Remedial Action Optimization Evaluation Penta Wood Products Site, Town of Daniels, Wisconsin Work Assignment No. 004-LRLR-05WE, Contract No. EP-S5-06-01

PREPARED FOR: Linda Martin/U.S. Environmental Protection Agency
Philip Richard/Wisconsin Department of Natural Resources

PREPARED BY: CH2M HILL

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1. Purpose and Scope

This memorandum presents the results of an evaluation of the impacts of five alternative operating scenarios on the cost and effectiveness of the long term remedial action (LTRA) at the Penta Wood Products (PWP) Superfund Site. The responsibility for remedy operation at the PWP Superfund Site will be transferred from the U.S. Environmental Protection Agency (EPA) to the Wisconsin Department of Natural Resources (WDNR) on September 1, 2014. In preparation for the transfer, EPA and WDNR are considering possible changes in the operation of the PWP Superfund Site. EPA directed CH2M HILL to review optimization of the plant operations by evaluating several scenarios that would allow operating costs to be lower, while continuing to protect environmental and human health in accordance with objectives in the Record of Decision (ROD).

The evaluation uses lessons learned from existing plant operations, plus historical operating costs, to estimate costs and to consider the general effect of five different scenarios. The operating scenarios were selected by WDNR and EPA on May 21, 2013, and subsequent meetings. Four of the scenarios adjust the pumping and treatment of groundwater operation, and the fifth scenario addresses disposal of solids at the site, this scenario also includes costs for the option of adding solidification. The following are the five scenarios:

- Scenario 1: Operate wells and treatment on a 2-week cycle; alternate 2 weeks on then 2 weeks off all year.
- Scenario 2: Operate wells and treatment on a 2 week cycle in summer (April through September); run full-time in winter (October through March).
- Scenario 3: Operate wells and treatment in winter (October through March) and shutdown the system in summer (April through September)
- Scenario 4: Full-time treatment system operation, but cycle which wells are operational, or operate certain wells with reduced pumping rates in order to reduce the waste stream.
- Scenario 5: Establish an onsite storage facility for wastes generated by the treatment system and incorporation of the waste into the corrective action management unit (CAMU) at a later date, with the option of solidification for the wastes.

The evaluation identifies options for optimizing the overall PWP Superfund Site remedial action (RA), potential costs savings, and considerations of system operation by the State of Wisconsin after August 2014.

2. Background

2.1 Previous Investigations

Between 1953 and 1992, posts and telephone poles were treated at the PWP Superfund Site with a 5 or 7 percent pentachlorophenol (PCP) solution in a No. 2 diesel fuel oil carrier, or with a waterborne salt treatment called chemonite, consisting of ammonia, copper oxide II, arsenate, and zinc. Excess amounts of the solution were leaked directly to the ground and, as a result of past operations, a light nonaqueous phase liquid (LNAPL) layer, smear zone, and dissolved-phase PCP plume exists in the groundwater.

2.2 Past Investigations and Record of Decision

In September 1998, the ROD was finalized specifying remedies to address soil and groundwater. The remedial approach implemented at the site addresses LNAPL and contaminants of concern in the groundwater by the following means:

- Extraction and treatment of the highly contaminated groundwater
- Monitored natural attenuation of contaminants in the groundwater
- LNAPL recovery
- Bioventing

The ROD also established a CAMU at the site to consolidate and cover remaining site contaminated materials. Soils with PCP contamination above 2.1 milligrams per kilogram (mg/kg) were removed from the site, while soils below this level were consolidated in the CAMU.

The objective of the PWP Superfund Site RA is as follows:

- Reduce or eliminate the potential risk to human health and ecological receptors associated with exposure to PCP and fuel oil components in surface water and groundwater.
- Reduce or control the source of contaminants.
- Meet the applicable or relevant and appropriate requirements (ARARs), including the reduction of concentrations of contaminants in the site's groundwater plume to WDNR's Preventative Action Limits (PALs).

The ROD establishes RAs to protect the environment and neighboring residents who use the groundwater as drinking water. It is unlikely that natural processes will make it safe to drink again within a reasonable time period, and groundwater is the sole drinking water source in the area. The risk assessment estimated that PCP groundwater concentrations in residential drinking water pose carcinogenic and noncarcinogenic risk, with levels greater than the EPA target risk range.

The ROD's conclusion about the No Action alternative includes the following statement:

> "Given the 4-acre LNAPL area that contains an estimated 550,000 gallons of residual-phase and free-phase LNAPL, continual loading of contaminants to the groundwater would likely occur for hundreds of years. It is unlikely that natural attenuation processes would reduce PCP concentrations in the center of the LNAPL area to PALs within a timeframe regarded as reasonable." The ROD noted that additional RAs would be considered if PCP concentrations did not decrease at an acceptable rate.

2.3 System Description

The RA at the PWP Superfund Site includes groundwater extraction and treatment, LNAPL recovery, bioventing, and natural attenuation. The groundwater system extracts and treats groundwater containing dissolved-phase PCP and depresses the water table in the LNAPL area to promote LNAPL removal. The bioventing system was installed to provide oxygen for the aerobic biodegradation of residual diesel fuel petroleum hydrocarbons and PCP in the LNAPL smear zone. The RA objectives of the groundwater collection and treatment system are to contain, collect, and treat groundwater from areas defined in the feasibility study report as exceeding 1,000 micrograms per liter [μg/L] PCP. The goal is to reduce the concentrations to a level that allows natural attenuation to achieve maximum contaminant levels (MCLs) of 1 μg/L PCP and PALs of 0.1 μg/L PCP within a reasonable time.

The CAMU was established during the RA to consolidate soils at the site that exceeded an onsite soil level for PCP of 2.1 mg/kg or 0.9 mg/kg for offsite soils (CH2M HILL 2000). The CAMU was established for permanent disposal of soils material at the site. Groundwater extract and bioventing were established within the CAMU to address existing soils and groundwater contamination at the site of the CAMU.

The groundwater extraction and treatment system has been operating continuously for 10 years. It started operating in the second half of 2000, initially operating for about 1 year until September 2001, when it was shut down for pilot testing and plant modifications intended to help meet effluent criteria. The system was restarted on February 27, 2004, and has been running continuously since, except for scheduled downtime from routine maintenance and repairs. The biovent system started in September 2007. It is operated during the summer (April through September) and turned off during the winter (October through March).

The PWP Superfund Site groundwater treatment system treats groundwater containing emulsified oils and dissolved PCP. The primary treatment train consists of coalescing oil/water separation, chemical conditioning (coagulation with ferric sulfate and flocculation with cationic polymer), dissolved air flotation (DAF), float dewatering using rotary drum vacuum filtration, granular activated carbon (GAC) adsorption of the DAF effluent, and final pH adjustment with the addition of caustic soda to the GAC effluent. Treated groundwater is discharged to an infiltration basin in the northwestern part of the site. The treatment system influent and effluent is monitored in accordance with a Wisconsin Pollution Discharge Elimination System permit-equivalent issued by WDNR.

Groundwater monitoring at the PWP Superfund Site includes semiannual sampling of up to 14 monitoring wells, 5 residential wells, and 1 onsite potable well, measuring static water levels in all monitoring wells, and measuring product levels in monitoring wells with LNAPL.

The groundwater treatment system, bioventing system operation, hazardous waste generation and disposal, groundwater monitoring, reporting, site inspection, and operation and maintenance (O&M) activities at the PWP Superfund Site are performed by CH2M HILL for EPA under Work Assignment No. 004-LRLR-05WE. The average annual O&M cost, including monitoring and reporting, for the systems is approximately $1,100,000 per year.

2.4 System Performance

Trend evaluation of the concentration data, in conjunction with the water level and LNAPL measurements, indicates that the groundwater extraction system is performing as planned. It is maintaining capture levels, and the zone of groundwater with elevated concentrations of PCP is decreasing. Under pumping conditions, the LNAPL layer is not expected to expand from its current footprint but does continue to be a source of PCP in groundwater.

The area with groundwater containing PCP concentrations in the semiconfined and confined aquifers at the PWP Superfund Site continues to decrease due to operation of the groundwater extraction system. The area exceeding 1,000 μg/L in the unconfined aquifer remains nearly identical to the areas where LNAPL is present. Due to the contact with LNAPL, the areal extent of the plume is not expected to reduce significantly without corresponding reductions in LNAPL although groundwater results due show order of magnitude reductions since the system started. The semiconfined aquifer, which has partial connection to the unconfined aquifer, has shown larger reductions likely due to not being directly in contract with the ongoing LNAPL contamination source. Please see the annual report for in-depth details of system performance (CH2M HILL 2013a).

A significant reduction in groundwater PCP concentrations is reflected in the steady decline of influent concentrations to the treatment system (reduced from 9,200 μg/L in 2004 to 1,350 μg/L in 2013).
The groundwater extraction and treatment system has removed an estimated 8,800 pounds of PCP mass and an estimated 13,641 pounds of PCP removed through the extraction of LNAPL from the environment from 2004 through 2013.

More rapid plume remediation resulting from the groundwater extraction is limited by the continued reduced dissolution of PCP from the LNAPL into the groundwater.

Evaluation of the data generated during 2013 suggested that areas at the perimeter or outside the PCP plume are under slight to strong oxidizing conditions and that natural attenuation is occurring, which is similar to conditions observed in previous years. Natural attenuation parameters, including nitrate, dissolved manganese, dissolved iron, sulfate, methane, chloride, and field parameters (specific conductance, dissolved oxygen, and oxidation reduction potential) are measured during each sampling event. The results are evaluated each year to determine whether the conditions in the aquifer can support natural attenuation. Benzene, toluene, ethylbenzene, and xylene (BTEX) and naphthalene are present in several wells in the area of concentrated PCP but are not present in any monitoring wells along or outside the plume perimeter. The bioventing system was constructed to reduce contamination in the vadose zone, reducing continuing sources of PCP to the groundwater. The bioventing was operated for about 5 months in 2013. During that time, the intermediate and deep wells and the shallow wells outside of the wood chip area showed a pattern of increasing oxygen levels and decreasing carbon dioxide levels during the months the biovent blower was running. Oxygen generally stabilized for each well at roughly 20 percent. Methane was generally not detected or was found in the wells at very low concentrations. The shallow wells within the wood chip area showed similar trends, but oxygen concentrations increased only slightly during operation of the biovent blower. Oxygen depletion and an increase in carbon dioxide and methane during the time the blower was turned off indicate that aerobic degradation is occurring.

Results from the residential wells sampled in May and October 2013 indicated the presence of PCP at very low concentrations in one residential well (less than the PAL of 0.1 μg/L) was consistent with historical detections. Based on the system and groundwater data is has been determine that the groundwater plume is currently contained onsite. In the past the system has been shut down periodically, usually due to routine maintenance where the system was shut down for at most 2-3 weeks. It has been established that after these shut down periods that the plume has maintained capture once the system was turned back on, this was determined through measurement of the potentiometric surface. It has not been determined whether plume capture would be maintained during a six month shutdown.

3. Alternative Operating Scenarios

Several operating scenarios were evaluated during the optimization study as part of a detailed evaluation of alternatives. Based on a review of the site conditions, technical feasibility, and long-term cost objectives, several site operating scenarios that could be considered individually or in combination for future site planning and discussion purposes have been identified.

3.1 Scenario 1

Scenario 1 involves operating the groundwater and LNAPL collection and treatment system year-round, on a cycle. A year-round 2-week-on/2-week-off cycle is recommended instead of a month-on/month-off cycle for the winter seasons (October through March) as well as the summer season (April through September. If the system was to be shut down for a full month in the winter season, it would possibly need to be winterized, and wear-and-tear on the system could be increased. The 2-week schedule would also benefit the summer schedule, coinciding with the bioventing schedule. Since the rate of groundwater migration is slow (on the order of 7 feet per year), the plume footprint would not change during the nonoperational period of 2 weeks; however, operating the system on alternate weeks, based on experience at the site, would have a low likelihood of expanding the plume. This scenario would reduce labor operating costs by approximately 40 percent, this estimate would include time for maintenance and shutdown while the system was down. There would likely be only an approximate 25 percent reduction in energy cost because the electrical system would continue to use energy during the 2 weeks of dormancy. Waste disposal costs and chemical supplies would be cut by 50 percent.

3.2 Scenario 2

Scenario 2 involves operating the groundwater and LNAPL collection and treatment system year-round, except that the system would cycle two weeks on/two weeks off in the summer season (April through September) while running continuously in the winter season (October through March). Since the rate of groundwater flow is slow (on the order of 7 feet per year), the area with elevated PCP would not be expected to change during the nonoperational period of alternate weeks; however, operating the system on alternate weeks, based on experience at the site, would have a low likelihood of expanding the plume.. The reduced operation would reduce labor operating costs by approximately 20 percent, the estimate would include some maintenance during shutdown periods. Energy costs would be reduced by 12 percent, and waste disposal and chemical costs would be reduced by approximately 25 percent.

3.3 Scenario 3

Scenario 3 involves operating the groundwater and LNAPL collection and treatment continuously in the winter season (October through March) with shutdown in the summer (April through September) season. Since the rate of PCP plume migration is slow (on the order of 7 feet per year), it is anticipated that Scenario 3 would not allow for re-expansion of the plume footprint. However, the system has not been shut down for this long in the lifetime of the treatment plant, so it is not known if there would be impacts to residential wells. Operating costs would be reduced by approximately 45 percent. It is estimated that the system would require 1 week to complete the long term start up and shutdown. Energy costs would be reduced by 45 percent. Waste disposal costs and chemical costs would be reduced by approximately 50 percent.

3.4 Scenario 4

Scenario 4 involves the groundwater and LNAPL collection and treatment system to operate year-round continuously, but at a decreased rate. This could be accomplished in the following two ways: fewer extraction wells could be used or the extraction wells could be pumped at a decreased rate. The treatment system was designed to operate at an average of 50 gallons per minute (gpm), allowing the chemistry to work properly. Operating at less-than-designed flow rates would not allow for efficient removal of emulsified oils, which would foul the GAC. Scenario 4 is not advised. The flow rate is currently 56.6 gpm allowing for a flow reduction of only 5 percent.

3.5 Scenario 5

Scenario 5 would continue operation of the groundwater, LNAPL collection, and treatment of the waste streams under any operating scenario, with the creation of an onsite waste storage facility and disposal within the CAMU. It would eliminate the requirement to incinerate the filter cake and spent carbon offsite, thus reducing transportation costs and incineration costs. Scenario 5 is described in more detail in the following section.

4.0 Conceptual Description of Scenario 5

Scenario 5 would eliminate the removal of waste from the site for permanent destruction and instead would place the waste into the CAMU. The filter cake and spent carbon both pass the toxicity characteristic leaching procedure (TCLP) criteria for PCP and dioxin; therefore, contamination would not be likely to leach to the groundwater, and would be contained beneath a cover. An additional option for including solidification has also been included in the cost estimates for further redundancy to contain the waste. Infiltration through the cover would continue to be allowed, and the bioventing system would still be operable beneath the waste as well. The WDNR would be required to provide an approval to incorporate the waste into the CAMU under the current interpretation of the regulations. The LNAPL recovered from the subsurface would continue to be removed from the site. Several strategies that were researched for Scenario 5 are as follows:

- Storage of filter cake and spent carbon.
- Placement of waste into the CAMU.
- Option of solidifying waste prior to placement in the CAMU.
- Implications in regards to the ROD.

