Five-Year Review Report

Fourth Five-Year Review Report
for
Libby Ground Water Contamination Superfund Site
City of Libby
Lincoln County, Montana

March, 2010

PREPARED BY

United States Environmental Protection Agency
Region 8

Denver, Colorado

Approved by: Date:

Eddie A. Sierra — 03/29/2010

Eddie A. Sierra
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USEPA, Region 8, Office of Ecosystems Protection and Remediation

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Acronyms and Abbreviations

AEI	Arrowhead Engineering, Inc.
AOC	Administrative Order on Consent
ARARs	Applicable or Relevant and Appropriate Requirements
ARM	Administrative Rules of the State of Montana
BaP	Benzo-a-pyrene
BIS	Boundary Injection System
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGWUA	Controlled Ground Water Use Area
ELF	Expanded Land Farm
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Difference
ft	feet
HI	Hazard Index
IP	International Paper
LTU	Land Treatment Unit
MCA	Montana Code Annotated
MCL	Maximum Contaminant Level
MDEQ	Montana Department of Environmental Quality
Mg/Kg	milligram per kilogram
mg/L	milligram per liter
msl	mean sea level
NAPL	non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PCP	pentachlorophenol
ppb	parts per billion
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RPFs	Relative Potency Factors
RPM	Remedial Project Manager
RSL	Regional Screening Level
SAETS	Source Area Extraction and Treatment System
SARA	Superfund Amendments and Reauthorization Act
SLC	Stimson Lumber Company
TCA	Trichloroethane
TEF	Toxicity Equivalence Factor

TI	Technical Impracticability
µg/L	micrograms per liter
USC	United States Code
USGS	United States Geologic Survey
VOC	Volatile Organic Compound
WCC	Woodward Clyde Corporation

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name: Libby Ground Water Contamination

EPA ID: MTD980502736

Region: EPA Region 8	**State:** Montana	**City/County:** Libby/Lincoln

SITE STATUS

NPL Status: x Final Deleted Other (specify):

Remediation status (choose all that apply): Under Construction x Operating Complete

Multiple OUs? x Yes No	**Construction completion date:** 09/20/93

Has site been put into reuse? Yes x No

REVIEW STATUS

Reviewing agency: x EPA State Tribe Other Federal Agency:

Author Name: Kathryn Hernandez

Author Title: Remedial Project Manager	**Author Affiliation:** U.S. EPA Region 8

Review period: October 2008 through December 2009

Date(s) of site inspection: June 25-26, 2009

Type of review:
x Statutory
____ Policy
Post-SARA _____
Non-NPL Remedial Action Site
Regional Discretion
Pre-SARA
NPL-Removal only
NPL State/Tribe-lead
_____

Review number: 1 (first) 2 (second) 3 (third) x Other (specify): 4th

Triggering action:
Actual RA Onsite Construction
Construction Completion
Other (specify):
Actual RA Start
Recommendation of Previous
x Five-Year Review Report

Triggering action date: 03/31/2005

Due date (five years after triggering action date): 03/31/2010

Issues: The remedy for Operable Unit (OU) 1 (institutional controls) is partially in effect, although full Site institutional controls for prevention of ground water use are not fully in place. Operation and maintenance activities associated with the OU2 remedy are ongoing at the Site. Based on the data review, Site inspection,

Five-Year Review Summary Form

interviews, and technical assessment, the following issues have been identified.

1. The City ordinance is not fully prohibiting the installation of new water wells or use of existing wells. During a recent drought, anecdotal evidence indicated that residents were installing wells, or putting into use existing wells that had not been closed.

2. The City ordinance does not include the Stimson lumber mill property, which lies to the east of the corporate limits of Libby and is currently being considered for redevelopment. The Stimson property also overlies a portion of the ground water pentachlorophenol (PCP) plume. The designation of a Controlled Ground Water use Area (CGWUA) may correct this issue, since it will identify the area where the plume has impacted upper aquifer ground water.

3. The toxicity factors and exposure assumptions used to calculate risk-based cleanup levels for soil have changed. The dermal exposure pathway was not considered in the 1997 risk-based soil cleanup levels. The soil remedy will need to be evaluated to determine if the revised cleanup levels are attainable.

4. The toxicity factors and exposure assumptions used to calculate risk-based cleanup levels for ground water have changed. The age-adjusted scenario for the ingestion of water by a child was not included in the 1997 Explanation of Significant Differences (ESD) cleanup levels for ground water. When risk-based cleanup levels for the non-carcinogenic polycyclic aromatic hydrocarbons (PAHs) are recalculated using an age-adjusted residential exposure scenario, they are lower than the cleanup levels in the 1997 ESD. For the carcinogenic PAHs that do not have Maximum Contaminant Levels (MCLs), some recalculated risk-based cleanup levels are higher and some are lower than the 1997 ESD cleanup levels depending on the specific changes to the toxicity factors.

5. The MCL for arsenic has changed from 50 micrograms per liter (µg/L) to 10 µg/L. While the arsenic contamination in upper aquifer ground water is not to be as widespread as the PAH and PCP contamination, the data set is more limited and warrants additional investigation.

6. The Montana Department of Environmental Quality (MDEQ) has issued Numeric Water Quality Standards that are, in some cases, more stringent than the risk-based cleanup levels for groundwater (MDEQ, 2008).

7. Due to the presence of mobile and residual non-aqueous phase liquid (NAPL) in the source area that will continue to act as a long-term contaminant source, and the lateral extent of the dissolved ground water contamination, certain areas of contaminated ground water cannot effectively be remediated by the current pump and treat remedy.

8. The current extent of the ground water monitoring well network is not adequate to monitor the extent of NAPL in the source area and the upper aquifer ground water plume to ensure public health and safety, and warrants further evaluation.

9. Vapor intrusion is a newly identified pathway. Ethylbenzene and naphthalene were detected at concentrations exceeding vapor intrusion screening criteria at 4 locations within the Stimson lumber mill property.

10. The potential presence of 1,4-dioxane in ground water at the Site is a data gap. Although there is no MCL for 1,4-dioxane, the health-based benchmark is 6.2 µg/L.

Recommendations and Follow-up Actions:

1. Initiate public awareness program(s) to prevent residents from using existing wells for irrigation or installing new wells.

Five-Year Review Summary Form

2. Expand City ordinance should be expanded to include the Stimson lumber mill property and potentially limited to the CGWUA.
3. Re-evaluate the soil remedy in light of changes to toxicity factors and exposure assumptions used to calculate risk-based cleanup levels for soil. Issue new soil cleanup levels in an ESD to the Record of Decision (ROD) for OU2, if appropriate.
4. Re-evaluate groundwater cleanup levels in light of changes to toxicity factors and exposure assumptions used to calculate risk-based cleanup levels. Issue new cleanup levels in an ESD to the ROD for OU2, if appropriate.
5. Collect and analyze additional ground water samples for arsenic to determine if the ground water remedy is protective.
6. MDEQ's Numeric Water Quality Standards should be evaluated relative to calculated risk-based levels. If the more stringent values are not warranted, issue an Applicable or Relevant and Appropriate Requirement (ARAR) waiver through an ESD for OU2, if appropriate.
7. Perform additional source characterization and evaluate remedial technologies for the upper aquifer.
8. Install additional wells to better delineate the NAPL source area and extent of the dissolved contaminant plume.
9. Perform additional sampling and analysis in the source area to evaluate the vapor intrusion pathway.
10. The analysis for 1,4-dioxane should be included in future ground water sampling events, particularly for samples collected in wells located in the NAPL source area.

Protectiveness Statement(s):
The remedy for OU1 is not protective. The existing institutional control, a City ordinance, does not include a portion of the upper aquifer PCP plume that is located beneath the Stimson lumber mill property (east of the City boundary). In addition, during a recent drought, anecdotal information indicated that some residents were installing new wells and/or using wells that had not been closed as part of the Buy Water Plan. Institutional controls preventing contaminated ground water use were meant to be temporary, but given the long-term timeframe for ground water cleanup, are important.

The remedy for OU2 is not protective. ARARs are not being met. It is uncertain whether the soil remedy can meet the revised risk-based cleanup levels. Risk-based cleanup levels for ground water have changed due to changes in toxicity factors and exposure assumptions. The concentrations of arsenic in ground water warrant further evaluation since the MCL has decreased from 50 to 10 µg/L. MDEQ numeric standards for water quality are, in many cases, more stringent than the risk-based cleanup levels for groundwater. The availability of new technologies for source zone characterization and remediation warrant further evaluation for the Site since it appears that the SAETS may not be adequately remediating the source zone and PCP plume. The problem is compounded by the current lack of comprehensive institutional controls. The vapor intrusion pathway and potential presence of 1,4-dioxane in ground water have been identified as issues, and warrant additional data collection and evaluation.

The remedial actions at OU1 and OU2 are not protective therefore the Site is not protective of human health and the environment. The action items identified above and below are necessary to ensure protectiveness.

Other Comments: The Site is generally well maintained and operated.

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1.0 Introduction

The United States Environmental Protection Agency (EPA) Region 8 has conducted a five-year review of the remedial actions implemented at the Libby Ground Water Contamination Superfund Site (hereafter referred to as the Site) located in and near the City of Libby, Lincoln County, Montana. The Site was originally part of a lumber and plywood mill complex where timbers and poles were treated primarily with creosote and pentachlorophenol. Soils and ground water are known to have been affected by the contaminants that include PAHs, PCP, dioxins, furans and arsenic.

The purpose of a five-year review is to determine whether the remedy at a site remains protective of human health and the environment and to document the methods, findings, and conclusions of the five-year review in a five-year review report. Five-year review reports identify issues found during the review, if any, and recommendations to address them. This is the fourth five-year review for the Site, and covers the period from October 2008 through March 2010. This Fourth Five-Year Review Report documents the results of the review for the Site, which was conducted in general accordance with EPA guidance on five-year reviews (Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-03B-P, *Comprehensive Five-Year Review Guidance* (EPA, 2001)).

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended, 42 USC §9601, *et seq*. and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) §300, *et seq*., call for five-year reviews of certain CERCLA remedial actions. This review was conducted in compliance with CERCLA and, to the extent practicable, the NCP. The statutory requirement to conduct a five-year review was added to CERCLA as part of the Superfund Amendments and Reauthorization Act of 1986 (SARA), P.L. 99-499. EPA classifies each five-year review as either "statutory" or "policy" depending on whether it is being required by statute or is being conducted as a matter of policy.

As specified by CERCLA and the NCP, statutory reviews are required for sites where, after remedial actions are complete, hazardous substances, pollutants, or contaminants will remain onsite at levels that will not allow for unrestricted use or unrestricted exposure. Statutory reviews are required at such sites if the ROD was signed after the effective date of SARA. CERCLA §121(c), as amended, 42 USC §9621(c), 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.*

The implementing provisions of the NCP, as set forth in the CFR, state at 40 CFR 300.430(f)(4)(ii):

> 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.

Five-year reviews of the remedial actions performed at this Site are required by statute because hazardous substances, pollutants, or contaminants remain onsite above levels that allow for unrestricted use and unlimited exposure. The previous three five-year reviews were completed in 1995, 2000, and 2005; the third and most-recent five-year review was signed by EPA on March 31, 2005.

2.0 Site Chronology

A chronology of significant events and dates for the Site is included in **Table 2-1**, below.

TABLE 2-1
Site Chronology – Libby Ground Water Superfund Site

Date	Event
1946	J. Neils Lumber Company begins lumber yard and wood treating operations
1969	Wood treating operations discontinued by then owner St. Regis
1979	Initial discovery of contamination in nearby residential drinking water well
September 8, 1983	Site added to the National Priorities List (NPL)
September 26, 1986	OU1 ROD signature
October 1, 1986	OU1 Remedial Design completion
November 1, 1986	OU1 Remedial Action completion
December 30, 1988	OU2 ROD signature
March 27, 1989	OU2 Remedial Design start
September 26, 1991	OU2 Remedial Design completion
October, 1989	Consent Decree approval by Court
October 18, 1989	OU2 Remedial Action start
September, 1993	ESD issued for OU2 that includes ARAR ground water standards for PCP, naphthalene, chrysene and benzo(a)anthracene in lower aquifer;
September 20, 1993	Site is Construction Complete
November 1, 1993	Champion sells mill property to Stimson Lumber Co.
January 24, 1995	First Five-year Review Report signed by EPA
January, 1997	ESD issued for OU2; ground water remediation levels are modified
1998	Land Treatment Unit (LTU) expansion
1999	Intermediate Injection System shut down based on then-current Site review
January 11, 1999	Technical Impracticability (TI) Evaluation Report for upper aquifer submitted to EPA
March, 1999	TI Evaluation Report approved
January, 2000	Coalescing Separator added to OU2 remedy (SAETS)
March, 2000	Second Five-year Review Report signed by EPA

Date	Event
June 20, 2000	International Paper merges with Champion International and assumes responsibility for operations and maintenance of remedial systems
2003	Stimson Lumber Company sells mill property to Lincoln County Port Authority
March, 2003	Boundary Injection System of OU2 remedy discontinued because believed to be unnecessary to SAETS performance
2005	Ground Water Monitoring Plan Updated to incorporate current understanding of extent of upper and lower aquifer plumes
March, 2005	Third Five-year Review Report signed by EPA
May, 2009	TI waiver of ARAR ground water standards for upper aquifer denied by EPA
August, 2009	Technology Evaluation Report for the Upper Aquifer prepared

3.0 Background

This section describes the physical setting of the Site, including a description of the land use, resource use, and environmental setting. This section also describes the history of contamination associated with the Site, the initial response actions taken at the Site, and the basis for each of the initial response actions. Remedial actions performed at the Site subsequent to the initial response actions are described in **Section 4**.

3.1 Physical Characteristics

The Site is located in northwestern Montana on the eastern edge of the City of Libby, within Township 11 North, Range 10 West, Section 25 of the U.S. Geological Survey (USGS) Libby, MT Quadrangle 7.5' map. It is bounded on the east by Libby Creek, on the south by private property, on the west by U.S. Highway 2, and on the north by the Kootenai River (**Figure 3-1**). The Site is located in a primarily mixed commercial/residential area. The approximate elevation of the Site is 6,420 feet (ft) above mean sea level (msl).

The topographic relief at the Site is relatively flat and dips gently towards the north-northeast. The area is well-drained due to the high infiltration rate of area soils. There are numerous surface water features on and near the Site. The Remedial Investigation (RI) report (Woodward Clyde Corporation (WCC), 1988a) describes these as ponds (the Fire Pond, log pond, plywood pond, and settling ponds), canals, losing and gaining alluvial systems (Flower Creek and Libby Creek), and a major river system of regional ground water discharge (the Kootenai River).

The regional geology of the Libby Valley consists of Precambrian rocks overlain by lacustrine deposits. The Precambrian rocks form the high mountains around the Libby Valley, while the glacial lakebed deposits form the lower cliffs along each side of Libby Valley. The Kootenai River and Libby Creek have cut into the lacustrine deposits and thick alluvial deposits, forming a discontinuous sequence of gravel, sand, silt and clay of glacial and alluvial origin.

Based on the boring logs from the numerous investigations completed at the Site, alluvial deposits consisting of sand, gravel, silt, clay and cobbles extend from the surface to approximately 140 to 190 ft below ground surface (bgs). Glacial till deposits consisting of low permeability silt and clay containing varying amounts of sand and gravel are present beneath the alluvial deposits. The transition between these units is subtle. The base of the glacial deposits is believed to occur at depths exceeding 500 ft, based on drilling data from well 3019 (located onsite near the former tank farm area), which did not encounter bedrock at that depth (WCC, 1993a).

