



FIVE-YEAR REVIEW REPORT

**Second Five-Year Review Report
for
Ritari Post and Pole Superfund Site
Sebeka
Wadena County, Minnesota**

September 2008

PREPARED BY:

**Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, Minnesota 55155**

Approved by:

Date:

Michael Kanner
Superfund Section Manager
Minnesota Pollution Control Agency

Approved by:

Date:



Richard C. Karl, Director
Superfund Division, Region 5
U.S. Environmental Protection Agency

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Five-Year Review Report

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List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
AST	Aboveground Storage Tank
ASTDR	Agency for Toxic Substance and Disease Registry
Bay West	Bay West, Inc.
CDC	Center for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Contaminant of Concern
Delta	Delta Environmental Consultants, Incorporated
Declaration	Declaration of Restrictions and Covenants, Easement, and Affidavit Concerning Real Property Contaminated with Hazardous Substances
dioxins	TCDD, other dioxins forms, and furans
DIR	Determination of Inadequate Response
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
HDPE	High Density Polyethylene
HRL	Health Risk Limit
HRS	Hazard Ranking System
LDRs	Land Disposal Restrictions
MCLs	Maximum Contaminant Levels
MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
MDL	Method Detection Limit
mg/kg	milligrams per kilogram
MP	Malcolm-Pirnie, Incorporated
MPCA	Minnesota Pollution Control Agency
NCP	National Contingency Plan
ng/L	nanograms per liter
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PAHs	Polynuclear Aromatic Hydrocarbons
PCP	Pentachlorophenol
ppb	parts per billion
ppm	parts per million
ppt	parts per trillion
psi	pounds per square inch
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAGS	Risk Assessment Guidance for Superfund
RAL	Minnesota Recommended Allowable Level
RAO	Remedial Action Objectives
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
Report	Five-Year Review Report
RFRA	Request for Response Action
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act

SDWA	Safe Drinking Water Act
SRV	Soil Reference Value
Site	Ritari Post and Pole Superfund Site
TCDD _{-eq.}	Tetrachlorodibenzodioxin-Equivalent, a measure of dioxins and furans relative to toxicity.
TEFs	Toxicity Equivalent Factors
Veit	Veit Companies
μg/kg	micrograms per kilogram
μg/L	micrograms per liter

Executive Summary

The former Ritari Post and Pole Superfund Site is located in Section 19 of Township 137N, Range 34W, in Meadow Township, outside of the town of Sebeka in Wadena County, Minnesota (Attachment 1). The surrounding area is remote and is primarily comprised of wooded and undeveloped land with few residential homes and limited agricultural operations. The Site is a former wood treating facility that manufactured treated fence posts and dimensional lumber. No active manufacturing is currently taking place at the Site. Contaminated soil at the Site has been in contact with ground water and served as a continual source of contamination to the ground water beneath the Site. The historic wood treating operations caused contamination with pentachlorophenol (PCP), and a group of dioxin and dioxin like chemicals including tetrachlorodibenzo-dioxin (TCDD) and other types of dioxins and furans. The Site area occupies approximately 10 acres with the single OU.

Remedial investigative activities indicated elevated concentrations of PCP and dioxins, measured as TCDD-Equivalents (TCDD_{eq}), were present in soil and ground water at the Site. The primary risk determined during the risk assessment was the human health risk, since PCP and dioxins are probable and known carcinogens. The exposure pathways associated with the Site included ingestion and dermal absorption of contaminants in ground water as well as ingestion and inhalation of contaminated soil and dust. The contaminants of concern (COCs) for soil and ground water at the Site are PCP and dioxins which were present at concentrations exceeding the acceptable health risk levels.

The soil remedy implemented at the Site consists of a soil and debris consolidation pile on an unlined pad with a Resource Conservation and Recovery Act- (RCRA-) compliant cap constructed for on-Site management and risk reduction associated with PCP- and TCDD_{eq}-contaminated soil, equipment and construction debris (i.e.-wood chips, concrete, sheet rock, etc.). The ground water remedy consists of residential well replacement, ground water monitoring and land use restrictions. Operation and maintenance (O&M) activities at the Site includes cap inspection and maintenance, and an identification sign and fencing to restrict access to the cap.

This is the second five-year review conducted for the Site. The trigger action for this five-year review is the September 29, 2003, the approval date for the First Five-Year Review. The first five-year review concluded that the remedy was constructed in accordance with the requirements of the 1994 Record of Decision (ROD), as modified by the 1999 Explanation of Significant Differences (ESD).

The previous five-year review identified several issues at the Site. These issues have largely been resolved. Erosion and animal damage to the cap were repaired and the cap is inspected at least annually and repaired as needed. Damaged monitoring wells 14U and 14L were abandoned. A warning sign was installed on the fence at the perimeter of the consolidation pile. A Declaration of Restrictions and Covenants, Easement, and Affidavit Concerning Real Property Contaminated with Hazardous Substances on the Site was filed and recorded at Wadena County. Most of the remaining impacted surface soil was excavated and transported off-site for disposal, following completion of a second Site ESD in 2008. During the removal of the surface soil, a limited amount of stained soil was encountered at approximately six inches below ground surface in three locations. Response actions are still required for this soil.

The remedy is currently functioning as intended and is protective of human health and the environment in the short-term. The soil response actions completed in 2001 and 2008 eliminated exposure pathways to the majority of the soil exceeding ROD action levels. The site remedy appears to be functioning as designed. Exposure assumptions, toxicity data, and RAOs used at the time of remedy selection are still valid. Site inspections and cap and fence maintenance ensure the cap integrity is maintained and access to

the cap is restricted. The potential for exposure to the limited amount of soil remaining on-site that exceeds ROD action levels does not pose an immediate threat because the areas where this soil is located are relatively small, covered by 6-inches of top soil, not regularly used, and have limited access. With respect to groundwater, the Ritari well has been replaced with a deep-aquifer well and long-term groundwater monitoring has been implemented for the Site. Ground water conditions are such that little or no migration is expected. The implementation of institutional controls has prevented the exposure to, or ingestion of, contaminated soils and groundwater to date. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure long-term protectiveness:

- After an evaluation, locations in Area A where stained soil was encountered and the one location in Area A where post-surface soil excavation confirmation sampling indicates the TCDD_{eq} concentration remains above the ROD action level will be addressed.
- The discrepancy for the one Area A excavation limit sample location that had a TCDD_{eq} concentration below the ROD action level in the 2007 sample, but higher than the ROD action level in the 2008 sample will be resolved.
- The current monitoring well network will be evaluated for sufficiency in assessing the possible off-site migration of PCP at concentrations exceeding the MCL in the upper aquifer. Additional monitoring wells will be installed, if appropriate.
- The 2003 QAPP and the 2003 Site O&M Plan will be updated to be consistent with changes made to ground water monitoring since the documents were written. Future ground water monitoring events will be performed at the frequency specified in the governing documents.
- Long term protectiveness of the remedy also requires compliance with effective ICs. Compliance with effective ICs will be ensured through long term stewardship by maintaining, monitoring and enforcing effective ICs as well as maintaining the site remedy components.

Institutional Control Evaluation activities will be conducted to evaluate the effectiveness of the institutional controls and the long-term Site stewardship. The IC evaluation activities which are detailed further in this report shall include an evaluation of any encumbrances on the title and whether all identified areas of soils and groundwater contamination are covered. Additionally, an Institutional Control Plan should be developed that incorporates the Institutional Control Evaluation, and if necessary, implement corrective measures.

FIVE-YEAR REVIEW SUMMARY FORM

Information in bold and italic font is Site-specific information.

SITE IDENTIFICATION		
Site name (from WasteLAN): <i>Ritari Post and Pole Superfund Site</i>		
EPA ID (from WasteLAN): <i>MND980904064</i>		
Region: <i>5</i>	State: <i>MN</i>	City/County: <i>Sebeka, Wadena County</i>
SITE STATUS		
NPL status: <i>Final</i>		
Remediation status (choose all that apply): <i>Complete</i>		
Multiple OUs?* <i>NO</i>	Construction completion date: <i>09 / 26 / 2001 (PCOR)</i>	
Has site been put into reuse? <i>NO</i>		
REVIEW STATUS		
Lead agency: <i>State- Minnesota Pollution Control Agency (MPCA)</i>		
Author name: <i>Steven Schoff</i>		
Author title: <i>Project Manager</i>	Author affiliation: <i>MPCA</i>	
Review period:** <i>October 2007 through September 2008</i>		
Date(s) of site inspection: <i>October 30, 2007</i>		
Type of review: <i>Post-SARA, Statutory</i>		
Review number: <i>2 (Second)</i>		
Triggering action: <i>Previous Five-Year Review Report</i>		
Triggering action date (from WasteLAN): <i>09 / 29 / 2003</i>		
Due date (five years after triggering action date): <i>09 / 29 / 2008</i>		

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form

Issues:

1. Three locations of stained soil in Area A were encountered during the surface soil removal work performed in 2008. These areas were covered with a geotextile fabric and then backfilled with clean soil. Analytical results from these locations and/or the sampling grids where the stained soil was located revealed pentachlorophenol (PCP) and/or TCDD_{eq} concentrations that exceeded the action levels specified in the ROD.

2. In addition to the stained soil/grid areas described under Issue #1, analytical results from confirmation samples collected from the bottom of Area A identified one additional location where the post-excavation TCDD_{eq} concentration remained above the ROD action level.
3. During the surface soil delineation work performed in 2007, four samples used to delineate excavation limits during the 2008 surface soil removal action were analyzed after the hold time expired. These locations were re-sampled in 2008 during the surface soil removal action. One of the four re-samples contained a TCDD_{eq} concentration above the ROD action level.
4. Ground water contour maps developed from recent ground water elevation measurements suggest a northeast component to ground water flow in the upper aquifer. There are no monitoring wells along the property boundary which are located northeast of the soil and other items which were consolidated and capped in 2001.
5. In 2007 the MPCA issued a Memorandum which modifies the ground water monitoring program for the Site. These modifications are not reflected in the 2003 QAPP or 2003 Site O&M Plan.
6. The last ground water monitoring event at the Site was performed in 2006 or two years ago. This is a greater time period than recommended in the MPCA 2007 Memo (annually) or the QAPP and Site O&M Plan (semi-annually).
7. The effectiveness of ICs and long-term stewardship procedures shall be evaluated. That evaluation shall include the Declaration of Restrictions and Covenants, Easement, and Affidavit Concerning Real Property Contaminated with Hazardous Substances (Declaration).
8. Ensure the effectiveness of ICs and plan for long-term stewardship of the Site to ensure effective ICs are maintained, monitored and enforced.