Based on the records from the previous 5 years of the treatment system operation at the PWP Superfund Site and the waste generation from those 5 years, the average mass of the spent carbon waste generated per year is approximately 63,000 pounds or 31 tons, and the average mass of the filter cake waste generated per year is approximately 211,000 pounds or 105 tons. On average, the spent carbon waste is disposed approximately 2.5 times every year, and the filter cake waste is disposed approximately 7 times a year. Based on the waste profile summary generated by North Shore Environmental, Inc., the average density of the spent carbon waste is approximately 50 pounds per cubic foot, and the average density of the filter cake waste is approximately 37 cubic foot. The carbon footprint of the waste would be reduced. At present, the site wastes are transported 740 miles, and emissions from the incineration would be eliminated.

The consistency of the waste stored may vary by seasonal temperature and humidity changes. Based on the density and the mass of the waste generated, it is estimated that approximately 50 cubic yards of spent carbon waste and 220 cubic yards of filter cake waste is generated by the treatment system annually.

Several other strategies for scenario 5 were considered but were ultimately discarded in favor of better or cheaper options. A description of these options are included in Attachment 1 for completeness. These include the following:

- Containment building instead of a concrete pad and rolloffs
- New CAMU instead of incorporation into the existing CAMU
- Reduction of waste using ultraviolet light or ozone

4.1 Storage of Filter Cake and Spent GAC

As a large-quantity generator (LQG) of hazardous waste, hazardous waste is allowed to accumulate onsite for up to 90 days in a central accumulation area without triggering Resource Conservation and Recovery Act (RCRA)-permitted storage requirements, provided the LQG is in compliance with NR 662.034. Under the scenario being evaluated, the filter cake and spent GAC would be stored onsite for longer than 90 days prior to placement in the CAMU, and therefore would trigger compliance with the substantive RCRA storage requirements in NR 664. Although the 90-day criterion can potentially be considered administrative, the requirements in NR 664 need to be met because they are more stringent than the requirements in NR 662. NR 664 also requires containment for containers and a closure plan. The NR 664 container requirements are summarized in Table 1. Attachment 2 provides the applicable sections of NR 664.

According to the LQG regulations, there are 3 types of units that wastes can be accumulated in for less than 90 days: containers, tanks, or containment buildings. Currently, site wastes are accumulated in containers. Tanks are not considered a practical option for storage of the wastes. Under NR 664, wastes can also be accumulated in onsite surface impoundments, waste piles, landfills, incinerators, drip pads, and miscellaneous units; however, they are not considered feasible or cost-effective for the waste streams at the PWP Superfund Site.

The site has sufficient space to construct a compliant container-storage area or containment building.

TABLE 1
Selected RCRA Container Storage and Containment Building Requirements
Penta Wood RCRA Optimization Evaluation

Regulation	Citation	Substantive Requirement
RCRA Container Storage	NR 664.0170 – 664.0174	Good condition; closed during storage, except when adding waste; weekly inspections
RCRA Container Storage - Containment	NR 664.0175	Base free of cracks and sufficiently impervious; sloped or the containment system shall be otherwise designed and operated to drain and remove liquids resulting from leaks, spills or precipitation, unless the containers are elevated; prevent run-on unless the collection system has sufficient excess capacity; spilled or leaked waste and accumulated precipitation must be removed in a timely manner.
RCRA Container Closure	NR 664.0178	All hazardous waste and hazardous waste residues shall be removed from the containment system, remaining containers, liners, bases, and soil containing or contaminated with hazardous waste.
RCRA Container Air Emissions Standards	NR 664.0179	Subchapters AA (process vents associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping operations) and BB (leaks from equipment that contains or contacts hazardous wastes with organic concentrations of at least 10 percent by weight) (includes pumps and valves in light and heavy liquid service, compressors, pressure-relief valves, valves in light liquid and gas service, open lines) do not apply, since the storage includes none of these processes. Subchapter CC also assumed to not apply since Subchapter CC applies to wastes with an average volatile organic concentration greater than or equal to 500 parts per million by weight (ppmw); Based on 2013 analytical data (SW8260) for detected analytes, the total volatile organic compound concentration in the filter cake is 29.41 mg/kg.

4.1.2 Containers

The following are the two primary differences between the LQG generator container requirements in NR 662.034 and the container storage requirements in NR 664 Subchapter I:

- Containers do not need secondary containment under the LQG requirements.
- A formal closure plan is not required for an LQG accumulation/storage area.

The conceptual design described in this evaluation is sized to accommodate 6 to 12 months of storage of both the filter cake and spent GAC that meets the NR 664 container storage requirements. Both filter cake and spent GAC would be stored in containers. The container storage area must have secondary containment and either prevent precipitation (for example, with a permanent cover) or be designed to accommodate precipitation. This evaluation considers a storage area that does not have a permanent cover, to minimize costs. The containers would be in good condition, closed when not adding or removing waste, and would have covers that would prevent precipitation from entering the container and windblown migration of waste.

Rigid covers are not required but are recommended and are assumed in this evaluation. In addition to achieving the described objectives, rigid covers would also achieve the standards set forth in NR 664, 1086 Air Emission Standards for Containers, and would minimize the likelihood of damage to the cover during the severe winters experienced in Daniels, Wisconsin.

Containers would undergo weekly inspections, and other applicable requirements in NR 664.0170 through NR 664.0179 would be met.

In order to store/containerize the waste generated onsite in accordance with applicable regulations (NR 664), at least nine watertight, sealed gate, roll-off boxes (storage containers), each with a capacity of at least 30 cubic yards, are proposed.. The storage containers will be fitted with 10-gauge sealed and gasketed sliding roof lids to prevent the infiltration of rain water during the storage period and to comply with the air emissions standards. The storage containers are expected to be stored on a concrete pad with berms to provide secondary containment for a period of up to 1 year, before being emptied.

The specifications of the storage containers and roof lids are provided in Attachment 3. The waste generated by the treatment system carries a state code of F027, designating it as a listed hazardous waste so a secondary containment system would be required. For the purpose of this evaluation, a secondary containment area of 100 feet wide by 70 feet long surrounded by a 1-foot high berm to accommodate 9 storage containers has been assumed. The containment area would be constructed with a 1 percent surface gradient towards the sump. During precipitation events, this secondary containment pad will be able to store up to 52,000 gallons of water. A conceptual sketch of the staging pad/secondary containment pad is presented in Attachment 4.

4.1.2 Incorporation of Waste into the CAMU

The stored waste would typically be placed in the CAMU once a year. A design to incorporate the waste would need to be created to place the waste in a manner and location to reduce erosion and minimize damage to any wells while maintaining gradual slopes within the boundaries of the CAMU. The waste would be moved several hundred feet from the storage areas to the CAMU, so plans for decontamination and spill prevention would be required. For the purpose of estimating costs, it is assumed the waste would be graded to the required elevations and slopes and one foot of clean soil would be imported to cover the waste. A full design for this portion of the project was not completed but subcontractor were consulted to get accurate quotes.

The filter cake and spent GAC appear to be CAMU eligible wastes under the requirements of NR 664.0552(1). "CAMU eligible wastes" are defined as (NR 664.0552(1)(a)):

> *"All solid and hazardous wastes, and all media (including groundwater, surface water, soils, and sediments) and debris, that are managed for implementing cleanup. As-generated wastes (either hazardous or non-hazardous) from ongoing industrial operations at a site are not CAMU-eligible wastes."*

Both the filter cake and spent GAC are CAMU eligible wastes because they are generated and managed to implement site cleanup rather than being generated by an ongoing industrial operation that is not associated with site cleanup.

4.1.3 Opening the Existing CAMU

The contaminated fill located within the CAMU would have similar types of contamination as the filter cake and spent GAC because these listed wastes are generated from treatment of groundwater at the site. The wastes placed in the CAMU when the CAMU was created to be treated using bioventing. The filter cake and spent GAC would need to undergo testing to identify whether it would be amenable to bioventing treatment, given the difference in media texture (for example, the filter cake is usually a silty-clayey texture, while the soil at the site is sand).

The ROD requires a soil cover to facilitate bioventing. If the filter cake and spent GAC were placed in the CAMU, the wastes would also need to have a soil cover, and may benefit from soil bioventing.

If the spent GAC and filter cake are added to the CAMU, the O&M plan will need to be modified to include routinely adding the wastes.

Stormwater management ARARs may be triggered by opening the CAMU. If the area disturbed is less than 1 acre, then the stormwater management requirements (NR 216) would be relevant and appropriate rather than applicable. The waste would be added to the edges of the CAMU, concentrated in areas with minimal wells. A design would be required prior to installing the waste to assure that the wastes could be accommodated without damaging wells. The addition to the CAMU would require a design, including required slopes and erosion prevention. Estimates include construction labor, field expenses, contracting, design, permits, health and safety, reporting, and project management costs, which are included in Attachment 5. The estimate is based on costs without full design consideration taken into account and should be considered preliminary.

TABLE 2
Evaluation of Operation Scenarios
Penta Wood Remedial Action Optimization Evaluation

Scenario	Description	Pros	Cons	Achievement of Objectives
Cycle the system year-round; 2 weeks on/2 week off	The system will be run 50% of the year. Perform groundwater extraction and treatment, LNAPL recovery, and bioventing. The rate of PCP migration at the site is limited; therefore, the footprint of the PCP plume would not significantly change during shutdown. Once the system is turned back on, the pumping rate can be increased to provide a slightly larger capture zone, if needed.	No additional capital cost and significant reduction in operating and waste costs if system is not operating every other week. Likely decrease waste produced by 50%.	Likely to require additional years of operation to meet cleanup objectives. In winter, during "off weeks," system building would still need to be heated and checked on each day.	Groundwater plume could expand slightly, but it is not expected to reach to offsite resident wells because of this change. Time to reach 1,000 µg/L PCP is estimated to double based on current trends in treatment system influent. Groundwater below site likely remains above 1 µg/L PCP MCL for at least 30 years.
Cycle the system in the summer season, run full-time in winter season	The system is run 75% of the year. The system is cycled 2 weeks-on/2 weeks-off in the summer months (April through September) and run continuously in the winter months (October through March).	Reduction in operating and waste costs if system is not operating continuously in the summer with no additional capital costs. Site operator could take on additional role at site that subcontractors currently perform (like site mowing) during "off" weeks. Could decrease waste produced by 25%.	Likely to require additional years of operation to meet cleanup objectives. Long-term O&M costs are still high.	Groundwater plume could expand slightly, but it is not expected to reach to offsite resident wells because of this change. Time to reach 1,000 µg/L PCP is estimated to increase by ¼ the amount of time based on current trends in treatment system influent. Groundwater at the site likely remains above 1 µg/L PCP MCL for at least 30 years.
Run the system for 6 out of 12 months a year; summer shutdown	The system is run 50% of the year (from October through March). Perform groundwater extraction and treatment, LNAPL recovery, and bioventing. The rate of PCP migration at the site is slow; the system has not been shutdown for 6 months, so it is not known if capture will be maintained. Once the system is turned back on, the pumping rate can be increased to provide a slightly larger capture zone, if needed.	Larger reduction in operating and waste costs if system is not operating during the summer months and no additional capital cost. Could decrease waste produced by 50%. If system is shut down in the summer, no winterization would need to occur, only some tank draining and cleaning for a summer shutdown.	An alternative staffing strategy would need to be considered for the site operator. A part-time operation could result in multiple operators being trained to operate the system, and temporary placement requiring travel expenses. Can prolong cleanup as a result reduced groundwater pore exchanges.	Groundwater plume could expand slightly, it is not known whether the plume would expand to the offsite residents. Time to reach 1,000 µg/L PCP is estimated to double based on current trends in treatment system influent. Groundwater at the site likely remains above 1 µg/L PCP MCL for at least 30 years.

TABLE 2
Evaluation of Operation Scenarios
Penta Wood Remedial Action Optimization Evaluation

Scenario	Description	Pros	Cons	Achievement of Objectives
Full time system operation with reduced pumping rates	Continue to operate system year-round but at a reduced capacity – only run selected extraction wells or operate extraction wells at a reduced pumping rate.	Decreased influent could result in less waste produced.	The treatment system is designed to operate at 50 gpm. Any long-term reduction in flow is not advised with the current system. Only 5% reduction in flow rate is possible.	Groundwater plume is likely to stay contained, so it is not expected to reach offsite resident wells because of this change. Groundwater at the site remains above 1 µg/L PCP MCL for at least 30 years.
Establish an onsite storage facility for waste disposal and incorporate the waste into the CAMU yearly	Install an onsite storage and disposal area for filter cake and spent GAC generated by the onsite wastewater treatment plant. The storage area would consist of a bermed concrete pad and water-tight roll-off boxes with rigid covers (construction dumpsters) for storage of up to 1 year. The waste material would then be placed into the onsite CAMU with a soil cover. The soil cover would consist of 6 inches of onsite borrow and 6 inches of imported topsoil.	Reduced disposal costs. Greener solution due to the elimination of a 730-mile one-way trip to Ohio to transport the materials for incineration. Consolidation of waste onsite has been successfully used in several site remediation in the state of Wisconsin, We Energies Manufactured Gas Plant in Milwaukee and We Energies Manufactured Gas Plant in Appleton.	Waste will remain onsite, WDNR would be required to assure protectiveness and would need to provide approval to keep the waste on site under the current CAMU.	Waste materials from the WWTP are disposed of in accordance with all applicable laws and regulations.

4.1.3 Incorporation of Principal Hazardous Constituents into the CAMU

Several strategies were analyzed to reduce the principal hazardous constituents (PHCs) at the site. Ultimately, the scenario to incorporate the spent carbon and filter cake into the CAMU without reduction of PHC was chosen to develop a cost estimate. The option does require WDNR to grant a waiver or approve the incorporation of the waste at the site without reduction of PHC at Penta Wood. There is precedent within the state of Wisconsin for allowing this at particular sites noted in Table 1. The option to include solidification was also included although the spent carbon and filter cake pass TCLP and are not considered a danger for leaching hazardous levels of contaminants to the groundwater. In 2013, the filter cake contained PCP at 830 mg/kg, and the spent GAC contained up to 3,100 mg/kg PCP and 2,700 picograms per gram DIOXIN Toxicity Equivalency Quotient (TEQ). For completeness a description of using ultraviolet light and ozone treatments to reduce the PHC at the site has been included in Attachment 1.