The upper 70 ft of the alluvial deposits contains the highest hydraulic conductivity of the water bearing units and is referred to as the "upper aquifer". The upper aquifer is unconfined and extends from the water table surface (5 to 30 ft bgs) to approximately 60 to 70 ft bgs. The aquifer materials are primarily silty gravel and sand with occasional layers of interbedded clayey, silty deposits. The general flow direction in the upper aquifer is north-northwest, towards the Kootenai River as shown in **Figure 3-2**. The hydraulic conductivity of the upper aquifer ranges from approximately 100 ft/day to 1,000 ft/day (WCC, 1988a).

A non-continuous, 40 to 60 foot thick, sequence of low permeability materials below the upper aquifer has been historically referred to as the "intermediate zone." The intermediate zone extends from approximately 60 to 70 ft bgs to 100 to 110 ft bgs. In some areas, the transition between the upper aquifer and intermediate zone is subtle, as the deposits of the intermediate zone are generally similar to

FIGURE 3-1
Site Location Map
Libby Ground Water Superfund Site
Libby, Montana

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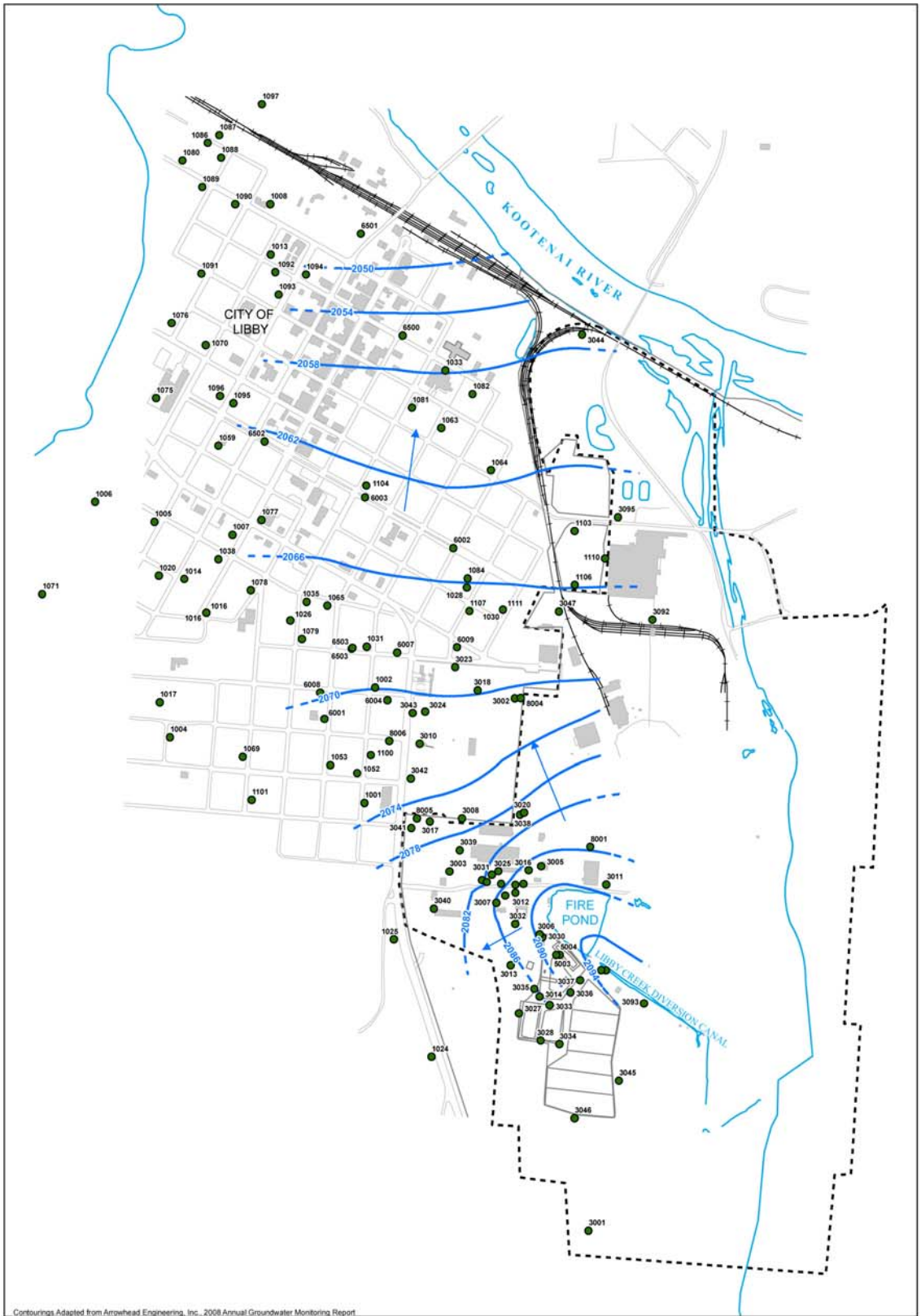
KOOTENAI RIVER
CITY OF LIBBY
2050
2054
2058
2062
2066
2070
2074
2078
2082
2086
2090
2094
FIRE POND
LIBBY CREEK DIVERSION CANAL
Contourings Adapted from Arrowhead Engineering, Inc., 2008 Annual Groundwater Monitoring Report
SITE LOCATION
Montana
Idaho
Wyoming
Index Map
Lincoln County, Montana
Legend
Monitoring Well
Groundwater Elevation Contour
(Dashed where inferred) from AEI 2009
Libby Ground Water Superfund Site
Groundwater Flow Direction
N
W
E
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400
800 Feet
FIGURE 3-2
Ground Water Elevations of the Upper Aquifer
September 2008
Libby Ground Water Superfund Site
Libby, Montana
CH2MHILL
\\COBRAGIS\PROJECTS\LIBBYMT\MAPFILES\5YEARREVIEW\FIG3-2_UPPERGWELE.MXD MBLEESS 10/15/2009 12:21:29

those of the upper aquifer, but contain a higher percentage of fine grained material. In some areas the intermediate zone acts as a relatively strong confining layer, and in others it is a weak confining layer. Overall, the intermediate zone is described as having a significantly lower hydraulic conductivity than the upper and lower aquifers (the lower aquifer is discussed in the next paragraph), with a reported value of about 1 ft/day (WCC, 1988a).

Alluvial deposits with somewhat lower hydraulic conductivity than the upper aquifer have been characterized from about 110 to 190 ft bgs and are labeled the "lower aquifer." The transition between the intermediate zone and lower aquifer is even more subtle than the transition between upper aquifer and the intermediate zone. The lower aquifer deposits consist of silty gravel and sand interbedded with sandy, gravelly silt and clay layers. The lower aquifer generally contains a higher silt and clay content than the upper aquifer with more silt and clay lenses than the upper aquifer. Previous reports estimated hydraulic conductivity values in the lower aquifer ranging from 50 to 200 ft/day, with an average of about 100 ft/day (WCC, 1988a). The depth to ground water in the lower aquifer is approximately 26 ft bgs beneath the Site and approximately 14 ft bgs offsite in the residential area northwest of the Site**.** The elevation of the water level in the lower aquifer is higher than the aquifer itself because the lower aquifer is confined and under pressure, and therefore the water level in a well screened in the lower aquifer will rise to a height that is reflective of the degree of pressurization. The general flow direction in the lower aquifer is north-northwest, towards the Kootenai River, as shown in **Figure 3-3** **(s**ince the intermediate zone does act as a relatively significant confining unit in some portions of the Site, and the upper and lower aquifers have historically been mapped as two distinct aquifers, this convention has been continued in this report).

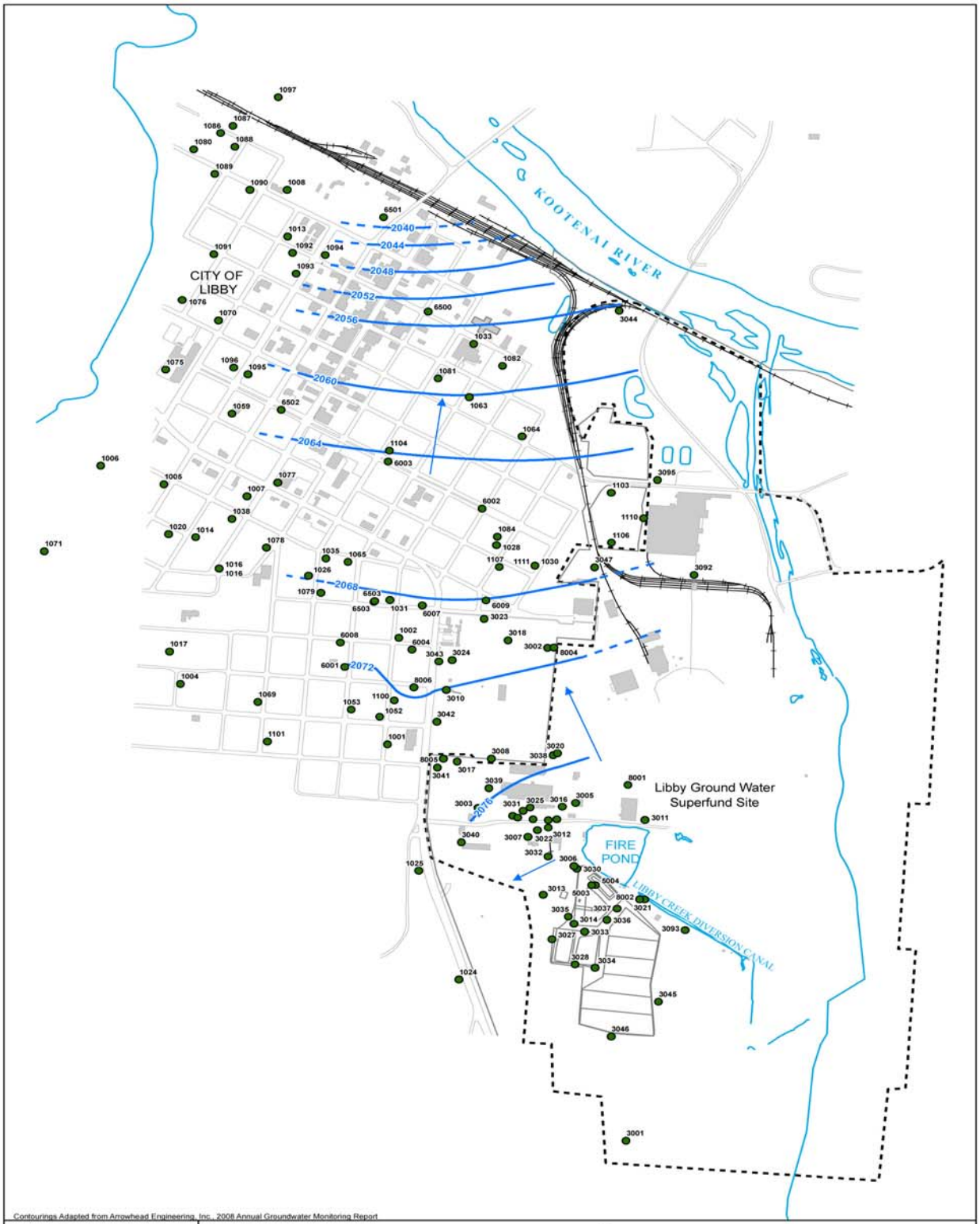
A vertical profile illustrating the generalized subsurface lithology and the potentiometric surface in the upper aquifer and lower aquifer is illustrated in **Figure 3-5** (**Figure 3-4** shows the location of the cross-section transect).

3.2 Land and Resource Use

The Site was the location of the J. Neils Lumber Company when wood treating operations began in approximately 1946. St. Regis Corporation purchased the lumber company and wood treating facility in 1957. St. Regis continued wood treating operations until 1969, when the facility was disassembled. In 1985, Champion International Corporation (Champion) bought the facility. Champion later sold the plywood mill to Stimson Lumber Company (SLC) in 1993 and in 2000 International Paper Company (IP) purchased Champion. SLC sold the mill property to the Lincoln County Port Authority in 2003. The remediation units, which were implemented at the Site beginning in 1991, are currently owned and operated by IP.

Land use in the portion of the Site where the lumber and plywood complex was located is classified as commercial and light industrial. The Site is surrounded by residential neighborhoods to the northwest and west. A golf course is located west and southwest (across Highway 2) from the Site. The Kootenai River lies north of the Site, and undeveloped forested land adjoins the Site to the east and south. Commercial businesses are located along the eastern property boundary near the middle of the Site. Sawmill operations occur along the northern portion of the property boundary near the Fire Pond.

The shallow ground water in the area was historically used by local residents for drinking and irrigation. Following the discovery of creosote contamination in a residential drinking water well, and subsequent listing of the Site on the NPL, an ordinance was put into place as part of the ROD for OU1 to prohibit the installation of new water wells in the upper and lower aquifers within the corporate limits of the City of Libby. Despite the ordinance, there is anecdotal evidence that some residents are either installing new wells or may be using existing wells that tap the upper and lower aquifers (Libby City Council, 2007). In addition, the City ordinance does not include a portion of the plume located


KOOTENAI RIVER
CITY OF LIBBY
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2044
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Libby Ground Water Superfund Site
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Libby Ground Water Superfund Site
Groundwater Flow Direction
N
W
E
S
0 400 800 Feet
FIGURE 3-3
Ground Water Elevations of the Lower Aquifer
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Libby Ground Water Superfund Site
Libby, Montana
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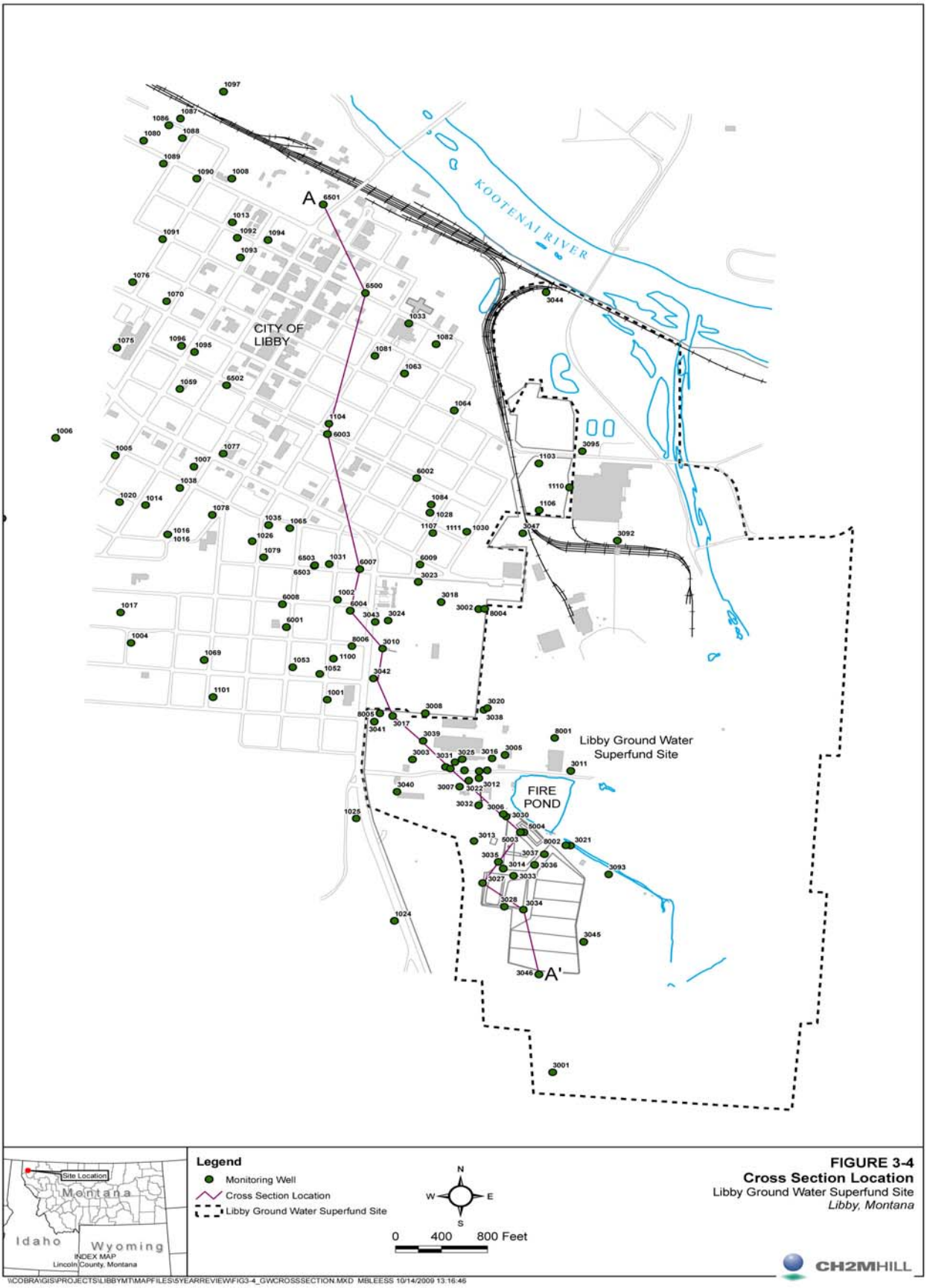