Recommendations and Follow-up Actions:

1. Complete a mini-feasibility study/options evaluation to determine the most appropriate remedy for the locations in Area A where stained soil was encountered. Implement the appropriate option(s).
2. Include the additional Area A grid location with the elevated TCDD_{eq} concentration in the mini-feasibility study/options evaluation described in Recommendation #1.
3. The discrepancy for the one Area A excavation limit sample location that had a TCDD_{eq} concentration below the ROD action level in the 2007 sample, but higher than the ROD action level in the 2008 sample should be resolved. The discrepancy may be resolved through additional sampling and/or inclusion in the mini-feasibility study/options evaluations described under Recommendation #1.
4. Continue to evaluate whether the current monitoring well network is sufficient for assessing the possible off-site migration of PCP at concentrations exceeding the MCL in the upper aquifer. Install additional monitoring wells, if appropriate.
5. Update the 2003 QAPP and the 2003 Site O&M Plan to be consistent with changes made to ground water monitoring since these documents were written.
6. Perform future ground water monitoring events at the frequency specified in the governing documents for this activity.
7. IC Evaluation activities should be completed by MPCA to evaluate the effectiveness of the existing ICs and long-term Site stewardship procedures.
8. An Institutional Control Plan should be developed by the Agencies that incorporates the Institutional Control Evaluation, and if necessary, implement corrective measures.

Protectiveness Statement(s):

The remedy is currently functioning as intended and is protective of human health and the environment in the short-term. The soil response actions completed in 2001 and 2008 eliminated exposure pathways to the majority of the soil exceeding ROD action levels. The site remedy appears to be functioning as designed. Exposure assumptions, toxicity data, and RAOs used at the time of remedy selection are still valid. Site inspections and cap and fence maintenance ensure the cap integrity is maintained and access to the cap is restricted. The potential for exposure to the limited amount of soil remaining on-site that exceeds ROD action levels does not pose an immediate threat because the areas where this soil is located are relatively small, covered by 6-inches of top soil, not regularly used, and have limited access. With respect to groundwater, the Ritari well has been replaced with a deep-aquifer well and long-term groundwater monitoring has been implemented for the Site. Ground water conditions are such that little or no migration is expected. The implementation of institutional controls has prevented the exposure to, or ingestion of, contaminated soils and groundwater to date. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure long-term protectiveness. After an evaluation, locations in Area A where stained soil was encountered and the one location in Area A where post-surface soil excavation confirmation sampling indicates the TCDD_{eq} concentration remains above the ROD action level will be addressed. The discrepancy for the one Area A excavation limit sample location that had a TCDD_{eq} concentration below the ROD action level in the 2007 sample, but higher than the ROD action level in the 2008 sample will be resolved. The current monitoring well network will be evaluated for sufficiency in assessing the possible off-site migration of PCP at concentrations exceeding the MCL in the upper aquifer. Additional monitoring wells will be installed, if appropriate. The 2003 QAPP and the 2003 Site O&M Plan will be updated to be consistent with changes made to ground water monitoring since the documents were written. Future ground water monitoring events will be performed at the frequency specified in the governing documents.

Long-term protectiveness of the remedy also requires compliance with effective ICs. Compliance with effective ICs will be ensured through long term stewardship by maintaining, monitoring and enforcing effective ICs as well as maintaining the site remedy components.

IC evaluation activities should be completed by MPCA to evaluate the effectiveness of the existing institutional controls and long-term Site stewardship procedures. The evaluation activities which are detailed further in this report shall include an evaluation of any encumbrances on the title and whether all identified areas of soils and groundwater contamination are covered. Additionally, an Institutional Control Plan should be developed that incorporates the Institutional Control Evaluation, and if necessary, implement corrective measures.

Date of last Regional review of Human Exposure Indicator (from WasteLAN): 13 July 2007

Status (from WasteLAN): Protective Remedy

Date of last Regional review of Ground Water Migration Indicator (from WasteLAN): 13 July 2007

Ground Water Migration Survey Status (from WasteLAN): Controlled

Five-Year Review Report

I. Introduction

The purpose of the five-year review is to determine whether the remedy at the Ritari Post and Pole Superfund Site (Site) is protective of human health and the environment. As required, the methods, findings, and conclusions of the review are documented in this five-year review report. In addition, the five-year review report identifies issues found during the review and recommendations to address them. The report addresses all remedial action phases of the Site and the Site as a whole.

The MPCA, in cooperation with U.S. EPA, is preparing this five-year review pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) § 1211 and the National Contingency Plan (NCP). CERCLA § 121 states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section (104) or (106), the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The U. S. EPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) § 300.430(f)(4)(ii) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

The MPCA conducted the second five-year review of the remedy and remedial actions implemented at the Site in Sebeka, Minnesota. This review was conducted by the State Project Manager (SPM) for the Site from October 2007 through September 2008. This report documents the results of the review and the inspection conducted by the MPCA. Bay West, Inc. (Bay West), a Contractor for the MPCA, assisted in the five-year review process. U.S. EPA partially funded the work through a cooperative agreement.

The first Five-Year Review was conducted by the MPCA and completed in 2003. This is the second statutory five-year review for the Site. The triggering action for this review is the date of the previous Five-Year Review, which was September 29, 2003. The statutory review is conducted because the hazardous substances, pollutants or contaminants remain at the site above criteria that allow for unlimited use and unrestricted exposure. The five-year review was performed for soil and ground water at the Site, as one operable unit (OU).

II. Site Chronology

Table 1: Chronology of Site Events by Date

Site Event	Date
Ritari began use of creosote wood treating products	1955
Ritari began use of PCP wood treating products	1959
MPCA inspected Ritari Site; noted improper storage and disposal of sludge wastes; collected samples for phenol analyses	1976
MPCA identified PCP in Ratcliff sand-point well	1979
MPCA determined PCP in Ratcliff well was likely from Ritari;	1980
Ritari installed new deep well for Ratcliff; PCP still detected in water	1980
PCP detected in pork liver and packaged meat samples from Ritari neighbor; Ratcliff's also had similar PCP detections in pork liver and meat samples	1980
In a preliminary inspection, the MPCA installed three monitoring wells near the Ritari operations. Analytical results revealed PCP contamination	December 1980
MPCA noted several large areas of soil contamination at the Site	1981
Monitoring well sampling indicated PCP present in ground water	1981
Minnesota Department of Health (MDH) identified PCP in two monitoring wells and the old Ratcliff well	1982
MPCA submitted letter requesting that Melvin Ritari submit a remedial action plan to clean up identified contamination at the Site	1982
Proposals for remedial action plan submitted to the MPCA	1982
MPCA concluded additional information was required to evaluate the proposed remedial alternatives	1983
Discovery of severity of contamination	April 1 1984
Preliminary Assessment	June 28 1985
Site scored a 30 on the EPA's Hazard Ranking System	1985
Site placed on NPL	1985
Site Investigation	September 10 1985
MPCA issued Request for Response Action (RFRA) to Glenn Ritari; Ritari informed MPCA lack of financial resources prevented him from taking action; MPCA issued Determination of Inadequate Response (DIR)	1986
EPA identified Glenn Ritari as responsible party for the Site. Remedial Investigation/Feasibility Study (RI/FS) was performed by Malcolm-Pirnie, Inc. (MP). MPCA authorized MP to develop RI/FS Work Plan	1987
Remedial Investigation performed	1990 - 92
Focused Feasibility Study completed	December 1993
Proposed Plan published, public meeting held	Jan. - Feb. 1994
Record of Decision (ROD) signed by MPCA and EPA	June 30 1994
EPA removed and disposed of 39 drums of spent wood treating solution	1997
Installation of three monitoring well nests, replacement of Ritari drinking water supply well and continued ground water monitoring.	1997-1998
MPCA re-evaluated soil alternative to reflect updated information prior to implementing remedial design/remedial action (RD/RA). Based on evaluation, MPCA developed Explanation of Significant Differences (ESD)	July 2 1999
Final Remedial Design Report approved by MPCA and EPA	2001
Quality Assurance Project Plan (QAPP) approved by MPCA and EPA	June 2001
Site construction activities completed - 2001 Soil Response Actions	June-October 2001
Remedial Action Completion Report approved by MPCA	June 2003
O&M Plan completed.	June 2003
Revised Quality Assurance Project Plan (QAPP) for ground water approved	June 2003

by MPCA and EPA.		
First Five-Year review Site inspection	August 21	2003
Soil borings advanced around Pettibone Shed and Office, with soil samples analyzed for PCP and TCDD _{eq} .	June	2004
Soil samples collected from three areas of Site for TCDD _{eq} analyses to delineate surface soil contamination	June - October	2007
Site Inspection for Second Five-Year Review	October 30	2007
Declaration filed in Wadena County	November 1	2007
Monitoring wells 14L and 14U were abandoned.	May 20	2008
MPCA developed ESD which allowed the disposal of soil at a Subtitle D landfill, provided the soil met stipulated criteria.	June	2008
Excavation and off-site disposal of surface soil in four areas completed.	June	2008
Stained soil identified at 6 inches below ground surface during surface soil excavation. Soil above the stained soil stockpiled on-site for testing.	June	2008
Soil stockpiled in June disposed of at a Subtile D landfill	September	2008

III. Background

Physical Characteristics

The former Ritari Post and Pole facility is located in southeast quarter of the southwest quarter of Section 19, Township T137N, R34W, in Meadow Township, outside of the town of Sebeka in Wadena County, Minnesota (Attachment 1, Figure 1). The Site is located in a rural, sparsely populated area approximately 3.5 miles northeast from Sebeka, Minnesota. The surrounding area is remote and primarily comprised of wooded and undeveloped land with few residential homes and limited agricultural operations. The Site area occupies approximately 10 acres with the single OU situated east, northeast of the residential home, near the southeast corner of a 212-acre parcel owned by the Ritari family. Access to the site is available from County Road 143.

