ATTACHMENT III

# STATEMENT OF BASIS

## For

# Ansul Fire Protection
# Stanton Street Facility

# EPA ID No.  WID 006 125 215

September 12, 2007

# Table of Contents

## 1. INTRODUCTION

This Statement of Basis (SB) presents and explains the proposed clean-up remedy to address contaminated groundwater, soil, and Menominee River sediment at the Ansul Fire Protection-Stanton Street Facility (Ansul), located in Marinette, Wisconsin. This is the final proposed remedy for the site under the current Administrative Order on Consent (AOC) from 1990. The corrective measure alternatives evaluated by Ansul are for areas within the Ansul property and the Menominee River. The clean-up of the Ansul property will be completed before the clean-up in the river, to avoid recontaminating the river.

The U.S. EPA is issuing this SB consistent with its public notification and participation responsibilities under the Resource Conservation and Recovery Act (RCRA). The document summarizes information that can be found in greater detail in the RCRA Facility Investigations (RFI), Corrective Measure Study (CMS), and other pertinent documents contained in the Administrative Record. The U.S. EPA encourages the public to review these documents to better understand the RCRA-related requirements and activities at the Ansul facility.

The U.S. EPA will select a final remedy after the public comment period has ended and comments provided by the public have been considered. U.S. EPA may modify the proposed remedy or select another remedy based on new information or public comments. Therefore, the public is encouraged to review and comment on all corrective measure scenarios. The public comment period begins on September 20, 2007 and ends on October 29, 2007. Information on how to make a comment can be found at the end of this document. All documents supporting this SB are contained in the Administrative Record located at the Stephenson Public Library in Marinette, Wisconsin, the administrative offices at the Ansul facility, and the U.S. EPA, Region 5 office in Chicago, Illinois.

# 2. SUMMARY OF PROPOSED REMEDIES

Contamination at the Ansul site and the Menominee River has been investigated for several years. Based on a *Data Summary Report* (2002) compiled by the Ansul company, regulators and the company agree that most of the site is contaminated with arsenic, and to a lesser degree, some other contaminants. The contamination levels were analyzed for what risks they may pose to human health and the environment (see Section 4). The Ansul Company has proposed remedies to minimize and prevent humans and aquatic life (fish and other organisms) from being exposed to unsafe levels of contamination in the soil, groundwater, and the riverbed. The remedies are planned to occur in phases to make sure that an area that is cleaned up is not recontaminated by an uncontrolled source. For example, currently, contaminated groundwater beneath the facility is flowing into the river. After the groundwater flow is under control, the clean-up in the River sediment can begin.

This section presents the remedies that are preferred by the U.S.EPA. Section 6 presents all of the remedies developed by Ansul. Section 7 presents these preferred remedies in greater detail

Land Remedies

## 2.1 On-site Soil Cover

The U.S. EPA proposes to cover portions of the soil surface with asphalt, soil or gravel to prevent exposure of workers/visitors to contaminated soils at the Ansul site. In less-often used areas of the site, a soil or gravel cover would be used. In areas of high traffic, the cover would consist of asphalt. All types of covers are expected to provide adequate protection of human health and the environment by preventing human and ecological exposure to soil with an arsenic concentration of greater than or equal to 32 parts per million (ppm). Ansul will perform an annual inspection and repair of the covers per an approved maintenance plan. Figure 1 shows the areas to be receiving a cap.

## 2.2 On-site Groundwater Barrier Wall

Groundwater Barrier Wall: Ansul will implement a multi-part groundwater control remedy, which will isolate groundwater at the site and substantially reduce migration of contaminants to the river. Ansul will isolate the groundwater beneath its property by installing an impermeable barrier wall ("containment barrier") in the subsurface generally following the site perimeter and including an additional portion of the wetlands to the east (see Figure 2). The containment barrier will be constructed of steel sheet piling or a slurry wall depending on site conditions. The containment barrier will be driven into either the glacial clay geologic layer existing on top of the limestone bedrock or into the bedrock itself if no substantial till (clay) layer exists. Installation of the containment barrier will substantially reduce migration of groundwater contamination to the river.

Groundwater Pumping System for Water Mounding Control: Ansul will also manage the groundwater on-site in an effort to keep groundwater at a constant elevation on an as needed basis to keep groundwater from mounding. Groundwater control will be accomplished using a passive groundwater collection system. While the collected groundwater will be treated to meet allowable disposal levels, this is not a traditional "pump and treat" system. The groundwater collection system water will use a technique similar to that successfully used to treat the former Eighth Street Slip barrier wall water in 1999. The treatment system will remove arsenic, as well as other contaminants identified at the site, from shallow groundwater which is less contaminated than the deep groundwater. Waste generated during this process will be sampled, handled, transported and disposed of appropriately at an off-site location.

With current technologies it would be extremely difficult to treat the deep groundwater at Ansul having very high arsenic concentrations. This is the rationale behind the approach to contain the contamination on-site within the barrier wall.

Phytopumping: In addition to the shallow groundwater pumping system described above, Ansul intends to provide a backup groundwater control system using trees which have been hybridized to use a lot of water, and which will also draw a significant amount of groundwater from the underlying shallow aquifer through the root systems. A recent field test demonstrated that the trees were successful in pumping large amounts of water and the accumulation of arsenic in the leaves is not enough to harm the trees. The system will be monitored and trees replaced as needed. The extent of acreage planted with trees will be dependent upon further field testing and groundwater modeling. Tests are currently taking place that will determine if during autumn, leaves will require special disposal.

Technology Review: Ansul, subject to EPA review and approval, will evaluate the effectiveness of the site remedy every five years. Included in this review will be 1) a discussion of how the existing clean-up system is performing; 2) a discussion of any proposed modifications to the existing remedy and a schedule for implementation; 3) a discussion of the current scientific and engineering knowledge useful to protect human health and the environment at the site; and 4) results of a literature search on arsenic treatment technologies. If environmental technology advances to a point where treating the more highly concentrated arsenic groundwater becomes practicable, Ansul will evaluate and implement the new technology options.

River Remedies

## 2.3 Menominee River Sediment Remediation

Dredging**:** Ansul will clean up the sediment (river bottom mud) in the Menominee River by removing the most heavily contaminated sediment by dredging. See Figure 3. Dredging will begin within one to two years of installing the groundwater barrier wall described above. The barrier wall will help prevent groundwater from flowing into the river and recontaminating the sediment. The areas designated for dredging were identified by sampling a large area of the river sediments and testing them for contamination. While some other contaminants are present in the sediment, the levels of arsenic are so high that they have become the focus of the sediment remedy. It is expected that by removing sediment with significant arsenic levels, that is, 50 milligrams per kilogram (mg/kg) and above, the other contaminants will also be removed. Figure 3 shows the areas in the Menominee River sediment with arsenic concentrations of 50 mg/kg and greater. This expectation will be confirmed by testing the sediments after the dredging is completed.

Monitored Natural Recovery: Some less contaminated sediment (less than 50 mg/kg) will be left in place following the dredging, but these sediments are expected to recover or clean-up over time from natural river processes. This type of clean-up remedy is called Monitored Natural Recovery (MNR). The U.S. EPA will require that the contaminated sediments that remain in place following dredging recover naturally within seven to ten years. During the MNR phase, institutional controls will be in place to prevent digging or trenching in the affected area in addition to a "no anchoring" zone being established.

Ansul will prepare a MNR Plan to demonstrate the natural recovery is successfully occurring and to predict when arsenic levels will reach the target clean-up concentration of 20 mg/kg (see Section 4.3 for a discussion of the risk analysis and target concentration). The predicted rate of natural recovery will be evaluated by taking samples of sediment at specified intervals (for example, every one to two years) to see if the arsenic in the sediment is decreasing at the expected rate. If the sediment is not cleaning up at the expected rate, the plan will call for a back-up measure, such as additional dredging.

Institutional Controls:

## 2.4 Land and River Remedies

Institutional controls are enforceable non-engineered instruments such as administrative and/or legal controls that minimize the potential human exposure to contamination by limiting land or resource use. Institutional controls are key elements of response alternatives because they influence and supplement the physical component of the remedy. Compliance with institutional controls is required to assume protectiveness for areas which do not allow for unlimited use or unrestricted access. Examples of institutional controls include easements, covenants, well drilling prohibitions, zoning restrictions, and special building permit requirements.

The U.S. EPA proposes that institutional controls be implemented for both the land and river portion of proposed selected remedy. For the land portion of the remedy the goal of the institutional control that is used is to ensure that the property use remains industrial, the cover is not disturbed and is inspected and maintained; the ground water barrier system wall is not disturbed and is maintained; and the ground water is maintained at ~~a~~ prescribed depth and is not used for potable purposes. For the river portion of the remedy the goal of the institutional controls that is to ensure that there is no anchoring, digging, dredging or trenching in the contaminated river sediments area during the period of time that MNR is occurring.

Ansul currently implements some controls on the use of its property. For instance, Ansul currently prohibits the use of groundwater at the site. It has a no-dig policy within the manufacturing area. These actions may be part of the institutional controls which Ansul will implement. Within 120 days of EPA's selection of the remedy Ansul will develop and submit to EPA for review and approval an Institutional Control Plan (IC Plan). The IC Plan will identify the areas of the land and of the river that will be subject to institutional controls, any present restrictions on the use of those areas and recommendations for future enforceable instruments which will implement institutional controls consistent with the goals identified in this Statement of Basis.