FIGURE 3-4
Cross Section Location
Libby Ground Water Superfund Site
Libby, Montana

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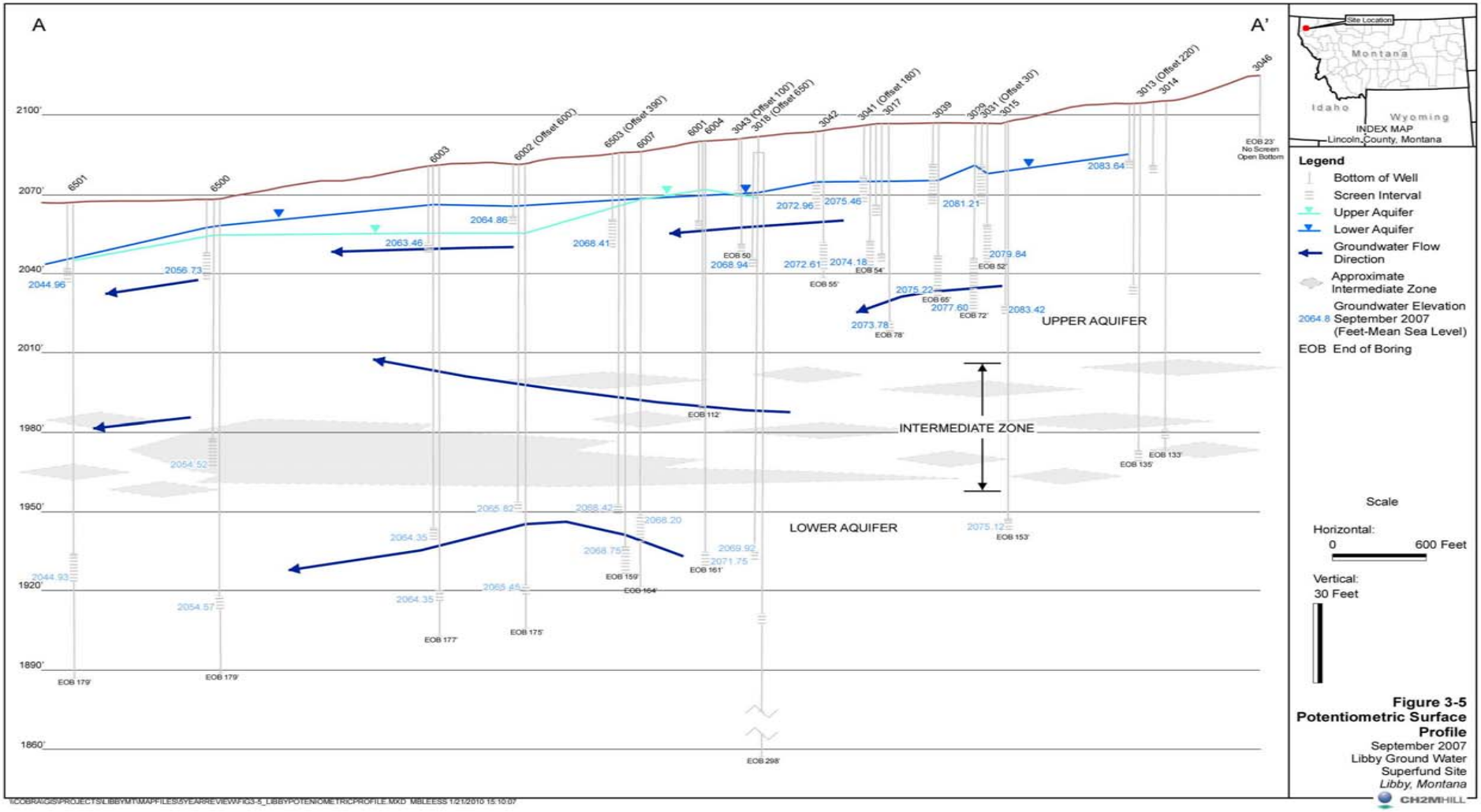

Figure 3-5
Potentiometric Surface Profile
September 2007
Libby Ground Water Superfund Site
Libby, Montana

near the Stimson lumber mill property. The other component of the OU1 ROD consisted of Champion's "Buy Water Plan" in which Libby residents were provided monetary compensation for using municipal water supply for irrigation and drinking water instead of contaminated private water wells. After the first five-year review, the Buy Water Plan was expanded to include a payment to residents who allowed Champion to plug and cap their wells in accordance with State of Montana well abandonment regulations. The second five-year review reported that 44 residential wells were abandoned by Champion as part of this expanded program. IP also plugged and capped an additional residential well in 2008. Additional details of the Buy Water Plan can be found in **Section 4.2**.

Currently, ground water modeling is being performed by IP as part of a study to determine the extent of a "controlled ground water use area" (CGWUA). The determination of the CGWUA considers ground water flow in the upper aquifer, the historical extent of contamination and the potential migration of the contaminant plume. The CGWUA would be incorporated into the ordinance to prevent the installation of wells within that area and prevent exposure of residents to the contaminants.

Surface water at the Site consists of the Fire Pond, log pond, plywood pond, and settling ponds, the Libby Creek diversion canal, which is used to control the water level in the Fire Pond, and Libby Creek. Outside of the Site, surface water features include Flower Creek to the west, and the Kootenai River to the north. The Kootenai River, which flows to the northwest, is a major river system of regional ground water discharge that is used locally for recreation including fishing, kayaking and white water rafting.

3.3 History of Contamination

The presence of wood treating compounds in ground water was first discovered in April 1979 when a creosote smell was noticed in water from a newly installed residential drinking water well. EPA and the MDEQ Water Quality Division conducted the initial investigation of the lumber mill in 1980. This initial study (documented in 1982) reported the presence of creosote, PAHs, and PCP in 3 of 11 residential wells sampled. Four different wood treating compounds were used at the lumber mill. They include creosote, which was used throughout the history of wood treating operations; PCP, which was typically combined with a carrier-oil such as diesel; salt solutions composed of various inorganic compounds such as copper-chromium-arsenate; and occasionally a mixture of PCP, mineral spirits, polyethylene-glycol, wax, creosote and fuel oil. The dismantled St. Regis wood treating facilities and waste disposal pits were identified as likely sources for the ground water and NAPL contamination. Due to the potential risk to human health and the environment posed by ground water contamination, the Site was placed on the NPL in September 1983.

EPA designated two OUs at the Site:

- OU1 consists of the alternative drinking water supply initiative sponsored by Champion for the affected and potentially-affected residents of Libby, and
- OU2 consists of the affected environmental media including the contaminated soils, the upper aquifer ground water, and the lower aquifer ground water.

3.4 Initial Response

St. Regis (the original responsible party) entered into an Administrative Order on Consent (AOC) with EPA on October 11, 1983, approximately one month after the Site was placed on the NPL. The AOC directed St. Regis to begin remedial investigations, feasibility studies, and remedial action programs. The objectives of the investigations were to define the extent of Site contamination, and to develop and evaluate available alternatives to remove or reduce potential threats to human health and the environment.

Four separate phases of site investigative work were performed, beginning in 1983:

- Phase I - Initial investigations conducted by MDEQ's Water Quality Bureau and EPA, as well as notification of concerns and listing on NPL.
- Phase II - Initial St. Regis sampling and investigations, and preparation of plans for additional field investigations.
- Phase III - Interim remedial measures and continued investigations, including the final report titled "Impact of Wood Treating Facilities at Libby, Montana" (Alsid et al., 1985). The results of the Phase III investigations concluded that wood treating compounds in the upper aquifer were migrating offsite. The Phase III report recommended additional investigations to refine ground water and contaminant movement and to further define the character and spatial distribution of wood treating compounds in the deeper aquifer.
- Phase IV - Field investigations were conducted in May 1985 and January 1986, under the Phase IV RI program. A RI (WCC 1988a) was performed to characterize the subsurface conditions and the nature and extent of contamination. The primary sources of ground water contamination identified during this RI were the waste pit area, the former butt dip and retort area, and the former tank farm (see **Figure 3-6)**.

A Consent Decree for cleanup of the Site was finalized in October 1989, providing final governmental approval and authority for Champion to proceed with design and implementation of the selected remedies. Remedial design was completed in September 1991, and since that time modifications have been made to the remediation system to improve performance and/or reduce operating costs.

3.5 Basis for Remedial Action

The ground water cleanup levels for the Site are based on MCLs where they exist. Where MCLs do not exist, ground water cleanup levels are based on calculated risk-based concentrations for the adult residential exposure scenario of $1x10^{-5}$. Soil clean-up levels are based on risk-based concentrations for the construction worker exposure scenario, also at a risk level of $1x10^{-5}$.

Some of the cleanup levels for the soil and upper aquifer ground water were amended in January 1997 when EPA issued an ESD in 1997 for the OU2 ROD to reflect more recent risk assessment practices and updated MCLs for the upper aquifer. Contaminants identified in the 1988 ROD for OU2 and the cleanup levels set in the 1997 ESD are presented in **Table 3-1**.

In addition to the contaminants listed in **Table 3-1**, an emerging contaminant issue has been identified for the Site. The chemical 1,4-dioxane is frequently used as a stabilizer in the solvent 1,1,1-trichloroethane (TCA), which has been detected at the Site. The potential presence of 1,4-dioxane in ground water has been identified as a data gap, and is one of the issues identified in this five-year review.


3023
1002
3018
6004
3002
8004R
3043
3024
8006
3010
1100
1052
3042
1001
3020
3038
8005
3017
3008
3041
8001
3039
3005
3003
3025
3016
3011
Approximate Former Mineral Spirits Tank Area
Approximate Tank Farm Area
3007
3022
3040
FIRE
POND
Approximate Former Retort Area
3032
3006
3030
1025
Approximate Former Butt Dip Area
Waste Pit Source
5004
5003
3013
8002
3021
LIBBY CREEK DIVERSION CANAL
3037
3035
3036
3014
3093
3033
3027
3028
3034
3045
3046
KOOTENAI RIVER
CITY OF
LIBBY
LIBBY GROUND WATER
SUPERFUND SITE
Site Reference
SITE LOCATION
Montana
Idaho
Wyoming
Index Map
Lincoln County, Montana
Legend
Monitoring Well
Identified Release Area
Libby Ground Water Superfund Site
N
W
E
S
0
150
300 Feet
FIGURE 3-6
Identified Release Areas
Libby Ground Water Superfund Site
Libby, Montana
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\\COBRA\GIS\PROJECTS\LIBBYMT\MAPFILES\5YEARREVIEW\FIG3-6_SOURCES.MXD MBLEESS 10/14/2009 13:33:09

TABLE 3-1
Cleanup Levels for Soil and Groundwater

	Soil		Ground Water	
Contaminants of Concern	**Cleanup Level (mg/Kg)**	**Basis[(e)]**	**Cleanup Level (μg/L)**	**Basis**
NON-CARCINOGENIC PAHS				
Acenapthene	166	Risk-Based Value HI=1.0	2190	Risk-Based Value HI=1.0
Anthracene	33		1100	
Fluorene	250		1460	
Fluoranthene	250		1460	
Naphthalene	NA		1460	
Pyrene	NA		1100	
Phenanthrene	NA		NA	
Acenapthylene	NA		NA	
Benzo (g,h,i) perylene	NA		NA	
CARCINOGENIC PAHS				
Chrysene	59,400	Risk-Based Value 10^{-5}	0.2	MCL
Benzo (a) anthracene	594		0.1	
Benzo (b) fluoranthene	594		0.2	
Benzo (k) fluoranthene	5,940		0.2	
Benzo (a) pyrene	59		0.2	
Indeno (1,2,3-c,d) pyrene	594		0.4	
Dibenzo (a,h)anthracene	59		0.3	
OTHER COMPOUNDS				
Pentachlorophenol	36	Risk-Based Value 10^{-5}	1.00	MCL
Benzene	NA		5.00	
Arsenic	NA		50.00	
FURANS				
tetra (2,3,7,8)	0.0289	Risk-Based Value 10^{-5}	NA	
tetra (non-2,3,7,8)	NA		NA	
penta (1,2,3,7,8)	0.0578	Risk-Based Value 10^{-5}	NA	
penta (2,3,4,7,8)	0.00587	Risk-Based Value 10^{-5}	NA	
penta (other)	NA		NA	
hexa (2,3,7,8)	0.0289	Risk-Based Value 10^{-5}	NA	

	Soil		Ground Water	
Contaminants of Concern	**Cleanup Level (mg/Kg)**	**Basis[(e)]**	**Cleanup Level (μg/L)**	**Basis**
hexa (non-2,3,7,8)	NA		NA	
hepta (2,3,7,8)	0.289	Risk-Based Value 10^{-5}	NA	
hepta (non-2,3,7,8)	NA		NA	
Octa	2.89	Risk-Based Value 10^{-5}	NA	
DIOXINS				
tetra (2,3,7,8)	0.00289	Risk-Based Value 10^{-5}	$3X10^{-5}$	MCL
tetra (non-2,3,7,8)	NA		NA	
penta (1,2,3,7,8)	0.00578	Risk-Based Value 10^{-5}	NA	
penta (non-2,3,7,8)	NA		NA	
hexa (2,3,7,8)	0.0289	Risk-Based Value 10^{-5}	NA	
hexa (non-2,3,7,8)	NA		NA	
hepta (2,3,7,8)	0.289	Risk-Based Value 10^{-5}	NA	
hepta (non-2,3,7,8)	NA		NA	
Octa	2.89	Risk-Based Value 10^{-5}	NA	

Notes:

NA: Not applicable

HI: Hazard Index

Remedial strategies for the lower aquifer and contaminated surface soils have been implemented independently of the upper aquifer. In 1993, an ARARs waiver was requested by IP for the lower aquifer due to the technical impracticability of removing NAPL in ground water and the improbability that the contamination in the lower aquifer poses a risk to human health and the environment due to a lack of use of this aquifer (WCC, 1993a). The ARAR waiver for the lower aquifer was granted by EPA in 1993, and an ESD for the OU2 remedy was issued by EPA. Institutional controls and long-term monitoring are currently in place for the lower aquifer.

In 1999 Champion submitted a TI Evaluation Report for the upper aquifer to EPA in support of an additional TI waiver for upper aquifer ARARs.