Land and Resource Use

The Site is a former wood treating facility that manufactured treated fence posts and dimensional lumber. The site was in operation from approximately 1955 to 1991 and used PCP-based treating solutions from 1959 to 1991. No active manufacturing is currently taking place at the Site. The projected future land use for the Site, as well as the surrounding area, is not expected to change from the current residential use.

Ground water is encountered at approximately 3 feet below ground surface. Ground water flow is predominantly to the east. As a result of historic wood treating operations at the site, ground water became contaminated with PCP and TCDD_{eq}. Surface water and off-site sediments were not found to be impacted by the contaminants of concern at concentrations above human health criteria.

Both historically and presently, residents in the vicinity of the Site rely on ground water as a water supply resource. Due to the remote, rural location of the Site, a municipal water supply is not available, nor is one likely to become available in the near future. However, the drinking water supply wells in the vicinity of the Site have been sampled and a replacement well was installed for an adjacent residence (Ratcliff) in 1980. A replacement water supply well was also installed in a deeper aquifer at the Ritari property in 1998 as part of the ground water remedy outlined in the ROD for the Site.

A consolidation pile with a RCRA-compliant cap constructed on-Site in 2001 for on-Site management and risk reduction associated with PCP- and TCDD_{eq}-contaminated soil. During its construction,

contaminated equipment and construction debris (i.e.-wood chips, concrete, sheet rock, etc.) were placed in the consolidation pile with the contaminated soil. The consolidation pile and cap occupy an area of approximately 22,000 square feet and is surrounded by a locked chain-link fence that was installed around the perimeter of the unit. The consolidation pile, cap and fence are located east, northeast and north of the Ritari home and various sheds, a garage and an office used by the Ritari's. Other than these structures, wooded areas generally surround the consolidation pile and fence. Monitoring wells installed adjacent to the consolidation pile, as well as other monitoring wells on-Site, continue to be monitored at a frequency determined by the MPCA.

In accordance with the remedy outlined in the ROD and as an institutional control mechanism, a restrictive covenant was placed on the property in 2007 to:

- 1) Prevent installation of water supply wells in the contaminated aquifer in the area of the Site, and,
- 2) Prevent future use of the Site property in a manner which may result in a release or exposure to contaminants.

History of Contamination

The Site was operated as a wood treating facility from approximately 1955 to 1991. The Ritari's utilized a creosote wood treatment process between start-up until 1957. Creosote treatment operations consisted of dipping wood into creosote holding tanks, then staging the treated wood for drying. In 1959, the Ritari's converted their process to a PCP-based treatment operation. Between 1959 and 1979, a heavy, oil-based PCP mixture was used. In 1979, the Ritari's transitioned to a water-based PCP solution.

The physical treatment method was similar for both the oil- and water-based PCP mixtures. The PCP solution was measured and combined with a carrier (oil or water). Pressure vessels were then loaded with bundles of lumber or posts on railracks and the PCP solution was heated and pumped into the vessels. The vessels were pressurized to approximately 150 pounds per square inch (psi) for three to five hours.

After the pressure was released, excess PCP fluid was pumped from the vessels back into the measuring tank to be reused in the next treatment batch. The treated bundles were then removed from the vessels. The bundles were drip-dried on the ground surface. This practice was discontinued in 1973, when the treated wood was allowed to drain in the pressure vessel overnight prior to drying in the open.

PCP sludge, generated as a residual by-product of the mixing and treatment processes, was removed from the measuring tank one to two times per year. The sludge was spread on the ground and allowed to dry in an area identified as the "sludge drying area" immediately south of the treatment area. Some sludge was also drummed and sold or distributed to neighboring farmers to use for their own wood treating needs.

The potential for environmental contamination at the Site was recognized in 1976, when the MPCA inspected the facility and noted the improper storage and disposal of sludge "wastes." Between 1976 and 1980, residential water supply wells in the area, as well as packaged pork samples from neighboring properties, were sampled and analyzed for phenols. PCP was detected in a water sample from a neighboring well and in the meat from the packaged pork samples analyzed by the Minnesota Department of Agriculture (MDA). In 1980, the MPCA determined that the contamination was likely from the Ritari facility.

Initial Response – Pre-Record of Decision

After PCP was detected in the Ratcliff sand point well in 1979, a new, deeper, well was installed in 1980. PCP was also detected in a water sample collected from the new well. Analysis of pork liver and packaged meat samples from the Ratcliff's and another Ritari neighbor in 1980 revealed the presence of PCP. The MPCA installed three monitoring wells near the Ritari operations in 1980 as part of a Preliminary Inspection. Analytical results documented the presence of PCP. The MPCA also noted several large areas of soil contamination during the Preliminary Investigation.

In 1982, the MPCA submitted a letter to Melvin Ritari requesting a remedial action plan (RAP) to clean-up the contamination identified at the site. RAP proposals were submitted to the MPCA, however, the MPCA concluded additional information was required to evaluate the proposed alternatives. A Discovery of Severity of Contamination (1984), Preliminary Assessment (1985) and Site Investigation (1985) were completed. In 1985, a Hazard Ranking System (HRS) score of 30 was determined for the Site, qualifying the site for listing on the NPL. The site was listed on the NPL at that time.

The MPCA issued a Request for Response Action (RFRA) to Glenn Ritari in 1986. Mr. Ritari, doing business as Ritari Post & Pole, responded that he was financially unable to complete the requested Site activities. The MPCA then issued a Determination of Inadequate Response (DIR), thereby acquiring assistance from the federal Superfund program via a Cooperative Assistance Grant. The remedial investigation took place from 1990 to 1992. A focused feasibility study was completed in 1993.

The Proposed Plan was approved by the EPA in January 1994 and a public meeting was held in February 1994, to solicit public involvement and comment. The ROD, addressing both soil and ground water, was signed by the MPCA and EPA in June 1994.

Basis for Taking Action

Remedial investigation work at the Site identified elevated PCP and TCDD_{eq} concentrations in soil and ground water at the Site. Polynuclear aromatic hydrocarbons (PAHs) were also detected in soil samples. However, due to the more significant carcinogenic risks associated with PCP and dioxins, and PAH detections being co-located with PCP and/or TCDD_{eq} detections, clean-up criteria for PAHs were not established for the Site. This was justified because the PCP and TCDD_{eq} remedies would also address PAHs.

The COCs in each media at the Site include:

Soil

PCP

Dioxins and furans in TCDD_{eq}

Ground Water

PCP

Dioxins and furans in TCDD_{eq}

PCP was once a widely used pesticide and wood preservative in the United States, but it is now a restricted use pesticide and is no longer available to the general public. PCP is extremely toxic to humans from acute (short-term) ingestion and inhalation exposure. Acute inhalation exposures in humans have resulted in neurological, blood and liver effects, and eye irritation. Chronic (long-term) exposure to PCP by inhalation in humans has resulted in effects on the respiratory tract, blood, kidney, liver, immune system, eyes, nose, and skin. Human studies are inconclusive regarding PCP exposure and reproductive effects. Studies suggest an association between exposure to PCP and cancer. The EPA has classified PCP as a probable human carcinogen.

Dioxins are classified as persistent, bioaccumulative, and toxic pollutants. These are highly toxic, long-lasting substances that can build up in the food chain to levels that are harmful to human and ecosystem health. Persistent means they remain in the environment for extended periods of time. Bioaccumulative means their concentration levels increase as they move up the food chain. As a consequence, animals at the top of the food chain (such as humans) tend to have the highest dioxin concentrations in their bodies. Dioxins can alter the fundamental growth and development of cells in ways that have the potential to lead to many kinds of impacts. A toxicity effect of dioxin is chloracne, a severe skin rash with an acne-like appearance that occurs mainly on the face and upper body. Other effects of exposure to large amounts of dioxin include skin rashes, skin discoloration, excessive body hair and possible liver damage.

Sampling activities performed during the RI indicated soil contamination was present in the surface and subsurface soils, primarily near the wood treatment area and associated tanks, the drying (drip) area and the area where the waste sludge was dried. PCP concentrations in soils were observed as high as 12,000 milligrams per kilogram (mg/kg) in the surface soils and up to 970 mg/kg in the subsurface soils. Concentrations of dioxins were generally lower than PCP concentrations but were also detected in the same Site areas with similar horizontal/vertical patterns. Concentrations of dioxins were observed at up to 36 micrograms per kilogram ($\mu\text{g}/\text{kg}$) in the surface soils and up to 25 $\mu\text{g}/\text{kg}$ in the subsurface soils. These peak concentrations were observed in the samples collected from the wood treating and sludge drying areas.

During the RI, twenty-six monitoring wells/piezometers were installed to delineate the horizontal and vertical extent of contamination, determine aquifer characteristics and assess plume stability. The COCs were detected in the upper sand/outwash aquifer. Similar to soil results, ground water samples collected near the wood treating area exhibited the highest COC concentrations. COC concentrations near the wood treating area ranged from 88 to 1,800 $\mu\text{g}/\text{L}$ for PCP and 56 to 1,640 nanograms per liter (ng/L) for dioxins. The RI Report concluded that contaminant concentrations decreased with increasing distance from the wood treating area. Contaminant concentrations also decreased vertically within the upper aquifer. The RI Report also stated that PCP and TCDD_{eq} impacts appeared to be limited to the Site.

The primary risk determined during the risk assessment was the human health risk, since PCP and dioxins are probable and known carcinogens, respectively. At the time the RI was performed, the highest PCP concentration detected in ground water samples was 6,400 $\mu\text{g}/\text{L}$, which was considerably greater than the MCL of 1 $\mu\text{g}/\text{L}$. Additionally, the TCDD_{eq} were considered to cause a higher risk for carcinogenic effects using the EPA acceptable risk criterion of one additional cancer case per million people. TCDD_{eq} concentrations were greater than the acceptable risk limit. The exposure pathways associated with the Site included ingestion and dermal absorption of ground water as well as ingestion and inhalation of soil and dust.

The results of the RI indicated that Site contamination in soil and ground water was caused by improper processing and disposal of wood treating solutions on-Site.

IV. Remedial Actions

Remedy Selection

The ROD for the Site was signed by the MPCA and the EPA on June 30, 1994. The ROD stipulated RAOs for the Site specifically for each media. The RAOs are:

Ground Water

Ground water response actions were developed based on federal maximum contaminant levels (MCLs).