# 3. FACILITY BACKGROUND

Ansul currently manufactures hand-held fire extinguishers and blends fire suppression agents at the 60-acre Ansul Facility located at One Stanton Street, City of Marinette, Wisconsin (Figure 1-1). Ansul or its predecessors have occupied the site since approximately 1915. Ansul's initial activities included production of cattle feed, refrigerants and selected specialty chemicals. Production of fire suppression chemicals began in 1934, and by 1983 Ansul had discontinued all other production at the facility.

From 1957 to 1977, Ansul manufactured an herbicide at the facility using cacadylic acid. One byproduct of the manufacturing process was a waste salt (cacadylic acid salt) that contained approximately two percent arsenic by weight; the balance consisted of sodium chloride and sodium sulfate. From the early 1960s until 1973, the waste salt was stored in uncovered; unlined waste piles while research continued on a feasible recycling process. Between 1960 and 1966 liquid wastewater (arsenic salts) discharged directly to the river. By 1977, approximately 95,000 tons of waste salt had been stored at the Salt Vault, in Building 59, and at the dock pile. In 1971, Ansul began disposing of the waste salt by transporting 7,500 tons to Chem-Met Services in Wyandotte, Michigan for landfill disposal in a state-approved facility; after Chem-Met lost its license, the remainder of the waste salt was transported to Waste Management's CID Landfill in Calumet City, Illinois for disposal. No exposed waste salts were present at the site after 1978.

Because releases from the waste salt piles resulted in environmental impacts, in 1973 the Wisconsin Department of Natural Resources (WDNR) issued Consent Order 2A-73-714 to Ansul. Under this Consent Order, Ansul conducted an investigation of the structural, subsoil, and groundwater conditions, assessed the effects of arsenic discharge to the Menominee River, and established a preliminary sampling and monitoring plan. The second provision required implementing a long term hazard management plan for handling the existing and newly-generated waste salt. The third provision required Ansul to construct and operate a groundwater treatment system.

From 1981 through 1986, a groundwater gradient control trench was installed and used to remove approximately 16 million gallons of contaminated groundwater, which was treated, and disposed of offsite. In April 1986, Ansul petitioned the WDNR to shut down the groundwater treatment system. The WDNR granted Ansul's request noting that Ansul had satisfied the quantity limitations stated in the Consent Order.

An Administrative Consent Order (ACO) between the U.S. EPA, the WDNR, and Ansul was signed on September 28, 1990. The ACO addressed corrective action requirements under the Resource Conservation and Recovery Act (RCRA) as amended by the Hazardous and Solid Waste Amendment of 1984 (HSWA). The ACO required a RCRA Facility Investigation (RFI) and Corrective Measures Study (CMS) program be implemented at the facility. These investigations were designed to address 11 Solid Waste Management Units (SWMUs) within the manufacturing area and the wetlands area.

Historical disposal practices at the facility have resulted in releases of arsenic into the environment. Additionally, other releases (chemical spills) have contributed to the arsenic contamination at the facility. From 1974 to the current time, over 25 investigations have been completed on behalf of Ansul to assess the nature and extent of the impact of these releases. A report entitled Summary of Findings Report 1974-2000 (URS, 2001) partially fulfilled the RFI requirements of the AOC. The RFI was completed and approved by U.S. EPA Region 5 late in 2006.

As a result of the investigations performed at the Ansul facility, interim measures have been performed at two areas, the former Salt Vault (a concrete lined area formerly used for uncovered storage of waste salts containing arsenic), and the Eighth Street Slip (a former logging slip located adjacent to the former Salt Vault). The interim measures completed to date consist of the installation of hydraulic barriers to the depth of bedrock to prevent the migration of contamination from or into the area surrounding the Salt Vault, removal of sediments from the slip area, and the construction of an asphalt cap over 90% of the areas of the former Salt Vault and the former Eighth Street Slip area.

**General Field Investigation Results of Contaminant Releases**

Arsenic and other constituents of potential concern (COPCs) have been detected in soil, groundwater, and sediment samples collected from the manufacturing area, as well as from the Menominee River Turning Basin, Eighth Street Slip and the wetlands area. Note: the Eighth Street Slip has a remedy in place, see above. Refer to Table 1 for maximum arsenic and other selected contaminant values (those that exceeded screening values) detected in various media.

**TABLE 1 - Maximum Values for Selected Contaminants in Various Media Results reported in mg/kg or ppm.**

| | On-Site Soils | Groundwater | | Menominee River | |
|---|---|---|---|---|---|
| | | On-Site | Off-Site | Sediment | Surface Water |
| Arsenic | 860 | 35,000 | 12,000 | 11,000 | 3,100 |
| 1,2 Dichlorobenzene | 93 | 2.9 | | | |
| Toluene | 370 | 6.6 | | | |
| Methylene Chloride | 66 | 2.7 | 0.07 | | |

Arsenic was detected in samples of sediment and surface water collected from the Eighth Street Slip, Menominee River between the Sixth Street Slip and Stanton Street, and in the turning basin. Of those, the highest arsenic concentrations in sediment and surface water were in the Eighth Street Slip. Note: An interim remedy for the Eighth Street Slip was constructed in 1999.

Arsenic impacts in the unsaturated soils are also widely distributed across the manufacturing area, primarily in areas formerly used for waste salt storage. These areas consist predominantly of exposed soils, while the remainder of the manufacturing area is covered by buildings or asphalt and concrete pavement.

Several other COPCs are present in the soils and groundwater at the manufacturing area. The other COPCs are mostly organic in nature and are associated with past spills in the manufacturing area. The corrective measures for arsenic impacts will address these other COPCs as well.

Arsenic impacts to groundwater are also present within the wetlands area. However, the concentrations are generally lower than those found in the manufacturing area. The arsenic concentrations are generally higher in the northwest portion of the wetlands area and are also higher at depth. The impacts in the wetlands area are most likely a result of dispersion of the contamination from the manufacturing area with local groundwater flow and not a result of activities in the wetlands area.

Arsenic in unsaturated soils is generally below background levels, 6.3 ppm, throughout the wetlands area, with the exception of the northwest portion of the area, where arsenic concentrations slightly exceed background levels.

Various properties near the facility not owned by Ansul (the football field between Water Street and the facility and the right-of-way of a few residences on Water Street) have been investigated for the presence of arsenic contamination. However, results indicate that arsenic values are less than the background values in the region, approximately 10 ppm.

Sediment in the Menominee River along the facility's northern boundary and extending out into the river about 600 feet from the shoreline have been shown to contain arsenic concentrations in excess of 10,000 ppm (greater than 1 weight percent). The source of this contamination is mainly runoff from historic arsenical salt piles into on-site groundwater and which subsequently flowed into the river.

## 4.0 SUMMARY OF RISKS

Ansul prepared ecological and human health risk assessments for its property and the Menominee River. The U.S. EPA and WDNR also evaluated risk in the Menominee River to develop the sediment target clean-up value. All the proposed remedies, including U.S. EPA's preferred remedy, attain the target clean-up numbers by reducing risks to ecological and human health, but at a range of costs. This section summarizes the results of the risk evaluations to develop the clean-up numbers that were used as a basis for alternatives.

Ansul Property: In human health risk assessment, exposure calculations are made based on "exposure scenarios" which consider how people (routine industrial worker, construction worker, trespasser, etc.) might be exposed to contamination based on what they do and how much time they spend at a given area. An analysis is made of how people might be exposed to contamination in various media (soil, groundwater, surface water, etc.). Some ways that people are exposed to contamination are through contact with skin, inhalation of soil particles, and ingestion of contaminated soil. An estimate is made to determine how toxic exposures are. Toxicity analysis is categorized into cancer-causing effects and non-cancer causing effects (such as asthma, liver disease, and skin lesions), based on the type of chemical. Risk is estimated differently for cancer-causing effects and for non-cancer causing effects.

For chemicals that cause cancer, the risk is estimated and expressed based on the chance that exposure will cause cancer. The chance of getting sick is usually expressed as a probability. For example, a common risk factor in the environmental field is 1-in-10,000. A 1-in-10,000 cancer risk, for example, would mean that for every 10,000 people exposed to a particular pollutant over a lifetime of 70 years, one additional person could be expected to get cancer over and above the normal number of cancer occurrences. For Ansul, the risk evaluation for cancer demonstrated that the total cancer risk for all exposure scenarios was within the U.S. EPA's general target risk-range for industrial exposures of 1-in 10,000 to 1-in 1,000,000 for current exposures. However, in agreement with the WDNR, the target risk-range at Ansul is a risk no greater than 1-in 100,000 (or $10^{-5}$). Through the use of the target risk-range and a site-specific worker-exposure scenario, a cleanup goal for surface soils at Ansul was adjusted to 32 mg/kg. Exposure to 32 mg/kg represents a cumulative cancer risk that does not exceed 1 in 100,000 (or $10^{-5}$).

For non-cancer causing effects, an estimate is made of the risk of exposure to all the chemicals at the site. The calculated risk estimate is compared to a "hazard index." Generally, a hazard index greater than one indicates the need for a remedial action to reduce the risk. The risk evaluation for Ansul demonstrated that hazard indices for non-cancer effects were below one for every exposure scenario except for the construction worker, indicating that no adverse non-cancer effects would be expected for the onsite industrial worker, the onsite adolescent trespasser, and offsite recreational visitors.

The hazard index for the construction worker scenario was 6.5, indicating a potential for non-cancer effects in construction workers exposed to soil and groundwater. Ingestion and dermal exposure to arsenic in groundwater were the primary contributors to the elevated hazard index (5.9 of the 6.5 value) for the construction workers. Construction worker exposure will be mitigated through institutional control remedies (see Sections 5.1 and 5.2).