4.0 Remedial Actions

The remedial action objective (RAO) for OU1 was to significantly reduce or eliminate human exposure to contaminated groundwater. The remedy selected in the ROD for OU1 (institutional controls) reduced or eliminated the consumption of contaminated ground water by local residents. The RAOs for OU2 were to prevent the exposure of Libby residents to contaminated ground water in the upper and lower aquifers by remediating the groundwater to MCLs or human health risk-based levels, eliminate the potential for exposure to contaminated soils through treatment and ultimate disposal of contaminated soils in a lined Land Treatment Unit (LTU); and protect the environment through contaminant source removal and cleanup of contaminated media through enhanced biodegradation processes that were designed for the contaminated soils and ground water of the Site.

Included in the sections below are an overview of remedy selection and remedy implementation for the OUs at the Site, and the ongoing operation and maintenance (O&M) activities performed and overall progress made at the Site in the period since completion of the third five-year review. IP assumed responsibility for the O&M activities of remedial operations in June of 2000.

4.1 Remedy Selection

As stated earlier, two RODs have been issued by EPA for the Site. The ROD for OU1 was signed on September 26, 1986 and the remedy consisted of:

1. Champion's Buy Water Plan in which Libby residents were provided monetary compensation for using municipal water supply for irrigation and drinking water instead of contaminated private water wells, and

2. an ordinance preventing the installation of new water wells for human consumption or irrigation in the upper and lower aquifer within the "corporate limits" for the City of Libby.

These measures were described as interim measures pending cleanup at the Site, if possible. It should be noted that the Stimson lumber mill property, which lies outside the eastern boundary of the City limits, is being considered for redevelopment and is not covered by the ordinance. An ongoing study being performed by IP will determine a CGWUA that may further refine the area covered by the ordinance.

The ROD for OU2 was signed on December 30, 1988, and prescribes the remedy and cleanup levels for the affected media (soil and ground water) at the Site. The OU2 remedy consists of:

1. Excavation of contaminated soils from identified source areas and placement within a waste pit that contains contaminated soils and debris from past disposal practices. These contaminated soils undergo a two-step enhanced biodegradation process. The initial treatment phase is conducted in the waste pit area and the contaminants are further degraded biologically after transfer (in lifts) to the LTU. The LTU is lined and will ultimately be capped with low permeability materials to serve as the final disposition location of the soils. Land treatment operations are working as planned.

2. Insertion of language into the current registered deed identifying the locations of hazardous substances disposal and treatment areas, and land use restriction of these areas.

3. Degradation of organic contaminants in the saturated zone of the waste pit area using in-situ bioremediation treatment processes.

4. Oil recovery wells to collect highly-contaminated ground water, which is treated in a fixed film bioreactor prior to reinjection.
5. In-situ enhanced biorestoration of upper aquifer ground water.
6. An ordinance prohibiting drilling new water supply wells within the corporate limits of the City of Libby, both within the upper and lower aquifers (this was also part of the ROD for OU1).
7. Monitoring activities to assess the performance of the remedy components throughout the life of the remedial activities at the Site. Long-term monitoring of the lower and upper aquifer water quality is also required to determine further movement of the respective contaminant plumes, ensure protection of public health and assess potential degradation of the Kootenai River water quality.
8. Review of Site conditions every five years after initiation of remedial action to ensure that human health and the environment are being protected by the remedy.

The OU2 remedy also included an interim remedy for the lower aquifer that required the PRP to conduct a pilot test to determine if enhanced biorestoration of the aquifer, both alone and in conjunction with oil recovery and oil dispersion techniques, is an effective method of remediation.

In September 1993, EPA modified the OU2 remedy for the Site through an ESD. The significant differences between the remedy described in the 1988 ROD and the ESD are described below:

1. The 1988 ROD described how the final remedy selected for the lower aquifer would be documented within a separate ROD. EPA determined that based on the simplicity of the final remedy, documentation of the selected remedy for the lower aquifer within an ESD to the 1988 ROD would be sufficient.
2. Based on information described within three lower aquifer reports submitted by Champion (WCC, 1993a, b, c), EPA, in consultation with MDEQ, determined that the final remedy for the lower aquifer will consist of the continuance of both institutional controls prohibiting installation of new water supply wells for consumption or irrigation within the City of Libby and the long-term ground water monitoring program initiated by Champion.
3. The limits established in the 1988 ROD for pyrene, naphthalene and phenanthrene in ground water were removed. EPA cited the rationale provided by field data and the language provided within a No-Migration Petition (WCC, 1990) as reasons for allowing the removal of these requirements.

All other aspects of the remedy documented in the 1988 ROD remained the same. A more detailed description of the revised components to the original remedy is presented in EPA's ESD for the Site (EPA 1993a).

In 1997, as the result of the first five-year review, EPA again modified the remedy selected for OU2 through a second ESD. The significant differences between the remedy described in the 1988 ROD, the 1993 ESD and the 1997 ESD are described below:

1. The MCL for PCP in ground water, adopted as a federal standard in 1992, replaced the PCP risk-based remediation level set in the 1988 ROD for the upper aquifer. The MCL is 1.0 µg/L.
2. The MCL for Dioxin TCDD in ground water, also adopted since the 1988 ROD was issued and calculated using Toxicity Equivalence Factors (TEF), was added to the remediation parameters in the ROD for the upper aquifer. The MCL for Dioxin TCDD is 3.0x10-5 µg/L.
3. The MCL for each of the carcinogenic PAHs in ground water listed in **Table 3-1** replaced the Total Carcinogenic PAH remediation level in the 1988 ROD for the upper aquifer.

4. The soil remediation level for Total Carcinogenic PAHs was revised to 59 milligrams per kilogram (mg/Kg) calculated as Benzo-a-pyrene (BaP) equivalents using the EPA 1993 relative potency factors (RPFs).
5. The soil remediation levels for Total Noncarcinogenic PAHs, based on a Hazard Index (HI) value of 1.0, listed in **Table 3-1**, were added to the list of remediation parameters.
6. The soil remediation levels for Dioxins/Furans were revised as indicated in **Table 3-1** to reflect the most recent TEF methodologies for risk-based value calculation.

4.2 Remedy Implementation

The remedial design for the remedy selected in the 1988 ROD for OU2 was completed in June 1989 (WCC, 1991). EPA filed a Construction Completion notice for the Site in the form of a Superfund Preliminary Site Close Out Report in 1993.

As constructed, the remedy for OU1 includes the following elements:

- An alternate water supply source offered to residents of Libby whose domestic wells were either impacted or potentially impacted by offsite contaminant migration in the upper aquifer. Those residents who agreed to participate in Champion's Buy Water Plan would obtain their water from Libby's public water system. Champion was allowed to cap and lock their well in return for monetary compensation to the well owners to pay for costs incurred by using metered public water. The first five-year review reported that 35 residential well owners were part of the Buy Water Plan.
- The Buy Water Plan was augmented in 1997. Champion offered to reimburse well owners affected by the Site contamination, in the amount of $2,000. In return, the well owners allowed Champion to permanently seal and disable the wells according to State of Montana well abandonment regulations. The second five-year review reported that 44 residential wells had been abandoned by Champion. IP reported that one additional well has also recently been abandoned.
- Champion also made twelve payments to the City of Libby for a fixed amount of irrigation water per household. Twelve payments of $30,000 per year we made to the City beginning in 1986.
- A city ordinance prohibiting the installation of new water supply wells (within City of Libby corporate limits) in the upper and lower aquifers for the purpose of consumption or irrigation. The ordinance was passed in 1986 and continues to be implemented. The ordinance may require modification to apply to a CGWUA, and the Stimson property may require annexation, since it lies outside of the area currently covered by the ordinance and is being considered for redevelopment. For the lower aquifer, the decision to continue the ordinance was described in EPA's ESD (EPA 1993a).

The remedy for OU2 includes:

- Contaminated soil from the identified source areas was excavated and placed within a waste pit that contained contaminated soils and debris from past disposal practices at the Site. Field investigations revealed that approximately 45,000 cubic yards of soil was contaminated by organic compounds associated with wood treating compounds. These contaminated soils underwent a two-step enhanced biodegradation process. The initial treatment phase was conducted in the waste pit area, and the contaminants were further biodegraded after transfer to the onsite LTU.
- An Extended Landfarm (ELF) was constructed to expedite the soil treatment process. Treatment of soils is now conducted on the ELF. Remediated soils are transferred to the original LTU, which will be the final disposition location of the soils.

- A performance monitoring program was established and is maintained by IP for the ELF and LTU activities consisting of soils, air, leachate, and ground water samples. This performance monitoring program has been implemented and allows the protectiveness of the landfarm operation to be evaluated. Annual reporting is currently being completed for the soil treatment activities.

- The remedy for the upper aquifer originally consisted of an innovative in-situ, enhanced biorestoration program. This program consisted of two separate injection well systems designed to introduce oxygen and nutrients (where needed) to biologically degrade the dissolved contaminants (PAHs and PCP) observed in the upper aquifer. These two injection systems are referred to as (1) the intermediate injection system and (2) the boundary injection system (BIS). The intermediate injection system was discontinued in 1998 and the BIS was discontinued in 2003. In addition to the in-situ enhanced biorestoration program, the source area extraction and treatment system (referred to as the SAETS) was constructed in 1989. The objective of the SAETS was to remove NAPL from the upper aquifer to improve the performance of the downgradient in-situ biorestoration systems. The SAETS currently consists of the Bioreactor System and the Coalescing Separator System. The components that make up the systems are: 1) three extraction wells (9006, 9008 and 9009), 2) two oil/water separators, and 3) bioreactor tanks and ancillary equipment. **Figure 4-1** illustrates the historical and current remediation system locations for the Site. The SAETS has been operating continuously since installation in 1989.

A comprehensive ground water monitoring program was initiated in the fall of 1991 to evaluate the overall distribution of contamination in the upper aquifer, and to assess the performance of the in-situ bioremediation system by monitoring ground water quality. Since entering the long-term ground water monitoring phase, the remedy has undergone numerous changes and adjustments. The current ground water monitoring program, approved by EPA in March 2005, is outlined in the Final Ground Water Monitoring Plan (Arrowhead Engineering, Inc. (AEI), 2005).

4.3 Operation and Maintenance (O&M)

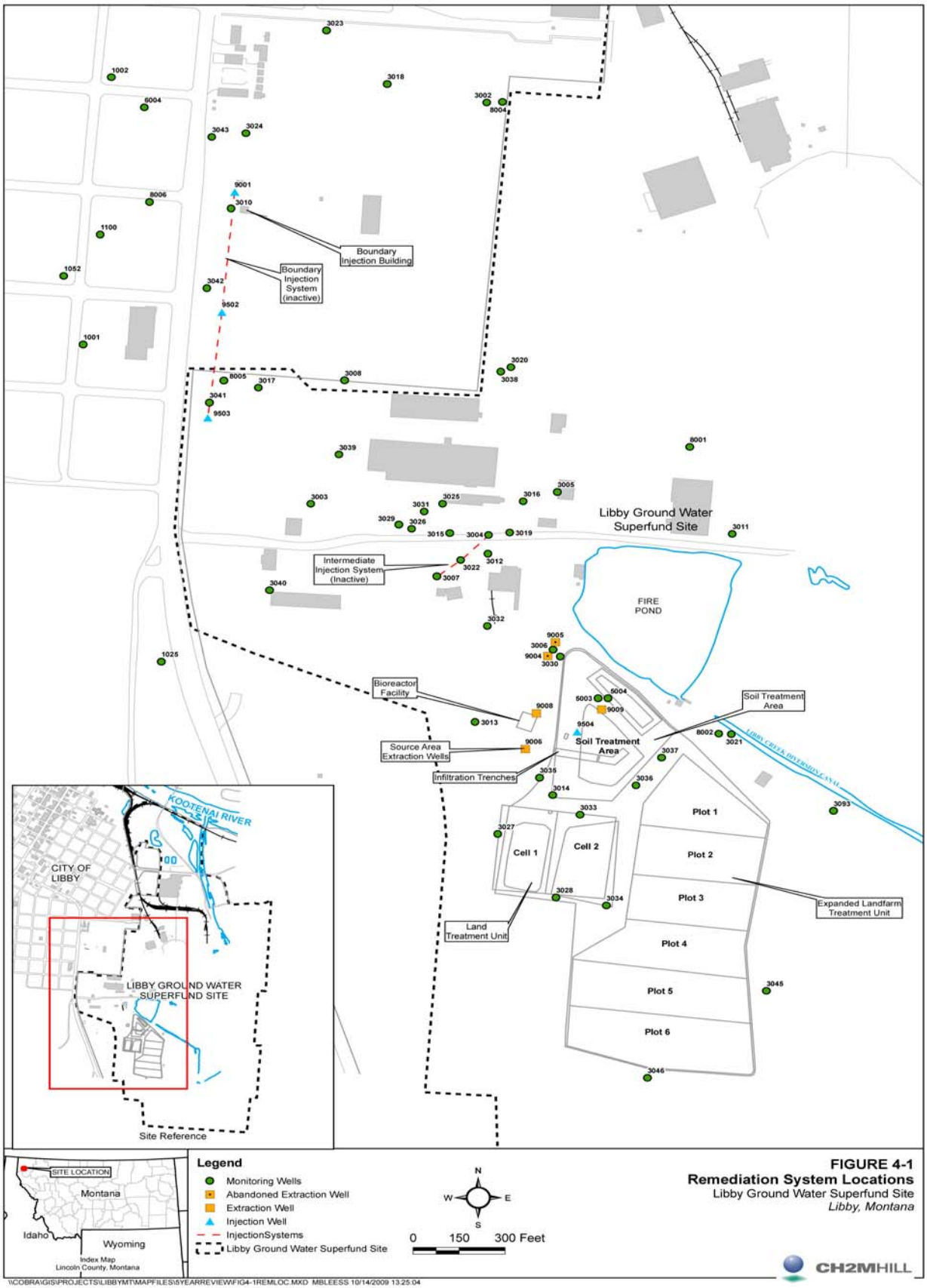
The 1988 ROD for the Site stipulates that an annual remedy evaluation be performed and reported. IP is responsible for conducting O&M activities at the Site and has contracted with AEI to perform these activities. Specific O&M requirements for various components of the remedy are contained in various O&M manuals developed for the Site, which are kept at the Site for use by the O&M staff.

Source Area Soils

O&M and long-term monitoring activities performed for the LTU, ELF, and X-19 treatment cell (collectively referred to as the landfarm) are described in the Annual Landfarm Operations Reports for each operational year (**AEI, 2006a, 2007a, 2008a, 2009a**). Operations include periodic cultivation and irrigation of the soils in the ELF. Once the soils in the ELF meet cleanup levels, the soil is transferred to the LTU. Leachate collected in the LTU sumps is sampled on a quarterly basis. All water collected from the sumps (591,250 gallons in 2008) is discharged directly to the infiltration galleries onsite. Three basic monitoring activities occur at the landfarm: 1) soil sampling in the treatment zone to evaluate contaminant degradation, soil moisture, and compliance with cleanup levels; 2) sampling of leachate from the collection sumps; and 3) berm integrity inspections.