4.1.3.1 Principal Hazardous Constituent Definition

NR 664.0552(d) requires that CAMU-eligible wastes be treated prior to placement in the CAMU if they are contaminated above certain risk levels, as follows:

> *(d) Minimum treatment requirements. Unless the wastes will be placed in a CAMU for storage or treatment only in accordance with sub. (6), CAMU−eligible wastes that, absent this section, would be subject to the treatment requirements of ch. NR 668, and that the department determines contain principal hazardous constituents shall be treated to the standards specified in subd. 3.*
>
> > *1. Principal hazardous constituents are those constituents that the department determines pose a risk to human health and the environment substantially higher than the cleanup levels or goals at the site.*
> >
> > *a. In general, the department will designate as principal hazardous constituents all of the following:*
> >
> > > *(1) Carcinogens that pose a potential direct risk from ingestion or inhalation at the site at or above 10^{-3}.*
> > >
> > > *(2) Non−carcinogens that pose a potential direct risk from ingestion or inhalation at the site an order of magnitude or greater over their reference dose.*

The preamble to promulgation of the federal regulations (67 Federal Register 2985; January 22, 2002) states that the CAMU treatment standards apply to "both soil and non-soil wastes, including sludges and debris."

Although risk assessment calculations have not been performed to determine what a 10^{-3} risk PCP or dioxin TEQ concentration would be, the soil cleanup goals for the PCP at the site are 2.1 mg/kg onsite and 0.9 mg/kg offsite, 2 to 3 orders of magnitude less than the concentration in the filter cake.

NR 664.0552(4)(d)1.b and c give WDNR significant leeway in what are designated as PHCs and may include factors such as constituent concentrations and fate and transport characteristics under site conditions.

According to NR 664.0552(4)(d)5, WDNR can adjust the required treatment level or method to a higher or lower concentration based on a number of issues, including the following:

- Technical impracticability
- Levels or methods would result in a PHC concentrations significantly above or below site cleanup levels
- Local community input
- Short-term risks posed by onsite treatment
- Long-term protection offered by the design of the CAMU

Both the filter cake and the spent GAC pass TCLP for all constituents. WDNR may wish to evaluate whether placement of non-treated filter cake or spent GAC into the existing CAMU, along with bioventing and groundwater extraction system operation and monitoring, provides an appropriate amount of long-term protection.

Note that the ROD was signed before the current CAMU regulations (NR 665.0552) were in place and references the old CAMU regulations (NR 636). The current CAMU regulations require treatment of PHCs before placing waste in the CAMU, while the old CAMU regulations (no longer in the Wisconsin Administrative Code) do not. (It appears that NR 636 may have been incorporated into NR 664.0551, Grandfathered CAMUs.)

4.1.3.2 PHC Treatment

Treatment Concentrations—Filter Cake

If the PCP in the filter cake is a PHC, the filter cake would need to be treated before placement in the CAMU as required by NR 664.0552(4)(d)4, unless exempted per NR 664.0552(4)(d)5. For non-metals, the filter cake would need to be treated to the higher of the following:

- 90 percent reduction in total PHC concentrations (to 83 mg/kg PCP), or
- 10 times the Universal Treatment Standard (UTS) (NR 668.48) (10 x 7.4 = 74 mg/kg PCP)

Therefore, the filter cake would need to be treated to 83 mg/kg, or a 90 percent decrease in the current PCP concentration before disposal in the CAMU. No other contaminants in the filter cake were above 10 times the UTS levels.

Treatment Concentrations—Spent GAC

If the dioxins in the spent GAC are PHCs, the spent GAC would need to be treated before placement in the CAMU as required by NR 664.0552(4)(d)4, unless exempted under NR 664.0552(4)(d)5. For non-metals, the filter cake would need to be treated to the higher of the following:

- 90 percent reduction in total PHC concentrations, or
- 10 times the UTS

UTSs exist only for specific dioxin congeners rather than for TEQs. Therefore, the GAC would need to be treated to 10 times the UTS (Table 3), or a 90 percent decrease in the respective current concentrations before disposal in the CAMU. No other contaminants in the spent GAC were above 10 times the UTS levels.

TABLE 3
Dioxin UTS
Penta Wood RCRA Optimization Evaluation

Dioxin	Universal Treatment Standard (mg/kg)	10 times UTS (mg/kg)
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-HpCDD)	0.0025	0.025
HxCDDs (All Hexachlorodibenzo-p-dioxins)	0.001	0.01
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.005	0.05
PeCDDs (All Pentachlorodibenzo-p-dioxins)	0.001	0.01
TCDDs (All Tetrachlorodibenzo-p-dioxins)	0.001	0.01

Preliminary costs for reduction of PHC were not completed, due to the anticipated estimated large cost for retrofitting the existing treatment system.

4.1.3.3 Solidification and Disposal within the Onsite CAMU

Solidification was explored as an option to further reduce the leachability of the PHCs, although solidification would not meet the CAMU treatment standards described as solidification only encapsulated the waste but does not reduce PHC. An exemption per NR 664.0552(d)5 would be required. The solidification would be conducted in a 15-by-8-by-8-foot mixing cell. The mixing cell would have a rigid cover to prevent infiltration of rain water and release of emissions when not in use. The mixing cell would be placed adjacent to the CAMU and within an area of contamination. The placement of the mixing cell adjacent to the CAMU rather than further away increases the efficiency and reduces the use of fossil fuels by preventing double hauling. The site wastes would be mixed with calciment bed ash for solidification and encapsulation of the PCP. The solidified materials would then be directly placed from the mixing cell into the CAMU. Samples would be collected at a frequency yet to be determined for TCLP and strength testing. The CAMU would be graded each time solidified materials were placed. The grading would be completed with a cap consisting of 6 inches of onsite borrow and 6 inches of topsoil in accordance with the ROD. Prior to the final acceptance of this scenario, a treatability study would need to be conducted to establish the mix design for solidification of the waste streams and whether vapor abatement would be required.

For the purpose of estimating the cost of using the CAMU for disposal rather than shipping residuals off site, the following conditions are assumed:

Groundwater monitoring, including the sampling of residential wells, would continue annually to determine if the plume is changing.

The sampling would be modified to monitor for leaching of newly incorporated waste into the CAMU, but this modification would not likely cause a cost increase.

Solidification does not reduce the PHCs, but may be considered as a secondary preventative measure for less leaching of hazardous constituents. Costs were included as an add-on to scenario 5 so this alternate could be considered. Although the solidification is an additional preventative measure the waste is not required to be solidified to be placed in the CAMU; and the WDNR would still need to grant an exemption from the treatment standard which requires actual reduction of the PHCs.

4.1.3.4 Waivers and Adherence to the ROD

4.1.3.4.1 Storage and the Existing CAMU

The existing ROD discusses CAMUs in general and discusses consolidation of arsenic- and PCP-contaminated soils and biopad concrete, but does not limit CAMU use to only these wastes. The option to store filter cake and spent GAC and subsequently place it in the CAMU was not considered during development or issuance of the ROD. Spent GAC was a known waste stream at the time the ROD was signed; filter cake was not. The groundwater treatment system was redesigned in 2000 and now includes a precipitation step that produces the filter cake. Currently, the spent GAC and filter cake wastes are stored onsite in containers for less than 90-days, meeting the RCRA generator standards ARAR.

Onsite storage of RCRA hazardous waste for longer than 90-days is not a significant or fundamental change to the ROD. However, the onsite placement of such waste into a CAMU rather than being sent offsite for incineration may be considered a significant or fundamental change to the remedy selected in the ROD. Because the ROD does not limit the CAMU-eligible wastes nor specify offsite disposal of the filter cake or GAC, a ROD amendment or explanation of significant differences (ESD) may not be needed if the current CAMU is used. Therefore, consistent with EPA guidance (EPA 1999), it is recommended that EPA evaluate issuing one of the following related to the ROD if the CAMU is used as described in Scenario:

(1) An ESD for a significant change
(2) A ROD amendment for a fundamental change

(3) A memorandum or note to the post-ROD file, with possible documentation for the public in a fact sheet, if EPA considers this change to be insignificant or minor.

The regulatory requirements are summarized in Table 4.

TABLE 4
Selected CAMU Issues
Penta Wood RCRA Optimization Evaluation

Regulation	Citation	Substantive Requirement
Placement of CAMU eligible wastes in CAMU	NR 664.0552(1)	Filter cake and GAC meet the definition of CAMU eligible waste
CAMU eligible waste and principal hazardous constituents (PHCs)	NR 664.0552(d)(1)	Determine if a CAMU eligible waste contains principal hazardous constituents (PHCs)
Treatment of wastes with PHCs	NR 664.0552(d)	Before going into the CAMU, the filter cake and may need to be treated to the higher of the following: • 90% reduction in total PHC concentrations, or • 10 times the UTS (NR 688.48)
Stormwater management	NR 216	Stormwater BMPs will be relevant and appropriate if the CAMU is re-opened to place the GAC and the filter cake in the CAMU.

5.0 Cost Summary

The cost estimates presented in Table 5 are order-of-magnitude estimates developed strictly for comparing the scenarios. The itemized summary of these costs are located in Attachment 5. They were prepared without equipment specifications, layout, design, or engineering calculations. The expected level of accuracy is +100/-50 percent. The range applies only to the scenarios as defined and does not account for changes in the scope of the scenarios. Selection of specific technologies or processes to configure remedial scenarios is intended not to limit flexibility during remedial design, but to provide a basis for preparing cost estimates.

The costs for the run-time modification Scenarios 1 through 4 were developed using the current costs to run the system from 2013. The final CAMU scenario and solidification option was estimated using price information from actual subcontractors. A contingency for the construction costs was estimated at 10 percent. The costs for the scenarios are shown in a form similar to a feasibility study, where costs are presented as a present net worth cost. The costs are for the next 10 years, presented in today's (2014) dollars. This approach allows the options to be compared equally including future savings from waste reduction, etc. The interest for the present net worth calculations was established at 7 percent. The cost estimates for construction were based on the amounts established from current operations and costs from subcontractors with knowledge of the site.

The final costs of the project and the resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, the implementation schedule, the firm selected for final engineering design, and other variables. Therefore, final project costs will vary from the cost estimates. Because of the factors, project feasibility and funding needs must be reviewed carefully before specific financial decisions are made or project budgets are established to help ensure proper project evaluation and adequate funding.

Table 5 summarizes the estimated costs for each of the scenarios. It breaks down the estimated capital, O&M, and present net worth costs.

TABLE 5
Scenario Cost Table
Penta Wood Remedial Action Optimization Evaluation

Description	Capital Cost	O&M Cost	Present Net Worth Through 2024 (10 years)	Key Assumptions
Cycle the system 2 weeks on/2 weeks off year round	$0	$653,767	$4,830,588	Running for 50% of full-time.
Cycle the system in the summer, run full-time in winter	$0	$881,482	$6,191,190	Running for 75% of full-time.
Run the system for 6 of 12 months a year; summer shutdown	$0	$658,259	$4,623,334	Shutdown in the summer would require mothballing of the system. Don't know if this scenario will keep groundwater contained.
Full-time system operation with reduced pumping rates	$0	$1,097,340	$7,707,260	5% reduction in groundwater treated.
Establish an onsite storage with placement of the waste into CAMU	$328,360	$960,275	$7,072,928	This option would require WDNR to grant a waiver for leaving waste onsite. Assumes system is operating 100% of the time.
Establishment of onsite storage with solidification and placement of waste into CAMU	$328,360	$1,057,987	$7,759,220	This option would require WDNR to grant an exception for leaving waste onsite. Pilot testing would need to be completed to verify solidification assumptions. System is running 100% of the time.
No Change – System run year-round	$0	$1,114,773	$7,829,696	Current system setup.

6.0 Recommendations

This memorandum presents an evaluation of scenarios that would (1) maintain site cleanup, and (2) reduce long-term O&M costs associated with continued operation of the PWP Superfund Site LTRA. Below are the scenarios and whether they are recommended.

Cycle 2 week on/2 weeks off year-round—This scenario of maintaining a cycling frequency of 2 weeks-on/2 weeks-off would reduce cost while maintaining plume containment. This scenario would also minimizing wear-and-tear on the system, and would coincide with the bioventing schedule.

This scenario is recommended.

Cycle 2 weeks on/2 weeks off in summer, run in winter—This scenario of maintaining a cycling frequency of 2 weeks-on/2 weeks-off in summer would reduce cost while maintaining plume containment. This scenario would also minimizing wear-and-tear on the system, and would coincide with the bioventing schedule.

This scenario is recommended.

Shutdown in summer, run in winter—Costs for this scenario would be reduced but it is not known whether this scenario would maintain the plume containment.

This scenario is recommended although it not known whether plume capture would be maintained after 6 months of shutdown.

Full-time system operation with reduced pumping—Cycling which wells are operational, or operate certain wells with reduced pumping rates would reduce costs by a small amount due to operational requirements for flow through the system.

> *This scenario is not recommended there would not be significant saving from reduced pumping.*

Waste storage and incorporation into the CAMU—This scenario would establish an onsite storage facility for wastes generated by the treatment system and would reduce cost but waste would remain on site.

> *This scenario is recommended with the caveat that WDNR would be required to approve the exemption to keep waste onsite without the level of treatment specified in the regulations; regulations give WDNR the authority to make this determination.*

Waste storage and incorporation into the CAMU with Solidification—This scenario would establish an onsite storage facility for wastes generated by the treatment system and would reduce cost but waste would remain on site. The waste would be encapsulated to prevent leaching.

> *This scenario is recommended with the caveat that WDNR would be required to approve the exemption to keep waste onsite without the level of treatment specified in the regulations; regulations give WDNR the authority to make this determination.*

6.1.1 References

CH2M HILL. 2000. *Penta Wood Products; Final Remedial Action Report*, December.

CH2M HILL. 2013a. *Penta Wood Products; Draft Annual Report*. April.

U.S. Environmental Protection Agency (EPA). 1999. *Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*. EPA 540-R-98-031, OSWER 9200.1-23P, NTIS: PB98-963241INX. July.

U.S. Environmental Protection Agency (EPA). 1998. *Penta Wood Products; Record of Decision*, R05-98/094. September.

Attachment 1
Scenario 5 – Differed Options

ATTACHMENT 1

Options that Were Researched but not used in Scenario 5

Containment Buildings

The site does not presently have a containment building. The containment building requirements include the following:

- Built to the design standards in NR 664, Subchapter DD, or NR 665, Subchapter DD, which are very similar.
- Written procedures so that wastes are removed every 90 days if managed under the large-quantity generator requirements.
- A formal closure plan unless managed in an accumulation area under the large-quantity generator requirements

A containment building can be considered but has not been costed, because it will likely be more expensive than a container storage area. After approximately 6 to 9 months, depending on the actual amount of waste generated, the wastes would be relocated into the corrective action management unit (CAMU).
In accordance with the CAMU rules, the wastes may need to be treated prior to placement in the CAMU. After the groundwater extraction and treatment system is shut down, the container storage area would undergo closure as specified in a closure plan.

TABLE 2
Selected RCRA Container Storage and Containment Building Requirements
Penta Wood RCRA Optimization Evaluation

Regulation	Citation	Substantive Requirement
RCRA Containment Building	NR 664.1100-1101	Completely self-enclosed and self-supporting. Has primary barrier. If liquids are present, has liquid collection system and secondary containment. Prevents fugitive dust.
RCRA Containment Building Design—Closure	NR 664.1102	Remove or decontaminate waste residues and surfaces; if cannot decontaminate the subsoils, close in accordance with landfill requirements.