- Minimize or prevent ingestion of ground water having PCP in excess of 1 part per billion (ppb).
- Minimize or prevent ingestion of ground water having TCDD_{eq} in excess of 0.03 parts per trillion (ppt).
- Minimize or prevent off-site migration of ground water having PCP in excess of 1 ppb and TCDD_{eq} in excess of 0.03 ppt.

Soil

- Minimize or prevent ingestion or direct contact with PCP-contaminated soil in excess of 0.03 milligrams PCP/kilogram body weight/day (mg/kg/day) (Ref Dose).
- Minimize or prevent ingestion or direct contact with soil posing 1.0E-4 to 1.0E-6 excess cancer risk from PCP and TCDD_{eq}.
- Minimize or prevent inhalation of dust posing excess cancer risk levels of 1.0E-4 to 1.0E-6 from PCP and TCDD_{eq}.

Using EPA's Risk Assessment Guidance for Superfund (RAGS) a soil clean-up criterion of 40 parts per million (ppm) or milligrams/kilogram (mg/kg) was calculated for PCP (1.0E-5 risk level for a residential scenario).

Based on calculations by the Agency for Toxic Substance and Disease Registry (ASTDR) and the Centers for Disease Control (CDC), a residential cleanup criterion of 1 ppb or microgram/kilogram (µg/kg) was established for TCDD_{eq}.

The summarized soil RA components specified in the ROD included: building and equipment decontamination and/or disposal; investigation of soil washing options; excavation and off-Site treatment of approximately 1,800 cubic yards of TCDD_{eq}-contaminated soil; excavation and on-Site biotreatment of approximately 3,000-8,000 cubic yards of PCP contaminated soil in a lined and bermed treatment cell; soil treatment cell monitoring to examine effectiveness of treatment; topsoil application and revegetation of Site; and institutional controls implementation including fencing the Site. Ground water RA components specified in the ROD included abandoning the Ritari water supply well; installing a deep aquifer water supply well for the Ritari residence; and ground water monitoring at the Site. Institutional controls identified in the ROD included establishing a well advisory to prevent installation of wells in the contaminated upper aquifer and deed restrictions to prevent future use of the property which may result in a release of and exposure to existing contamination.

In 1999, the MPCA reassessed the soil RA selected for the Site based on updated information and developed an explanation of significant differences (ESD). The ESD addressed the effectiveness and costs of the proposed soil RAs as well as the re-evaluated risks and proposed the following modifications to the soil RAs, as specified in the ROD.

- Implementing the contingency remedy involved the excavation of contaminated soil, followed by consolidation and containment utilizing a RCRA-compliant cap. Execution of this RA replaced both on-Site biotreatment of PCP-contaminated soils via a treatment cell and off-Site treatment and disposal of TCDD_{eq}-contaminated soil. The contingency remedy also eliminated the need for investigating soil washing.

- As part of the RCRA facility closure, the ROD dictated that all Site buildings and equipment should be demolished and removed. Instead, the ESD specified the buildings be assessed individually to determine if contamination is present and if so, decontaminate if possible. Only the structures and equipment that required full demolition or dismantling would be removed from the Site.

The ESD was signed by the MPCA in June 1999 and was approved and signed by the Director of the Superfund Division for the EPA on July 2, 1999.

Remedy Implementation

Ground Water RAs

The RAs stipulated in the ROD were implemented in several phases at the Site. While not identified as a RA in the ROD, the EPA removed and disposed of thirty-nine drums containing spent wood treating solution in 1997. A deep well was installed for the Ritari residence in January 1998. The monitoring well network was installed in 1997 and updated in 1998. The RA Contractor award was made on September 26, 1998, which is considered the Construction Start date.

Soil RAs

The soil RAs were detailed in the ROD and later modified by the first ESD, signed by both the MPCA and EPA in July 1999. Subsequent to approval of the ESD, the MPCA initiated the RD phases, contracting Bay West for assistance in 1999. In 2001, Bay West submitted the Final Remedial Design Report identifying excavation areas, limits and volumes as well as additional activities as part of the Remedial Action Plan (RAP). Bay West assisted the MPCA in preparing bid specifications in February 2001. Veit Companies (Veit) was selected as the construction contractor and was authorized to proceed on April 19, 2001. The Quality Assurance Project Plan (QAPP) prepared for soil RA activities at the Site was approved by the EPA on June 20, 2001.

Soil RAs were implemented on-Site from June through October, 2001. Contaminated soil was placed on a 144-foot by 152-foot pad that was a minimum of one-foot thick and constructed of Class V material. Contaminated wood piles, rubber hose, sheetrock from demolition activities, drill cuttings, building materials and scabbled concrete and debris were dispersed within the contaminated soil in the consolidation pile. Metal that could not be cleaned or used as scrap metal was also placed in the consolidation pile.

The containment structure for aboveground storage tanks (AST) #1 and #2, the containment structure for ASTs #3 and #4, and on-Site buildings were decontaminated in accordance with the Final Design Report and decontamination specifications. The four ASTs were cleaned and disposed of as scrap. The concrete dike floors were broken up and added to the consolidation pile.

The concrete floor of the Pettibone building was broken up and added to the consolidation pile and a new concrete floor was poured in place. The office building construction materials included insulation containing asbestos. The insulation was removed and disposed of in accordance with the asbestos abatement plan for the Site. Contaminated drywall from the building was placed in the consolidation pile and the floor was decontaminated. The floor was then covered with a 40-mil textured high density polyethylene (HDPE) liner and covered with a fresh layer of concrete.

After the completion of consolidation work, a multi-layer, RCRA compliant, cap was constructed in accordance with the remedial design. A 6-foot high chain-link fence and locking access gate were

installed around the perimeter of the capped consolidation pile. Four shallow monitoring wells were installed to monitor ground water quality proximal to the consolidation pile. Previously, twelve monitoring wells had been abandoned as was necessary to allow soil excavation and consolidation pile construction to proceed in accordance with the design.

On September 14, 2001, immediately prior to completion of Site activities, both EPA and MPCA staff visited the Site and conducted a pre-final inspection. During this pre-final inspection, the MPCA and EPA determined the remedy had been constructed in accordance with the RD requirements. The areas excavated in 2001 and location of the consolidated and capped soil and other materials are illustrated in Attachment 1, Figure 2.

On behalf of the MPCA, Bay West completed the Remedial Action Completion Report and O&M Plan in June 2003. The excavation work performed in 2001 was based on locations where the PCP concentrations exceeded the ROD action level, with the assumption that areas where the TCDD_{eq} concentrations exceeded the ROD action level would be co-located. Comparing the Remedial Action Completion Report and data collected by Delta Environmental Consultants, Inc. (Delta) in 1993, it was noted that TCDD_{eq} concentrations in excess of the Site cleanup goal were detected in a few soil samples located in areas that were the PCP concentrations did not exceed the ROD action level. As excavation limits were based solely on PCP concentrations, these areas were not excavated in 2001.

The first Five-Year Review Report recommended addressing any remaining impacted soil to eliminate the exposure pathway and to prevent contaminants from further leaching into the ground water at the Site. To that end, Bay West advanced seven direct push borings in the vicinity of the Pettibone shed and the office building in 2004. Data collected during the 2001 RA implementation suggested soil in these areas may contain PCP and/or TCDD_{eq} concentrations above the corresponding ROD actions levels. All PCP concentrations were below the PCP action level of 40 ppm (mg/kg). One TCDD_{eq} concentration was above the TCDD_{eq} action level of 1 µg/kg.

The MPCA issued a policy memo on August 29, 2006, related to the disposal of TCDD_{eq} contaminated material, under specific circumstances. In this memo, the MPCA stated that soils containing TCDD_{eq} concentrations of 10 ppb or less may be considered for disposal in a Minnesota "Subtitle D" landfill. The 10 ppb value is based on the Universal Treatment Standard for dioxin (1 ppb) multiplied by a factor of 10, as allowed for soils in the U.S. EPA's Phase IV Land Disposal Restrictions (LDRs).

In 2007 Bay West collected approximately 70 surface soil samples during three separate mobilizations to the Site. These samples were collected to delineate the lateral extent of TCDD_{eq} concentration exceedances in three areas that were not included in the 2001 RAs. These three areas were identified by comparing the 2001 excavation limits with the 1993 data collected by Delta. During each sampling event, some samples were analyzed by the laboratory for TCDD_{eq} immediately upon receipt. Other samples were placed on hold, with analysis contingent upon the results from the samples that were analyzed immediately. Ultimately, a total of 51 samples were analyzed. As a result of this work, the lateral extent of TCDD_{eq} concentrations exceeding the ROD action level was delineated in all three areas. All TCDD_{eq} analytical results from the 2007 investigation were less than 10 ppb.

The ROD identified a listed hazardous waste, F032, in the soil at the Site. PCP and TCDD_{eq} are hazardous constituents of F032. Historically, 100 percent of the soil at the Site containing PCP and/or TCDD_{eq} at concentrations exceeding their corresponding clean-up criteria was considered to be a F032 hazardous waste. Based on the 2006 policy memo, and the results of the 2004 and 2007 investigations, the MPCA made a determination in 2008 that the remaining TCDD_{eq}-impacted surface soil at the Site did not contain or no longer contained F032, a listed hazardous waste. Based on this determination, an ESD was prepared to document a change in the final disposition of the remaining impacted surface soil on-Site.

Rather than consolidating and capping this surface soil as the contingency remedy specified in the ROD and invoked in the 1999 ESD, the surface soil would be disposed of in a “Subtitle D” Landfill. The MPCA and EPA signed the 2008 ESD on June 02 and June 06, 2008, respectively.

Excavation of surface soil in the one area where the TCDD_{eq} concentration exceeded 1 µg/kg in 2004 and the three areas investigated in 2007 was performed later in June 2008. The lateral extent of all four excavations were bounded by sampling locations where the TCDD_{eq} concentrations were less than the ROD action level of 1 µg/kg or an existing building on site. The four excavation areas (A, B, C, and D) are illustrated in Attachment 1, Figure 3.