SAETS

O&M and long-term monitoring activities associated with the SAETS and performed at the Site since 1993 are described in the SAETS Annual Operations Reports for each operational year (**AEI, 2005a, 2006b, 2007b, 2008b, 2009b**). The SAETS is designed to operate continuously, and in 2008 experienced only minor interruptions associated with pump malfunctions, power outages and normal system maintenance. In 2008, approximately 10 million gallons of oil-contaminated ground water


Boundary Injection Building
Boundary Injection System (inactive)
Intermediate Injection System (Inactive)
Libby Ground Water Superfund Site
FIRE POND
Bioreactor Facility
Source Area Extraction Wells
Infiltration Trenches
Soil Treatment Area
Soil Treatment Area
Land Treatment Unit
Expanded Landfarm Treatment Unit
Plot 1
Plot 2
Plot 3
Plot 4
Plot 5
Plot 6
Cell 1
Cell 2
KOOTENAI RIVER
CITY OF LIBBY
LIBBY GROUND WATER SUPERFUND SITE
Site Reference
SITE LOCATION
Montana
Idaho
Wyoming
Index Map
Lincoln County, Montana
Legend
Monitoring Wells
Abandoned Extraction Well
Extraction Well
Injection Well
InjectionSystems
Libby Ground Water Superfund Site
N
W
E
S
0
150
300 Feet
FIGURE 4-1
Remediation System Locations
Libby Ground Water Superfund Site
Libby, Montana
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\\COBRA\GIS\PROJECTS\LIBBYMT\MAPFILES\5YEARREVIEW\FIG4-1REMLOC.MXD MBLEESS 10/14/2009 13:25:04

were extracted using three wells, and piped to the treatment facility. Nutrients, temperature, dissolved oxygen and pH are monitored weekly to ensure optimal operation of the bioreactor system. PAHs and PCP are monitored in the bioreactor influent and effluent to evaluate system performance. It is estimated that the bioreactor successfully degraded 1378 pounds of PAHs and 211 pounds of PCP in 2008, and that the overall performance in 2008 is similar to that of 2007. The overall performance of the coalescing separator in 2008 was also similar to 2007; approximately 730 gallons of free product were collected in the gravity separator in 2008. While the SAETS is functioning properly, it is apparent that continued operation of the system will be required for decades in order to meet cleanup levels for the upper aquifer. This is due to large amounts of NAPL that remain in place in the source area, and will continue to act as a long-term source of dissolved-phase contaminants to the upper aquifer. In addition, it is not apparent that the upper aquifer PCP plume is stable, or has been fully defined. The current extent of the ground water monitoring well network does not appear to be adequate to monitor the extent of NAPL in the source area and the upper aquifer ground water plume to ensure public health and safety.

O&M activities at the Site have evolved as the conditions have changed, but current O&M of the SAETS is adequate to ensure consistent system operation. The total system expenses for the SAETS averaged approximately $84,000 annually over the last five years. The annual O&M costs for the entire project averaged approximately $303,000. These costs are considered to be acceptable.

In 2009, EPA denied the TI waiver request of ARAR ground water standards for the upper aquifer due to the recognition that technologies for the remediation of NAPL have advanced during the past decade and warrant consideration, and that the upper aquifer PCP plume may be migrating or inadequately defined. Alternative remedial strategies for the upper aquifer are currently being evaluated and include in-situ chemical oxidation, surfactant-enhanced in-situ chemical oxidation, and in-situ thermal treatment (steam-enhanced extraction), in-situ bioremediation, and monitored natural attenuation.

Ground Water Monitoring

Long-term ground water monitoring at the Site includes collection of ground water samples for chemical analysis and water levels from the monitor well network at the Site. The monitoring program for the Site is examined on a yearly basis to determine if wells and/or analyses can be eliminated from the program. The long-term ground water monitoring program has been adjusted in terms of numbers of wells sampled and sampling frequency as the overall data set for the Site has increased. Since 2005, ground water sampling has been conducted in accordance with the Final Ground Water Monitoring Plan (AEI, 2005b), and the results are documented in the Annual Ground Water Monitoring Reports for the Upper and Lower Aquifer (AEI 2006c, 2007c, 2008c, 2009c). Four groups of wells are monitored:

- Group 1L – Perimeter Monitoring Well Network, Lower Aquifer. The primary objective of collecting data from these wells is to evaluate possible changes in the distribution of PCP from year to year, in the area outside of Site-related contaminants.
- Group 2L – Interior Monitoring Well Network, Lower Aquifer. The primary objective of collecting data from these wells is to monitor for changes on contaminant concentrations that may result from remedial actions in the upper aquifer, or other changes in the lower aquifer.
- Group 1U – Perimeter Monitoring Well Network, Upper Aquifer. The purpose of collecting data from these wells is to evaluate potential plume movement in the upper aquifer.

- Group 2U – Interior Monitoring Well Network, Upper Aquifer. The primary objective of collecting data from these wells is to evaluate contaminant trends in historically contaminated wells.

In addition, in 2008, ground water samples were collected from 15 upper aquifer wells to evaluate natural attenuation parameters.

5.0 Progress Since the Last Five-Year Review

This is the fourth five-year review conducted for the Site. The third five-year review was completed in March 2005. The findings of the third five-year review, the status of recommendations and follow-up actions, the results of implemented actions, and the status of any other issues are described in the following sections.

5.1 Protectiveness Statement from Third Five-Year Review

The protectiveness statement from the third five-year review, signed on March 31, 2005, stated:

> *The third five-year review of the remedial action for soil and ground water at the Libby Ground Water Site has resulted in the determination that the remedial actions are protective of human health and the environment.*

5.2 Third Five-Year Review Recommendations and Follow-up Actions

The third five-year review of the Site recommended two follow-up actions to ensure the continuation of protectiveness. These follow-up actions, their status, and their applicability to this five-year review, are shown in Table 5-1.

TABLE 5-1
Third Five-Year Review Recommendations and Status of Follow-up Actions

Recommended Action from Third Five-Year Review	Lead	Status of Recommended Action	Applicable to Fourth Five-Year Review
If the TI waiver is approved, incorporate the TI waiver conditions into the ROD as specified in EPA guidance (as previously recommended in the second five-year review). In conjunction with this activity, the boundaries of the area within which the waiver will apply must be determined.	EPA	Complete. TI Waiver of ARAR ground water standards for the upper aquifer was denied in May of 2009.	No
Continue to observe the effectiveness of the city ordinance prohibiting new wells. Should the ordinance become ineffective, a petition for designation of a controlled ground water use area should be prepared and submitted to the Montana Department of Natural Resources and Conservation.	EPA	Ongoing. Anecdotal information indicates that some residents may be installing new wells and/or using wells that had not been closed. The City ordinance does not include a large portion of the plume located on the Stimson property outside of the eastern boundary of Libby's corporate limits. A portion of this area is currently being considered for redevelopment. Modeling is being performed by IP to define a CGWUA under appropriate state law, and IP is working with the State of Montana and City of Libby health officials to develop a controlled ground water use designation.	Yes

6.0 Five-Year Review Process

This fourth five-year review for the Site has been conducted in general accordance with EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). The review process included interviews with relevant parties, a Site inspection, and a review of the applicable data and reports covering the remedy implementation, performance monitoring, and O&M. The activities conducted as part of this review and specific findings are described in the following sections.

6.1 Administrative Components

The fourth five-year review for the Site was led by Kathryn Hernandez, Remedial Project Manager (RPM) for EPA Region 8. The following team members assisted in the review:

- Lisa DeWitt, MDEQ
- Tom Richardson, IP
- David Cosgriff, AEI
- D. Henry Elsen, Site Attorney, EPA
- Andrew Schmidt, Hydrogeologist, EPA
- Rebecca Carovillano, CH2M HILL
- Jason Cole, CH2M HILL
- Brad Woodard, CH2M HILL

The components of the review included document and data review, Site inspection, interviews, and preparation of this report.

6.2 Community Involvement

Public notices announcing the beginning of the fourth five-year review were published in the Kootenai Valley Record, the Montanian, and The Western News during the time period covering October 17 to October 22, 2008 (copies are provided in **Attachment 1**). Upon final concurrence of the Fourth Five-Year Review Report, the report will be placed in the information repositories for the Site, including Libby City Hall at 952 E. Spruce Street, the MDEQ office in Helena, Montana, the EPA Region 8 Records Center in Helena, Montana (which contains the full Administrative Record and other records for the Site), and the EPA Region 8 office in Denver, Colorado. A public notice will then be published in the Kootenai Valley Record, the Montanian, and The Western News to summarize the findings of the review and announce the availability of the report at the information repositories. A brief summary of this report will be distributed to community members in the form of a fact sheet.

6.3 Document Review

This five-year review for the Site included a review of relevant Site documents, including decision documents, sampling and investigation reports, annual O&M reports, and related monitoring data. Documents reviewed are listed in **Attachment 2**.

6.4 Review of Data Collected During Five-Year Review Period

The data reviewed as part of this fourth five-year review included ground water sampling analytical results, soil sampling results, water level data, and NAPL observations. The ground water SAETS operational data, such as flow rates, volumes of ground water extracted and treated, and mass removal

data were also reviewed as part of this fourth five-year review. The results of this data review are discussed in the following paragraphs.

Based on September 2008 data, the depth to ground water in the upper aquifer varies from about 5 to 10 ft bgs near the Kootenai River (Well 3044) to 28 to 30 ft bgs in the residential area northwest of the Site. The potentiometric surface of the upper aquifer is variable across the Site. The general ground water flow direction is north towards the Kootenai River, but localized variations in the potentiometric surface illustrate the influence of the stratigraphy and variations in the hydraulic conductivity, and influence of surface water features. **Figure 3-2** shows the September 2008 potentiometric surface and ground water flow direction for the upper aquifer (AEI, 2009c).

The horizontal hydraulic gradient in the upper aquifer in the southern portion of the Site is generally toward the northwest and ranges from 0.009 to 0.012 vertical feet per horizontal foot (ft/ft). Just offsite in the residential area to the west, the hydraulic gradient is toward the north and ranges from 0.004 to 0.008 ft /ft. The gradient closer to Kootenai River (north-northwest of the Site) is to the north and ranges from 0.008 to 0.011 ft/ft.

The horizontal hydraulic gradient of the lower aquifer in the southern portion of the Site is generally toward the northwest at 0.004 ft/ft. Just offsite in the residential area to the west of the Site, the hydraulic gradient is toward the north ranging from 0.003 to 0.006 ft/ft. The gradient closer to Kootenai River is to the north and ranges from 0.008 to 0.009 ft/ft. In general, the flow direction and gradient in the lower aquifer shows less variability than that of the upper aquifer (**Figure 3-3**).

In general, the vertical flow gradients are not consistent across the Site. Of the seven nested wells that were monitored in 2007 and 2008, four exhibit upward vertical flow gradients and three exhibit downward flow gradients (CH2M HILL, 2009). The gradients themselves vary significantly, from 0.0027 ft/ft to 0.0175 ft/ft. The inconsistency in flow direction is evidence that the intermediate zone is laterally discontinuous and does not serve as a consistent confining layer between the upper and lower aquifers across the entire Site.

Currently, the PCP contamination exists in the upper aquifer from approximately the waste pit area to over 2,700 ft to the north-northwest. The leading edge of the plume (as defined by the concentrations of PCP that exceed the MCL of 1 µg/L) extends approximately 1,300 ft beyond the Stimson property line. Currently approximately five wells are used to define the plume width. Historically the plume width has been shown to be approximately 1,400 ft wide (**Figure 6-1**).

In general, the distribution of PAHs in ground water is similar to the distribution of PCP. Ground water samples were last monitored for PAHs in 2004, and then in 2008, 22 wells (19 of which were screened in the upper aquifer, 3 were screened in the intermediate zone) were sampled for PAHs as part of a vapor intrusion study performed by IP (URS, 2009). In 2004, naphthalene was detected at low concentrations in well 3010, which is very close to the leading edge of the PCP plume (this well was not sampled in 2008). In 2008, IP also sampled the same 22 wells for dissolved and total arsenic. The concentration of total arsenic in one well exceeded the current MCL of 10 µg/L, but the concentration of dissolved arsenic in the same well was less than the MCL. Additional sampling and data analysis is warranted to determine if the arsenic in ground water requires remediation.

O&M and long-term monitoring activities performed for the landfarm are described in the Annual Landfarm Operations Reports for each operational year (AEI, 2006a, 2007a, 200a, 2009a). Operations include periodic cultivation and irrigation of the soils in the ELF. Once the soils in the ELF meet cleanup levels, the soil is transferred to the LTU. Leachate collected in the LTU sumps is sampled on a quarterly basis. All water collected from the sumps (591,250 gallons in 2008) is discharged directly to the infiltration galleries onsite. Three basic monitoring activities occur at the landfarm: 1) soil sampling in the treatment zone to evaluate contaminant degradation, soil moisture, and compliance


1084
1028
1106
1035
1065
1107
1030
1111
1047
1026
1079
6503
<0.5
6503
1031
6007
6009
NS
3023
1002
3018
9.6
6008
3002
<0.5
8004
6004
3043
0.65J
3024
6001
<0.5
8006
<0.5
3010
NS
1100
1053
1052
3042
<0.5
1001
3038
NS
3020
8005
3017
NS
3008
NS
3041
<0.5
3039
360
8001
3003
NS
3025
NS
3031
160
3016
NS
3005
3029
3100
3015
NS
3004
3019
3026
NS
3011
<0.5
3007
3022
3012
3040
1.3
3032
NS
1025
3006
3030
5003
5004
3013
6500
8002
3021
<0.5
3037
3035
3036
3014
3033
3027
NS
3028
3034
1024
N
W
E
S
0
150
300 Feet
CH2M HILL interpretation of PCP contamination based on September 2008 analytical data.
SITE LOCATION
North Dakota
Montana
Idaho
Wyoming
Index Map
Lincoln County, Montana
Legend
Monitoring Well
Libby Ground Water Superfund Site
NAPL Observed in the Upper Aquifer (Historical and 2008, AEI 2009)
PCP Concentrations in the Upper Aquifer (AEI, 2009)
470 - PCP Concentration in micrograms per liter (µg/L), September 2007
NS - Not Sampled
1.9' - Product Thickness (feet)
NAPL - Non-Aqueous Phase Liquid
PCP - Pentachlorophenol
FIGURE 6-1
PCP Concentrations in Upper Aquifer
September 2008
Libby Ground Water Superfund Site
Libby, Montana
CH2MHILL
\\COBRA\GIS\PROJECTS\LIBBYMT\MAPFILES\5YEARREVIEW\FIG6-1_PCP.MXD MBLEESS 10/15/2009 12:19:10

with cleanup levels; 2) sampling of leachate from the collection sumps; and 3) berm integrity inspections.

O&M and long-term monitoring activities associated with the SAETS and performed at the Site since 1993 are described in the SAETS Annual Operations Reports for each operational year (AEI, 2005b, 2006b, 2007b, 2008b, 2009b). The SAETS is designed to operate continuously, and in 2008 experienced only minor interruptions associated with pump malfunctions, power outages and normal system maintenance. In 2008, approximately 10 million gallons of oil-contaminated ground water were extracted using three wells, and piped to the treatment facility. Nutrients, temperature, dissolved oxygen and pH are monitored weekly to ensure optimal operation of the bioreactor system. PAHs and PCP are monitored in the bioreactor influent and effluent to evaluate system performance. It is estimated that the bioreactor successfully degraded 1378 pounds of PAHs and 211 pounds of PCP in 2008, and that the overall performance in 2008 is similar to that of 2007. The overall performance of the coalescing separator in 2008 was also similar to 2007; approximately 730 gallons of free product were collected in the gravity separator in 2008.

According to the 1999 TI Evaluation Report, if the system is to operate at the current performance level (i.e. 1,000 to 2,000 gallons of NAPL recovered per year), recovery of NAPL would take decades. This would also leave residual NAPL in place that would continue to act as a long term source of dissolved contamination.

6.5 Interviews

The following people were invited to respond to questions about the remedy operations, progress of the remedy towards achieving remedial goals, incidents and concerns, etc:

- Kathryn Hernandez, RPM, EPA
- Lisa DeWitt, Environmental Specialist, MDEQ
- Tom Richardson, Remediation Project Manager of IP
- David Cosgriff, Environmental Engineer and Site Manger, AEI

In addition, Dan Thede, Director of City Services with the City of Libby was interviewed regarding the enforcement of the ordinance prohibiting the installation of new wells within the City limits.