There were no potential unacceptable risks to ecological receptors (plants and animals) within the onsite fenced areas of the site, mainly because there is little habitat within the manufacturing area. There were also reportedly no unacceptable risks to ecological receptors from arsenic in the natural area (see Figure 1) based on the risk assessment criteria.

### 4.1 Groundwater

Groundwater quality standards for substances detected in, or having the potential of entering the groundwater resources in Wisconsin are established in Wisconsin Administrative Code (WAC) Chapter NR 140. The chapter establishes Preventative Action Limits (PAL) and Enforcement Standards (ES) for a variety of compounds and chemicals, including arsenic. For substances that have carcinogenic, mutagenic, or terratogenic properties, the PAL is 10% of the ES; for all other compounds the PAL is 20% of the ES. WAC Chapter NR 722 establishes that remedial actions must reduce contaminant concentrations to the PAL to the extent technically and economically feasible. If groundwater restoration to the PAL is determined not to be feasible, the ES may not be exceeded at any point of compliance. The PAL and ES for arsenic in groundwater are 1.0 micrograms per liter (ug/l) and 10 ug/l, respectively.

### 4.2 Soil

The State of Wisconsin has developed procedures to determine how much soil and groundwater contamination can safely stay behind after a site clean-up. This level of contamination of "clean-up number" is used to focus clean-up efforts on areas where contamination levels are higher than that number. U.S. EPA developed a site-specific surface soil clean-up number at Ansul of 32 mg/kg of arsenic, based on State and U.S. EPA procedures for evaluating risk to an industrial worker. Soils having greater than 32 mg/kg of arsenic are targeted for a remedy that would reduce or eliminate a person's exposure to those soils.

The soil clean-up number of 32 mg/kg of arsenic was developed to protect the industrial worker against an excess cancer risk of 1 in 100,000 (or $10^{-5}$) from exposure to arsenic as a single contaminant, as well as exposure to arsenic combined with all other chemicals at the site ("cumulative excess cancer risk"). This risk estimate was based on an estimate of how much soil an industrial worker working indoors, the routine scenario at Ansul, would inadvertently ingest on a daily basis. For this worker, the U.S. EPA soil screening guidance (1996) models an adult working for 25 years.

**4.3 Menominee River Sediment**

Sampling and testing of the river sediment has shown that the arsenic concentrations are in excess of 12,000 mg/kg, although on the average, the concentrations are much lower. WDNR used independent lines of ecological and toxicological evidence to identify a site specific clean-up level (WDNR, 2005, WDNR, 2006). The WDNR analysis determined that an average residual concentration of 20 mg/kg of arsenic would be protective of life in the river, particularly the survival, growth, and reproduction of organisms that live in the sediment and are at the bottom of the food chain. An analysis of risks to human health shows no current or future exposure risks although it should be noted that the clean-up in the river would also be protective of people.

<u>Ecological Risks</u> The U.S. EPA and WDNR have established risk-based cleanup levels for the sediment based on what is considered to be safe for plants and animals that live in or use the river. A major factor of the risk analysis is focused on the most exposed organisms (receptors) which were evaluated for their tolerance of contaminated sediment. These are the animals that live in the upper foot of sediment, are important in the river food chain, and are called the benthic community. The benthic community is identified as one of the Beneficial Use Impairments for the Lower Menominee AOC and is identified in the Menominee Remedial Action Plan (RAP) as being impaired by contaminated sediment (WDNR, 1996). In the aquatic food chain, the benthic animals are eaten by larger animals, such as fish, which in turn are eaten by larger animals and birds, as well as by people. A healthy and reproducing benthic community in the Menominee River is one of the goals of the Ansul site clean-up and Menominee RAP.

The U.S. EPA has selected a clean-up target of 20 mg/kg arsenic in the river. This target is supported by multiple lines of evidence (refer to the WDNR memo dated July 28, 2005 and the WDNR memo dated August 9, 2006) and the WDNR guidance document titled *Consensus-Based Sediment Quality Guidelines Recommendations for Use & Application Interim Final Guidance* dated December 2003. Other lines of evidence were considered in selecting the target value, including an estimate of potential effects to other animals. This target value is anticipated to protect all animals that live in and around the river, as well as people.

U.S. EPA is proposing to first dredge those areas having concentrations equal to or greater than 50 mg/kg of arsenic (see Figure 3). The clean-up target for the dredging phase of the remedy is based on weighing cost-effectiveness of the dredging remedy with an ecological risk evaluation. Following dredging, the river sediments will again be sampled and tested to determine whether the dredging was performed according to requirements, and to establish a baseline of conditions for the next phase of the remedy. The U.S.EPA is proposing Monitored Natural Recovery (MNR), a passive remedy, as the second phase of the remedy to address the remaining areas of contamination that exceed

20 mg/kg of arsenic.

People Consuming Fish: Fish data collected by WDNR between 1977 and 1990 indicated that on an average, the fish fillets and edible portions contained a total arsenic concentration of 0.6 ppm. Many studies have documented that up to 90% of arsenic in fish is in the form of organo- arsenicals that have low bioavailability and low toxicity. By applying a bioavailability factor to the risk calculation, the excess cancer risk due to the cumulative exposure from fish ingestion exceeded the WDNR acceptable cumulative cancer risk level of $10^{-5}$ but was within the U.S. EPA's cancer risk range of $10^{-4}$ to $10^{-6}$.

## 5.0 SCOPE OF CORRECTIVE ACTION

Corrective measures are necessary to address contamination present in on-site soils, groundwater and river sediment in the manufacturing and wetlands areas adjoining shoreline associated with the Ansul facility. A summary of the contamination present and the scope of the corrective measures that need to be taken to protect receptor populations are provided below.

### 5.1 Groundwater

Ansul will manage the groundwater on site in an effort to keep groundwater at a constant elevation, most likely close to the current natural elevation, subject to EPA review and approval, not as a means to treat subsurface contamination. The groundwater pumping will be performed on an as-needed basis to keep the site dry and groundwater from mounding and to provide an inward hydraulic gradient, which prevents groundwater migrating to the river. Groundwater control will be accomplished using a pump system as noted earlier. The amount of groundwater available over time will be significantly minimized due to the asphalt and vegetative soil covers, which will minimize the groundwater infiltration and recharge. The groundwater treatment system used to treat the extracted groundwater within the containment barrier will be similar in concept to that successfully used to treat the former Eighth Street Slip carriage water (membrane technology). The groundwater treatment system will remove arsenic from the shallow groundwater so that discharge of treated water meets Wisconsin water discharge limits under their National Pollutant Discharge Elimination System (NPDES) permit, 0.68 ppm. Waste generated during this process will be sampled, handled, transported and disposed of appropriately at an off-site location.

In addition to the shallow groundwater pump and treat system, Ansul intends to provide a supplemental groundwater control system using trees capable of drawing a significant amount of water from the underlying shallow aquifer. The current plan is to plant as many trees as possible on the site to maximize groundwater drawdown using non-mechanical means. Field test plots established in 2006 have shown the trees to be quite successful in pumping large volumes of water. The extent of acreage planted with appropriate tree species will be dependent upon demonstrated success in the field test plots.

The U.S. EPA proposes that institutional controls be implemented to ensure long-term protectiveness of the ground water component of the selected remedy. The institutional controls include enforceable mechanisms which ensure that 1) the cover is not disturbed and is inspected and maintained; 2) the ground water barrier system wall is not disturbed and is maintained; and 3) the ground water is maintained at a prescribed depth and is not used for potable purposes. Additionally, remediation and construction workers will be required to follow the site-specific health and safety plan to prevent direct contact from groundwater. Ansul currently implements some controls on the use of its property. For instance, Ansul currently prohibits the use of groundwater at the site. These actions may be part of the institutional controls which Ansul will implement. Within 120 days of EPA's selection of the remedy Ansul will develop and submit to EPA for review and approval an Institutional Control Plan ("IC Plan"). The IC Plan will identify the areas that will be subject to institutional controls, any present restrictions on the use of those areas and recommendations for future enforceable instruments which will implement institutional controls consistent with the goals identified in this Statement of Basis.

Due to the inefficient treatment options currently available for removing arsenic from groundwater, Ansul will evaluate the effectiveness of the site remedy every five years. Included in this review will be 1) a discussion of how the current system is performing; 2) a discussion of the current scientific and engineering knowledge useful to protect human health and the environment at the site; 3) a discussion of any proposed modifications to the existing remedy as well as a schedule for implementation; and 4) results of a literature search on arsenic treatment technologies. If it becomes more efficient to treat arsenic in the groundwater in the future, Ansul will evaluate and implement the new technology options at that time.

Exposure to contaminated groundwater under the construction worker risk scenario is a potentially complete exposure pathway due to concentrations of arsenic exceeding the PAL at the Ansul facility. It should be noted that groundwater is not a current source of drinking water onsite. Monitoring data, however, shows the potential for offsite migration of impacted groundwater.

The potential risk from contaminated groundwater that exceeds the PAL warrants a corrective measure to protect human health. The goal of the proposed corrective measure is to sever all exposure pathways to groundwater. This includes direct contact of workers and migration of contaminated groundwater to the Menominee River. Groundwater contamination, at levels above the risk based criteria, exists beneath the entire site. However, reduction in arsenic concentrations to the PAL at the point of compliance, the Menominee River, may not be technically or economically feasible, (see Section 6.0). Therefore, groundwater flow from the facility will need to be severed. If further evaluation of the selected corrective measures alternative concludes that remediation to the PAL is not technically or economically feasible, an alternate concentration limit based upon performance criteria of the alternative may be more appropriate. Since the risks associated with site groundwater arsenic concentrations are orders of magnitude above relevant standards, the scope of groundwater corrective action needs to encompass the entire site.