New CAMU

The CAMU design requirements found in NR 664.0552(5)(c) will be an applicable or relevant and appropriate requirements (ARAR) for a new CAMU. The design requirements include the following:

- Composite liner (30-mil flexible membrane and 2-inch compacted soil [less than 1 x 10^{-7}]) and leachate collection system designed to maintain less than 30 centimeters depth of leachate over the liner
- Locating the CAMU in an area of existing contamination
- Groundwater monitoring to detect potential releases from the new CAMU
- Provide corrective action, if needed, for leaks from the CAMU
- Close the CAMU with a cap that accomplishes the following:
  - Minimizes migration of liquids through the CAMU
  - Functions with minimum maintenance and promotes drainage
  - Accommodates settling
  - Has a permeability less than the liner

Preliminary costs were not estimated for the CAMU option because it would likely be more expensive than using the existing CAMU.

Creation of a New CAMU

A new CAMU would probably require preparation of an explanation of significant differences (ESD) to the Record of Decision (ROD), which would include a public comment period as required by 40 *Code of Federal Regulations* 300.435(c)(2)(i). Because the ROD has one CAMU as part of the remedy, the addition of another CAMU is not believed to be a fundamental change that would require the ROD to be amended (EPA 1999). EPA has stated that while the ESD is being prepared and made available to the public, the lead agency may proceed with the predesign, design, construction, or operation activities associated with the remedy (EPA 1999).

Treatment of Primary Waste Prior to Incorporation into the CAMU

Treatment by Generator per NR 662.034

Generators can treat in tanks, containers, or containment buildings. The site is currently a large-quantity generator based on the amount of filter cake and spent GAC produced. If the filter cake is treated onsite prior to placement in the CAMU, hazardous waste generator requirements become an ARAR for this activity and would be applicable (NR 662.034). The generator requirements include treatment and disposal within 90 days; 90 days may potentially be considered an administrative requirement at Comprehensive Environmental Response, Compensation, and Liability Act sites because the substantive requirements of NR 662.034 (which references NR 665, Subchapter I for Containers, NR 665 Subchapter DD for Containment Buildings, and NR 665, Subchapter J for Tank Systems) and NR 664 Subchapters I, DD, and J are similar (although NR 664 requires secondary containment for containers). A waste analysis plan to show that treatment is successful would be needed. Note that thermal treatment is not allowed for treatment by generators.

Treatment per NR 664 Requirements

Land treatment of hazardous waste is prohibited (NR 664 Subchapter M). Land treatment within a CAMU can be performed only if the waste is subsequently disposed of outside of the CAMU (NR 664.0552(d)). Therefore, treatment under NR 664 would be performed in either a container, containment building, or tank with requirements similar to the generator requirements as discussed in the container section of the *Remedial Action Optimization Evaluation Technical Memorandum, Penta Wood Products Site, Town of Daniels, Wisconsin* (CH2M HILL 2014).

Treatment of Groundwater prior to Generation of Waste

The Penta Wood Products Superfund Site groundwater treatment system includes a pretreatment system to remove emulsified oil from the groundwater prior to separation of the pentachlorophenol (PCP) using granular activated carbon. The primary constituent of concern in this treatment and separation process is the PCP, which is concentrated in the emulsified oil and removed by the pretreatment system. The PCP is accumulated in the dissolved air flotation (DAF) float waste material, which is dewatered using a rotary drum vacuum filter with a diatomaceous earth precoat. After dewatering, the filter cake is contained for hauling to an approved disposal facility as an F032-listed hazardous waste. Possible alternative treatment approaches to degrade the PCP, thus rendering the filter cake nonhazardous, are presented in the following sections.

Ultraviolet Light

It has been suggested that the current treatment process could possibly incorporate ultraviolet light (UV) to aid in the degradation of the PCP so that it could be disposed of on the facility site.

Typically, PCP does break down in sunlight over a period of time, though the use of UV light for this purpose would require clear process water that is free from suspended solids and particulates to ensure its effectiveness. However since the PCP resides in an oil matrix that is separated in the DAF process, the use of UV is significantly hampered.

Since UV light is only as effective as its ability to penetrate water and provide a specific intensity (dose) of UV light, a process flow with suspended solids and oils will reflect or hamper the process and its effectiveness. In addition, the UV lamps may become irreversibly fouled with the oil and particulate from the process flow, even if the groundwater is processed through the pretreatment system.

Ozone Water Treatment

Since UV light works on a basic principle that forms free radicals of oxygen at the point of contact, another possible treatment consideration would be the use of ozone to oxidize the PCP and possibly convert it to a simpler carbon structure that can be degraded or assimilated by biological organisms over time.

In its current state, PCP is a strong and persistent biological growth inhibitor; however, when converted by sunlight over a period of time, aerobic and anaerobic organisms have been known to degrade the material in place, thus allowing for its ultimate disposal on the facility site.

By incorporating ozone into the current separation water treatment process, the PCP can be partially oxidized, thus converting it to an organic compound that can be composted in a specialized containment area and allowing for the natural biological action to degrade this material over time. Another possible alternative would be to apply ozone in the DAF separation process prior to the extraction of the PCP-laden float in an attempt to oxidize the PCP to determine if it can be degraded to a nonhazardous material without the use of biological degradation.

Since UV and ozone would be a new process addition to the treatment system at Penta Wood, a testing and evaluation will be necessary and would be performed on the facility site on a small scale, allowing for an assessment of this method of treatment and conditioning regarding its feasibility and performance.

A small side stream of process water could be treated using a small portable ozone unit, with the treated water being sent to a compost containment rich with specific biological organisms that would be capable of degrading complex carbon molecules of this type over a period of time.

If the direct oxidation approach using ozone in the DAF separation process is successful, the PCP could potentially be degraded to a nonhazardous material without the use of biological treatment, thus allowing for onsite disposal of the process waste. Costs for this option were not considered in the final scenario analysis because it is considered too expensive to be considered in this optimization study.

TABLE 4
Table Title
Penta Wood RCRA Optimization Evaluation

Regulation	Citation	Substantive Requirement
Management of wastes during treatment	NR 662.034	Hazardous waste generator requirements will be applicable to wastes while being treated.
New CAMU design requirements	NR 664.0552(5)(c)	Composite liner (30-mil flexible membrane and 2-foot compacted soil [less than 1 x 10^{-7}]) and leachate collection system designed to maintain less than 30 centimeter depth of leachate over the liner: • Locate the CAMU in an area of existing contamination. • Groundwater monitoring to detect potential releases from the new CAMU. • Provide corrective action, if needed for leaks from the CAMU. • Close the CAMU with a cap that does the following: – Minimizes migration of liquids through the CAMU. – Functions with minimum maintenance and promotes drainage. – Accommodates settling. Has a permeability less than the liner.

Works Cited

CH2M HILL. 2014. *Remedial Action Optimization Evaluation Technical Memorandum, Penta Wood Products Site, Town of Daniels, Wisconsin.* February.

U.S. Environmental Protection Agency (EPA). 1999. *Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*" July, EPA 540-R-98-031, OSWER 9200.1-23P, NTIS: PB98-963241INX.

Attachment 2
Tank System Regulations

accumulated precipitation until the collected material is detected and removed.

(b) The base shall be sloped or the containment system shall be otherwise designed and operated to drain and remove liquids resulting from leaks, spills or precipitation, unless the containers are elevated or are otherwise protected from contact with accumulated liquids.

(c) The containment system shall have sufficient capacity to contain 10% of the volume of containers or the volume of the largest container, whichever is greater. Containers that do not contain free liquids need not be considered in this determination.

(d) Run−on into the containment system shall be prevented unless the collection system has sufficient excess capacity in addition to that required in par. (c) to contain any run−on which might enter the system.

(e) Spilled or leaked waste and accumulated precipitation shall be removed from the sump or collection area in as timely a manner as is necessary to prevent overflow of the collection system.

Note: If the collected material is a hazardous waste under ch. NR 661, it shall be managed as a hazardous waste in accordance with all applicable requirements of chs. NR 662 to 666. If the collected material is discharged through a point source to waters of the state, it is subject to the requirements of ss. 283.31 and 283.33, Stats.

(3) Storage areas that store containers holding only wastes that do not contain free liquids need not have a containment system defined by sub. (2), except as provided by sub. (4), provided that either of the following conditions is met:

(a) The storage area is sloped or is otherwise designed and operated to drain and remove liquid resulting from precipitation.

(b) The containers are elevated or are otherwise protected from contact with accumulated liquid.

(4) Storage areas that store containers holding F020, F021, F022, F023, F026 or F027 wastes that do not contain free liquids shall have a containment system defined by sub. (2).

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0176 Special requirements for ignitable or reactive waste. Containers holding ignitable or reactive waste shall be located at least 15 meters (50 feet) from the facility's property line.

Note: See s. NR 664.0017(1) for additional requirements.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0177 Special requirements for incompatible wastes. (1) Incompatible wastes, or incompatible wastes and materials (see ch. NR 664 Appendix V for examples) may not be placed in the same container, unless s. NR 664.0017 (2) is complied with.

(2) Hazardous waste may not be placed in an unwashed container that previously held an incompatible waste or material.

Note: As required by s. NR 664.0013, the waste analysis plan shall include analyses needed to comply with this section. Also, s. NR 664.0017(3) requires wastes analyses, trial tests or other documentation to assure compliance with s. NR 664.0017(2). As required by s. NR 664.0073, the owner or operator shall place the results of each waste analysis and trial test, and any documented information, in the operating record of the facility.

(3) A storage container holding a hazardous waste that is incompatible with any waste or other materials stored nearby in other containers, piles, open tanks or surface impoundments shall be separated from the other materials or protected from them by means of a dike, berm, wall or other device.

Note: The purpose of this section is to prevent fires, explosions, gaseous emission, leaching or other discharge of hazardous waste or hazardous waste constituents which could result from the mixing of incompatible wastes or materials if containers break or leak.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06; **correction in (1) made under s. 13.92 (4) (b) 7., Stats., Register March 2013 No. 687.**

NR 664.0178 Closure. At closure, all hazardous waste and hazardous waste residues shall be removed from the containment system. Remaining containers, liners, bases and soil containing or contaminated with hazardous waste or hazardous waste residues shall be decontaminated or removed.

Note: At closure, as throughout the operating period, unless the owner or operator can demonstrate in accordance with s. NR 661.03(4) that the solid waste removed from the containment system is not a hazardous waste, the owner or operator becomes a generator of hazardous waste and shall manage it in accordance with all applicable requirements of chs. NR 662 to 666.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0179 Air emission standards. The owner or operator shall manage all hazardous waste placed in a container in accordance with the applicable requirements of subchs. AA, BB and CC.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

Subchapter J — Tank Systems

NR 664.0190 Applicability. The requirements of this subchapter apply to owners and operators of facilities that use tank systems for storing or treating hazardous waste except as otherwise provided in subs. (1) to (3) or in s. NR 664.0001.

(1) Tank systems that are used to store or treat hazardous waste which contains no free liquids and are situated inside a building with an impermeable floor are exempted from the requirements in s. NR 664.0193. To demonstrate the absence or presence of free liquids in the stored or treated waste, method 9095 (paint filter liquids test) as described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA SW−846, incorporated by reference in s. NR 660.11 shall be used.

(2) Tank systems, including sumps, as defined in s. NR 660.10, that serve as part of a secondary containment system to collect or contain releases of hazardous wastes are exempted from the requirements in s. NR 664.0193 (1).

(3) Tanks, sumps and other collection devices or systems used in conjunction with drip pads, as defined in s. NR 660.10 and regulated under subch. W, shall meet the requirements of this subchapter.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0191 Assessment of existing tank system's integrity. (1) For each existing tank system that does not have secondary containment meeting the requirements of s. NR 664.0193, the owner or operator shall determine that the tank system is not leaking or is unfit for use. Except as provided in sub. (3), the owner or operator shall obtain and keep on file at the facility a written assessment reviewed and certified by an independent, qualified registered professional engineer, in accordance with s. NR 670.011 (4), that attests to the tank system's integrity by March 1, 1992.

(2) This assessment shall determine that the tank system is adequately designed and has sufficient structural strength and compatibility with the wastes to be stored or treated, to ensure that it will not collapse, rupture or fail. At a minimum, this assessment shall consider all of the following:

(a) Design standards, if available, according to which the tank and ancillary equipment were constructed.

(b) Hazardous characteristics of the wastes that have been and will be handled.

(c) Existing corrosion protection measures.

(d) Documented age of the tank system, if available (otherwise, an estimate of the age).

(e) Results of a leak test, internal inspection or other tank integrity examination such that:

1. For non−enterable underground tanks, the assessment shall include a leak test that is capable of taking into account the effects of temperature variations, tank end deflection, vapor pockets and high water table effects.

2. For other than non−enterable underground tanks and for ancillary equipment, this assessment shall include either a leak

test, as described in subd. 1., or other integrity examination, that is certified by an independent, qualified, registered professional engineer in accordance with s. NR 670.011 (4), that addresses cracks, leaks, corrosion and erosion.

Note: The practices described in the American Petroleum Institute (API) Publication, Guide for Inspection of Refinery Equipment, Chapter XIII, "Atmospheric and Low−Pressure Storage Tanks", 4th edition, 1981, may be used, where applicable, as guidelines in conducting other than a leak test.

(3) Tank systems that store or treat materials that become hazardous wastes subsequent to March 1, 1991, shall conduct this assessment within 12 months after the date that the waste becomes a hazardous waste.

(4) If, as a result of the assessment conducted in accordance with sub. (1), a tank system is found to be leaking or unfit for use, the owner or operator shall comply with the requirements of s. NR 664.0196.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0192 Design and installation of new tank systems or components. **(1)** Owners or operators of new tank systems or components shall obtain and submit to the department, at time of submittal of the feasibility and plan of operation report, a written assessment, reviewed and certified by an independent, qualified registered professional engineer, in accordance with s. NR 670.011 (4), attesting that the tank system has sufficient structural integrity and is acceptable for the storing and treating of hazardous waste. The assessment shall show that the foundation, structural support, seams, connections and pressure controls (if applicable) are adequately designed and that the tank system has sufficient structural strength, compatibility with the wastes to be stored or treated and corrosion protection to ensure that it will not collapse, rupture or fail. This assessment, which will be used by the department to review and approve or disapprove the acceptability of the tank system design, shall include, at a minimum, all of the following information:

(a) Design standards according to which the tanks and ancillary equipment are constructed.

(b) Hazardous characteristics of the wastes to be handled.

(c) For new tank systems or components in which the external shell of a metal tank or any external metal component of the tank system will be in contact with the soil or with water, a determination by a corrosion expert of all of the following:

1. Factors affecting the potential for corrosion, including but not limited to, all of the following:

a. Soil moisture content.

b. Soil pH.

c. Soil sulfides level.

d. Soil resistivity.

e. Structure to soil potential.

f. Influence of nearby underground metal structures (e.g., piping).

g. Existence of stray electric current.

h. Existing corrosion−protection measures (e.g., coating, cathodic protection).