Interview Record Forms documenting the interviews conducted are provided in **Attachment 3** of this report and interview responses are briefly summarized in the following paragraphs.

Kathryn Hernandez, RPM for EPA Region 8 indicated that she was not aware of any community concerns related to the Site, other than the restriction prohibiting Libby residents from drilling new wells and using water for irrigation, and that there have been no incidents or violations at the Site that have prompted a response from EPA. Ms. Hernandez did indicate that there were reported incidents of new wells being drilled, or existing ("grandfathered") wells being tapped because of drought conditions and the conclusion of the Buy Water Plan. Ms. Hernandez seemed satisfied that the "new" Buy Water Plan had solved this problem for the time-being. Ms. Hernandez stated that little progress had been made towards reaching remedial goals, and indicated that options to expedite achieving the remedial goals were being evaluated.

Lisa DeWitt, Project Manager for MDEQ, stated that the remedial operations at the Site are improving the area. However, Libby citizens, in response to drought conditions, rising city water costs and the restriction on installing private wells due to the city ordinance, revived their efforts to reinstate the Buy Water Plan. As a result, IP subsidized the costs of the operation of the city water plant. Ms. DeWitt indicated that she was not aware of any negative events at the Site (such as dumping or vandalism) that required a response from local authorities. There was one recorded spill at the Site in 2007, which was appropriately reported, contained and remediated. Ms. DeWitt noted that while

soil remediation is likely to take 3 to 5 years to complete, ground water remediation will take decades to complete using the current remedial process. Changes to the ground water remediation system would require a complete re-evaluation and evaluation of cost effectiveness.

Tom Richardson, Remediation Project Manager with IP, indicated that the remediation system is functioning as expected, and progress is being made as anticipated. He suggested that the remedy could be changed to expedite achieving the remediation goals by possibly targeting NAPL removal, abandoning the current system of biological treatment of ground water, and instituting monitored natural attenuation for the dissolved ground water plume. Related to this, Mr. Richardson suggested that a reduction in sampling and analytical frequency may be viable. Mr. Richardson is not aware of any incidents related to the Site that have prompted a response from local authorities. Mr. Richardson is not aware of any enforcement issues related to the City ordinance prohibiting the installation of new water wells. He did note that one additional previously installed well was abandoned by IP at the request of the owner, and the owner was compensated. Mr. Richardson is not aware of any system problems or changes that have impacted progress towards meeting remedial goals, or have affected the protectiveness of the remedy.

David Cosgriff, Arrowhead Engineering, Inc., is responsible for onsite O&M activities. Mr. Cosgriff noted that the remediation system is functioning as expected and in compliance with the design documents and O&M requirements. Mr. Cosgriff is not aware of any system problems or changes that have impacted progress towards meeting remedial goals, or have affected the protectiveness of the remedy. He did note that the biological component of the SAETS could be discontinued to make the remedy more cost effective.

In addition, a telephone interview was conducted with **Dan Thede**, Director of City Services with the City of Libby, concerning the ordinance prohibiting the installation of new ground water wells. Mr. Thede has worked for the City for over 20 years. He stated that the ordinance prohibiting the installation of new ground water wells is still in effect and that only 2 well permit applications had been submitted in the past 5 to 6 years. The City did not allow those wells to be installed. Mr. Thede also stated that it was not the City's responsibility to enforce or ensure that any existing wells located in the City were not being used for consumption or irrigation purposes.

6.6 Site Inspection

An inspection was conducted at the Site on June 25-26, 2009. The complete Site inspection checklist is provided in **Attachment 4**. Photographs taken during the Site inspection are provided in **Attachment 5**.

Based on the Site inspection, the Site appears to be well maintained, and there was no evidence of vandalism. Access restrictions, including fences and signs, were in place (see photographs 13, 17, 18 in **Attachment 5**). The main gate was locked and in good condition. Vegetative cover consists primarily of native grasses and small shrubs and trees around the Fire Pond and along the Libby Creek Diversion Canal (see photographs 20, 21 in **Attachment 5**).

Most of the existing onsite and several offsite ground water monitoring wells were visited during the Site inspection and were observed to be in good condition and all inspected onsite wells were protected with bollards (see photograph 19 in **Attachment 5**).

Observations during the Site inspection (see photographs 5, 6 in **Attachment 5**) indicate the LTU and ELF are being maintained properly. There did not appear to be any excessive erosion, and berms (when appropriate) were in good condition. At the time of the inspection, irrigation of select LTU plots was being conducted to insure proper moisture content of the soils for biodegradation. The equipment to rotate the soils was stored outside in a central location. This equipment appeared to be well maintained.

The SAETS building was securely locked prior to entry for the Site inspection. The inside of the building was well-kept and organized. Along with the remediation equipment, the building contained a desk for completing paper work and file cabinets for storing inspection and O&M records (see photographs 1, 3 and 4 in **Attachment 5**). All the equipment inside the building was labeled. The above-ground storage tank located outside the remediation building used to store the recovered NAPL was labeled and had secondary containment (see photograph 2 in **Attachment 5**). Overall, the SAETS building and equipment appeared to be in very good working condition.

7.0 Technical Assessment

The five-year review must determine whether the remedy at a Site is protective of human health and the environment. EPA guidance provides three questions to be used as a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy. These questions are answered for the Site in the following paragraphs. At the end of this section is a summary of the technical assessment.

7.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

OU1

The remedy for OU1 is not functioning as intended. The remedy for OU1 involved an alternative water supply source for Libby residents whose wells were either influenced or potentially influenced by offsite upper aquifer contaminant plume migration. The alternative water supply initiative was augmented by Champion's Buy Water Plan. According to the third five-year review for the Site, in 1998 44 residential wells were abandoned by Champion, and the well owners were compensated for their wells (EPA, 2005). According to Tom Richardson, Remediation Project Manager for IP (see S**ection 7.3**), during the past five years one additional previously installed well was abandoned by IP at the request of the owner, and that owner was compensated.

In addition, the remedy for OU1 incorporated a City ordinance (provided in **Attachment 6)** prohibiting the installation of new water wells within City limits. The city ordinance remains in effect but appears to be limited in effectiveness. During a recent drought, some residents were installing new wells and using wells that had not been capped. In addition, the City ordinance does not include the Stimson property, which lies to the east of the corporate limits of Libby, and is currently being considered for redevelopment.

OU2

The remedy for OU2 is functioning as intended. However, the remedy is not removing a significant volume of source material, and may not meet revised standards noted in this report. The components of the remedy for OU2 are summarized in **Section 4.2**. A brief summary of the remedy performance for soil and ground water is provided below.

Soils/Source Area

The RAOs and cleanup goals for the source zone soils have been not been achieved, and therefore treatment of contaminated soils must continue until the cleanup levels are met. Contaminant concentrations in soil are declining due to the treatment consisting of periodic cultivation and irrigation to maintain consistent moisture and oxygen levels. Based on the current rate of remediation, it is estimated that the remaining soils will take an additional three to five years to meet the soil cleanup levels. This is consistent with the expectation in the decision documents given the quantity of soil being treated, the contaminant levels, and the cleanup levels to be achieved (although this will require re-evaluation in light of the revised risk-based cleanup levels discussed in **Section 7.2**).

Upper Aquifer Ground Water

The RAOs and cleanup goals for upper aquifer ground water have been not been achieved, although because of the amount of NAPL that remains in the subsurface and the remediation technology being employed, this is not unexpected. The SAETS is removing NAPL and dissolved PAHs and PCP from the source area. The system has been in operation for over 17 years, and has removed approximately 14,400 pounds of contaminants (through 2008).

The three extraction wells are located in one portion of the Site where mobile NAPL is available for removal. There was a 72 percent decrease in recovered NAPL from Well 9006 from 2004 to 2007, indicating this part of the source area is becoming depleted in NAPL. The NAPL yields from wells 9008 and 9009 are decreasing at a slower rate and combined for over 8500 pounds of NAPL removal in 2007.

The fixed-film bioreactor has a dissolved PAH removal efficiency of 97 to 99 percent. The average dissolved PCP removal in the bioreactor unit decreased to 75 percent in 2007. PCP removal appears to be more sensitive to oxygen, nutrient and biological changes in the fixed-film bioreactor.

Based on the data review and Site inspection, it appears that the remedy is functioning as intended by the decision documents. However due to the large areal extent of NAPL at the Site, the extent of the upper aquifer PCP plume has not been affected by operation of the SAETS. While the system could be expected to remove thousands of pounds of NAPL from the source area over the next 5 years, thousands of additional pounds will remain, much of it as immobile NAPL that will continue to act as a long-term source of dissolved contaminants in ground water.

System Operation and Maintenance

O&M activities at the Site have evolved as the conditions have changed and experience with the operation and reliability of the SAETS has improved with time. Since O&M began in late 1989, Site operations have undergone various optimization improvements. Currently, remedy operations consist of the continuous operation of the landfarm, and monthly onsite inspections and routine maintenance. Current O&M is adequate to ensure the system continues to operate as intended.

Monitoring Activities

The long-term monitoring program is examined on a yearly basis to determine if wells and/or laboratory analyses can be eliminated from the sampling program. Adjustments to the long-term monitoring program are documented in the annual O&M reports. The long-term monitoring program has been adjusted in terms of numbers of wells sampled and sampling frequency (fewer wells are sampled on a less frequent basis) as the overall data set for the Site has increased. The long-term ground water monitoring plan was last updated in 2005 (AEI, 2005b).

Opportunities for Optimization

Alternative remedial strategies for the Site are currently being evaluated. These strategies employ technologies that have been developed during the past decade and have been shown to be effective in treating source zone contamination. A significant reduction in source zone size and amount of product present will be necessary in order to meet RAOs and cleanup levels for the upper aquifer.

In the future, if the current SAETS remains in place and concentrations of dissolved PAH and PCP decrease in the upper aquifer, activated carbon may become a more cost effective method of removing these contaminants from the water that has passed through the oil-water separator. The fixed-film bioreactor performance requires that ground water be heated from 10º C to 22º C at a flow rate of 14 gallons per minute. This energy requirement should be compared to the cost of using activated carbon to remove dissolved PAH and PCP.

Early Indicators for Potential Remedy Problems

The source zone does not appear to be well characterized and the current remedy (SAETS) may leave significant quantities of mobile and residual NAPL in place, which will act as a long-term source of dissolved contaminants in the upper aquifer. This will preclude the ability to meet RAOs in the upper aquifer for decades.

7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

OU1

Yes, the RAOs used at the time of the remedy are still valid for this OU. Exposure assumptions, toxicity data, and cleanup levels are not relevant to this OU.

OU2

No. The ground water cleanup levels for the Site are based on MCLs where they exist. Where MCLs do not exist, ground water cleanup levels are based on calculated risk-based concentrations for the adult residential exposure scenario (the acceptable level of risk was $1x10^{-5}$). Soil clean-up levels are based on risk-based concentrations for the construction worker exposure scenario.

The residential adult and construction worker exposure scenarios were used as the basis for the risk-based cleanup levels presented in the 1988 ROD for OU2. In 1994, the exposure assumptions and toxicity data behind these risk-based concentrations were reviewed, and revised risk-based cleanup levels for several contaminants were issued in the 1997 ESD (several other cleanup levels also changed due to promulgation of MCLs for PCP and many of the carcinogenic PAHs, and changes in the classification from carcinogenic to non-carcinogenic for other PAHs – refer to **Section 3.5** and **Table 3-1**). The toxicity data, exposure assumptions, cleanup levels and remedial objectives were reviewed for this five year review, and are discussed in the following sections.

Changes in Toxicity Factors for the Chemicals of Concern at the Libby Ground Water Site

Toxicity factors for some of the contaminants have changed from the factors used in 1994, as noted in **Table 1** in **Attachment 7**. These updated toxicity factors were obtained from the EPA Regional screening Level table (EPA, 2008a). The TEFs were obtained from the 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds (Van den Berg, et al; 2006).

Changes in Exposure Assumptions

The exposure factors that were used to calculate the 1997 ESD risk-based cleanup levels for soils were reviewed to determine if they are consistent with updated guidance contained in the EPA Risk Assessment Guidance for Superfund (RAGS): Volume I – Human Health Evaluation Manual (EPA, 1991) and EPA RAGS: Volume I (EPA, 2004). **Table 2** in **Attachment 7** contains the exposure factors for an adult construction worker. As shown in this table, the 1997 ESD cleanup levels for soil evaluated the ingestion and inhalation exposure pathways for soil, but did not include the dermal exposure pathway. When soil risk-based cleanup levels are recalculated using the dermal exposure scenario, updated guidance and updated toxicity factors, cleanup levels for dioxins, and furans decrease (except for furan penta (2,3,4,7,8) and dioxin tetra (2,3,7,8)), while cleanup levels for non-carcinogenic PAHs, carcinogenic PAHs, and PCP increase as shown in **Table 7-1**.

Vapor intrusion, which is the movement of volatile organic compounds (VOCs) from contaminated soil or ground water into existing buildings, or the potential migration of VOCs into future buildings overlying or near contaminated ground water or soil, has become a newly identified pathway that was not considered at the time of the ROD for OU2. A vapor intrusion study was conducted in 2008 and the results indicate that none of the constituents analyzed for in wells located outside of the Stimson property had contaminant detections exceeding vapor intrusion screening criteria (URS, 2009). Ethylbenzene and naphthalene were detected at concentrations exceeding vapor intrusion screening criteria at four locations within the Stimson property. The vapor intrusion pathway warrants further evaluation.

TABLE 7-1
Cleanup Levels for Soil Using Revised Exposure Assumptions and Toxicity Factors.