### 5.2 Soil

For the purpose of the Corrective Action work at Ansul, "surface soils" are defined as unsaturated materials (soils that are not completely or always wet), about 0-2 feet below ground surface and "subsurface soils" as soils deeper than two feet below ground surface.

Based on the risk estimation, a remedy to reduce or eliminate risk is needed for over four acres of soil to protect a person working at or visiting Ansul. The U.S. EPA proposes to cover the surface soil with asphalt, soil, or gravel.

In areas of high traffic, the cover would consist of a low-porosity material (e.g., asphalt cover underlain by the appropriate thickness of aggregate. In less-often used areas of the site, a soil or gravel cover would be used. All types of covers are expected to be protective of human and ecological exposure to contaminated soils. Ansul would be required to perform an annual inspection and maintenance of the covers such as repairing any cracks in the asphalt.

As a way of understanding the magnitude of contamination, soil samples from a nearby "clean" area are analyzed for chemical content. These clean areas are called "background" soils. Arsenic is a naturally occurring element and so most soils contain arsenic to varying degrees. For Ansul, the background arsenic soil concentrations were 6.3 mg/kg. Generally, cleanup levels are not set at concentrations below natural background levels (U.S. EPA 2002).

In the natural area at the east end of the property, arsenic in unsaturated soils is generally below background levels with the exception of the northwest portion of the area. There, the arsenic concentrations slightly exceed background levels.

The corrective action proposal does not include a remedy for subsurface soil contamination, due to the possibility that the groundwater contained within the barrier wall may contaminate the subsurface soil with arsenic. However, long term maintenance of the surface soil cap and on-site excavation controls will protect human health by preventing the exposure to subsurface contaminants. Consequently, the U.S. EPA proposes that institutional controls be implemented to ensure long-term protectiveness of the soil remedies. The institutional controls will include enforceable mechanisms which ensure that the covers are not disturbed and are routinely inspected and maintained and that the property is used only for industrial purposes. Remediation and construction workers will follow the site-specific health and safety plan to prevent direct contact from subsurface soil areas contaminated with arsenic. Within 120 days of EPA's selection of the remedy Ansul will develop and submit to EPA for review and approval an Institutional Control Plan (IC Plan). The IC Plan will identify the areas that will be subject to institutional controls, any present restrictions on the use of those areas and recommendations for future enforceable instruments which will implement institutional controls consistent with the goals identified in this Statement of Basis.

Soil background concentrations of arsenic at the site are 6.3 mg/kg. However, based on an assessment of human health associated with arsenic and other COPCs at the site, the U.S. EPA has selected a risk based cleanup level of 32 ppm for arsenic contamination in the manufacturing area and 16 mg/kg for soils outside the Ansul property. These cleanup numbers are based upon certain site-specific exposure assumptions and were agreed to by the WDNR. Based on these cleanup levels over four acres of surface soils on the Ansul property will be covered. For a small contaminated area located outside the facility, and outside the containment barrier, the more stringent clean-up level of 16 mg/kg applies (see Figure 1). This surface soil will be removed, backfilled with clean fill and re-contoured.

**5.3 Sediment**

Sediment in the portion of the Menominee River adjacent to the facility contains significant arsenic contamination values, in some instances, in excess of 10,000 ppm. The U.S.EPA and the WDNR have selected a target cleanup level equal to 20 ppm of arsenic in the sediments based on risk evaluations and comparable sediment removal actions within the State of Wisconsin (See Section 4.3). The target concentration will be achieved in two phases. First, Ansul will remove sediments in the river having average arsenic concentrations of greater than 50 mg/kg. Averaging methods will be addressed by Ansul in the design documents submitted during the project using available EPA guidance documents (e.g. Methods for Evaluating the Attainment of Cleanup Standards, USEPA, 1989). Sediment removal will begin after appropriate monitoring of the groundwater remedy (containment barrier) is performed to ensure substantial reduction of contaminant flux to the river has occurred, but no later than one to two years after completion of construction of the containment barrier. Some less-contaminated sediment (on average less than 50 mg/kg) will be left in place following the dredging. The second phase of the sediment remedy addresses these areas which are expected to recover or clean-up over time from natural river processes. This type of clean-up remedy is called Monitored Natural Recovery (MNR). The U.S. EPA will require that the natural recovery occur within seven to10 years. During this second phase of the remedy controls on the use of the river located near the dredged area will be necessary. The goal of the institutional controls is to ensure that there is no anchoring, digging, dredging or trenching in the contaminated river sediments area during the period of time that MNR is occurring. Within 120 days of EPA's selection of the remedy Ansul will develop and submit to EPA for review and approval an Institutional Control Plan ("IC Plan"). The IC Plan will identify the areas of the river that will be subject to institutional controls, any present restrictions on the use of those areas and recommendations for future enforceable instruments which will implement institutional controls consistent with the goals identified in this Statement of Basis.

Ansul used sampling information to estimate how much sediment needs to be removed based on arsenic contamination levels in the Menominee River (Ansul, 2000, 2003). Based on weighing Ansul's cost-benefit analysis (Ansul, 2003) against risk evaluations, the preferred remedy is the dredging of sediments having greater than 50 ppm of arsenic, resulting in the removal of approximately 74,000 cubic yards. This analysis is presented in Section 6.2. Ansul will submit design documents to address how the accompanying dredge waters will be separated from the contaminated sediment and be treated, how impacts to the river will be minimized, and other dredging issues.

Prior to completing the dredging remedy, Ansul will develop a MNR Plan based on the requirements of the *Framework for Evaluating the Effectiveness of Monitored Natural Recovery (MNR) as a Contaminated Sediment Management Option* (U.S.EPA 2005). The MNR Plan will predict when the 20 mg/kg arsenic concentration will be attained and provide the data and calculations that support the prediction. The in-field monitoring effort will document the attenuation of the residual arsenic in the river sediments toward the target concentration of 20 ppm. U.S.EPA expects that the target value should be attained within seven to 10 years after dredging, based on the on-site barrier wall succeeding in substantially reducing the source of contamination. Within 30 days of completion of the construction of the groundwater barrier Ansul will propose to the EPA a comprehensive monitoring program to measure the ability of the barrier wall to reduce the contamination source to the river. The comprehensive monitoring program will also be designed to collect relevant data during the period leading up to and during the MNR period. In the event that scheduled monitoring of sediment demonstrates that MNR goals are not being met or will not meet the 20 ppm arsenic concentration within seven to 10 years after completion of the sediment. Ansul will propose to the EPA a contingent remedy designed to reach 20 ppm arsenic within one year. The contingent remedy will be subject to EPA review and approval. The contingent remedy may include additional dredging or other more actively engineered remedies

.

# 6.0 SUMMARY OF POTENTIAL REMEDY ALTERNATIVES

## 6.1 On-Site Groundwater and Soil Contamination

The potential remedial alternatives evaluated by Ansul to address groundwater and soil contamination at the facility are presented below.

**Alternative 1: Cap and Contain**

This corrective action alternative is designed to isolate soils and groundwater beneath the site by constructing below-ground barrier walls to surround the Ansul property (see Figure 2 for the proposed barrier wall location). Groundwater would be prevented from entering or leaving the area within the walls. This type of remedy has been successful at containing contamination at the Eighth Street Slip and former salt vault areas and the proposal for Alternative One would be an extension of the current system. The new subsurface barriers would consist of impermeable sheet piling or slurry walls installed along the property boundary to the depth of bedrock. An operations and maintenance (O&M) plan will be submitted to EPA that will properly monitor and maintain the barrier system. These requirements will be incorporated into an enforceable document which will ensure long-term compliance.

At the surface, a cover would be placed to minimize exposure to contaminated soils and to decrease the amount of rainwater percolation (see Figure 1 showing the portions of the site due to be capped). The surface barrier would consist of an asphalt cap with a suitable granular base. Alternatively, the soil barrier may consist of existing building slabs, or at least one foot of gravel or soil. A storm water drainage network would be designed to convey rainwater runoff from the paved areas. This alternative is designed to help prevent additional groundwater migration.

**Alternative 2: Funnel and Gate Permeable Reactive Barrier**

This corrective action alternative would consist of the construction of a funnel and gate permeable reactive barrier (PRB) built into a smaller version of the type of slurry wall described in Alternative One. The funnel and gate system would be constructed along the property boundary with the Menominee River. The "funnel" portion of the PRB would be an impermeable wall installed to bedrock/till directing groundwater toward the "gate" system which would consist of multiple openings along the funnel walls. These gates would be designed to include a reactive material expected to remove arsenic to the extent practicable. Since groundwater would be treated in this scenario, it is not necessary to encapsulate the entire site, therefore the slurry wall in this alternative would be much smaller than the one proposed in Alternative 1.

Pursuant to the remedy selection process, Ansul evaluated the potential effectiveness of over 10 potential PRB materials. None of the tested materials provided adequate arsenic removal. Therefore, this remedy would not adequately protect human health and the environment.