2. The type and degree of external corrosion protection that are needed to ensure the integrity of the tank system during the use of the tank system or component, consisting of one or more of the following:

a. Corrosion−resistant materials of construction such as special alloys, fiberglass reinforced plastic, etc.

b. Corrosion−resistant coating (such as epoxy, fiberglass, etc.) with cathodic protection (e.g., impressed current or sacrificial anodes).

c. Electrical isolation devices such as insulating joints, flanges, etc.

Note: The practices described in the National Association of Corrosion Engineers (NACE) standard, "Recommended Practice (RP−02−85)—Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems", and the American Petroleum Institute (API) Publication 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems", may be used, where applicable, as guidelines in providing corrosion protection for tank systems.

(d) For underground tank system components that are likely to be adversely affected by vehicular traffic, a determination of design or operational measures that will protect the tank system against potential damage.

(e) Design considerations to ensure all of the following:

1. Tank foundations will maintain the load of a full tank.

2. Tank systems will be anchored to prevent flotation or dislodgment where the tank system is placed in a saturated zone.

3. Tank systems will withstand the effects of frost heave.

(2) The owner or operator of a new tank system shall ensure that proper handling procedures are adhered to in order to prevent damage to the system during installation. Prior to covering, enclosing or placing a new tank system or component in use, an independent, qualified installation inspector or an independent, qualified, registered professional engineer, either of whom is trained and experienced in the proper installation of tank systems or components, shall inspect the system for the presence of any of the following items:

(a) Weld breaks.

(b) Punctures.

(c) Scrapes of protective coatings.

(d) Cracks.

(e) Corrosion.

(f) Other structural damage or inadequate construction or installation.

All discrepancies shall be remedied before the tank system is covered, enclosed or placed in use.

(3) New tank systems or components that are placed underground and that are backfilled shall be provided with a backfill material that is a noncorrosive, porous, homogeneous substance and that is installed so that the backfill is placed completely around the tank and compacted to ensure that the tank and piping are fully and uniformly supported.

(4) All new tanks and ancillary equipment shall be tested for tightness prior to being covered, enclosed or placed in use. If a tank system is found not to be tight, all repairs necessary to remedy the leaks in the system shall be performed prior to the tank system being covered, enclosed or placed into use.

(5) Ancillary equipment shall be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion or contraction.

Note: The piping system installation procedures described in American Petroleum Institute (API) Publication 1615 (November 1979), "Installation of Underground Petroleum Storage Systems", or ANSI Standard B31.3, "Petroleum Refinery Piping", and ANSI Standard B31.4 "Liquid Petroleum Transportation Piping System", may be used, where applicable, as guidelines for proper installation of piping systems.

(6) The owner or operator shall provide the type and degree of corrosion protection recommended by an independent corrosion expert, based on the information provided under sub. (1) (c), or other corrosion protection if the department believes other corrosion protection is necessary to ensure the integrity of the tank system during use of the tank system. An independent corrosion expert shall supervise the installation of a corrosion protection system that is field fabricated, to ensure proper installation.

(7) The owner or operator shall obtain and keep on file at the facility written statements by those persons required to certify the design of the tank system and supervise the installation of the tank system in accordance with the requirements of subs. (2) to (6), that attest that the tank system was properly designed and installed and that repairs, pursuant to subs. (2) and (4), were performed. These written statements shall also include the certification statement as required in s. NR 670.011 (4).

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0193 Containment and detection of releases. **(1)** In order to prevent the release of hazardous waste or hazardous constituents to the environment, secondary containment that meets the requirements of this section shall be provided (except as provided in subs. (6) and (7)):

(a) For all new tank systems or components, prior to their being put into service.

(b) For all existing tank systems used to store or treat EPA hazardous waste numbers F020, F021, F022, F023, F026 and F027, within 2 years after March 1, 1991.

(c) For those existing tank systems of known and documented age, within 2 years after March 1, 1991 or when the tank system has reached 15 years of age, whichever comes later.

(d) For those existing tank systems for which the age cannot be documented, within 8 years of March 1, 1991; but if the age of the facility is greater than 7 years, secondary containment shall be provided by the time the facility reaches 15 years of age, or within 2 years of March 1, 1991, whichever comes later.

(e) For tank systems that store or treat materials that become hazardous wastes subsequent to March 1, 1991, within the time intervals required in pars. (a) to (d), except that the date that a material becomes a hazardous waste shall be used in place of March 1, 1991.

(2) Secondary containment systems shall be all of the following:

(a) Designed, installed and operated to prevent any migration of wastes or accumulated liquid out of the system to the soil, groundwater or surface water at any time during the use of the tank system.

(b) Capable of detecting and collecting releases and accumulated liquids until the collected material is removed.

(3) To meet the requirements of sub. (2), secondary containment systems shall be at a minimum all of the following:

(a) Constructed of or lined with materials that are compatible with the wastes to be placed in the tank system and shall have sufficient strength and thickness to prevent failure owing to pressure gradients (including static head and external hydrological forces), physical contact with the waste to which it is exposed, climatic conditions and the stress of daily operation (including stresses from nearby vehicular traffic).

(b) Placed on a foundation or base capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system and capable of preventing failure due to settlement, compression or uplift.

(c) Provided with a leak−detection system that is designed and operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of hazardous waste or accumulated liquid in the secondary containment system within 24 hours, or at the earliest practicable time if the owner or operator can demonstrate to the department that existing detection technologies or site conditions will not allow detection of a release within 24 hours.

(d) Sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spills or precipitation. Spilled or leaked waste and accumulated precipitation shall be removed from the secondary containment system within 24 hours, or in as timely a manner as is possible to prevent harm to human health and the environment, if the owner or operator can demonstrate to the department that removal of the released waste or accumulated precipitation cannot be accomplished within 24 hours.

Note: If the collected material is a hazardous waste under ch. NR 661, it is subject to management as a hazardous waste according to all applicable requirements of chs. NR 662, 663, this chapter and 665. If the collected material is discharged through a point source to waters of the state, it is subject to ss. 283.31 and 283.33, Stats. If discharged to a publicly owned treatment works (POTW), it is subject to s. 283.21(2), Stats. If the collected material is released to the environment, it may be subject to the reporting requirements of 40 CFR part 302 and the requirements of s. 292.11, Stats., and chs. NR 706 to 726.

(4) Secondary containment for tanks shall include one or more of the following devices:

(a) A liner (external to the tank).

(b) A vault.

(c) A double−walled tank.

(d) An equivalent device as approved by the department.

(5) In addition to the requirements of subs. (2) to (4), secondary containment systems shall satisfy the following requirements:

(a) External liner systems shall be all of the following:

1. Designed or operated to contain 100% of the capacity of the largest tank within its boundary.

2. Designed or operated to prevent run−on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run−on or infiltration. The additional capacity shall be sufficient to contain precipitation from a 25−year, 24−hour rainfall event.

3. Free of cracks or gaps.

4. Designed and installed to surround the tank completely and to cover all surrounding earth likely to come into contact with the waste if the waste is released from the tank (i.e., capable of preventing lateral as well as vertical migration of the waste).

(b) Vault systems shall be all of the following:

1. Designed or operated to contain 100% of the capacity of the largest tank within its boundary.

2. Designed or operated to prevent run−on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run−on or infiltration. The additional capacity shall be sufficient to contain precipitation from a 25−year, 24−hour rainfall event.

3. Constructed with chemical−resistant water stops in place at all joints (if any).

4. Provided with an impermeable interior coating or lining that is compatible with the stored waste and that will prevent migration of waste into the concrete.

5. Provided with a means to protect against the formation of and ignition of vapors within the vault, if the waste being stored or treated meets any of the following:

a. The definition of ignitable waste under s. NR 661.21.

b. The definition of reactive waste under s. NR 661.23, and may form an ignitable or explosive vapor.

6. Provided with an exterior moisture barrier or be otherwise designed or operated to prevent migration of moisture into the vault if the vault is subject to hydraulic pressure.

(c) Double−walled tanks shall be all of the following:

1. Designed as an integral structure (i.e., an inner tank completely enveloped within an outer shell) so that the outer shell contains any release from the inner tank.

2. Protected, if constructed of metal, from both corrosion of the primary tank interior and of the external surface of the outer shell.

3. Provided with a built−in continuous leak detection system capable of detecting a release within 24 hours, or at the earliest practicable time, if the owner or operator can demonstrate to the department, and the department concludes, that the existing detection technology or site conditions would not allow detection of a release within 24 hours.

Note: The provisions outlined in the Steel Tank Institute's (STI) "Standard for Dual Wall Underground Steel Storage Tanks" may be used as guidelines for aspects of the design of underground steel double−walled tanks.

(6) Ancillary equipment shall be provided with secondary containment (e.g., trench, jacketing, double−walled piping) that meets the requirements of subs. (2) and (3) except for all of the following:

(a) Aboveground piping (exclusive of flanges, joints, valves and other connections) that is visually inspected for leaks on a daily basis.

(b) Welded flanges, welded joints and welded connections, that are visually inspected for leaks on a daily basis.

(c) Sealless or magnetic coupling pumps and sealless valves, that are visually inspected for leaks on a daily basis.

(d) Pressurized aboveground piping systems with automatic shut−off devices (e.g., excess flow check valves, flow metering shutdown devices, loss of pressure actuated shut−off devices) that are visually inspected for leaks on a daily basis.

(7) The owner or operator may obtain a variance from the requirements of this section if the department finds, as a result of a demonstration by the owner or operator that alternative design and operating practices, together with location characteristics, will prevent the migration of any hazardous waste or hazardous constituents into the groundwater or surface water at least as effectively as secondary containment during the active life of the tank system; or, that in the event of a release that does migrate to groundwater or surface water, no substantial present or potential hazard will be posed to human health or the environment. New underground tank systems may not, per a demonstration in accordance with par. (b), be exempted from the secondary containment requirements of this section.

(a) In deciding whether to grant a variance based on a demonstration of equivalent protection of groundwater and surface water, the department will consider all of the following:

1. The nature and quantity of the wastes.

2. The proposed alternate design and operation.

3. The hydrogeologic setting of the facility, including the thickness of soils present between the tank system and groundwater.

4. All other factors that would influence the quality and mobility of the hazardous constituents and the potential for them to migrate to groundwater or surface water.

(b) In deciding whether to grant a variance based on a demonstration of no substantial present or potential hazard, the department will consider all of the following:

1. The potential adverse effects on groundwater, surface water and land quality taking into account all of the following:

a. The physical and chemical characteristics of the waste in the tank system, including its potential for migration.

b. The hydrogeological characteristics of the facility and surrounding land.

c. The potential for health risks caused by human exposure to waste constituents.

d. The potential for damage to wildlife, crops, vegetation and physical structures caused by exposure to waste constituents.

e. The persistence and permanence of the potential adverse effects.

2. The potential adverse effects of a release on groundwater quality, taking into account all of the following:

a. The quantity and quality of groundwater and the direction of groundwater flow.

b. The proximity and withdrawal rates of groundwater users.

c. The current and future uses of groundwater in the area.

d. The existing quality of groundwater, including other sources of contamination and their cumulative impact on the groundwater quality.

3. The potential adverse effects of a release on surface water quality, taking into account all of the following:

a. The quantity and quality of groundwater and the direction of groundwater flow.

b. The patterns of rainfall in the region.

c. The proximity of the tank system to surface waters.

d. The current and future uses of surface waters in the area and any water quality standards established for those surface waters.

e. The existing quality of surface water, including other sources of contamination and the cumulative impact on surface−water quality.

4. The potential adverse effects of a release on the land surrounding the tank system, taking into account all of the following:

a. The patterns of rainfall in the region.

b. The current and future uses of the surrounding land.

(c) The owner or operator of a tank system, for which a variance from secondary containment had been granted in accordance with the requirements of par. (a), at which a release of hazardous waste has occurred from the primary tank system but has not migrated beyond the zone of engineering control (as established in the variance), shall do all of the following:

1. Comply with the requirements of s. NR 664.0196, except sub. (4).

2. Decontaminate or remove contaminated soil to the extent necessary to do all of the following:

a. Enable the tank system for which the variance was granted to resume operation with the capability for the detection of releases at least equivalent to the capability it had prior to the release.

b. Prevent the migration of hazardous waste or hazardous constituents to groundwater or surface water.

3. If contaminated soil cannot be removed or decontaminated in accordance with subd. 2., comply with the requirement of s. NR 664.0197 (2).

(d) The owner or operator of a tank system, for which a variance from secondary containment had been granted in accordance with the requirements of par. (a), at which a release of hazardous waste has occurred from the primary tank system and has migrated beyond the zone of engineering control (as established in the variance), shall do all of the following:

1. Comply with the requirements of s. NR 664.0196 (1) to (4).

2. Prevent the migration of hazardous waste or hazardous constituents to groundwater or surface water, if possible, and decontaminate or remove contaminated soil. If contaminated soil cannot be decontaminated or removed or if groundwater has been contaminated, the owner or operator shall comply with the requirements of s. NR 664.0197 (2).

3. If repairing, replacing or reinstalling the tank system, provide secondary containment in accordance with the requirements of subs. (1) to (6) or reapply for a variance from secondary containment and meet the requirements for new tank systems in s. NR 664.0192 if the tank system is replaced. The owner or operator shall comply with these requirements even if contaminated soil can be decontaminated or removed and groundwater or surface water has not been contaminated.

(8) All of the following procedures shall be followed in order to request a variance from secondary containment:

(a) The department shall be notified in writing by the owner or operator that the owner or operator intends to conduct and submit a demonstration for a variance from secondary containment as allowed in sub. (7) according to the following schedule:

1. For existing tank systems, at least 24 months prior to the date that secondary containment must be provided in accordance with sub. (1).

2. For new tank systems, at least 30 days prior to entering into a contract for installation.

(b) As part of the notification, the owner or operator shall also submit to the department a description of the steps necessary to conduct the demonstration and a timetable for completing each of the steps. The demonstration shall address each of the factors listed in sub. (7) (a) or (b).

(c) The demonstration for a variance shall be completed within 180 days after notifying the department of an intent to conduct the demonstration.

(d) If a variance is granted under this subsection, the department will require the licensee to construct and operate the tank system in the manner that was demonstrated to meet the requirements for the variance.

(9) All tank systems, until the time that secondary containment that meets the requirements of this section is provided, shall comply with the following:

(a) For non−enterable underground tanks, a leak test that meets the requirements of s. NR 664.0191 (2) (e) or other tank integrity method, as approved or required by the department, shall be conducted at least annually.

(b) For other than non−enterable underground tanks, the owner or operator shall either conduct a leak test as in par. (a) or develop a schedule and procedure for an assessment of the overall condition of the tank system by an independent, qualified registered professional engineer. The schedule and procedure shall be adequate to detect obvious cracks, leaks and corrosion or erosion that may lead to cracks and leaks. The owner or operator shall remove the stored waste from the tank, if necessary, to allow the condition of all internal tank surfaces to be assessed. The frequency of these assessments shall be based on the material of construction of the tank and its ancillary equipment, the age of the system, the type of corrosion or erosion protection used, the rate of corrosion or erosion observed during the previous inspection and the characteristics of the waste being stored or treated.