	Soil – 1997 ESD		**Soil – 2010**	
Contaminants of Concern	**Cleanup Level (mg/Kg)**	**Basis[(e)]**	**Cleanup Level (mg/Kg)**	**Basis**
NON-CARCINOGENIC PAHS				
Acenaphthene	166	Risk-Based Value HI=1.0	41,700	Risk-Based Value HI=1.0
Anthracene	33		208,600	
Fluorene	250		27,800	
Fluoranthene	250		27,800	
Naphthalene	NA		NA	
Pyrene	NA		NA	
Phenanthrene	NA		NA	
Acenaphthylene	NA		NA	
Benzo (g,h,i) perylene	NA		NA	
CARCINOGENIC PAHS				
Chrysene	59,400	Risk-Based Value 10^{-5}	66,659.1	Risk-Based Value 10^{-5}
Benzo (a) anthracene	594		666.7	
Benzo (b) fluoranthene	594		666.7	
Benzo (k) fluoranthene	5,940		6,665.9	
Benzo (a) pyrene	59		66.7	
Indeno (1,2,3-c,d) pyrene	594		666.7	
Dibenzo (a,h)anthracene	59		66.7	
OTHER COMPOUNDS				
Pentachlorophenol	36	Risk-Based Value 10^{-5}	3,351	Risk-Based Value 10^{-5}

	Soil – 1997 ESD		Soil – 2010	
Contaminants of Concern	**Cleanup Level (mg/Kg)**	**Basis[(e)]**	**Cleanup Level (mg/Kg)**	**Basis**
FURANS				
tetra (2,3,7,8)	**0.0289**	Risk-Based Value 10^{-5}	**0.0148**	Risk-Based Value 10^{-5}
tetra (non-2,3,7,8)	NA		NA	
penta (1,2,3,7,8)	**0.0578**	Risk-Based Value 10^{-5}	**0.0189**	Risk-Based Value 10^{-5}
penta (2,3,4,7,8)	0.00578	Risk-Based Value 10^{-5}	0.0092	Risk-Based Value 10^{-5}
penta (other)	NA		NA	
hexa (2,3,7,8)	**0.0289**	Risk-Based Value 10^{-5}	**0.0148**	Risk-Based Value 10^{-5}
hexa (non-2,3,7,8)	NA		NA	
hepta (2,3,7,8)	**0.289**	Risk-Based Value 10^{-5}	**0.0205**	Risk-Based Value 10^{-5}
hepta (non-2,3,7,8)	NA		NA	
Octa	**2.89**	Risk-Based Value 10^{-5}	**0.0213**	Risk-Based Value 10^{-5}
DIOXINS				
tetra (2,3,7,8)	0.00289	Risk-Based Value 10^{-5}	0.00454	Risk-Based Value 10^{-5}
tetra (non-2,3,7,8)	NA		NA	
penta (1,2,3,7,8)	**0.00578**	Risk-Based Value 10^{-5}	**0.00454**	Risk-Based Value 10^{-5}
penta (non-2,3,7,8)	NA		NA	
hexa (2,3,7,8)	**0.0289**	Risk-Based Value 10^{-5}	**0.02884**	Risk-Based Value 10^{-5}
hexa (non-2,3,7,8)	NA		NA	
hepta (2,3,7,8)	**0.289**	Risk-Based Value 10^{-5}	**0.06210**	Risk-Based Value 10^{-5}
hepta (non-2,3,7,8)	NA		NA	
Octa	**2.89**	Risk-Based Value 10^{-5}	**0.07091**	Risk-Based Value 10^{-5}

Notes:

NA: Not applicable

HI: Hazard Index

Since MCLs do not exist for the non-carcinogenic PAHs regulated at the Site, a comparison was made of the exposure assumptions used to calculate risk-based cleanup levels for ground water. Several exposure factors have changed, as shown in **Table 3** in **Attachment 7**. It appears that the human health risk calculations performed in 1994 did not include an age-adjusted scenario for the ingestion of water by a child. The exposure factors for the age-adjusted resident were obtained from EPA (1991). When risk-based cleanup levels for the non-carcinogenic PAHs are recalculated using an age-adjusted residential exposure scenario, they are lower than the cleanup levels in the 1997 ESD. For the

carcinogenic PAHs that do not have MCLs, the recalculated risk-based cleanup levels are higher than the 1997 ESD cleanup levels for all but dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene, as shown in **Table 7-2.**

An emerging contaminant issue has also been identified for the Site. The chemical 1,4-dioxane is frequently used as a stabilizer in the solvent TCA, which has been detected at the Site. Although there is no MCL for 1,4-dioxane, the health-based benchmark is 6.2 µg/L. The potential presence of this chemical in ground water at the Site is considered to be a data gap and for this reason it should be included in future ground water sampling events.

TABLE 7-2
Cleanup Levels for Ground Water Using Revised Exposure Assumptions and Toxicity Factors

	Ground Water – 1997 ESD		**Ground Water – 2010**	
Contaminants of Concern	**Cleanup Level (µg/L)**	**Basis**	**Cleanup Level (µg/L)**	**Basis**
NON-CARCINOGENIC PAHS				
Acenaphthene	**2190**	Risk-Based Value HI=1.0	**1730**	Risk-Based Value HI=1.0
Anthracene	**11000**		**8640**	
Fluorene	**1460**		**1150**	
Fluoranthene	**1460**		**1150**	
Naphthalene	**1460**		**580**	
Pyrene	**1100**		**860**	
Phenanthrene	NA		NA	
Acenaphthylene	NA		NA	
Benzo (g,h,i) perylene	NA		NA	
CARCINOGENIC PAHS				
Chrysene	0.2	MCL	29	RSL
Benzo (a) anthracene	0.1		0.29	RSL
Benzo (b) fluoranthene	0.2		0.29	RSL
Benzo (k) fluoranthene	0.2		2.9	RSL
Benzo (a) pyrene	0.2		0.2	MCL
Indeno (1,2,3-c,d) pyrene	**0.4**		**0.29**	RSL
Dibenzo (a,h)anthracene	**0.3**		**0.029**	RSL

	Ground Water – 1997 ESD		Ground Water – 2010	
Contaminants of Concern	**Cleanup Level (µg/L)**	**Basis**	**Cleanup Level (µg/L)**	**Basis**
OTHER COMPOUNDS				
Pentachlorophenol	1.00	MCL	1.00	MCL
Benzene	5.00		5.00	
Arsenic	**50.00**		**10.00**	

Notes:

NA: Not applicable

RSL: Regional screening level from Regional Screening Level Table, USEPA, Sept. 2008. RSLs are based on a target risk of 10-5.

Changes in Ground Water Cleanup Levels

A comparison of the ground water cleanup levels to current EPA MCLs[1], indicates that the MCL for arsenic was lowered from 50 µg/L to 10 µg/L in 2006[2] (see **Table 7-2**). In addition, Montana has issued revised numerical water quality standards for surface water aquatic life and human health (MDEQ, 2008). Several of the human health water quality standards are less than the revised ground water cleanup levels, as shown in **Table 7-3**.

TABLE 7-3
Comparison of MDEQ Human Health Water Quality Standards to 2010 Cleanup Levels Using Revised Exposure Assumptions and Toxicity Factors

	Ground Water – MDEQ (2008)		Ground Water – 2010	
Contaminants of Concern	**Cleanup Level (µg/L)**	**Basis**	**Cleanup Level (µg/L)**	**Basis**
NON-CARCINOGENIC PAHS				
Acenaphthene	**670**	Priority Pollutant Criteria	**1730**	Risk-Based Value HI=1.0
Anthracene	**2100**	Health Advisory	**8640**	
Fluorene	1100	Priority Pollutant Criteria	1150	
Fluoranthene	**130**	Priority Pollutant Criteria	**1150**	
Naphthalene	**100**	Health Advisory	**580**	
Pyrene	830	Priority Pollutant Criteria	860	
Phenanthrene	NA		NA	
Acenaphthylene	NA		NA	
Benzo (g,h,i) perylene	NA		NA	

[1] United States Environmental Protection Agency. Maximum Contaminant Levels, http://www.epa.gov/safewater/contaminants/index.html#mcls, September, 2008a.

[2] On January 22, 2001 EPA adopted a new standard for arsenic in drinking water at 10 parts per billion (ppb), replacing the old standard of 50 ppb. The rule became effective on February 22, 2002. The date by which systems must comply with the new 10 ppb standard was January 23, 2006. (Source: http://www.epa.gov/safewater/arsenic/regulations.html)

Contaminants of Concern	Ground Water – MDEQ (2008)		Ground Water – 2010	
	Cleanup Level (µg/L)	Basis	Cleanup Level (µg/L)	Basis
CARCINOGENIC PAHS				
Chrysene	50	Health Advisory	29	RSL
Benzo (a) anthracene	0.5		0.29	RSL
Benzo (b) fluoranthene	0.5		0.29	RSL
Benzo (k) fluoranthene	5		2.9	RSL
Benzo (a) pyrene	**0.05**		**0.2**	MCL
Indeno (1,2,3-c,d) pyrene	0.5		0.29	RSL
Dibenzo (a,h)anthracene	0.05		0.029	RSL
OTHER COMPOUNDS				
Pentachlorophenol	1.00	MCL	1.00	MCL
Benzene	5.00		5.00	
Arsenic	10.00		10.00	

Notes:

NA: Not applicable

RSL: Regional screening level from Regional Screening Level Table, USEPA, Sept. 2008, RSLs are based on a target risk of 10-5.

Changes in Applicable or Relevant and Appropriate Regulations (ARARs)

ARARs for this Site were identified in the 1988 ROD for OU2. The five-year review for this Site included identification and evaluation of changes in the ROD-specified ARARs to determine whether such changes may affect the protectiveness of the selected remedy. ARARs that were included in the 1988 ROD for soils/source areas are listed in **Attachment 7**.

No additional ARARs for the soils/source areas were identified during this five year review. In addition, it is believed that there have been no changes in location-specific or action-specific ARARs that would bear on protectiveness and therefore warrant analysis in this five-year review. While there have been some recodifications and revisions of ARARs, these would not affect the protectiveness. The cleanup levels specified in the ROD are based on risk-based concentrations calculated for the construction worker exposure scenario. Many of the toxicity factors and exposure assumptions have changed since the last time these cleanup levels were calculated (refer to **Section 7.1**).

ARARs that were included in the 1988 ROD for upper and lower aquifer ground water are listed in **Attachment 7**. The 1988 ROD specified that ground water cleanup levels were to be protective of human health, and therefore MCLs are used for contaminants where they exist. If there are no MCLs, risk-based (10^{-5}) cleanup levels are used. As of January 23, 2006, the MCL for arsenic in ground water decreased from 50 µg/L to 10 µg/L. In addition, many of the toxicity factors and exposure assumptions have changed, which affects the risk-based concentrations for the many of the PAHs (refer to **Section 7.2**). In 2008, MDEQ issued revised numeric water quality standards (MDEQ, 2008). Several of the ground water human health standards in MDEQ's numeric water quality standards are

less then the calculated risk-based cleanup levels using the revised toxicity factors and exposure assumptions (see **Table 7-3**). No additional ARARs were identified as part of this five-year review.

7.3 Question C: Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

OU1

Yes. The City ordinance appears to be limited in effectiveness. During a recent drought, there was anecdotal evidence that some residents were installing new wells or using wells that had not been closed (Libby City Council, 2007). In addition, the City ordinance does not include a portion of the plume located near the Stimson lumber mill property, located in the northern half of the facility.

OU2

Yes. As introduced previously in this five-year review, vapor intrusion has become a newly identified pathway that was not considered at the time of the ROD for OU2. A vapor intrusion study was conducted in 2008 for onsite and offsite locations. The results indicate that none of the constituents analyzed for in wells located offsite detected concentrations exceeding vapor intrusion screening criteria. Ethylbenzene and naphthalene were detected at concentrations exceeding vapor intrusion screening criteria at four locations within the Stimson property. Additional investigation is warranted since this property may be redeveloped in the future.

An emerging contaminant issue has also been identified for the Site concerning 1,4-dioxane, which is frequently used as a solvent stabilizer. The presence of this chemical in ground water at the Site is considered to be a data gap and for this reason it should be included in future ground water sampling events.

7.4 Summary of the Technical Assessment

The remedy for OU1 is not protective. The City ordinance does not include a portion of the plume beneath the Stimson lumber mill property (east of the City boundary). During a recent drought, there was anecdotal evidence that some residents were installing new wells or using existing wells that had not been closed.

The remedy for OU2 is not protective. Even though the SAETS could be expected to remove thousands of pounds of NAPL from the source area over the next 5 years, thousands of additional pounds will remain in place, much of it as immobile NAPL that will continue to act as a long-term source of dissolved contaminants in ground water. In addition, changes in toxicity factors and exposure assumptions have resulted in revised risk-based cleanup levels for soil and ground water that will require evaluation of the existing remedies. The revised Montana Numeric Water Quality Standards were identified as an additional ARAR for ground water. Other issues that will require further evaluation include the extent of NAPL in the source area, the downgradient extent of the dissolved contaminant plume, the vapor intrusion pathway, and the potential presence of 1,4-dioxane in ground water.

In summary, the remedial actions at OU1 and OU2 are not protective, and therefore the Site is not protective of human health and the environment.

8.0 Issues

The following issues were identified during this five-year review.

TABLE 8-1
Summary of Identified Issues

		Affects Protectiveness (Yes/No)	
OU	**Issues**	**Current**	**Future**
1	**1. The City ordinance is not fully prohibiting the installation of new water wells.** During a recent drought, anecdotal evidence indicated that residents were installing wells, or putting into use wells that had not been closed. The use of wells should be prohibited (irrespective of property boundaries) and enforceable.	Yes	Yes
1	**2. The City ordinance does not include the Stimson property, which lies to the east of the corporate limits of Libby and is currently being considered for redevelopment.** The Stimson property also overlies a portion of the ground water PCP plume. The designation of a CGWUA may correct this issue, since it will identify the area where the plume has impacted upper aquifer ground water.	Yes	Yes
2	**3. The toxicity factors and exposure assumptions used to calculate risk-based cleanup levels for soil have changed.** It appears that the dermal exposure pathway was not considered in the 1997 risk-based soil cleanup levels. The soil remedy will need to be evaluated to determine if the revised cleanup levels are attainable.	Yes	Yes
2	**4. The toxicity factors and exposure assumptions used to calculate risk-based cleanup levels for ground water have changed**. It appears that the age-adjusted scenario for the ingestion of water by a child was not included in the 1997 ESD cleanup levels for ground water. When risk-based cleanup levels for the non-carcinogenic PAHs are recalculated using an age-adjusted residential exposure scenario, they are lower than the cleanup levels in the 1997 ESD. For the carcinogenic PAHs that do not have MCLs, some recalculated risk-based cleanup levels are higher and some are lower than the 1997 ESD cleanup levels depending on the specific changes to the toxicity factors.	Yes	Yes
2	**5. The MCL for arsenic has changed from 50 µg/L to 10 µg/L.** While it does not appear the arsenic contamination in upper aquifer ground water is as widespread as the PAH and PCP contamination, the data set is more limited and warrants additional investigation. The maximum concentration of total arsenic from the 2008 sampling event was 26.4 µg/L in well 3041.1, and this was the only sampled well that had a concentration that exceeded the drinking water standard.	Yes	Yes
2	**6. MDEQ has issued Numeric Water Quality Standards that are, in some cases, more stringent than the risk-based cleanup levels for groundwater (MDEQ, 2008).**	Yes	Yes

		Affects Protectiveness (Yes/No)	
OU	**Issues**	**Current**	**Future**
2	**7. Due to the presence of mobile and residual NAPL in the source area that will continue to act as a long-term contaminant source, and the lateral extent of the dissolved ground water contamination, certain areas of contaminated ground water cannot effectively be remediated by the current pump and treat remedy.** It is expected that operation of the SAETS will be necessary for several decades to remediate a portion of the onsite PCP plume and will not be fully effective. The remediation of the offsite portion of the PCP plume, and the extent of the source area, warrants further evaluation.	Yes	Yes
2	**8. The current extent of the ground water monitoring well network does not appear to be adequate to monitor the extent of NAPL in the source area and the upper aquifer ground water plume to ensure public health and safety.**	Yes	Yes
2	**9. Vapor intrusion is a newly identified pathway.** Ethylbenzene and naphthalene were detected at concentrations exceeding vapor intrusion screening criteria at 4 locations within the Stimson property.	Yes	Yes
2	**10. The potential presence of 1,4-dioxane in ground water at the Site is considered to be a data gap.** Although there is no MCL for 1,4-dioxane, the health-based benchmark is 6.2 µg/L.	Yes	Yes

9.0 Recommendations and Follow-up Actions

To address these issues, the following recommendations and follow-up actions have been defined.