**Alternative 3: Cap and Contain with Hydraulic Control**

This alternative incorporates everything described in Alternative 1, and is currently being utilized as an interim measure in the Eighth Street Slip and former salt vault areas. It makes use of the existing barriers as part of the overall subsurface barrier system at the site. The new subsurface barriers would consist of impermeable sheet piling or slurry walls installed along the property boundary to the depth of bedrock. The surface barrier consists of an asphalt cap with a suitable granular base. A storm water drainage network would be designed to convey runoff from the paved areas. This alternative is designed to prevent groundwater migration as well as storm water runoff to the river. In addition to the components described in Alternative 1, this alternative proposes to utilize plants to provide additional hydraulic control of the contaminated groundwater due to their water use needs. The process is called phytopumping. As a result of the uptake of groundwater, the plants will naturally lower the groundwater level, supplementing the mechanical groundwater management system. It should be noted that arsenic is poisonous to most plant life; therefore, care must be taken when choosing which species to plant. Hybrid poplar trees are most commonly used in phytopumping due to their high water usage rate and overall hardiness. If, for any reason the phytopumping aspect of this alternative fails to meet expected performance standards, a contingency plan will be instituted focused on maintaining groundwater at a prescribed elevation within the barrier wall.

The facility is currently conducting a pilot test to determine the effectiveness of phytopumping as well as its ability to contribute to groundwater hydraulic control at the site. To date, preliminary results of the pilot test appear to be positive.

**Alternative 4: Permeable Reactive Barrier with Phytopumping**

This alternative incorporates activities identified in Alternative 2, as well as using phytopumping for groundwater control as described in Alternative 3. This corrective action alternative would consist of the construction of a funnel and gate PRB. The PRB would extend to bedrock along the shoreline of the river. The PRB would allow the discharge of groundwater under natural flow conditions through gates along the barrier. These gates would be designed to include a reactive material expected to remove arsenic to the extent practicable. The impermeable subsurface barrier wall will be used to funnel the groundwater flow to the treatment gates. Since groundwater is being treated it is not necessary to construct a barrier around the entire site, therefore the slurry wall under this alternative would be much smaller than the one proposed in Alternative 1. This alternative also proposes to utilize plants to provide additional hydraulic control of the contaminated groundwater due to their water use needs. As a result of uptake of groundwater the plants will naturally lower the groundwater level, supplementing the mechanical groundwater management system. It should be noted that arsenic is poisonous to most plant life; therefore, care must be taken when choosing which species to plant. A pilot test on-site in 2006 demonstrated that the levels of arsenic being taken up did not harm the trees. Hybrid poplar trees are most commonly used at remedial sites due to their high water usage rate and overall hardiness.

Pursuant to the remedy selection process, Ansul evaluated the potential effectiveness of over 10 potential PRB materials. None of the tested materials provided adequate removal of arsenic. Therefore, this remedy would not adequately protect human health and the environment.

**Alternative 5: In-situ Stabilization**

Stabilization involves the introduction of a material into the subsurface that will react with the contamination to render it less soluble, therefore reducing its ability to leach to the groundwater or limiting its mobility within the groundwater. A potential stabilization amendment is Enviro-Blend®. Enviro-Blend® has been successfully used in ex-situ applications as a stabilizing agent for hazardous waste and has been shown to effectively immobilize arsenic in-situ and form insoluble compounds causing aqueous concentrations to drop. However, challenges associated with in situ stabilization involve the difficulty of successfully delivering the amendments to a heterogeneous geology and the difficulty of mixing these components in the subsurface.

**Estimated Costs of Alternatives**

Ansul estimates the capital cost, annual operation and maintenance (O&M) cost, and total estimated cost for each potential remedy alternative to be:

**TABLE 2 - Estimated Cost of Alternatives for On-Site Remedy**
**(Alternatives 1,2,4, and 5 in 2003 dollars; Alternative 3 in 2007 dollars)**

| Alternative | Direct Cost | Indirect Cost | O&M | Total |
|---|---|---|---|---|
| Alt. 1-Cap & Contain | $6,982,500 | $500,000 | $700,000 | $8,182,500 |
| Alt. 2-PRB | $6,907,000 | $815,000 | $600,000 | $8,322,000 |
| Alt. 3-Cap & Contain w/Hydraulic Control | $12,562,479 | $0 | $4,269,274 | $16,811,753 |
| Alt. 4-PRB w/Phytopumping | $5,422,650 | $802,400 | $850,000 | $7,076,050 |
| Alt. 5-In-Situ Stabilization | $70,050,000 | $450,000 | $600,000 | $71,100,000 |

## 6.2 Off-Site Menominee River Sediment

The potential remedy alternatives evaluated by Ansul to address Menominee River contamination at the facility are presented below.

**Alternative A: Hydraulic Dredging**

Hydraulic dredging involves using a submersible auger-like cutting head connected to the surface with a large diameter, large capacity hose. The cutter head, or dredge, operates on the sediment to be removed on the river bottom. The sediment is piped through the hose to either a barge or on-land staging facility. This alternative was successfully used to complete the Eighth Street Slip Interim Measure in 1999. The largest variable in the cost estimate for this alternative is water treatment because of the large volume of water entrained with the sediment. In addition, as there is no available on-site storage for the dredge water and the treatment train specifications assumed the dredge water would be treated at the same rate it was produced. The cost of water treatment is based upon the use of a large reverse osmosis (RO) unit. It may be determined that the RO unit is not required or that it would be more effective to construct a holding pond for the dredge slurry.

**Alternative B: Mechanical Dredging and Monitored Natural Recovery (MNR)**

Alternative 2 is similar to Alternative 1, the major difference being mechanical verses hydraulic dredging. There are several advantages to mechanical dredging, including; a higher solids content in the dredge slurry, which leads to less water treatment; ability to dredge on steep slopes; ability to remove debris; and ability to reach near shore sediments. Disadvantages are that mechanical dredging is much slower than hydraulic dredging, not as accurate in achieving target elevations, may result in greater resuspension of sediments and includes a transportation component between the dredge and final sediment destination (hydraulic dredge slurry is typically pumped directly via a pipeline from the dredge to its destination). The MNR portion of the alternative requires long term and appropriate monitoring of the further contaminant reduction in the sediment through natural processes.

**Alternative C: Sand Cap**

Sand caps have been proven effective as a means of isolating contaminated sediments in some riverine environments, and the cost of construction is typically less than that of dredging, because there are no treatment or disposal costs. The largest variable in the cost of the cap is the source of cap material. Cap material is typically either dredged clean sediment from uncontaminated dredging projects or from a local upland source. For this evaluation, it is assumed local sand is available at a reasonable price. In riverine environments such as near Ansul, the cap would also be armored with riprap or similar material to limit erosion.  The major disadvantage to capping is that the capped area needs to be monitored until the contamination is reduced to non-regulated concentrations through natural attenuation or evidence is sufficient that contaminants under the cap continue to remain isolated from the aquatic environment.  Monitoring includes testing the integrity of the cap and testing for contaminant migration into the cap material, surrounding sediments or the water column and into ecological receptors.  A natural cap may require maintenance to maintain the cap thickness and to mitigate for migration of contaminants into the cap material.  The amount of maintenance depends on the dynamics of the underwater environment, the quality of cap placement, and the quality of capping materials used.  Cap maintenance may include additional placement of sand or riprap. The navigational channel and biological habitat and would need to be taken into account prior to implementing this remedy.

**Alternative D:  Synthetic Cap**

A synthetic cap operates similarly to a natural cap.  A fabric pillow filled with concrete (or similar) is used as an isolating barrier between the contaminated sediment and the river environment, and the cap prevents contaminant migration to surrounding sediments. The cost for a synthetic cap is less variable, as it does not depend on locally available materials.  The synthetic cap was more expensive than the natural cap under the assumptions used, but may be less expensive if local sources are not available for the natural cap.

A synthetic cap has not been used as extensively in environmental applications and therefore, may require more regulatory steps than the natural cap.  The synthetic cap will require annual monitoring and maintenance, but maintenance is expected to be less than for a natural cap.  A synthetic cap may not be effective in an area where fish habitat must be maintained.  A combination sand and synthetic cap may be effective in an area with steep river bottom slopes where maintenance of fish habitat is required.

**Alternative E: Excavation in the Dry**

Excavation in the dry is typically implemented at sites with shallow (0-6 feet) water or when the area is easy to isolate.  The cost for excavation in the dry is typically higher than for dredging in an open, moving water application such as that proposed on the Menominee River.  The cost becomes more reasonable for a smaller area, such as a scenario where only the sediments with 100 ppm or greater were to be excavated, or possibly in areas easy to isolate, such as the Sixth Street slip.

| Alternative | Direct Cost | Indirect Cost | O&M | Total |
|---|---|---|---|---|
| Alt. 1-Hydraulic Dredging @ 50 ppm | $10,425,000 | $4,575,000 | $0 | $15,000,000 |
| Alt. 2-Mechanical Dredging @ 50 ppm | $10,620,681 | $0 | $386,075 | $11,006,756 |
| Alt. 3-Sand Cap | $2,500,000 | $1,000,000 | $1,700,000 | $5,200,000 |
| Alt. 4-Synthetic Cap | $5,800,000 | $2,300,000 | $1,100,000 | $9,200,000 |
| Alt. 5-Excavation in the Dry | $11,000,000 | $6,000,000 | $0 | $17,000,000 |

**TABLE 3 - Estimated Cost of Alternatives – River Contamination (Alternative B in 2007 dollars)**

## 7.0 EVALUATION OF PROPOSED REMEDY

### 7.1 On-Site Groundwater and Contaminated Soils

U.S. EPA's proposed remedy to clean up on-site groundwater and contaminated soils at the Ansul facility is:

**Alternative 3: Cap and Contain with Hydraulic Control**

The following discussion profiles the performance of the proposed remedy against the standards for the major technical components of the remedy.