(c) For ancillary equipment, a leak test or other integrity assessment as approved by the department shall be conducted at least annually.

Note: The practices described in the American Petroleum Institute (API) Publication Guide for Inspection of Refinery Equipment, Chapter XIII, "Atmospheric and Low−Pressure Storage Tanks", 4th edition, 1981, may be used, where applicable, as guidelines for assessing the overall condition of the tank system.

(d) The owner or operator shall maintain on file at the facility a record of the results of the assessments conducted in accordance with pars. (a) to (c).

(e) If a tank system or component is found to be leaking or unfit for use as a result of the leak test or assessment in pars. (a) to (c), the owner or operator shall comply with the requirements of s. NR 664.0196.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0194 General operating requirements. **(1)** Hazardous wastes or treatment reagents may not be placed in a tank system if they could cause the tank, its ancillary equipment or the containment system to rupture, leak, corrode or otherwise fail.

(2) The owner or operator shall use appropriate controls and practices to prevent spills and overflows from tank or containment systems. These include at a minimum all of the following:

(a) Spill prevention controls (e.g., check valves, dry disconnect couplings).

(b) Overfill prevention controls (e.g., level sensing devices, high level alarms, automatic feed cutoff or bypass to a standby tank).

(c) Maintenance of sufficient freeboard in uncovered tanks to prevent overtopping by wave or wind action or by precipitation.

(3) The owner or operator shall comply with the requirements of s. NR 664.0196 if a leak or spill occurs in the tank system.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0195 Inspections. **(1)** The owner or operator shall develop and follow a schedule and procedure for inspecting overfill controls.

(2) The owner or operator shall inspect at least once each operating day all of the following:

(a) Aboveground portions of the tank system, if any, to detect corrosion or releases of waste.

(b) Data gathered from monitoring and leak detection equipment (e.g., pressure or temperature gauges, monitoring wells) to ensure that the tank system is being operated according to its design.

(c) The construction materials and the area immediately surrounding the externally accessible portion of the tank system, including the secondary containment system (e.g., dikes) to detect erosion or signs of releases of hazardous waste (e.g., wet spots, dead vegetation).

Note: Section NR 664.0015(3) requires the owner or operator to remedy any deterioration or malfunction found. Section NR 664.0196 requires the owner or operator to notify the department within 24 hours of confirming a leak. Also, if a hazardous substance is released to the environment, 40 CFR part 302 may require the owner or operator to notify the national response center and s. 292.11, Stats., and ch. NR 706 may require the owner or operator to notify the department.

(3) The owner or operator shall inspect cathodic protection systems, if present, according to, at a minimum, all of the following requirements to ensure that they are functioning properly:

(a) The proper operation of the cathodic protection system shall be confirmed within 6 months after initial installation and annually thereafter.

(b) All sources of impressed current shall be inspected or tested, or both, as appropriate, at least bimonthly (i.e., every other month).

Note: The practices described in the National Association of Corrosion Engineers (NACE) standard, "Recommended Practice (RP−02−85)—Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems" and the American Petroleum Institute (API) Publication 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems", may be used, where applicable, as guidelines in maintaining and inspecting cathodic protection systems.

(4) The owner or operator shall document in the operating record of the facility an inspection of those items in subs. (1) to (3).

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0196 Response to leaks or spills and disposition of leaking or unfit−for−use tank systems. A tank system or secondary containment system from which there has been a leak or spill, or which is unfit for use, shall be removed from service immediately, and the owner or operator shall satisfy the following requirements:

(1) CESSATION OF USE; PREVENT FLOW OR ADDITION OF WASTES. The owner or operator shall immediately stop the flow of hazardous waste into the tank system or secondary containment system and inspect the system to determine the cause of the release.

(2) REMOVAL OF WASTE FROM TANK SYSTEM OR SECONDARY CONTAINMENT SYSTEM. (a) If the release was from the tank system, the owner or operator shall, within 24 hours after detection of the leak or, if the owner or operator demonstrates that it is not possible, at the earliest practicable time, remove as much of the waste as is necessary to prevent further release of hazardous waste to the environment and to allow inspection and repair of the tank system to be performed.

(b) If the material released was to a secondary containment system, all released materials shall be removed within 24 hours or in as timely a manner as is possible to prevent harm to human health and the environment.

(3) CONTAINMENT OF VISIBLE RELEASES TO THE ENVIRONMENT. The owner or operator shall immediately conduct a visual inspection of the release and, based upon that inspection, do all of the following:

(a) Prevent further migration of the leak or spill to soils or surface water.

(b) Remove, and properly dispose of, any visible contamination of the soil or surface water.

(4) NOTIFICATIONS, REPORTS. (a) Any release to the environment, except as provided in par. (b), shall be reported to the department within 24 hours of its detection. If the release has been reported pursuant to ch. NR 706, that report will satisfy this requirement.

(b) A leak or spill of hazardous waste is exempted from the requirements of this subsection if it is all of the following:

1. Less than or equal to a quantity of one pound.

2. Immediately contained and cleaned up.

(c) Within 30 days of detection of a release to the environment, a report containing all of the following information shall be submitted to the department:

1. Likely route of migration of the release.

2. Characteristics of the surrounding soil (soil composition, geology, hydrogeology, climate).

3. Results of any monitoring or sampling conducted in connection with the release (if available). If sampling or monitoring data relating to the release are not available within 30 days, these data shall be submitted to the department as soon as they become available.

4. Proximity to downgradient drinking water, surface water and populated areas.

5. Description of response actions taken or planned.

(5) PROVISION OF SECONDARY CONTAINMENT, REPAIR OR CLOSURE. (a) Unless the owner or operator satisfies the requirements of pars. (b) to (d), the tank system shall be closed in accordance with s. NR 664.0197.

(b) If the cause of the release was a spill that has not damaged the integrity of the system, the owner or operator may return the system to service as soon as the released waste is removed and repairs, if necessary, are made.

(c) If the cause of the release was a leak from the primary tank system into the secondary containment system, the system shall be repaired prior to returning the tank system to service.

(d) If the source of the release was a leak to the environment from a component of a tank system without secondary containment, the owner or operator shall provide the component of the system from which the leak occurred with secondary containment that satisfies the requirements of s. NR 664.0193 before it can be returned to service, unless the source of the leak is an aboveground portion of a tank system that can be inspected visually. If the source is an aboveground component that can be inspected visually, the component shall be repaired and may be returned to service without secondary containment as long as the requirements of sub. (6) are satisfied. If a component is replaced to comply with the requirements of this paragraph, that component shall satisfy the requirements for new tank systems or components in ss. NR 664.0192 and 664.0193. Additionally, if a leak has occurred in any portion of a tank system component that is not readily accessible for visual inspection (e.g., the bottom of an inground or onground tank), the entire component shall be provided with secondary containment in accordance with s. NR 664.0193 prior to being returned to use.

(6) CERTIFICATION OF MAJOR REPAIRS. If the owner or operator has repaired a tank system in accordance with sub. (5), and the repair has been extensive (e.g., installation of an internal liner; repair of a ruptured primary containment or secondary containment vessel), the tank system may not be returned to service unless the owner or operator has obtained a certification by an independent, qualified, registered, professional engineer in accordance with s. NR 670.011 (4) that the repaired system is capable of handling hazardous wastes without release for the intended life of the system. This certification shall be submitted to the department within 7 days after returning the tank system to use.

Note: The department may, on the basis of any information received that there is or has been a release of hazardous waste or hazardous constituents into the environment, issue an order under s. 291.37 or 291.85, Stats., requiring corrective action or other response as deemed necessary to protect human health or the environment.

Note: See s. NR 664.0015(3) for the requirements necessary to remedy a failure. Also, if a hazardous substance is released to the environment, 40 CFR part 302 may require the owner or operator to notify the national response center and s. 292.11, Stats., and ch. NR 706 may require the owner or operator to notify the department.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0197 Closure and long−term care. (1) At closure of a tank system, the owner or operator shall remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste, and manage them as hazardous waste, unless s. NR 661.03 (4) applies. The closure plan, closure activities, cost estimates for closure and financial responsibility for tank systems shall meet all of the requirements specified in subchs. G and H.

(2) If the owner or operator demonstrates that not all contaminated soils can be practicably removed or decontaminated as required in sub. (1), then the owner or operator shall close the tank system and perform long−term care in accordance with the closure and long−term care requirements that apply to landfills (s. NR 664.0310). In addition, for the purposes of closure, long−term care and financial responsibility, such a tank system is then considered to be a landfill, and the owner or operator shall meet all of the requirements for landfills specified in subchs. G and H.

(3) If an owner or operator has a tank system that does not have secondary containment that meets the requirements of s. NR 664.0193 (2) to (6) and has not been granted a variance from the secondary containment requirements in accordance with s. NR 664.0193 (7), then:

(a) The closure plan for the tank system shall include both a plan for complying with sub. (1) and a contingent plan for complying with sub. (2).

(b) A contingent long−term care plan for complying with sub. (2) shall be prepared and submitted as part of the feasibility and plan of operation report.

(c) The cost estimates calculated for closure and long−term care shall reflect the costs of complying with the contingent closure plan and the contingent long−term care plan, if those costs are greater than the costs of complying with the closure plan prepared for the expected closure under sub. (1).

(d) Financial assurance shall be based on the cost estimates in par. (c).

(e) For the purposes of the contingent closure and long−term care plans, such a tank system is considered to be a landfill, and the contingent plans shall meet all of the closure, long−term care and financial responsibility requirements for landfills under subchs. G and H.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0198 Special requirements for ignitable or reactive wastes. (1) Ignitable or reactive waste may not be placed in tank systems, unless par. (a), (b) or (c) applies:

(a) The waste is treated, rendered or mixed before or immediately after placement in the tank system so that all of the following apply:

1. The resulting waste, mixture or dissolved material no longer meets the definition of ignitable or reactive waste under s. NR 661.21 or 661.23.

2. Section NR 664.0017 (2) is complied with.

(b) The waste is stored or treated in such a way that it is protected from any material or conditions that may cause the waste to ignite or react.

(c) The tank system is used solely for emergencies.

(2) The owner or operator of a facility where ignitable or reactive waste is stored or treated in a tank shall comply with the requirements for the maintenance of protective distances between the waste management area and any public ways, streets, alleys or an adjoining property line that can be built upon as required in Tables 2−1 to 2−6 of the National Fire Protection Association's "Flammable and Combustible Liquids Code" (1977 or 1981), incorporated by reference in s. NR 660.11.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0199 Special requirements for incompatible wastes. (1) Incompatible wastes, or incompatible wastes and materials (see ch. NR 664 Appendix V for examples), may not be placed in the same tank system, unless s. NR 664.0017 (2) is complied with.

(2) Hazardous waste may not be placed in a tank system that has not been decontaminated and that previously held an incompatible waste or material, unless s. NR 664.0017 (2) is complied with.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06; **correction in (1) made under s. 13.92 (4) (b) 7., Stats., Register March 2013 No. 687.**

NR 664.0200 Air emission standards. The owner or operator shall manage all hazardous waste placed in a tank in accordance with the applicable requirements of subchs. AA, BB and CC.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

Subchapter K — Surface Impoundments

NR 664.0220 Applicability. This subchapter applies to owners and operators of facilities that use surface impoundments to treat, store or dispose of hazardous waste except as s. NR 664.0001 provides otherwise.

History: CR 05−032: cr. Register July 2006 No. 607, eff. 8−1−06.

NR 664.0221 Design and operating requirements. **(1)** Any surface impoundment that is not covered by sub. (3) or s. NR 665.0221 shall have a liner for all portions of the impoundment (except for existing portions of the impoundment). The liner shall be designed, constructed and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil or groundwater or surface water at any time during the active life (including the closure period) of the impoundment. The liner may be constructed of materials that may allow wastes to migrate into the liner (but not into the adjacent subsurface soil or groundwater or surface water) during the active life of the facility, provided that the impoundment is closed in accordance with s. NR 664.0228 (1) (a). For impoundments that will be closed in accordance with s. NR 664.0228 (1) (b), the liner shall be constructed of materials that can prevent wastes from migrating into the liner during the active life of the facility. The liner shall be all of the following:

(a) Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the waste or leachate to which they are exposed, climatic conditions, the stress of installation and the stress of daily operation.

(b) Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression or uplift.

(c) Installed to cover all surrounding earth likely to be in contact with the waste or leachate.

(2) The owner or operator will be exempted from the requirements of sub. (1) if the department finds, based on a demonstration by the owner or operator, that alternate design and operating practices, together with location characteristics, will prevent the migration of any hazardous constituents (see s. NR 664.0093) into the groundwater or surface water at any future time. In deciding whether to grant an exemption, the department will consider all of the following:

(a) The nature and quantity of the wastes.

(b) The proposed alternate design and operation.

(c) The hydrogeologic setting of the facility, including the attenuative capacity and thickness of the liners and soils present between the impoundment and groundwater or surface water.

(d) All other factors which would influence the quality and mobility of the leachate produced and the potential for it to migrate to groundwater or surface water.

(3) The owner or operator of each new surface impoundment unit on which construction commences after June 1, 1995, each lateral expansion of a surface impoundment unit on which construction commences after June 1, 1995 and each replacement of an existing surface impoundment unit that is to commence reuse after June 1, 1995 shall install 2 or more liners and a leachate collection and removal system between the liners. "Construction commences" is as defined in s. NR 660.10 under "existing facility".

(a) 1. The liner system shall include both of the following:

a. A top liner designed and constructed of materials (e.g., a geomembrane) to prevent the migration of hazardous constituents into the liner during the active life and long−term care period.

b. A composite bottom liner, consisting of at least 2 components. The upper component shall be designed and constructed of materials (e.g., a geomembrane) to prevent the migration of hazardous constituents into this component during the active life and long−term care period. The lower component shall be designed and constructed of materials to minimize the migration of hazardous constituents if a breach in the upper component were to occur. The lower component shall be constructed of at least 3 feet (91 cm) of compacted soil material with a hydraulic conductivity of no more than $1x10^{-7}$ cm/sec.

2. The liners shall comply with sub. (1) (a), (b) and (c).

(b) The leachate collection and removal system between the liners, and immediately above the bottom composite liner in the case of multiple leachate collection and removal systems, is also a leak detection system. This leak detection system shall be capable of detecting, collecting and removing leaks of hazardous constituents at the earliest practicable time through all areas of the top liner likely to be exposed to waste or leachate during the active life and long−term care period. The requirements for a leak detection system in this subsection are satisfied by installation of a system that is, at a minimum, all of the following:

1. Constructed with a bottom slope of 1% or more.

2. Constructed of granular drainage materials with a hydraulic conductivity of $1x10^{-1}$ cm/sec or more and a thickness of 12 inches (30.5 cm) or more; or constructed of synthetic or geonet drainage materials with a transmissivity of $3x10^{-4}$ m^2/sec or more.

3. Constructed of materials that are chemically resistant to the waste managed in the surface impoundment and the leachate expected to be generated, and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying wastes and any waste cover materials or equipment used at the surface impoundment.