The scope of work for the 2008 removal action was the excavation and disposal of the top six inches of surface soil from Excavation Areas A, B, C, and D. In a small portion of Area B, surface soil was excavated to a depth of approximately 18 inches, as analytical results from the 2007 investigation documented TCDD_{eq} concentrations exceeding 1 µg/kg at a depth of 1 foot below ground surface (Attachment 1, Figure 4). A total of 547 cubic yards was excavated from the four areas and transported off-site for disposal at a Subtitle D landfill in Buffalo, Minnesota. Confirmation samples (composite) were collected from the base of each excavation for TCDD_{eq} analyses, with the number of samples collected from each excavation based on the size of each excavation and MPCA Risk-Based Site Characterization and Sampling Guidance. A total of 29 composite samples were collected from the four excavations.

During the excavation of Area A, stained soil was observed in three locations after the top six inches of surface soil was removed (Attachment 1, Figure 4). The excavated surface soil from these three areas was stockpiled separate from other excavated soil. Two composite soil samples were collected from the stockpile for waste characterization testing. Analytical results for PCP were less than the ROD action level (40 µg/kg). Analytical results for TCDD_{eq} were less than 10 µg/kg. No other compounds were detected at a sufficient concentration to be of a regulatory concern. In July 2008, the MPCA made a determination that the stockpiled soil is non-hazardous. The stockpiled soil was disposed of at a Subtitle D Landfill in Buffalo, Minnesota, in 2008.

Composite samples from the three stained areas were also collected. After sampling, the stained areas were surveyed for residual staining and/or a geotextile fabric, and backfilled with clean fill. PCP and/or TCDD_{eq} concentrations in the stained areas exceeded the corresponding action level, as specified in the ROD.

As shown in Table 2, the PCP and TCDD_{eq} concentrations exceeded the ROD action levels of 40 mg/kg (PCP) and 1.0 µg/kg (TCDD_{eq}) in two of the three samples.

Table 2 – Stained Soil Analytical Results		
Sample Name	PCP Concentration (mg/kg)	TCDD_{eq} Concentration (µg/kg)
Grid 10	487	5.1
Grid 11	735	6.6
Grid 13	12.5	0.26

The TCDD_{eq} concentrations in 26 of the 29 excavation confirmation samples were less than 1 µg/kg (Attachment 1, Figure 5). Two of the three confirmation samples which had a TCDD_{eq} concentration exceeding 1 µg/kg were collected from grids where stained soil was observed (Grids 11 and 13). The

remaining confirmation sample which had a TCDD_{eq} concentration exceeding 1 µg/kg was collected from Grid #7, immediately north of Grid #11. As TCDD_{eq} concentrations for all confirmation samples collected from Areas B, C and D were less than 1 µg/kg, RAs in Areas B, C and D are considered complete.

During the surface soil delineation work performed in 2007, four samples used to delineate excavation limits during the 2008 surface soil removal action were analyzed after the hold time expired. These locations were re-sampled in 2008 during the surface soil removal action, with the expectation that a hold time exceedance would not appreciably change the TCDD_{eq} result. One of the four excavation boundary re-samples contained a TCDD_{eq} concentration above the ROD action level. The sample with the elevated TCDD_{eq} concentration was collected from Area A (Attachment 1, Figure 6).

Based on, the elevated TCDD_{eq} concentrations in confirmation samples collected from two of the three grid areas where stained soil was identified and one grid area adjacent to a grid with stained soil, the elevated PCP concentrations in two of the three stained soil composite samples, and the elevated TCDD_{eq} concentration in one excavation boundary location re-sampled in 2008, additional response actions are required for Area A. Sections VIII (Issues) and IX (Recommendations and Follow-Up Actions), provide a greater discussion of future activities that will be required to address the remaining issues associated with Area A.

Institutional Controls

ICs are required to ensure the protectiveness of the remedy. ICs are non-engineered instruments, such as administrative and legal controls that help minimize the potential for exposure to contamination and that protect the integrity of the remedy. ICs are required to assure the long-term protectiveness for any areas which do not allow for unlimited use or unrestricted exposure (UU/UE).

The ROD provides that “[a] well advisory, established by the Minnesota Department of Health in conjunction with the MPCA, will prevent the installation of water supply wells in the contaminated upper aquifer in the area of the Site. Deed restrictions pursuant to Minn. Stat. § 115B.16 will be filed and recorded with the register of deeds in Wadena County to prevent future use of the property which may result in a release of, or exposure to, existing contamination (i.e., excavation, farming, residential use etc.).”

Evaluation of Current Conditions, Existing ICs and Planning for Additional ICs, if Necessary

The site is zoned as Mixed (Agricultural/Residential/Forestry District). Based on its present use, the property is currently assessed as Agricultural – Non-homestead.

Cleanup goals for soil and groundwater allow for and were based on:

- unlimited use/unrestricted exposure (UU/UE)
- residential use
- commercial
- industrial use
- limited commercial or industrial (containment)

other (explain)

The PCP soil clean-up criterion (40 mg/kg) was developed using EPA's RAGS, with a 1.0E-5 risk level for a residential scenario. The TCDD_{eq} soil clean-up criterion (1 µg/kg) was developed based on calculations by the ASTDR and CDC for a residential area.

Site specific clean-up goals were not established for groundwater. Rather than achieving specified numeric clean-up criteria, the intent of groundwater RAOs included in the ROD is to prevent exposure to contaminated groundwater. Groundwater RAOs consist of minimizing or preventing the ingestion or off-site migration of groundwater containing a PCP concentration in excess of 1 ppb or a TCDD_{eq} concentration in excess of 0.03 ppt.

In accordance with the remedy outlined in the ROD and as an institutional control mechanism, a Declaration was recorded in the Office of County Recorder, Wadena County, Minnesota on November 1, 2007. (Attachment 2) The Declaration sets forth use restrictions for the legally defined areas containing the hazardous waste cell, contaminated soils and groundwater. The use restrictions include access restrictions to the fenced consolidation cap; a prohibition on disturbance of the fenced area; a prohibition on wells; a prohibition on excavation, farming, residential housing, temporary housing for children, play areas, schools, hospitals, nursing homes, day-care centers, pre-school centers, or other similar purposes; a prohibition on digging or excavation that exposes ground water; a prohibition on the construction of underground structures or basements; a prohibition on any activity or change that adversely affects the protectiveness of the remedy; and a prohibition on the removal of fill for off-site use as clean fill. In addition, the Declaration grants and conveys an easement to the MPCA rights and interest in the property to enforce the use restrictions, to enter the property, and to conduct environmental response actions. Attached to the Declaration are drawings that illustrate the extent of soil and groundwater contamination for the legally-defined restricted areas.

Table 3 below identifies those areas that do not support UU/UE and summarizes the institutional controls for those restricted areas.

Table 3. Institutional Controls Summary Table

Media, Engineered Controls & Areas that Do Not Support UU/UE @ Current Conditions	IC Objective	IC Instrument Implemented
All soil within the restricted area, including the fenced and capped consolidation area and historic soil contamination areas.	<ol style="list-style-type: none"> 1) No unauthorized personnel allowed inside the fence surrounding the capped soils and consolidated materials. No disturbance or alteration above, beneath or adjacent to the fenced area. 2) No well at any depth for any purpose without notice to and prior approval by MPCA. 3) No use that could result in a release or exposure to existing contamination. Strict prohibition on excavation, farming, residential housing, temporary housing for children, play areas, schools, hospitals, nursing homes, day-care centers, pre-school centers, or other similar purposes. 4) No digging or excavation that exposes groundwater. 5) No construction of underground structures or basements. 6) No activity or change that adversely affects the protectiveness of the Site. 7) No removal of soils from the Site for off-site use as clean fill or any other purpose. 	Declaration of Restrictions and Covenants, Easement, and Affidavit Concerning Real Property Contaminated with Hazardous Substances (filed on 11/01/2007) (Under review)
Ritari residence	Shallow groundwater usage is prohibited.	- Same as Above (Under Review)
Contaminated shallow groundwater underlying the Facility	Prohibit groundwater use	- Same as Above (Under Review)
Deep groundwater underlying the Facility	Prohibit groundwater use unless permitted	- Same as Above (Under Review)
Area not known to have contaminated soil or groundwater but which could become contaminated if a well or hole were constructed and pumped.	No wells at any depth for any purpose without notice to and prior approval of MPCA.	- Same as Above (Under Review)

Maps which depict the current conditions of the site and areas which do not allow for UU/UE will be developed as part of the IC Workplan discussed below.

Evaluation of Current Compliance: No Site uses which are inconsistent with the implemented ICs or the remedy's IC objectives have been noted. Access to the site is restricted by a fence. Based on inspections and interviews, neither MPCA nor U.S. EPA are aware of site or media uses which are inconsistent with the stated objectives of the ICs. Besides the operation of the remedy and O&M activities in the waste consolidation and impacted soils area, the only usage at the facility is an occasional visit by the family to the former Ritari home for recreational purposes. The Ritari residential home is outside the waste consolidation and impacted soil areas. The remedy appears to be functioning as intended.

Evaluation of Long Term Stewardship: Long term protectiveness at the site requires compliance with use restrictions to assure the remedy continues to function as intended. To assure proper maintenance and monitoring of effective ICs, long term stewardship procedures will be reviewed and a plan developed. The plan would include regular inspection of ICs at the site and annual certification to U.S. EPA that ICs are in place and effective. Additionally, use of a communications plan and use of one-call system should be explored for long term stewardship

Evaluation of Existing ICs and Follow-up Activities

At this time, initial IC evaluation activities have revealed that ICs are in-place. However, additional steps must be taken to evaluate the protectiveness of ICs. As mentioned above, the Declaration of Restrictions and Covenants, Easement, and Affidavit Concerning Real Property Contaminated with Hazardous Substances (Declaration) was confirmed to have been filed on November 1, 2007. This instrument, generically known as deed restrictions, needs further evaluation to assure it is effective. It is noted that the establishment of a well advisory by the MDH is one IC described in the ROD which has not been implemented. Given the filing of the Declaration which restricts well construction, the necessity of the well advisory will be examined as part of the Institutional Control Evaluation activities discussed below.

An Institutional Study consisting of specific IC Evaluation activities will be undertaken by the MPCA to fully explore whether the ICs are functioning as intended to ensure long-term protectiveness of the remedy. The purpose is to evaluate the effectiveness of the existing ICs and determine if additional work is needed to enhance the reliability of them.

