 days/year for continuing long term exposures.

The basis for the RBRG calculation is the relationship between the soil lead concentration and the blood lead concentration in the developing fetus of adult women that have site exposures. The risk-based goal for the central estimate of blood lead concentration in adult concern is as follows:

(Equation 2)

$$PbB_{adult,central,goal} = \frac{PbB_{fetal,0.95,goal}}{GSD_{i,adult}^{1.645} \cdot R_{fetal/maternal}}$$

where:

$PbB_{adult,central,goal}$ = Goal for central estimate of blood lead concentration (g/dL) in adults (i.e., women of child-bearing age) that have site exposures. The goal is intended to ensure that $PbB_{fetal,0.95,goal}$ does not exceed 10 g/dL.

$PbB_{fetal,0.95,goal}$ = Goal for the 95th percentile blood lead concentration (g/dL) among fetuses born to women having exposures to the specified site soil concentration. This is interpreted to mean that there is a 95% likelihood that a fetus, in a woman who experiences such exposures, would have a blood lead concentration no greater than $PbB_{fetal,0.95,goal}$ (i.e., the likelihood of a blood lead concentration greater than 10 g/dL would be less than 5 %).

$GSD_{i,adult}$ = Estimated value of the individual geometric standard deviation (dimensionless); the GSD among adults (i.e., women of child-bearing age) that have exposures to similar on-site lead concentrations, but that have non-uniform response (intake, biokinetics) to site lead and non-uniform off-site lead exposures. The exponent 1.645, is the value of the standard normal deviate used to calculate the 95th percentile from a lognormal distribution of blood lead concentration.



CALCULATION SHEET

PROJECT	EPA WA No. 52-4LOG
JOB NUMBER	20385 - 052
CALC NO.	052-001
SHEET NO.	4 of 5
SHEET REV	0

SUBJECT Assessing Risks Associated with NonResidential Adult Exposures to Lead in Soil
 BY K. Shaw DATE 4 June, 1999

$R_{\text{fetal/material}}$ = Constant of proportionality between fetal blood lead concentration at birth and material blood lead concentration (dimensionless).

The soil lead concentration associated with a given exposure scenario and $PbB_{\text{adult,central,goal}}$ and then be calculated by rearranging Equation 1 and substituting $PbB_{\text{adult,central,goal}}$ for $PbB_{\text{adult,central}}$:

(Equation 3)

$$RBRG = PbS = \frac{(PbB_{\text{adult,central,goal}} - PbB_{\text{adult,0}}) \cdot At}{(BKSF \cdot IR_s \cdot AF_s \cdot EF_s)}$$

It is this form of the algorithm that can be used to calculate a RBRG where the RBRG represents the soil lead concentration (PbS) that would be expected to result in a specified adult blood lead concentration ($PbB_{\text{adult,central,goal}}$) and corresponding 95th percentile fetal blood lead concentration ($PbB_{\text{fetal,0.95,goal}}$).

Calculations: The following calculation uses the recommended default values presented in Table 1.

Calculation of Equation 3 requires a determination of $PbB_{\text{adult,central,goal}}$ from equation 2:

$$PbB_{\text{adult,central,goal}} = \frac{10}{(3.388)(0.9)} = 3.28 \text{ g/dL}$$

Substituting 3.28 in Equation 3 and using default values from Table 1,

$$RBRG = \frac{(3.28 - 2.0)(365)}{(0.4)(0.05)(0.12)(219)} = 881.5 \text{ g/g}$$

This results in a proposed cleanup value for soil lead at the MRI site estimated at 880 mg/kg.



CALCULATION SHEET

PROJECT EPA WA No. 52-4LOG
 JOB NUMBER 20385-052
 CALC NO. 052-001
 SHEET NO. 5 of 5
 SHEET REV 0

SUBJECT Assessing Risks Associated with NonResidential Adult Exposures to Lead in Soil
 BY K. Shaw DATE 4 June, 1999

Table 1. Summary of Default Parameter Values for the Risk Estimation Algorithm

Parameter	Unit	Value	Comment
$PbB_{fetal,0.95goal}$	g/dl	10	For estimating RBRGs based on risk to the developing fetus.
$GSD_{i,adult}$	--	1.8 2.1	Value of 1.8 is recommended for a homogeneous population while 2.1 is recommended for a more heterogeneous population.
$R_{fetal/maternal}$	--	0.9	Based on Goyer (1990) and Graziano et al. (1990).
$PbB_{adult,0}$	g/dL	1.7-2.2	Plausible range based on NHANES III phase 1 for Mexican American and non-Hispanic black, and white women of child bearing age (Brody et al. 1994). Point estimate should be selected based on site-specific demographics.
BKSF	g/dL per g/day	0.4	Based on analysis of Pocock et al. (1983) and Sherlock et al. (1984) data.
IR_S	g/day	0.05	Predominantly occupation exposures to indoor soil-derived dust rather than outdoor soil; (0.05 g/day= 50 mg/day).
EF_S	day/yr	219	Based on U.S. EPA (1993) guidance for average time spent at work by both full-time and part-time workers (see Appendix for recommendations on minimum exposure frequency and duration).
AF_S	--	0.12	Based on an absorption factor for soluble lead of 0.20 and a relative bioavailability of 0.6 (soil/soluble).