4. Designed and operated to minimize clogging during the active life and long−term care period.

5. Constructed with sumps and liquid removal methods (e.g., pumps) of sufficient size to collect and remove liquids from the sump and prevent liquids from backing up into the drainage layer. Each unit shall have its own sump. The design of each sump and removal system shall provide a method for measuring and recording the volume of liquids present in the sump and of liquids removed.

(c) The owner or operator shall collect and remove pumpable liquids in the sumps to minimize the head on the bottom liner.

(d) The owner or operator of a leak detection system that is not located completely above the seasonal high water table shall demonstrate that the operation of the leak detection system will not be adversely affected by the presence of groundwater.

(4) The department may approve alternative design or operating practices to those specified in sub. (3) if the owner or operator demonstrates to the department that the design and operating practices, together with location characteristics, will do both of the following:

Attachment 3
Roll off Specifications

www.bucksfab.com

1-800-233-0867

Rolling Roof Unit



APPLICATIONS:

Used In

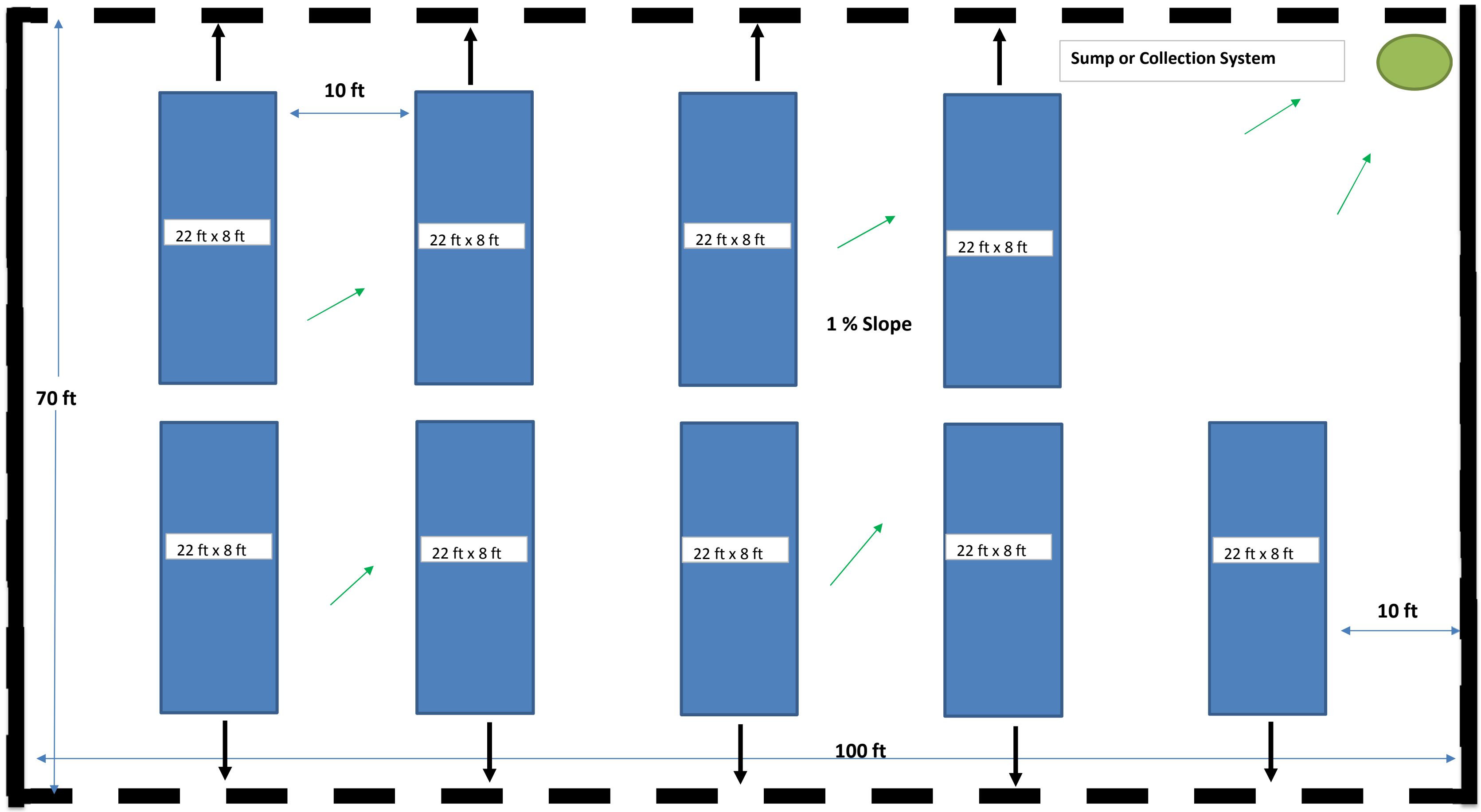
- **Septic**
- **Dewatering**
- **Oil Fields**
- **Hazardous Waste Transport**


Specifications:

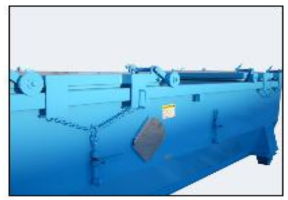
UNDERSTRUCTURE............. 3" CHANNEL 4.1 LBS/FT AT 16" APART
LONG RAILS......................... 2" X 6" X 1/4" TUBING
BULLNOSE........................... SOLID 1 1/4" PLATE BURNOUT
FLOOR................................. 3/16" 2 PIECES BUTT WELDED
PUSH PLATE......................... 26" X 16" X 3/16"
HOOKPLATE......................... 23" X 15" X 3/4"
WHEELS............................... 8" X 10" LONG REAR
8" X 6" LONG FRONT (STANDARD ONLY ON CABLE)
WHEEL AXLES...................... 1 1/2" SOLID ROUND BAR
NOSE ROLLERS.................... 4" DIAMETER X 6" LONG
SIDE WALL........................... 10 GAUGE
BULK HEAD.......................... 10 GAUGE
TOP RAIL.............................. 3" X 4" X 7 GAUGE TUBING
SIDE POST........................... 3" X 5" FORMED ON 24" CENTERS
REAR CORNER POST.......... 3 1/2" X 7" X 3/16" FORMED
TAILGATE SHEET.................. 10 GAUGE
TAILGATE LATCH.................. VERTICAL LIFT HANDLE
TAILGATE FRAME................. VERTICAL 3" X 4" X 7 GAUGE TUBING
HORIZONTAL 3 X 4 X 7 GAUGE TUBING
SEAL..................................... ALL RUBBER P-SEAL IN TRACK
HINGES................................. HEAVY DUTY SLOTTED SLIDING TYPE
WITH BINDER
PAINT.................................... EXTERIOR ONE SOLID COLOR
INTERIOR AND BOTTOM PRIME
ROOF LIDS............................ 10 GAUGE SEALED GASKETED SLIDING ROOF LIDS
60" X 88" WIDE

Bucks Fabricating • 3547 Perry Highway • Hadley, PA 16130 • 1-800-233-0867 • Fax: (724)-253-3863
A DIVISION OF DEIST INDUSTRIES, INC.

Attachment 4
Concrete Pad Layout


Sump or Collection System
10 ft
22 ft x 8 ft
22 ft x 8 ft
22 ft x 8 ft
22 ft x 8 ft
1 % Slope
70 ft
22 ft x 8 ft
22 ft x 8 ft
22 ft x 8 ft
22 ft x 8 ft
22 ft x 8 ft
10 ft
100 ft

5:1 Sloped Berm Wall (1 ft High, 1 ft wide at top) for truck access and Container Mobilization/transportation



Attachment 5
Itemized Cost Scenarios

Penta Wood Optimization Study 2014
Long-term Remedial Action Options Cost Estimation
Project No. 419801
Date of Estimate: February, 2014

LTRA Yearly Cost 2013:

Component Description	Quantity		Unit Price	Component Cost	Category Subtotal	NPV
CAPITAL COSTS						
CONSTRUCTION COSTS						
SUBTOTAL IMPLEMENTATION COSTS						**$0**
TOTAL CAPITAL COST ESTIMATE						**$0**
OPERATION AND MAINTENANCE COSTS						
Operation and Mainenance per year						
Utilities						
Electricity	12	MO	$4,000	$48,000		
Telephone	12	MO	$2,256	$27,072		
Propane	6	MO	$4,500	$27,000		
Waste Disposal and Chemicals						
Hazardous Waste Disposal (Filter Cake)	79	Tons	$2,267	$179,093		
Hazardous Waste Disposal (Spent Carbon)	22.4	Tons	$1,907	$42,717		
Hazardous Waste Disposal (LNAPL)	3950	gal	$9.60	$37,920		
Carbon Changeout	3	LS	$35,137	$105,411		
Chemical (Ferric)	10441	gal	$4.53	$47,298		
Chemical (Caustic)	7654	gal	$4.44	$33,984		
Chemical (Diatomatious Earth)	3600	lbs	$0.45	$1,620		
Chemical (Polymer)	90	gal	$7.32	$659		
Subcontracts						
Laboratory Services	12	MO	$2,000	$24,000		
Electrician oncall Services	12	MO	$650	$7,800		
Trash Services	12	MO	$100	$1,200		
Subtotal Subcontractor O&M Costs per year				$583,773		
Labor Costs						
PM & Administration	12	MO	$ 7,000	$84,000		
Subcontract Procurement	1	YR	$ 20,000	$20,000		
Subcontract Mangement	12	MO	$ 1,750	$21,000		
Analytical Support and Data Validation	12	MO	$ 667	$8,000		
Cleanup Validation (Groundwater Sampling)	1	YR	$ 43,000	$43,000		
System Operation	12	MO	$ 28,333	$340,000		
Reporting	1	YR	$ 15,000	$15,000		
Subtotal Labor Costs				$531,000		
Total O&M Costs (one year)				$1,114,773		
Total O&M Costs (ten years)				$11,147,726		
Average annual cost, spread over 10 year O & M period					$1,114,773	
Present Worth of O&M						**$7,829,696**
Interest 0.07						
Number of Years 10						
Total Annual O & M Cost Estimate					$1,114,773	
TOTAL Present Worth of O&M (Rounded to Thousands)						**$7,829,696**
TOTAL Present Worth of Capital and O & M (Rounded to Thousands)						**$7,829,696**

Primary Assumptions:
1) Assumed interest rate for Present Worth calculations: 7.0%
2) Costs are in 2014 dollars.
4) Cost estimate does not include the projected cost of contingency actions.
5) The expected accuracy of the cost estimate is -30 % to +50%.

Penta Wood Optimization Study 2014
Long-term Remedial Action Options Cost Estimation
Project No. 419801
Date of Estimate: February, 2014

LTRA Yearly Cost With Two Week Cycling:

Component Description	Quantity		Unit Price	Component Cost	Category Subtotal	NPV
			CAPITAL COSTS			
CONSTRUCTION COSTS						
SUBTOTAL IMPLEMENTATION COSTS						**$0**
TOTAL CAPITAL COST ESTIMATE						**$0**
			OPERATION AND MAINTENANCE COSTS			
Operation and Maintenance per year						
Utilities						
Electricity (cost are 50% lower during shutdown	0.75	YR	$48,000	$36,000		
Telephone	1	YR	$2,256	$2,256		
Propane	6	MO	$4,500	$27,000		
Waste Disposal and Chemicals						
Hazardous Waste Disposal (Filter Cake)	40	Tons	$2,267	$90,680		
Hazardous Waste Disposal (Spent Carbon)	11.2	Tons	$1,907	$21,358		
Hazardous Waste Disposal (LNAPL)	2000	gal	$9.60	$19,200		
Carbon Changeout	1.5	LS	$35,137	$52,706		
Chemical (Ferric)	5200	gal	$4.53	$23,556		
Chemical (Caustic)	3800	gal	$4.44	$16,872		
Chemical (Diatomaceous Earth)	1800	lbs	$0.45	$810		
Chemical (Polymer)	45	gal	$7.32	$329		
Subcontracts						
Laboratory Services	6	MO	$2,000	$12,000		
Electrician on call Services	6	MO	$650	$3,900		
Trash Services	6	MO	$100	$600		
Subtotal Subcontractor O&M Costs per year				$307,267		
Labor Costs						
PM & Administration	12	MO	$ 7,000	$84,000		
Subcontract Procurement	1	YR	$ 20,000	$20,000		
Subcontract Management	6	MO	$ 1,750	$10,500		
Analytical Support and Data Validation	6	MO	$ 667	$4,000		
Cleanup Validation (Groundwater Sampling)	1	YR	$ 43,000	$43,000		
System Operation (minimal maintenance required during shutdown periods)	7.2	MO	$ 28,333	$204,000		
Reporting	1	YR	$ 15,000	$15,000		
Subtotal Labor Costs				$380,500		
Total O&M Costs (one year)				$687,767		
Total O&M Costs (ten years)				$6,877,670		
Average annual cost, spread over 10 year O & M period					$687,767	
Present Worth of O&M						**$4,830,588**
Interest 0.07						
Number of Years 10						
Total Annual O & M Cost Estimate					$687,767	
TOTAL Present Worth of O&M (Rounded to Thousands)						**$4,830,588**
TOTAL Present Worth of Capital and O & M (Rounded to Thousands)						**$4,830,588**

Primary Assumptions:
1) Assumed interest rate for Present Worth calcula 7.0%
2) Costs are in 2014 dollars.
4) Cost estimate does not include the projected cost of contingency actions.
5) The expected accuracy of the cost estimate is -30 % to +50%.

Penta Wood Optimization Study 2014
Long-term Remedial Action Options Cost Estimation
Project No. 419801
Date of Estimate: February, 2014

LTRA Yearly Cost Summer Cycling with Full Winter Operation:

Component Description	Quantity		Unit Price	Component Cost	Category Subtotal	NPV
CAPITAL COSTS						
CONSTRUCTION COSTS						
SUBTOTAL IMPLEMENTATION COSTS						**$0**
TOTAL CAPITAL COST ESTIMATE						**$0**
OPERATION AND MAINTENANCE COSTS						
Operation and Mainenance per year						
Utilities						
Electricity	0.88	YR	$48,000	$42,240		
Telephone	1	YR	$2,256	$2,256		
Propane	6	MO	$4,500	$27,000		
Waste Disposal and Chemicals						
Hazardous Waste Disposal (Filter Cake)	60	Tons	$2,267	$136,020		
Hazardous Waste Disposal (Spent Carbon)	16.8	Tons	$1,907	$32,038		
Hazardous Waste Disposal (LNAPL)	2963	gal	$9.60	$28,445		
Carbon Changeout	2	LS	$35,137	$70,274		
Chemical (Ferric)	7840	gal	$4.53	$35,515		
Chemical (Caustic)	5740	gal	$4.44	$25,486		
Chemical (Diatomatious Earth)	2700	lbs	$0.45	$1,215		
Chemical (Polymer)	67.5	gal	$7.32	$494		
Subcontracts						
Laboratory Services	9	MO	$2,000	$18,000		
Electrician oncall Services	9	MO	$650	$5,850		
Trash Services	9	MO	$100	$900		
Subtotal Subcontractor O&M Costs per year				$425,732		
Labor Costs						
PM & Administration	12	MO	$ 7,000	$84,000		
Subcontract Procurement	1	YR	$ 20,000	$20,000		
Subcontract Mangement	9	MO	$ 1,750	$15,750		
Analytical Support and Data Validation	9	MO	$ 667	$6,000		
Cleanup Validation (Groundwater Sampling)	1	YR	$ 43,000	$43,000		
System Operation	9.6	MO	$ 28,333	$272,000		
Reporting	1	YR	$ 15,000	$15,000		
Subtotal Labor Costs				$455,750		
Total O&M Costs (one year)				$881,482		
Total O&M Costs (ten years)				$8,814,819		
Average annual cost, spread over 10 year O & M period					$881,482	
Present Worth of O&M						**$6,191,160**
Interest 0.07						
Number of Years 10						
Total Annual O & M Cost Estimate					$881,482	
TOTAL Present Worth of O&M (Rounded to Thousands)						**$6,191,160**
TOTAL Present Worth of Capital and O & M (Rounded to Thousands)						**$6,191,160**

Primary Assumptions:
1) Assumed interest rate for Present Worth calculations: 7.0%
2) Costs are in 2014 dollars.
4) Cost estimate does not include the projected cost of contingency actions.
5) The expected accuracy of the cost estimate is -30 % to +50%.