The IC evaluation activities shall include:

- mapping of the physical description, based on current conditions, identifying: current boundaries of restricted areas associated with the site and areas which will not allow for UU/UE, (preferably in both paper and GIS format), and evaluation of the physical areas of the recorded deed restrictions to assure that all areas are covered by the ICs,
- evaluating the legal description(s) contained in the existing deed restrictions to ensure it covers the UU/UE areas;
- evaluating property title work (preferable a current title commitment) to confirm ownership and determine whether some interest, such as a mortgage or utility easement, might defeat the efficacy of the institutional controls;
- evaluating the effectiveness of the current Declaration to ensure it prevents the installation of groundwater wells in the vicinity of the site property;
- evaluating the necessity of the well advisory required by the ROD;

- evaluating the existing deed restrictions to determine if all objectives are included in an IC and that IC embodies the appropriate objective/restriction;
- evaluating the current deed restrictions to assure that it is enforceable by MPCA;
- and, as mentioned above, evaluating the long-term stewardship procedures at the Site.

Once the IC evaluation activities have been completed, an Institutional Control Plan will be developed by MPCA/EPA to incorporate the results of the IC evaluation activities and provide for corrective measures as needed to ensure long-term protectiveness of the remedy. The IC Plan will include a schedule and plan for additional IC evaluation activities, if needed, and steps for long-term stewardship to ensure that effective ICs are monitored and maintained.

System Operations/Operation and Maintenance

Ground Water Monitoring

During the five-year review period, ground water monitoring was performed in May and November 2004, May/June and November 2005, and June 2006 by collecting ground water samples from the Site-associated monitoring well network (Attachment 1, Figure 7). A discussion of ground water quality is provided as part of "Data Review" under Section VI of this Five-Year Review.

Consistent with historic practices, long-term ground water monitoring will continue to be performed at the Site through the collection of ground water samples from a network of twelve Site monitoring wells. Ground water samples will be collected annually, or at an alternate frequency determined appropriate by the MPCA, and submitted to a fixed-base laboratory for PCP analysis. Field sampling and laboratory analysis will be performed in accordance with the June 2003 revision of the ground water QAPP. The QAPP outlines key personnel, sampling procedures, sample analysis, data quality objectives, quality control measures, and data reporting requirements.

Site Operation and Maintenance

Other than the repair of burrows and cracks in the consolidated material cover, reseeding sparsely vegetated areas of the cap and installing a warning sign on the security fence surrounding the consolidated material (all performed in 2004), O&M efforts at the Site were minimal during the five-year review period. These efforts consisted primarily of inspection and general upkeep of the consolidation area. Consistent with historic practices, future O&M activities will include site inspections, likely performed simultaneously with ground water sampling. The inspections will consist of visual examination of the Site including the access road, Site identification sign, and the consolidation area including the gate, fencing, and cap. The cap has been, and will continue to be, examined for settlement, erosion, plants with tap roots, and burrow holes. Inspection observations and maintenance recommendations will be recorded in the field. Cap and fence maintenance will be performed as necessary to maintain cap integrity and limit access to the capped area.

O&M activities are expected to continue at the Site for an indefinite period of time which is quantified as thirty years for planning purposes. Site O&M activities, including ground water monitoring and Site inspections, have been on-going since the last Five-Year Inspection.

O&M Costs

Table 4 shows the O&M costs. The O&M costs associated with the Site include ground water monitoring/sampling and consolidation pile inspection and occasional maintenance. The O&M costs are estimated at approximately \$23,000 per year for the standard annual O&M activities of ground water

sampling/monitoring and a Site inspection, not including QAPP revisions. It is anticipated that additional maintenance activities required at the Site, such as fence maintenance or vegetation reseeded, will require an estimated additional \$5,000 expenditure once every five years.

Activity	Cost One Year	Cost 30 Years*
Soils O&M	\$ 5,000	\$ 76,863
Ground Water Monitoring	\$18,000	\$276,707
Total	\$23,000	\$353,570

*** - Present Value Cost Assuming 5% Annual Inflation
2008 pricing used for cost estimates
The cost of state staff oversight is not included.**

V. Progress since the last Review

This is the second five-year review for the Ritari Post and Pole Site. The first five-year review was completed and signed on September 29, 2003. Recommendations and follow-up actions from the 2003 five-year review are as shown in Table 5 below:

Table 5: Recommendations and Follow-up Actions Taken Since the Last Five-Year Review

Issue from 1st Five-Year Review	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Animal Burrows/ Cracks	Repair current burrows and cracks and revise the O&M repair task to ensure future burrows and cracks are identified during the Site visits and repaired.	MPCA	Fall 2003	Burrows and cracks repaired. O&M repair task write-up amended to include recording all observations of burrows and other damage to cap.	May 2004
Sparse Cover/ Minor Erosion	Re-seed areas of topsoil with sparse vegetation; rake over and repair areas with minor erosion as necessary	MPCA	2004	Areas were reseeded; eroded areas were repaired and reseeded.	May 2004
Absence of warning sign	Install a sign near gate on fence around cap to warn against unauthorized access or entry	MPCA	2004	“Danger – Keep Out” sign was installed.	May 2004

Table 5: Actions Taken Since the First Five-Year Review

Issue from 1st Five-Year Review	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Abandon unused wells and piezometers	If monitoring wells and piezometers are not on the current ground water monitoring list, abandon them if they will not be used again in the future	MPCA	2004	Wells 14U and 14L were abandoned by a licensed MDH well driller.	May 2008
Impacted Soil	Address remaining impacted soil to eliminate the exposure pathway and to prevent contaminants from further leaching into the ground water at the Site.	MPCA	2004	Dioxin-impacted surface soils from 4 areas of the Site were excavated and transported off-site for disposal. Additional stained soil was encountered below ground surface during the performance of the work.	June 2008
Lack of institutional controls for ground water	Implement institutional controls to prevent future ground water development and prevent exposure to contaminated soil at the Site.	MPCA	Fall 2003	Declaration of Restrictions and Covenants, Easement, and Affidavit Concerning Real Property Contaminated with Hazardous Substances filed with Wadena County.	Nov. 1, 2007

Other Actions Taken Since the Last Five-Year Review

In 2006, in addition to PCP and TCDD_{eq}, select monitoring wells were sampled for polynuclear aromatic hydrocarbons (PAHs), semi-volatile organic compounds (SVOCs) volatile organic compounds (VOCs) and diesel range organics. This work was performed to assess whether chemicals typically present in various PCP carrier solvents historically used at the site were present at concentrations that exceeded federal MCLs and/or health risk limits (HRLs) promulgated by the State of Minnesota. Results for this work can be summarized as follows:

- Of the nine monitoring wells and two residential wells analyzed for PAHs, only the sample from MW-16 contained PAHs above the laboratory reporting limit (LRL). A total of seven PAHs were detected in the MW-16 ground water sample. MCLs have not been established for any the seven PAHs. The MDH has established a HRL for three of the seven PAHs detected. The concentrations of all three PAHs were less than their corresponding HRL.
- Of the eight monitoring wells and two residential wells analyzed for VOCs, only the sample from MW-13U contained a VOC above the LRL. The only VOC detected at MW-13U was 1,2,4-trimethylbenzene, at a concentration of 1.9 µg/L. Neither a MCL nor a HRL have been established for this compound.
- Of the eight monitoring wells analyzed for SVOCs, the only SVOC detected above its corresponding LRL was PCP.
- DRO was detected in all eight monitoring wells where this test was performed. The DRO concentrations ranged from 110 µg/L to 1,100 µg/L. Neither a MCL nor a HRL has been established for DRO.

As the concentrations of all analytes detected were either below their corresponding MCL and/or HRL, or neither an MCL nor a HRL has been established for a detected analyte, the MPCA determined that future analysis for PAHs, VOCs, SVOCs and DRO was not warranted at the Site.

In 2007, the ground surface and top of casing elevations were re-surveyed for the monitoring well network. This work was performed as the accuracy of the historic survey data was suspect due to changed conditions from frost heaving or other factors. With current survey data, ground water flow directions can be assessed more accurately.

VI. Five-Year Review Process

EPA notified MPCA of the start of the five-year review in a letter dated December 29, 2007. MPCA notified its consultants of the start of the five-year review. The review team included:

- ◆ MPCA Site Project Manager: Steven Schoff
- ◆ MPCA Hydrogeologist: Dave Scheer
- ◆ MPCA Contractor: Bay West: Paul Walz
- ◆ MPCA Public Information Officer: CoriAhna Rude-Young
- ◆ EPA Remedial Project Manager: Karen Mason-Smith
- ◆ Minnesota Department of Health Human Health Risk Assessor: Ginny Yingling
- ◆ Ecological Risk Assessor: Steve Hennes
- ◆ MPCA Human Health Risk Assessor: Emily Hansen

A review schedule which addressed the following components of the five-year review was developed for October 2007 through September 2008:

- Site Inspection,
- Document review,
- Data Review,
- Community Involvement,
- Interviews,
- Five-Year Review Report Development and Review

Community Notification and Involvement

The community was notified via a Public Notice in the Wadena Pioneer Journal on June 26, 2008. A copy of the Public Notice is provided in Attachment 3. The MPCA did not receive any calls or written comments from the public in the 30-day time period following the Public Notice.

Document Review

Documents reviewed for this five-year review are referenced in Attachment 4. The applicable or relevant and appropriate requirements (ARARs) and to be considered (TBC) policies and guidance documents, as listed in the 1994 ROD were also reviewed.

Data Review

Ground Water

Ground water monitoring for PCP has been conducted at the Site since 1980. Historically, ground water samples have been collected from three residential water supply wells (Ritari, Ratcliff and Worm), as well as the Site associated monitoring wells. The Ritari home is no longer occupied. Its use is limited to periodic family gatherings and hunting trips. In the fall of 2004, the Ritari's winterized their well (i.e., took it out of service). The Ritari well was removed from the sampling list at that time.

During a September 18, 2008 meeting on-site with the property owner, it was determined that a considerable amount of remodeling work has occurred inside the residential home over the past couple years. In conjunction with the remodeling effort, the residential water supply well has been returned to service. As such, groundwater monitoring will resume at the residential well during the next annual groundwater monitoring event, which is scheduled to take place in October 2008.