**Protect Human Health and the Environment**. The goals of protecting human health and the environment are met by the surface cover and groundwater barrier remedies. Human contact with groundwater and soils would be greatly reduced or eliminated by the groundwater containment and surface cover remedies. Groundwater would be contained within constructed barrier walls and kept underground by hydraulic controls (pumping measures) and prevented from migrating to the river or up to the surface. The cover system design would aid in redirecting rainfall and snowmelt to the stormwater management system instead of adding water to the ground. The surface covers would minimize or prevent people from coming into contact with contaminated soil and groundwater. Groundwater migration to the Menominee River would be substantially decreased by the barrier walls.

**Exposure to Soils and Groundwater** The surface covers (i.e., asphalt, soil and gravel) would create barriers between people and contaminated soil and groundwater. The people who would be in the manufacturing area are mainly routine workers and the occasional visitor or trespasser. Since this alternative would not treat subsurface contamination, future subsurface construction in the manufacturing area could potentially expose construction workers to contaminated soils and groundwater. This exposure would be controlled through the implementation of institutional controls which would restrict subsurface activity and impose the use of personal protective equipment and clothing.

The barrier walls would alter groundwater flow patterns around the site. Some groundwater would be either passively removed through the groundwater control system proposed or through direct pumping. In either case, the groundwater will generate some arsenic-contaminated wastewater which will be treated on site or handled, transported, and disposed of at an off-site location.

The environmental impact on the manufacturing area, an area consisting of the main plant, not including the wetlands to the east, see Figure 1, would be minimal, as this area is already developed and the cap (e.g. asphalt, soil and gravel) and contain alternative would simply prevent direct exposure to contaminated soil and groundwater. Since this alternative does not treat subsurface contamination, future subsurface construction in the manufacturing area would have the potential to expose contaminated soils and groundwater. This exposure may be controlled through the implementation of institutional controls which restrict such subsurface activity. If subsurface contamination, however, is not adequately contained Ansul will be required to develop and implement a contingency plan. Such a plan will be subject to EPA review and approval.

**Impacts to the Undeveloped Area**. The contaminated groundwater extends to the southeast portion of the Ansul property, which is an undeveloped area that includes some dry-end scrub wetland with small pockets of marsh. The barrier walls and surface cover would have a significant impact on this area (see figure 2 showing the extent of the barrier walls). To minimize the impact of the cap and contain remedy within the natural area, soil or gravel rather than asphalt will be evaluated as a surface cover. Work in the wetlands would require a permit from the U.S. Army Corps of Engineers (ACOE) and the State of Wisconsin. Ansul will meet with the ACOE, U.S. EPA, and the State to discuss permit requirements and how to minimize the wetlands impacts, including replacement of affected wetlands and design modifications to the remedy. Following these discussions, Ansul will submit a proposal to U.S. EPA (for approval) that meets the wetlands requirements of ACOE and the WDNR, as well the clean-up goals established for the site. The proposal must be submitted within 60 days following the meeting with the ACOE.

**Attain Media Cleanup Standards.** The selected remedy is not designed to treat contamination present in the subsurface; therefore, implementation of this alternative will not ultimately attain media cleanup standards as discussed earlier in this document. The remedy, will, however prevent exposure of workers to contamination at the surface. Additionally, this portion of the selected remedy should decrease the migration of arsenic contamination to the sediments. A reduction in the arsenic loading to the sediments will assist in attaining the clean-up standards for the sediments.

**Comply with Any Applicable Standards for Management of Wastes**. Waste generated during implementation of the remedy (e.g., soil and groundwater) will be properly characterized and treated/disposed in accordance with all applicable regulations. Among the applicable standards are the previously referred to NPDES standards for water discharge to the river; the RCRA standards for hazardous soil/sediment waste; and wetland requirements for the area southeast of the manufacturing area.

**Control Sources and Releases.** The barrier system and hydraulic control measures associated with this alternative would be designed to encapsulate existing soil and groundwater contamination and substantially decrease its migration outside of the barrier system.

**Long-term Reliability and Effectiveness**. Engineered barriers such as cap and containment are relatively reliable for as long as the structural integrity of the barrier and cap is maintained. Subsurface barriers are generally stable; however compatibility of the subsurface barrier with the contaminants that it may come into contact with would be the main threat to its structural integrity. Surface barriers require periodic inspection and maintenance. Subsurface barriers generally have a design life of 30 to 50 years. Since this alternative is not designed to reduce contaminant levels over time, the barriers are likely to require substantial repair or replacement over the course of their design life. The facility will develop an O and M plan, subject to EPA review and approval, to inspect, test, and perform any monitoring to ensure expected performance is maintained over time. Further protection of the barrier wall will be attained through institutional controls e.g. easements which contain digging restrictions.

**Reduction in the Toxicity, Mobility, or Volume of Wastes**. This alternative is designed to prevent the migration of contaminated groundwater. This is accomplished through the impermeable barriers substantially decreasing groundwater migration, and the surface barriers limiting the infiltration of rain and surface water. This alternative is not designed to reduce the toxicity or volume of wastes.

**Short-term Effectiveness**. Remedial construction activities may expose the site workers to the subsurface contamination. However, site work will follow stringent health and safety practices intended to minimize contact with subsurface contamination during the remedy implementation. Corrective measure activities associated with contaminated soil and groundwater require the development of a health and safety plan. An O&M manual will be developed for the hydraulic control portion of the remedy which includes phytopumping and the passive groundwater collection system within the barrier wall. This manual along with appropriate institutional controls will ensure proper maintenance during the design life of the project.

**Implementability**. Although the construction methods for this alternative are fairly straightforward and have been employed for decades, implementation at this site may be difficult. The manufacturing area already has a substantial amount of asphalt paving and an analysis of this existing pavement would be required to determine if it could be effectively utilized as part of the overall cap. Additionally, a storm water management system would be needed to direct water away from covered areas. Construction of the barrier within a portion of the undeveloped areas having wetlands will require a permit from the U.S. Army Corp of Engineers and WDNR under the Clean Water Act section 404 permit program.

The remedy will be monitored for effectiveness and for maintenance. If arsenic contamination at the site is found to not be adequately contained and controlled, Ansul would be required to develop and implement a contingency plan. Such a plan would be subject to US EPA review and approval.

**Cost**. Based on 2003 estimates, the cost of the various remedial alternatives to address contaminated groundwater and areas of concern varies from approximately $8 to $71 million. The total estimated cost of the cap and contain with hydraulic control remedy is $17 million. This remedy is anticipated to provide the most cost effective protection of both human and ecological health.

### 7.2 Off-Site Contamination - Menominee River Sediment

U.S. EPA's proposed remedy to clean up contaminated Menominee River sediment at the Ansul facility is:

**Alternative B: Mechanical Dredging and Monitored Natural Remediation**

The following discussion profiles the performance of the proposed remedy against the standards for the major technical components of the remedy.

**1. Protect Human Health and the Environment**. The mechanical dredging technique would adequately address the ecological impacts associated with the sediment contamination. The alternative would be designed to minimize carrier water generated by the dredging process and thereby greatly reduce the amount of contaminated water that would have to be handled once the sediment is dewatered on land.

The environmental impact to the Menominee River using environmental mechanical dredging will be reduced. This dredging technique will minimize sediment suspension at the dredging site. Appropriate turbidity barriers will be deployed to aid in further reducing suspended fine sediment from drifting down gradient in the river.

Hydraulic dredging was considered but is rejected due to the large volumes of contaminated water that will be produced carried along with the sediments removed. Reducing carrier water has the added benefit of minimizing the technical problem associated with water treatment of high levels of arsenic. It has been shown that it is currently technically difficult to treat high levels of dissolved arsenic (Ansul, 2005, Zhu, 2007). While the dredging will produce significant improvements in the health of the sediment, the residual arsenic remaining will be reduced by MNR. The MNR process will further reduce arsenic levels to those protective of human health and the environment (20 ppm). An operations and maintenance plan will be developed by the facility to describe all aspects of MNR including appropriate measurements to be made, frequency of measurement, locations, etc.

**2. Attain Media Cleanup Standards.** The selected remedy is not designed to initially reach contamination clean up targets by itself; however the post-dredging phase will require a longer term MNR program to ensure that the clean up target is reached within a reasonable time. Dredging will attain a target arsenic concentration of 50 ppm and MNR is targeting 20 ppm. If these targets are not attained, then some other appropriate technology reviewed and approved by the EPA will be implemented to achieve 20 ppm.

**3. Comply with Any Applicable Standards for Management of Wastes**. Waste generated during implementation of the remedy (e.g., carriage water, dewatered contaminated sediment) will be properly characterized and treated/disposed in accordance with all applicable regulations.

**4. Control Sources and Releases.** The mechanical dredging activity outlined in this alternative would be designed to minimize to the maximum extent practicable, refuge contaminated sediment transported down river. Siltation curtains, or some other appropriate technology will be used to aid in preventing contamination migration outside of the dredging area.

**5. Long-term Reliability and Effectiveness**. Mechanical dredging has a long history of being successfully applied to sites. Physically removing contaminated sediment from the riverine environment is a major advantage of this alternative. Data indicates MNR may work in reducing arsenic values to 20 ppm within 7-10 years, however, if it does not, then EPA will require a contingency plan that will meet the 20 ppm level within 1 year.

**6. Reduction in the Toxicity, Mobility, or Volume of Wastes**. While this alternative is not designed to initially remove all arsenic in the sediments to target levels, a substantial mass of arsenic contamination will be removed from the river. Removing this waste encourages a shorter natural recovery of the remaining arsenic.

**7. Short-term Effectiveness**. Remedial mechanical dredging activities may expose the site workers to the subsurface contamination. However, site work will follow stringent health and safety practices intended to minimize contact with subsurface contamination during the remedy implementation. Corrective measure activities associated with contaminated sediment require the development of a health and safety plan. An O&M manual will be developed for the dewatering portion of the remedy and the MNR phase of the remedy (e.g., including information on how to conduct appropriate monitoring and implementation of navigation and dredging in the MNR area of the site.