Penta Wood Optimization Study 2014
Long-term Remedial Action Options Cost Estimation
Project No. 419801
Date of Estimate: February, 2014

LTRA Yearly Cost; Summer Shutdown with Full Winter Operation:

Component Description	Quantity		Unit Price	Component Cost	Category Subtotal	NPV
CAPITAL COSTS						
CONSTRUCTION COSTS						
SUBTOTAL IMPLEMENTATION COSTS						**$0**
TOTAL CAPITAL COST ESTIMATE						**$0**
OPERATION AND MAINTENANCE COSTS						
Operation and Mainenance per year						
Utilities						
Electricity (startup and shutdown will take 1/2 month each)	6.5	MO	$4,000	$26,000		
Telephone	1	YR	$2,256	$2,256		
Propane	6	MO	$4,500	$27,000		
Waste Disposal and Chemicals						
Hazardous Waste Disposal (Filter Cake)	40	Tons	$2,267	$90,680		
Hazardous Waste Disposal (Spent Carbon)	11.2	Tons	$1,907	$21,358		
Hazardous Waste Disposal (LNAPL)	2000	gal	$9.60	$19,200		
Carbon Changeout	1.5	LS	$35,137	$52,706		
Chemical (Ferric)	5200	gal	$4.53	$23,556		
Chemical (Caustic)	3800	gal	$4.44	$16,872		
Chemical (Diatomatious Earth)	1800	lbs	$0.45	$810		
Chemical (Polymer)	45	gal	$7.32	$329		
Subcontracts						
Laboratory Services	6	MO	$2,000	$12,000		
Electrician oncall Services (1/2 month each for startup and shutdowr	6.5	MO	$650	$4,225		
Trash Services	6	MO	$100	$600		
Subtotal Subcontractor O&M Costs per year				$297,592		
Labor Costs						
PM & Administration	12	MO	$ 7,000	$84,000		
Subcontract Procurement	1	YR	$ 20,000	$20,000		
Subcontract Mangement	6	MO	$ 1,750	$10,500		
Analytical Support and Data Validation	6	MO	$ 667	$4,000		
Cleanup Validation (Groundwater Sampling)	1	YR	$ 43,000	$43,000		
System Operation (1/2 month each for shutdown and startup)	6.5	MO	$ 28,333	$184,166		
Reporting	1	YR	$ 15,000	$15,000		
Subtotal Labor Costs				$360,666		
Total O&M Costs (one year)				$658,259		
Total O&M Costs (ten years)				$6,582,587		
Average annual cost, spread over 10 year O & M period					$658,259	
Present Worth of O&M						**$4,623,334**
Interest 0.07						
Number of Years 10						
Total Annual O & M Cost Estimate					$658,259	
TOTAL Present Worth of O&M (Rounded to Thousands)						**$4,623,334**
TOTAL Present Worth of Capital and O & M (Rounded to Thousands)						**$4,623,334**

Primary Assumptions:
1) Assumed interest rate for Present Worth calculations: 7.0%
2) Costs are in 2014 dollars.
4) Cost estimate does not include the projected cost of contingency actions.
5) The expected accuracy of the cost estimate is -30 % to +50%.

Penta Wood Optimization Study 2014
Long-term Remedial Action Options Cost Estimation
Project No. 419801
Date of Estimate: February, 2014

LTRA Yearly Cost - Pumping Rates Declined by 10%:

Component Description	Quantity		Unit Price	Component Cost	Category Subtotal	NPV
			CAPITAL COSTS			
CONSTRUCTION COSTS						
SUBTOTAL IMPLEMENTATION COSTS						**$0**
TOTAL CAPITAL COST ESTIMATE						**$0**
			OPERATION AND MAINTENANCE COSTS			
Operation and Mainenance per year						
Utilities						
Electricity	12	MO	$4,000	$48,000		
Telephone	12	MO	$2,256	$27,072		
Propane	12	MO	$2,250	$27,000		
Waste Disposal and Chemicals						
Hazardous Waste Disposal (Filter Cake)	75	Tons	$2,267	$170,025		
Hazardous Waste Disposal (Spent Carbon)	21.2	Tons	$1,907	$40,428		
Hazardous Waste Disposal (LNAPL)	3752	gal	$9.60	$36,019		
Carbon Changeout	3	LS	$35,137	$105,411		
Chemical (Ferric)	9919	gal	$4.53	$44,933		
Chemical (Caustic)	7271	gal	$4.44	$32,283		
Chemical (Diatomatious Earth)	3420	lbs	$0.45	$1,539		
Chemical (Polymer)	86	gal	$7.32	$630		
Subcontracts						
Laboratory Services	12	MO	$2,000	$24,000		
Electrician oncall Services	12	MO	$650	$7,800		
Trash Services	12	MO	$100	$1,200		
Subtotal Subcontractor O&M Costs per year				$566,340		
Labor Costs						
PM & Administration	12	MO		$84,000		
Subcontract Procurement	1	YR		$20,000		
Subcontract Mangement	12	MO		$21,000		
Analytical Support and Data Validation	12	MO		$8,000		
Cleanup Validation (Groundwater Sampling)	1	YR		$43,000		
System Operation	12	MO		$340,000		
Reporting	1	YR		$15,000		
Subtotal Labor Costs				$531,000		
Total O&M Costs (one year)				$1,097,340		
Total O&M Costs (ten years)				$10,973,404		
Average annual cost, spread over 10 year O & M period					$1,097,340	
Present Worth of O&M						**$7,707,260**
Interest 0.07						
Number of Years 10						
Total Annual O & M Cost Estimate					$1,097,340	
TOTAL Present Worth of O&M (Rounded to Thousands)						**$7,707,260**
TOTAL Present Worth of Capital and O & M (Rounded to Thousands)						**$7,707,260**

Primary Assumptions:
1) Assumed interest rate for Present Worth calculations: 7.0%
2) Costs are in 2014 dollars.
4) Cost estimate does not include the projected cost of contingency actions.
5) The expected accuracy of the cost estimate is -30 % to +50%.

Penta Wood Optimization Study 2014
Long-term Remedial Action Options Cost Estimation
Project No. 419801
Date of Estimate: February, 2014

LTRA Yearly Cost 2013 plus CAMU option:

Component Description	Quantity		Unit Price	Component Cost	Category Subtotal	NPV
	CAPITAL COSTS					
CONSTRUCTION COSTS						
Continment Pad	309	CY	$320		$98,880	
Earthwork Construction Cost	1	EA	$43,921		$43,921	
Roll off Containers	9	EA	$12,466		$112,193	
Construction Subtotal					**$254,994**	
Scope and Bid Contingency	10%				**$25,499**	
SUBTOTAL CONSTRUCTION COSTS						**$280,493**
IMPLEMENTATION COST ALLOWANCES						
Bid/Performance Bonds	5.0%				$14,025	
Permitting	1.0%				$2,805	
Health and Safety	2.5%				$7,012	
Completion Report Preparation	1.00	LS	$10,000		$10,000	
Engineering Design Costs	5.0%				$14,025	
SUBTOTAL IMPLEMENTATION COSTS						**$47,867**
TOTAL CAPITAL COST ESTIMATE						**$328,360**
	OPERATION AND MAINTENANCE COSTS					
Operation and Mainenance per year						
Utilities						
Electricity	1	YR	$48,000	$48,000		
Telephone	1	YR	$2,256	$2,256		
Propane	12	MO	$2,250	$27,000		
Waste Disposal and Chemicals						
Hazardous Waste Disposal (Filter Cake)	0	Tons	$2,267	$0		
Hazardous Waste Disposal (Spent Carbon)	0	Tons	$1,907	$0		
Incorporation of waste into the CAMU (600 tons)	1	EA	$85,700	$85,700		
Hazardous Waste Disposal (LNAPL)	3950	gal	$9.60	$37,920		
Carbon Changeout	3	LS	$35,137	$105,411		
Chemical (Ferric)	10441	gal	$4.53	$47,298		
Chemical (Caustic)	7654	gal	$4.44	$33,984		
Chemical (Diatomatious Earth)	3600	lbs	$0.45	$1,620		
Chemical (Polymer)	90	gal	$7.32	$659		
Solidification						
Subcontracts						
Laboratory Services	12	MO	$2,000	$24,000		
Electrician oncall Services	12	MO	$650	$7,800		
Trash Services	12	MO	$100	$1,200		
Subtotal Subcontractor O&M Costs per year				$422,847		
Labor Costs						
PM & Administration	12	MO		$84,000		
Subcontract Procurement (includes new construction)	1	YR		$20,000		
Subcontract Mangement (includes new construction)	12	MO		$21,000		
Analytical Support and Data Validation	12	MO		$8,000		
Cleanup Validation (Groundwater Sampling)	1	YR		$43,000		
Design of waste incorporation into CAMU	7.5%	Project		$6,428		
System Operation	12	MO		$340,000		
Reporting	1	YR		$15,000		
Subtotal Labor Costs				$537,428		
Total O&M Costs (one year)				$960,275		
Total O&M Costs (ten years)				$9,602,748		
Average annual cost, spread over 10 year O & M period					$960,275	

Penta Wood Optimization Study 2014
Long-term Remedial Action Options Cost Estimation
Project No. 419801
Date of Estimate: February, 2014

LTRA Yearly Cost 2013 plus CAMU option:

Component Description		Quantity	Unit Price	Component Cost	Category Subtotal	NPV
Present Worth of O&M						**$6,744,568**
Interest	0.07					
Number of Years	10					
Total Annual O & M Cost Estimate					$960,275	
TOTAL Present Worth of O&M (Rounded to Thousands)						**$6,744,568**
TOTAL Present Worth of Capital and O & M (Rounded to Thousands)						**$7,072,928**

Primary Assumptions:
1) Assumed interest rate for Present Worth calculations: 7.0%
2) Costs are in 2014 dollars.
4) Cost estimate does not include the projected cost of contingency actions
5) The expected accuracy of the cost estimate is -30 % to +50%.

Penta Wood Optimization Study 2014
Long-term Remedial Action Options Cost Estimation
Project No. 419801
Date of Estimate: February, 2014

LTRA Yearly Cost 2013 plus CAMU option:

Component Description	Quantity		Unit Price	Component Cost	Category Subtotal	NPV
			CAPITAL COSTS			
CONSTRUCTION COSTS						
Continment Pad	309	CY	$320		$98,880	
Earthwork Construction Cost	1	EA	$43,921		$43,921	
Roll off Containers	9	EA	$12,466		$112,193	
Construction Subtotal					**$254,994**	
Scope and Bid Contingency	10%				**$25,499**	
SUBTOTAL CONSTRUCTION COSTS						**$280,493**
IMPLEMENTATION COST ALLOWANCES						
Bid/Performance Bonds	5.0%				$14,025	
Permitting	1.0%				$2,805	
Health and Safety	2.5%				$7,012	
Completion Report Preparation	1.00	LS	$10,000		$10,000	
Engineering Design Costs	5.0%				$14,025	
SUBTOTAL IMPLEMENTATION COSTS						**$47,867**
TOTAL CAPITAL COST ESTIMATE						**$328,360**
			OPERATION AND MAINTENANCE COSTS			
Operation and Mainenance per year						
Utilities						
Electricity	1	YR	$48,000	$48,000		
Telephone	1	YR	$2,256	$2,256		
Propane	12	MO	$2,250	$27,000		
Waste Disposal and Chemicals						
Hazardous Waste Disposal (Filter Cake)	0	Tons	$2,267	$0		
Hazardous Waste Disposal (Spent Carbon)	0	Tons	$1,907	$0		
Incorporation of waste into the CAMU (600 tons)	1	EA	$85,700	$85,700		
Hazardous Waste Disposal (LNAPL)	3950	gal	$9.60	$37,920		
Carbon Changeout	3	LS	$35,137	$105,411		
Chemical (Ferric)	10441	gal	$4.53	$47,298		
Chemical (Caustic)	7654	gal	$4.44	$33,984		
Chemical (Diatomatious Earth)	3600	lbs	$0.45	$1,620		
Chemical (Polymer)	90	gal	$7.32	$659		
Solidification (600 tons)	1	EA	$95,100.00	$95,100		
Subcontracts						
Laboratory Services	12	MO	$2,000	$24,000		
Electrician oncall Services	12	MO	$650	$7,800		
Trash Services	12	MO	$100	$1,200		
Subtotal Subcontractor O&M Costs per year				$517,947		
Labor Costs						
PM & Administration	12	MO		$84,000		
Subcontract Procurement (includes new construction)	1	YR		$20,000		
Subcontract Mangement (includes new construction)	12	MO		$21,000		
Analytical Support and Data Validation	12	MO		$8,000		
Cleanup Validation (Groundwater Sampling)	1	YR		$43,000		
Design of solidification and incorporation into the CAMU	5.0%	project		$9,040		
System Operation	12	MO		$340,000		
Reporting	1	YR		$15,000		
Subtotal Labor Costs				$540,040		
Total O&M Costs (one year)				$1,057,987		
Total O&M Costs (ten years)				$10,579,873		

Penta Wood Optimization Study 2014
Long-term Remedial Action Options Cost Estimation
Project No. 419801
Date of Estimate: February, 2014

LTRA Yearly Cost 2013 plus CAMU option:

Component Description		Quantity	Unit Price	Component Cost	Category Subtotal	NPV
Average annual cost, spread over 10 year O & M period					$1,057,987	
Present Worth of O&M						**$7,430,860**
Interest	0.07					
Number of Years	10					
Total Annual O & M Cost Estimate					$1,057,987	
TOTAL Present Worth of O&M (Rounded to Thousands)						**$7,430,860**
TOTAL Present Worth of Capital and O & M (Rounded to Thousands)						**$7,759,220**

Primary Assumptions:
1) Assumed interest rate for Present Worth calculations: 7.0%
2) Costs are in 2014 dollars.
4) Cost estimate does not include the projected cost of contingency actions.
5) The expected accuracy of the cost estimate is -30 % to +50%.