Now that source area soils have been removed (i.e., placed in the consolidation pile and capped), long-term groundwater monitoring at the Site is performed to provide information about natural reduction of the groundwater contaminant concentrations. Ground water monitoring data for the last five years for PCP and TCDD_{eq} was reviewed for the monitoring well network and the three residential wells historically sampled as part of the ground water monitoring program. Historical data for the wells was also reviewed, as available. While RAOs do not include defined ground water clean-up criteria for the site, the RAOs do require that the MCLs for PCP and TCDD_{eq} not be exceeded at the property boundary. While not an RAO for ground water on-site, MCLs are used for comparison purposes for ground water beneath the Site. The MCLs for PCP and TCDD_{eq} are 1.0 µg/L and 30 pg/L (or .030 ng/L), respectively.

Table 6 shows analytical results for ground water samples collected in 2005 and 2006 (the most recent ground water sampling event). In 2006, PCP was detected at a concentration above the LRL in eight of the seventeen monitoring wells sampled for this analyte. The PCPs results were above the MCL in all eight samples. With respect to the wells installed along the Ritari's eastern property line and near the southwest corner of the Ratcliff property, none of the samples collected from these wells contained a PCP concentration above the LRL. Similarly, none of the samples collected from the residential wells contained a PCP concentration above the LRL. PCP concentrations detected in 2006 are illustrated in Figures 8 through 11 (Attachment 1).

A review historical PCP data suggests the PCP concentration is increasing at some locations proximal to the consolidated and capped materials. From May 2004 through November 2005, the PCP concentrations were below or near the LRLs at monitoring wells MW-10U, MW-13U, MW-15 and MW-17, all located within the upper aquifer. During the June 2006 ground water monitoring event, the PCP concentrations at these four locations were 42.9 µg/L, 497 µg/L, 150 µg/L and 315 µg/L. The PCP concentrations in MW-10L, located in the lower aquifer, were below or near the LRLs from May 2004 through May/June 2005. In November 2005 and June 2006, the PCP concentration increased to 34.6 µg/L and 167 µg/L, respectively. Conversely, the PCP concentrations in upper aquifer monitoring wells MW-14 and MW-16, and lower aquifer monitoring well MW-13L, have declined by more than 50% between the May/June 2005 and the June 2006 ground water monitoring events.

TCDD_{eq} concentrations generally exhibit a declining trend. During the most recent ground water monitoring event (June 2006), eight monitoring wells and two residential wells were sampled for TCDD_{eq}. Five of the samples contained a TCDD_{eq} concentration above the LRL. However, all five detections were below the MCL.

Based on a review of the historical ground water analytical data, in 2007, the MPCA prepared a memorandum of findings, conclusions and recommendations associated with ground water monitoring at the Site. Key recommendations for the ground water monitoring program include:

- Sampling twelve monitoring wells for PCP on an annual basis.
- Removing the Ratcliff well and Worm well from the ground water monitoring program. Ground water does not flow towards the Worm well. Monitoring wells MW-16U, MW-16L and MW-16D are located up-gradient of the Ratcliff well. Results from these wells will provide adequate preemptive notice that contamination from the Ritari site may impact the Ratcliff well.
- Revising the QAPP to be consistent with changes to the ground water sampling program that have occurred since the most recent version of the QAPP went into effect (Revision #1, June 2003).

Parameter	PCP (µg/L)			TCDD-Eq. (µg/L)	
	MCL	1.0			30
Sample Date	May/June 2005	Nov. 2005	June 2006	May/June 2005	June 2006
Ratcliff Well	<0.51	<0.5	<0.52	1.0	0.0043
Worm Well	<0.51	NS	<0.52	NS	<0.27 ^{BU}
Ritari Well	NS	NS	NS	NS	NS
MW-10U	<0.53	<0.51	42.9	0.58	<0.35 ^{BU}
MW-10L	0.54	34.6	167	0.00	<0.32 ^{BU}
MW-11U	NS	<0.5	<0.54	NS	NS
MW-11L	NS	<0.51	<0.52	NS	NS
MW-12U	<0.50	<0.52	<0.52	8.3	NS
MW-13U	<0.51	2.2^{BJ}	497	0.21	<0.91 ^{BU}
MW-13L (& Dup.)	195(260)	282(267)	63(63.6)	0.00(0.0027)	<0.63 ^{BU} (<0.22) ^{BU}
MW-14	644	702	353	24	14
MW-15	<0.52	0.99 ^{BJ}	150	0.86	14
MW-15U	<0.53	<0.51	<0.52	0.17	NS
MW-15L	<0.53	<0.51	<0.51	0.019	NS
MW-15D	<0.52	<0.51	<0.5	0.049	NS
MW-16U	<0.53	<0.51	<0.52	0.97	NS
MW-16L	<0.52	<0.5	<0.51	0.55	NS
MW-16D	<0.52	<0.51	<0.5	0.00	NS
MW-16 (& Dup.)	663(559)	1320(1100)	300^J(219^J)	100(91)	17(15)
MW-17	<0.52	<0.51	315	3.4	4.3

Note – Bold results indicate exceedance of MCL

NS = Not Sampled

J = Estimated

BJ = Estimated concentration due field blank contamination

BU = Estimated non-detect due to field blank contamination

Site Inspection

The Site inspection was conducted on October 30, 2007 by the MPCA, EPA, and MPCA's Contractor, Bay West. The purpose of the inspection was to assess the protectiveness of the remedy, including the presence of fencing to restrict access, the integrity of the cap and the condition of Site monitoring wells.

The Site Inspection Checklist and photographs taken during the Site visit are provided in Attachment 5.

Interviews

The MPCA is in regular communication with the current property owner regarding the Site status and activities planned. As such, a formal interview with the property owner was not conducted. Due to the low population density proximal the Site and lack of community interest, no other interviews were conducted as part of the review.

VII. Technical Assessment

This section focuses on answering the following three key questions:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Question A: Is the remedy functioning as intended by the decision documents?

YES

Based on a review of Site-related documents, Applicable or Relevant and Appropriate Requirements (ARARs), risk assumptions and the results of the Site Inspection, it appears the remedy is functioning as intended by the ROD, as modified by the two ESDs. Soil RAOs were established in the ROD to minimize or prevent the ingestion, direct contact and/or inhalation of soil that would cause adverse health affects. The ROD also stipulated risk-based clean-up criteria for PCP and TCDD_{eq} which are appropriate for a residential area. The consolidation and capping of contaminated soil, wood chips, construction debris and contaminated equipment in 2001 addressed potential exposure pathways to most of the un-saturated contaminated soil and other contaminated materials on-Site. Routine inspection and maintenance of the cap and associated security fence assure that the potential for exposure to the consolidated materials is minimized. The excavation and off-site disposal of additional surface soil in 2008 removed the majority of the remaining contaminated soil that wasn't included in the 2001 field effort.

Ground water RAOs were established to prevent the ingestion or off-site migration of ground water containing PCP and/or TCDD_{eq} concentrations above their corresponding MCLs. Response actions identified in the ROD to achieve ground water RAOs included abandonment of the existing Ritari well, installation of a new on-site water well in a deeper aquifer, installation of additional down-gradient monitoring wells, and ground water monitoring. All ground water response actions have been implemented. The Declaration filed with Wadena County prevents water supply wells from being installed on-site and prohibits use of the property in a manner which may result in exposure to contaminated materials that remain on-site. Ground water monitoring is an effective tool to ensure PCP and TCDD_{eq} concentrations do not exceed their corresponding MCLs at the property boundary.

ICs have been put in place. Currently, there is no evidence of any Site or groundwater uses which are inconsistent with the objectives of the ICs. However, to make sure that the ICs are effective in the long

term, specific IC evaluation activities will be conducted. Also, compliance with ICs is required to assure that the remedy continues to function as intended. Compliance with effective ICs will be ensured through long term stewardship by maintaining and monitoring effective ICs as well as maintaining the site remedy components.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

YES

The exposure assumptions used to develop the soil and ground water RAOs are still valid as land use at the Site has not changed and is not likely to change in the foreseeable future. In 2005, the World Health Organization (WHO) revised the toxicity equivalent factors (TEFs) used to convert individual dioxin and furan concentrations into TCDD_{eq} concentrations. The previous (i.e., 1998) and current (i.e., 2005) WHO TEFs are provided in Table 7. Of the 17 dioxin and furan compounds included in a TCDD_{eq} calculation, two TEFs increased (more toxic) and two TEFs decreased (less toxic). For these four compounds, the sum of the 1998 TEFs was 0.5502. The sum of the 2005 TEFs was 0.3306, or a decrease of 0.2916. As a group, the four compounds can generally be considered to be slightly less toxic than they were at the time the ROD was developed. It is noted that this statement cannot be universally applied. For example, if the only compounds detected in an individual sample are the compounds with higher TEFs, the sample would be considered more toxic than in 1998. However, as the contribution to the TCDD_{eq} calculation for the two compounds with reduced TEFs is orders of magnitude larger than the two compounds with increased TEFs, a TCDD_{eq} concentration calculated with the 2005 TEFs will almost always be less than or equal to TCDD_{eq} concentration calculated with the 1998 TEFs. As such, the excavation work completed in 2008 was performed to a slightly higher standard than the excavation work completed in 2001.

Table 7: World Health Organization Toxicity Equivalent Factors - 1998 and 2005

Compound	WHO 1998 TEF	WHO 2005 TEF	Change from 1998*
chlorinated dibenzo-p-dioxins			
2,3,7,8-TCDD	1	1	
1,2,3,7,8-PeCDD	1	1	
1,2,3,4,7,8-HxCDD	0.1	0.1	
1,2,3,6,7,8-HxCDD	0.1	0.1	
1,2,3,7,8,9-HxCDD	0.1	0.1	
1,2,3,4,6,7,8-HpCDD	0.01	0.01	
OCDD	0.0001	0.0003	0.0002
chlorinated dibenzofurans			
2,3,7,8-TCDF	0.1	0.1	
1,2,3,7,8-PeCDF	0.05	0.03	-0.02
2,3,4,7,8-PeCDF	0.5	0.3	-0.2
1,2,3,4,7,8-HxCDF	0.1	0.1	
1,2,3,6,7,8-HxCDF	0.1	0.1	
1,2,3,7,8,9-HxCDF	0.1	0.1	
2,3,4,6,7,8-HxCDF	0.1	0.1	
1,2,3,4,6,7,8-HpCDF	0.01	0.01	
1,2,3,4,7,8,9-HpCDF	0.01	0.01	
OCDF	0.0001	0.0003	0.0002

* A negative value indicates it is considered less toxic than originally thought.