**8. Implementability**. The methods for this alternative are fairly straightforward and have been employed for many years. There is a substantial historic record of successfully applying environmental mechanical dredging. Appropriate analysis of de-watering and subsequent disposal of that water will be conducted to determine the best method of addressing the carriage water. In addition, a similar analysis will be undertaken to determine the best method of addressing proper disposal of the de-watered sediment. Mechanical dredging will require appropriate authorization from the United States Army Corps of Engineers. MNR is itself, a straight forward remedy to implement. Prior to implementation of the MNR phase, a plan will be developed covering what will monitoring and sampling will be done during the MNR phase. The plan will include a proposal for a network of monitoring locations, frequency of sampling and monitoring targets. In addition, deed restrictions will be put in place that will prohibit digging, trenching, and dredging in addition, a "no anchoring" zone will be established in the MNR area of the river.

**9. Cost**. The estimated cost of the various remedial alternatives to address contaminated sediment and areas of concern varies from approximately $5 to $17 million. The total estimated cost of the environmental mechanical dredging at the 50 ppm arsenic target is $11 million. Although no specific cost estimate is associated with the MNR component at this time, it will be a definite, but smaller percentage of the larger, more active dredging phase cost estimate. This remedy is anticipated to provide the most cost effective protection of human and ecological health and the environment.

Based on information currently available, the proposed remedy (cap and contain with hydraulic control and environmental mechanical dredging with monitored natural remediation) provides the best balance of corrective measure scenarios with respect to the standards described above. U.S. EPA believes that within 7 to 10 years the proposed remedy will be protective of human health and the environment, and will effectively control the exposure to contaminants in the river once sediment concentrations achieve 20 ppm. In addition, the post-dredging remedy of MNR will ultimately provide a path to attaining applicable target values, and progress will be periodically assessed. All applicable standards regarding groundwater protection and onsite/offsite waste management will be addressed and complied with during the corrective measures implementation process.

## 8.0 PUBLIC PARTICIPATION

U.S. EPA seeks input from the local community on the remedy proposed to address contaminated groundwater, soil, and sediment at the Ansul facility. U.S. EPA will initiate a 45-day public comment period to allow participation of the local community in the final remedy selection.

The Administrative Record for the Ansul facility is available at the following locations:

**Stephenson Public Library**
1700 Hall Avenue
Marinette, Wisconsin 54143
715 732 7570

**U.S. EPA, Region 5**
Waste, Pesticides and Toxics Division Records Center
77 West Jackson Boulevard, 7th Floor
Chicago, Illinois 60604-3590
(312) 886-0902
Hours: Mon-Fri, 8:00 a.m. – 4:00 p.m.

After consideration of the comments received, U.S. EPA will select the final remedy and document its selection in the Final Decision and Response to Comments. In addition, public comments will be summarized and responses provided. The Final Decision and Response to Comments will be drafted at the conclusion of the public comment period and incorporated into the Administrative Record

To send written comments or request information on the Ansul facility, please contact:

Martha Y. Robinson
Community Relations Coordinator
U.S. Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Internal Services Section, DM-7J
Chicago, Illinois 60604-3590
(312) 886-6141
E-mail: robinson.martha@epa.gov

## 9.0 REFERENCES


Tyco Safety Products, 2006. Facility Fact Sheet – The Occurrence of Arsenic and the Geochemistry of Groundwater. December, 2006, 3pp.

Tyco Safety Products, 2003a. Corrective Measures Study, Manufacturing and Wetlands Area. May 9, 2003. 60pp.

Tyco Safety Products, 2003b. Menominee River Sediment Remedial Alternatives Evaluation. November 24, 2003. 13pp.

Tyco Safety Products, 2003c. Upland (On-Shore) Soils Cost Evaluation, Remedial Alternatives Evaluation. November 24, 2003. 8pp.

Tyco Safety Products, 2007b. Pre-Design Remedial Engineering Report, Manufacturing and Wetlands Area. March, 2007. 59pp.

Tyco Safety Products, 2007a. Addendum 01 to the Corrective Measures Study, Manufacturing and Wetlands Area. January, 2007. 21pp.

U. S. EPA, 2005. Chapter 4.0 - Monitored Natural Recovery. pp. 4.1 – 4.13. *In* Contaminated Sediment Remediation Guidance for Hazardous Waste sites. December. EPA-540-R-05-012.

U.S. EPA, 2002. Office of Solid Waste and Emergency Response, Office of Emergency and Remedial Response, April 26, 2002, OSWER 285.6-07P

U. S. EPA, 2001. Phytoremediation of Contaminated Soil and Groundwater at Hazardous Waste Sites. EPA/540/S-01/500. Office of Research and Development, Washington, DC. February 2001.

U. S. EPA,1991. Guidance on RCRA Corrective Action Decision Documents, The Statement of Basis Final Decision and Response to Comments. EPA/540/G-91/001. Office of Research and Development, Washington, DC. February, 1991.

U. S. EPA, 1989. Statistical Methods for Evaluating the Attainment of Cleanup Standards, Vol. 1: Soils and Solid Media, EPA 230/02-89-042.

U. S. EPA, 1992. Statistical Methods for Evaluating the Attainment of Cleanup Standards, Vol. 2: Ground Water, EPA 230-R-92-014.

U. S. EPA, 1992. Statistical Methods for Evaluating the Attainment of Cleanup Standards, Vol. 3: Reference-Based Standards for Soils and Solid Media, EPA 230-R-94-004.

WDNR, 1996. Lower Menominee River Remedial Action Plan Update. WDNR PUBL-WR-410-96. February 1996.

WDNR, 2005. Recommendation for Threshold Bound Effect Concentration Range for Arsenic in the Sediments of the Turning Basin Area and 6th Street Slip Areas of the Menominee River to be Used to Select a Remedial Goal to Protect Site-Specific Aquatic-Related Assessment Endpoints. Memo dated July 28, 2005, 15 pp.

WDNR, 2006. Sediment Cleanup Value – Arsenic. Memo dated August 9, 2006.

## FIGURES

Enlarged versions of the figures will be available in the Administrative Record repository for Ansul in the Stephenson Public Library, Marinette, Wisconsin and at a USEPA web site which is currently being developed to feature the remedial work at the Ansul site. The figures are also available from U.S. EPA upon request (see page 31).

1) Figure showing facility layout, location of buildings, Eighth Street Slip etc., and on-site locations where soil arsenic values at 32 ppm and above are found.

2) Figure showing proposed location of the on-site vertical barrier wall.

3) Figure showing contaminated river sediment arsenic values of 50 ppm and greater.

Figure 1.

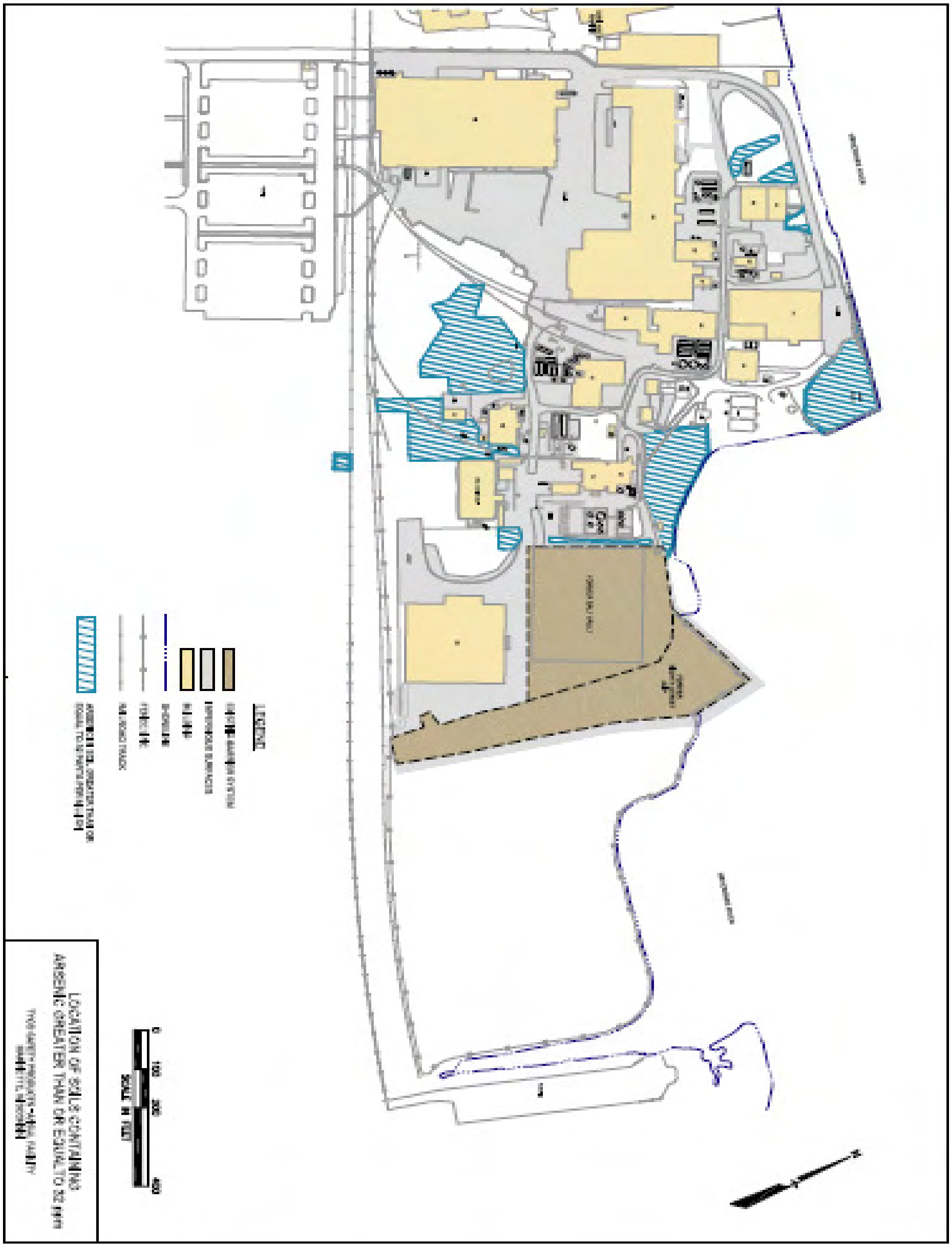

LOCATION OF SOILS CONTAINING
ARSENIC GREATER THAN OR EQUAL TO 32 ppm
SCALE IN FEET
0
100
200
400

Figure 2

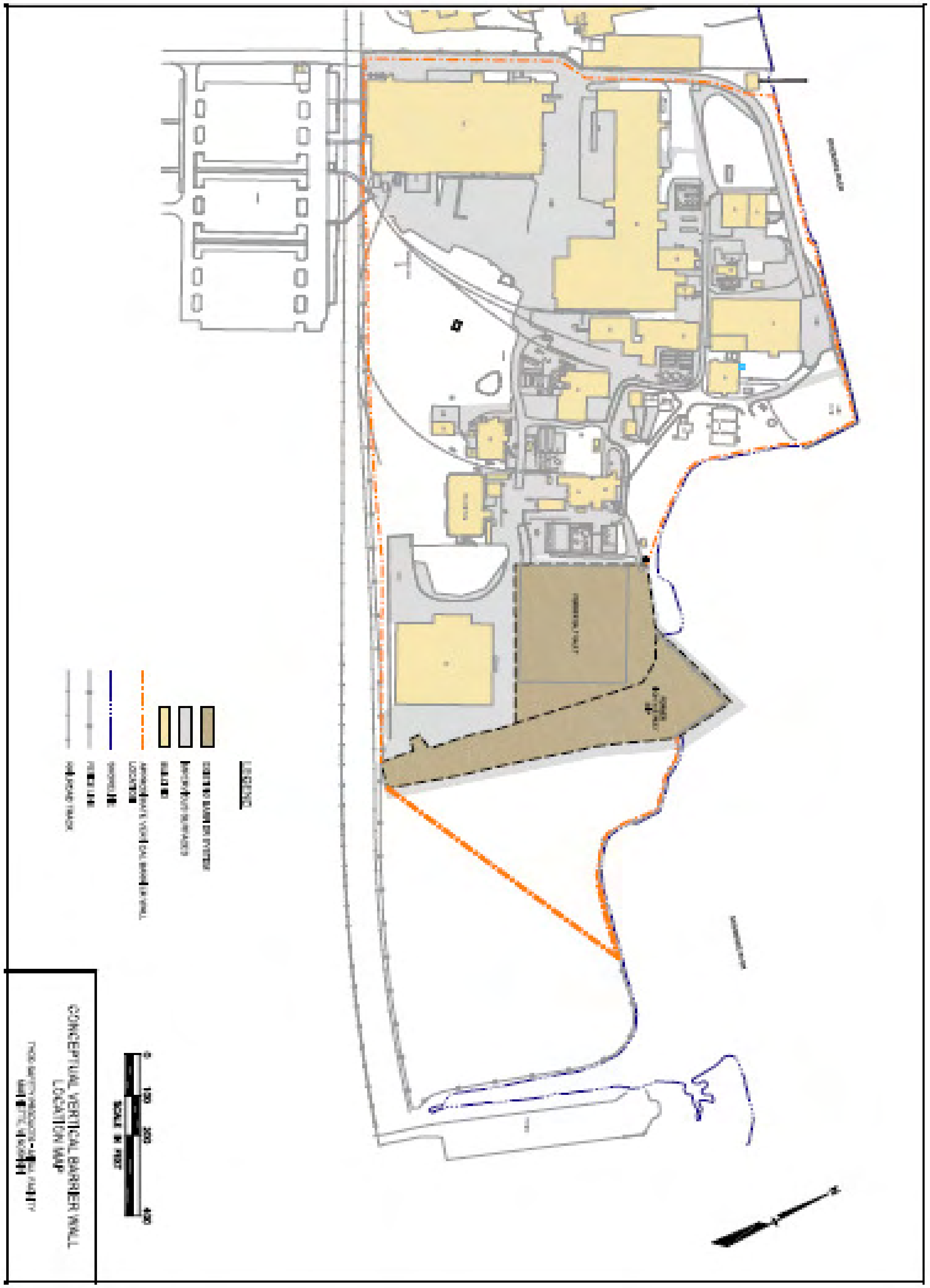
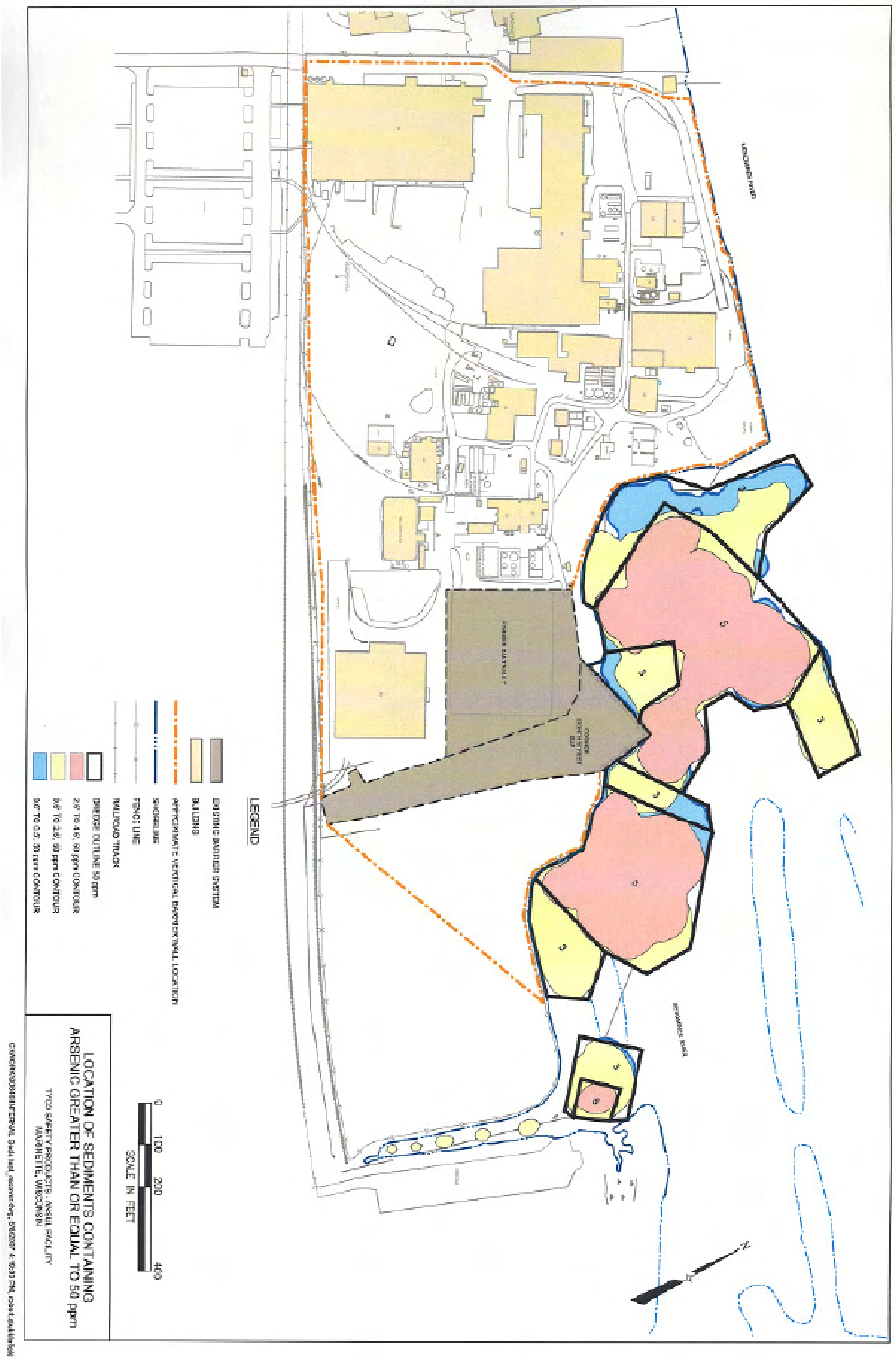

LEGEND
SCALE IN FEET
0
100
200
400
CONCEPTUAL VERTICAL BARRIER WALL
LOCATION MAP

Figure 3.



LEGEND
EXISTING BARRIER SYSTEM
BUILDING
APPROXIMATE VERTICAL BARRIER WALL LOCATION
SHORELINE
FENCE LINE
RAILROAD TRACK
DREDGE OUTLINE 50 ppm
LOCATION OF SEDIMENTS CONTAINING ARSENIC GREATER THAN OR EQUAL TO 50 ppm
TYCO SAFETY PRODUCTS - ANSUL FACILITY
MARINETTE, WISCONSIN
SCALE IN FEET
0
100
200
400
N