The soil RAOs of minimizing or preventing the ingestion, direct contact and/or inhalation of soil that would cause adverse health effects and the ground water RAOs of preventing the ingestion or off-site migration of ground water containing PCP and/or TCDD_{eq} concentrations above their corresponding MCLs are still valid for the site. The risk based soil clean-up criteria established for the site are still valid, as is the use of MCLs as the standard to be maintained at the property boundary.

ICs have been put in place. No Site uses which are inconsistent with the implemented ICs or the remedy's IC objectives were noted during the Site inspection. However, to make sure the ICs are effective in the long term, specific IC evaluation activities will be conducted

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

NO

MPCA is not aware of any new information that could call into question the protectiveness of the remedy.

Technical Assessment Summary

Soil and ground water were evaluated for changes in chemical-specific, action-specific and location-specific ARARs and other Site physical characteristics. All known applicable files were reviewed. A Site inspection, which included the MPCA's O&M Contractor was conducted. At the Site inspection, no changes from the as-built Site close-out reports to the Site's current condition were noted.

To answer Question A for the Soil and ground water, MPCA staff evaluated the RAs and RAOs. Other than a limited amount of soil in one of the four areas where surface soil was removed in 2008, the soil remedy is essentially complete. Provided the cap and fence continue to be maintained in a manner consistent with historical practices, the potential for exposure to soil, contaminated materials and construction debris consolidated on-site in 2001 is minimal. The potential for exposure to surface soil excavated in 2008 is not an issue, as this soil has been disposed of at a Subtitle D landfill.

To answer Question A for ground water, MPCA staff evaluated all current ground water monitoring well data. Other than documenting MCLs are not exceeded at the property boundary through continued ground water monitoring, and verifying the requirements of the Declaration is being adhered to, the ground water remedy is complete.

To Answer Question B for soil and ground water, MPCA staff assembled the pertinent new standards. The only change noted was a decrease in the toxicity of some of the dioxins and furans included in the TCDD_{eq} calculation.

With regard to Question C, there is no new information which calls into question the protectiveness of the remedy.

VIII. Issues

Appropriate RAs must be selected and implemented for the three locations/grid areas in Area A where stained soil was encountered during surface soil excavation and disposal work was performed in 2008. RAs must also be selected and implemented for the one additional location in Area A where the post-excavation confirmation sample results suggest the TCDD_{eq} concentration is still above the ROD action level. RAs must be consistent with the ROD, and the 1999 and 2008 ESDs.

During surface soil investigation work performed in 2007, four soil samples used to determine excavation boundaries were analyzed beyond the hold time allowed by the analytical method. The four locations were re-sampled in 2008, in conjunction with the performance of surface soil excavation and disposal work. One of the four samples contained a TCDD_{eq} concentration greater than the ROD action level. The cause for this discrepancy needs to be investigated and appropriate RAs selected and implemented.

Ground water contour maps developed from recent ground water gauging events suggest there is a northeast component to ground water flow in the upper aquifer (Attachment 1, Figure 12 and 13). All monitoring wells located on the Ritari property boundary are located east and southeast of the southeast corner of the consolidated and capped soil, construction debris and contaminated equipment. The existing monitoring well network may not be sufficient to assess the possible off-site migration of PCP that is detected in monitoring wells MW10U, MW-10L, MW-13U, MW-13L and MW-17. Ground water flow directions and analytical results must be closely monitored for the possible off-site migration of PCP, at a concentration greater than its MCL, north of the existing MW-16 U, MW-16L and MW-16D well nest. Additional monitoring wells may need to be installed to fully assess the potential for off-site migration to occur in this direction.

In 2007, the MPCA prepared a memorandum that recommended specific changes to the Ritari ground water monitoring program. Other changes to the ground water monitoring program have occurred since June 2003, the date of the most recent QAPP revision. Some of the changes are also inconsistent with the Site's O&M Plan (June 2003). Both the QAPP and the Site O&M Plan need to be updated to reflect current conditions.

The most recent ground water monitoring event was completed in 2006. As such, the time period between monitoring events is greater than stated in the MPCA's 2007 memorandum and the QAPP/Site O&M Plan.

IX. Recommendations and Follow-up Actions

Recommendations and follow-up-actions to site issues are summarized below in Table 8.

Table 8: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Over-sight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
1. Three locations of stained soil in Area A were encountered during the surface soil removal work performed in 2008. These areas were covered with a geotextile fabric and then backfilled with clean soil. Analytical results from these locations revealed pentachlorophenol (PCP) and/or TCDD _{eq} concentrations that exceeded the action levels specified in the ROD.	Complete a mini-feasibility study/options evaluation to determine the most appropriate remedy for the locations in Area A where stained soil was encountered. Implement the appropriate option(s).	MPCA	EPA	September 2009	No	Yes
2. Besides the three locations described in Issue #1, analytical results from confirmation samples collected from the bottom of Area A identified one additional location where the post-excavation TCDD _{eq} concentration remained above the ROD action level.	Include the Area A grid locations with elevated TCDD _{eq} concentration in the mini-feasibility study/options evaluation described in Recommendation #2.	MPCA	EPA	March 2009	No	Yes

Issue	Recommendations and Follow-up Actions	Party Responsible	Over-sight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
During the surface soil delineation work performed in 2007, four samples used to delineate excavation limits during the 2008 surface soil removal action were analyzed after the hold time expired. These locations were re-sampled in 2008 during the surface soil removal action. One of the four re-samples contained a TCDD _{eq} concentration above the ROD action level.	The discrepancy for the one Area A excavation limit sample location that had a TCDD _{eq} concentration below the ROD action level in the 2007 sample, but higher than the ROD action level in the 2008 sample should be resolved. The discrepancy may be resolved through additional sampling and/or inclusion in the mini-feasibility study/options evaluations described previously.	MPCA	EPA	March 2009	No	Yes
4. Ground water contour maps developed from recent ground water elevation measurements suggest a northeast component to ground water flow in the upper aquifer. There are no monitoring wells along the property boundary which are located northeast of the soil and other items which were consolidated and capped in 2001.	Continue to evaluate whether the current monitoring well network is sufficient for assessing the possible off-site migration of PCP at concentrations exceeding the MCL in the upper aquifer. Install additional monitoring wells, if appropriate.	MPCA	EPA	December 2010	No	Yes
5. In 2007 the MPCA issued a Memorandum which modifies the ground water monitoring program for the Site. These modifications are not reflected in the 2003 QAPP or 2003 Site O&M Plan.	Update the 2003 QAPP and the 2003 Site O&M Plan to be consistent with changes made to ground water monitoring since these documents were written.	MPCA	EPA	March 2009	No	Yes

Issue	Recommendations and Follow-up Actions	Party Responsible	Over-sight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
6. The last ground water monitoring event at the Site was performed in 2006 or two years ago. This is a greater time period than recommended in the MPCA 2007 Memo (annually) or the QAPP and Site O&M Plan (semi-annually).	Perform future ground water monitoring events at the frequency specified in the governing documents for this activity.	MPCA	EPA	October 2008	No	Yes
7 Assess effectiveness of institutional controls and long-term stewardship procedures.	Institutional Control Evaluation activities will be conducted. (The IC evaluation activities are detailed in this report)	MPCA	EPA	March 2009	No	Yes
8 Ensure effectiveness of ICs and plan for long-term stewardship of the Site to ensure effective ICs are maintained, monitored and enforced.	An Institutional Control Plan will be developed. The Plan will incorporate the results of the evaluation activities and plan for additional IC activities as needed including planning for long-term stewardship.	MPCA/EPA	EPA	September 2009	No	Yes

X. Protectiveness Statement

The remedy is currently functioning as intended and is protective of human health and the environment in the short-term. The soil response actions completed in 2001 and 2008 eliminated exposure pathways to the majority of the soil exceeding ROD action levels. The site remedy appears to be functioning as designed. Exposure assumptions, toxicity data, and RAOs used at the time of remedy selection are still valid. Site inspections and cap and fence maintenance ensure the cap integrity is maintained and access to the cap is restricted. The potential for exposure to the limited amount of soil remaining on-site that exceeds ROD action levels does not pose an immediate threat because the areas where this soil is located are relatively small, covered by 6-inches of top soil, not regularly used, and have limited access. With respect to groundwater, the Ritari well has been replaced with a deep-aquifer well and long-term groundwater monitoring has been implemented for the Site. Ground water conditions are such that little or no migration is expected. The implementation of institutional controls has prevented the exposure to,

or ingestion of, contaminated soils and groundwater to date. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure long-term protectiveness: After an evaluation, locations in Area A where stained soil was encountered and the one location in Area A where post-surface soil excavation confirmation sampling indicates the TCDD_{eq} concentration remains above the ROD action level will be addressed. The discrepancy for the one Area A excavation limit sample location that had a TCDD_{eq} concentration below the ROD action level in the 2007 sample, but higher than the ROD action level in the 2008 sample will be resolved. The current monitoring well network will be evaluated for sufficiency in assessing the possible off-site migration of PCP at concentrations exceeding the MCL in the upper aquifer. Additional monitoring wells will be installed, if appropriate. The 2003 QAPP and the 2003 Site O&M Plan will be updated to be consistent with changes made to ground water monitoring since the documents were written. Future ground water monitoring events will be performed at the frequency specified in the governing documents. Long term protectiveness of the remedy also requires compliance with effective ICs. Compliance with effective ICs will be ensured through long term stewardship by maintaining, monitoring and enforcing effective ICs as well as maintaining the site remedy components. An Institutional Control Evaluation will be prepared to evaluate the adequacy of the institutional controls in the long term, which include an evaluation of any encumbrances on the title and whether all identified areas of soils and groundwater contamination are covered. Additionally, an Institutional Control Plan should be developed that incorporates the Institutional Control Evaluation, and if necessary, implement corrective measures.

XI. Next Review

The next five-year review for the Ritari Post and Pole Superfund Site is required five years from the signature date of this review.

Attachments for this Five-Year Review are available by placing a request using the Customized CERCLIS/RODS Report Order Form.

<http://www.epa.gov/superfund/sites/phonefax/rods.htm>