TABLE 9-1
Recommendations and Follow-up Actions

					Follow-up Actions: Affects Protectiveness (Y/N)	
OU	**Recommendations/Follow-up Actions**	**Party Responsible**	**Oversight Agency**	**Milestone Date**	**Current**	**Future**
1	1. Public awareness efforts should be made to prevent residents from using existing wells for irrigation or installing new wells.	City of Libby EPA	EPA, MDEQ	9/1/2010	Yes	Yes
1	2. The City ordinance should be expanded to include the Stimson mill property and potentially limited to the CGWUA.	IP, City of Libby, EPA	EPA, MDEQ	12/31/2010	Yes	Yes
2	3. Soil cleanup levels should be re-evaluated in light of changes to toxicity factors and exposure assumptions used to calculate risk-based cleanup levels. New cleanup levels should be issued in an ESD to the ROD for OU2.	EPA	EPA, MDEQ	6/1/2011	Yes	Yes
2	4. Ground water cleanup levels should be re-evaluated in light of changes to toxicity factors and exposure assumptions used to calculate risk-based cleanup levels. New cleanup levels should be issued in an ESD to the ROD for OU2.	EPA	EPA, MDEQ	6/1/2011	Yes	Yes
2	5. Additional arsenic data should be collected in monitoring wells to determine if the ground water remedy is protective.	IP, EPA	EPA, MDEQ	6/1/2011	Yes	Yes
2	6. MDEQ's Numeric Water Quality Standards should be evaluated relative to calculated risk-based levels. If the more stringent values are not warranted, an ARAR waiver should be issued through an ESD for OU2.	EPA, MDEQ	EPA, MDEQ	6/1/2011	Yes	Yes
2	7. Additional source characterization should be performed and remedial technologies should be evaluated for the upper aquifer.	IP, EPA	EPA	12/31/2010	Yes	Yes
2	8. Additional wells should be installed to better delineate the NAPL source area and extent of the dissolved contaminant plume.	IP, EPA	EPA	12/31/2011	Yes	Yes

					Follow-up Actions: Affects Protectiveness (Y/N)	
OU	**Recommendations/Follow-up Actions**	**Party Responsible**	**Oversight Agency**	**Milestone Date**	**Current**	**Future**
2	9. Additional sampling should be performed in the source area, and a risk evaluation should be performed.	IP, EPA	EPA	6/1/2011	Yes	Yes
2	10. The analysis for 1,4-dioxane should be included in future ground water sampling events, particularly for samples collected in well located in the NAPL source area.	IP, EPA	EPA	6/1/2011	Yes	Yes

10.0 Protectiveness Statement

The remedy for OU1 is not protective. The current City ordinance does not include a portion of the upper aquifer PCP plume that is located beneath the Stimson lumber mill property (east of the City boundary). In addition, anecdotal information obtained during a recent drought indicates that some residents were installing new wells and/or using existing wells that had not been closed as part of the Buy Water Plan.

The remedy for OU2 is not protective. ARARs are not being met. It is uncertain whether the soil remedy can meet the revised risk-based cleanup levels. Risk-based cleanup levels for ground water have changed due to changes in toxicity factors and exposure assumptions. The concentrations of arsenic in ground water warrant further evaluation since the MCL has decreased from 50 to 10 µg/L. MDEQ numeric standards for water quality are, in many cases, more stringent than the risk-based cleanup levels for groundwater. The availability of new technologies for source zone characterization and remediation warrant further evaluation for the Site since it appears that the SAETS may not be adequately remediating the source zone and PCP plume. The problem is compounded by the current lack of comprehensive institutional controls. The vapor intrusion pathway and potential presence of 1,4-dioxane in ground water have been identified as issues, and warrant additional data collection and evaluation.

The remedial actions at OU1 and OU2 are not protective, and therefore the Site is not protective of human health and the environment.

11.0 Next Review

The next five-year review, the fifth for the Site, should be completed before March, 2015.

Attachment 1

Public Notices Regarding the Five-Year Review

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Kootenai Valley Record
507 Mineral Ave.
Libby, MT 59923

Five-Year Review of Cleanup Libby Groundwater Superfund Site

The U.S. Environmental Protection Agency (EPA) is conducting a five-year review on the Libby Groundwater site. The review will address the status of the cleanup at the site and the laws that apply to the cleanup.

The Five-Year Review is a regular EPA checkup on a Superfund site to make sure that cleanup decisions continue to protect people and the environment. This will be the fourth five-year review for the site.

The Libby Groundwater Site is located on the southern portion of the former Stimson Mill property and includes soil and groundwater treatment units that were constructed to remove contamination from former wood-treating operations. The performance of the treatment systems will be evaluated during the review.

A report containing the results of the review will be available in Spring 2009. This report is a public document. Interested individuals can view a copy by visiting the site Information Repository at the Lincoln County Department of Environmental Health in the Lincoln County Annex at 418 Mineral Ave. or at the EPA Information Center at 501 Mineral Ave.

If you would like to learn more about the site, would like to request a copy of the report, or have comments concerning the review, please visit the Information Repository at the Lincoln County Annex or contact EPA's Remedial Project Manager, Kathryn Hernandez toll free at 1-800-227-8917 x6101.

protects public access

groups who supported SB 78 sued a number of landowners along the Ruby River in Madison County.

In Judge Loren Tucker's nonsense decision, there were three important holdings:

1) the width of the right of way at a county bridge is 60 feet;

2) the public is entitled to use the entire 60 foot right of way;

3) the fences authorized for use in Madison County running to the edge of the bridges are not encroachments.

Relying on the testimony of the fishermen who challenged the law, Judge Tucker easily concluded the fences were not designed to block and/or intimidate the public from accessing the Ruby River. In other words, Judge Tucker has the shown the fallacy of the need to enact legislation to clarify "the legality of accessing our rivers and streams from public rights-of-ways."

Let's be clear: SB 78 is not necessary to preserve our right to hunt and fish. These rights have been secure long before SB 78 was contemplated, and they continue to rest easy without it.

Likewise, Rep. Vincent also showed the courage to make a principled stand and fight for legislation that protects landowners and the recreating public alike. SB 78 is nothing more than an attempt to pit the fisherman against the rancher or the landowner against the public.

House District 2 deserves a representative who can keep a cool head and work for practical solutions that benefit the many, not the few. Please join me in voting to re-elect Rep. Vincent, a leader all of us can count on.

Kyle Nelson, Missoula
(I'm a registered voter from Rexford)

nists speak

I was raised to believe that the best way to expose extremists is to let them speak. If they are kooks, then let them hang themselves with their own words.

In his book *The Art of War*, the ancient military tactician Sun Tzu, wrote: "Know your enemy, and in 100 battles, you shall find victory."

In other words, if Libby residents actually believe that Mr. Koehler is, as Mr. Hirst implies, an enemy of Libby, then the community should be allowed to read what Koehler says, pick apart his arguments point by point and then refute them point by point.

If you instead try to suppress Koehler's voice locally, then you are revealing that you fear his words. Your fear will not carry either you or your community toward any satisfactory resolution of an issue.

Phillip Bigelow, Libby

ices because the president vetoed that bill. We also know that $22 billion didn't go to shoring up the levies in New Orleans after hurricane Katrina because our president nixed that, saying it was too expensive. Any auditor worth his salt would smell embezzlement if this happened in a corporation.

But how about the final act? After allowing banks and insurance companies to run our nation has "crapped the bed" and yet all those trillions of dollars must have gone somewhere.

We know it didn't go to Iraq or the war on terrorism since the soldier's families had to buy their equipment. And how much could it really cost per capita to waterboard a terrorist? Then again, maybe I just have too much time on my hands.

Dale Chapman, Libby

Five-Year Review of Cleanup Libby Groundwater Superfund Site

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Montanian, Oct. 22, 2008

LHS girls get Corvallis in

The Western News

The Libby High School girls soccer team will open the Class A state playoffs on Saturday with a home game against Corvallis.

The Lady Loggers will take to the field at 1 p.m.

Corvallis is the No. 3 seed out of the South while Libby is the top seed from the North. The winner will face the winner of Billings Central (No. 1 East) vs. Stevensville (No. 2 South).

Eight teams qualify for the playoffs. The other two first-round games pit Hamilton (No. 1 South) against Columbia Falls (No. 3 North) and Belgrade (No. 2 East) against Whitefish (No. 2 North).

The Libby boys also qualified for state and will play on the road as the No. 2 seed out of the North. The Loggers will face Park out of Livingston on Saturday. As of Wednesday afternoon, the start time of the game had not yet been determined. The Montana High School Association's soccer coordinator said school officials there were still working on scheduling to nail down the start time.

The winner of the game will advance to the semifinals to play the winner of Corvallis (No. 1 South) vs. Bigfork (No. 3 North). Other first-round games are Billings Central

Five-Year Review of Cleanup Libby Groundwater Superfund Site

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Attachment 2

Documents Reviewed

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Alsid/Carr, Alsid & Associates, J. R. Carr/Associates. 1985. *Impact of Wood Treating Operations at Libby, Montana, Phase III Field Investigation.* June 1985

Arrowhead Engineering, Inc., 2005a. *2004 Annual Operations Report Source Area Extraction And Treatment System Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2005b. *Final Ground Water Monitoring Plan*.

Arrowhead Engineering, Inc., 2006a. *2005 Annual Landfarm Operations Report for the Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2006b. *2005 Annual Operations Report Source Area Extraction And Treatment System Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2006c. *2005 Annual Ground Water Monitoring Report For The Upper And Lower Aquifer Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2007a. *2006 Annual Landfarm Operations Report for the Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2007b. *2006 Annual Operations Report Source Area Extraction And Treatment System Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2007c. *2006 Annual Ground Water Monitoring Report For The Upper And Lower Aquifer Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2008a. *2007 Annual Landfarm Operations Report for the Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2008b. *2007 Annual Operations Report Source Area Extraction And Treatment System Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2008c. *2007 Annual Ground Water Monitoring Report For The Upper And Lower Aquifer Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2009a. *2008 Annual Landfarm Operations Report for the Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2009b. *2008 Annual Operations Report Source Area Extraction And Treatment System Libby Ground Water Site Libby, Montana.* March.

Arrowhead Engineering, Inc., 2009c. *2008 Annual Ground Water Monitoring Report For The Upper And Lower Aquifer Libby Ground Water Site Libby, Montana.* March.

CH2M HILL, 2009. *Review of 1999 Technical Impracticability Evaluation Report and Recommended Technology Approach for the Libby Groundwater Site.* March.

City of Libby, 1986. Water Well Ordinance (fax copy), Ordinance No. 1353. October.

EPA, 1986. *Record of Decision Libby Ground Water Superfund Site Lincoln County, Montana.* December.

EPA, 1988a. *Record of Decision Libby Ground Water Superfund Site Lincoln County, Montana.* December.

EPA, 1991. *Risk Assessment Guidance for Superfund: Volume 1 – Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)*, December.

EPA, 1993b. *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration. Interim Final.* OSWER Directive 9234.2-25. September.

EPA, 1993a. *Explanation of Significant Differences Libby Ground Water Contamination.* EPA/ESD/R08-93/500. September.

EPA, 1995. *Five Year Review for Libby Ground water Superfund Site Lincoln County, Montana* January.

EPA, 1997. *Explanation of Significant Differences Libby Ground Water Contamination.* January.

EPA, 2000a. *Second Five-Year Review Report for Libby Ground Water Site Libby, Lincoln County, Montana.* March.

EPA, 2000b. *National Oil and Hazardous Substances Pollution Contingency Plan, Code of Federal Regulations, Title 40, Volume 20, Parts 300 to 399,* January.

EPA, 2001. *Office of Solid Waste and Emergency Response Directive 9355.7-03B-P, Comprehensive Five-Year Review Guidance.*

EPA, 2004. *Risk Assessment Guidance for Superfund: Volume 1 – Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)*, July.

EPA, 2005. *Third Five-Year Review Report for Libby Ground Water Site Libby, Lincoln County, Montana.* March.

EPA, 2008a. *Risk-based Concentration Table*, September.

EPA, 2008b. *Maximum Contaminant Levels (MCLs),* http://www.epa.gov/safewater/contaminants/index.html#mcls, September.

Libby City Council Meeting Minutes, August, 2007.
http://www.cityoflibby.com/Aug2007Minutes.html

Montana Department of Environmental Quality, 2008. *DEQ-7 Montana Numeric Water Quality Standards*. February.

URS Corporation [URS], 2009. *Libby Groundwater Site Confirmation Sampling Data Evaluation And Vapor Intrusion Screening Report*. January.

Van den Berg M, Birnbaum LS, Denison M, De Vito M, Farland W, Feeley M, Fiedler H, Hakansson H, Hanberg A, Haws L, Rose M, Safe S, Schrenk D, Tohyama C, Tritscher A, Tuomisto J, Tysklind M, Walker N, Peterson RE. 2006. *The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds.* Toxicol Sci. 93(2):223-41.

Woodward-Clyde Consultants, 1988a. *Phase IV, Step 3 Remedial Investigation Report Libby, Montana Ground Water Contamination Site.* April.

Woodward-Clyde Consultants, 1988b. *Feasibility Study for Site Remediation Libby, Montana.* November.

Woodward-Clyde Consultants, 1990. *No Migration Petition, Land Treatment Units, Final.* Libby Ground Water Superfund Site. Libby, Montana. Prepared for Champion International Corporation.

Woodward-Clyde Consultants, 1991. *Remedial Design Report, Upper Aquifer Operable Unit. Ground Water Site, Libby, Montana*. August. Addendum #1, November.

Woodward-Clyde Consultants, 1993a. *Technology Evaluation Report for the Lower Aquifer.* Prepared for Champion International Corp. Stanford, Connecticut. August.

Woodward-Clyde Consultants, 1993b. *Lower Aquifer Characterization Report*. Libby Ground Water Superfund Site. Libby, Montana. Prepared for Champion International Corp. Stanford, Connecticut. August.

Woodward-Clyde Consultants, 1993c. *Focused Risk Assessment Report for the Lower Aquifer, Final.* Libby Ground Water Superfund Site. Libby, Montana. Prepared for Champion International Corp. Stanford, Connecticut.

Woodward-Clyde Consultants, 1999. *Technical Impracticability Evaluation Report, Libby Groundwater Site, Montana.* January.

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Attachment 3

Interview Record Forms

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Five-Year Review Interview Record Libby Ground Water Contamination Site Libby, Montana	**Interviewee: Kathryn Hernandez – USEPA** Site Remedial Project Manager email: Hernandez.Kathryn@epamail.epa.gov

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method**
Libby Ground Water Superfund Site	EPA ID: MT0000048611	7/13/09	email

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Kathryn Hernandez	EPA Region 8	303-312-6101	Hernandez.Kathryn@epamail.epa.gov	1595 Wynkoop Street Denver, Colorado 80202
Rebecca Carovillano	CH2M HILL, as rep of EPA	720-286-2115	rebecca.carovillano@ch2m.com	9193 South Jamaica Street Englewood, Colorado 80112
Brad A. Woodard	CH2M HILL, as rep of EPA	720-286-0724	brad.woodard@ch2m.com	9193 South Jamaica Street Englewood, Colorado 80112

Interview Questions

1. What is your overall impression of the work conducted at the site since the third Five-Year Review period (i.e., after March 2005)?

Response: There has been minimal work conducted primarily consisting of land treatment and minimal pump/treat of source material.

2. From your perspective, what effect has continued remedial operations at the site had on the surrounding community? Are you aware of any ongoing community concerns regarding the site or its operation and maintenance?

Response: There are not community concerns that I know of regarding the site O&M. The site seems to have little impact on the surrounding community, other than there inability to drill wells and use water for irrigation.

3. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please describe purpose and results.

Response: There have been several site visits in the past 2 years and regular reports are received. There have been no formal inspections. The purpose of the site visits were to examine the current remedial activities.

4. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, or anything that required emergency response from local authorities? If so, please give details.

Response: No

5. Have there been any complaints, violations, or other incidents related to the site that required a response by your office? If so, please summarize the events and result.

Response: No

6. Are you aware of any problems or difficulties encountered since the third Five-Year Review that have impacted progress or resulted in a change in O&M procedures? Please describe changes and impacts.

Response: Because of the drought and the conclusion of the buy-water program, there was numerous incidents reported that new wells were being installed and that residents were tapping into existing "grandfathered" wells. This problem seems to have ended with the new buy-water program.

7. What is your impression of how long it will take until the remediation goals are met, and do you have any concerns about the estimated length of time it will take to achieve the remediation goals?

Response: It seems we have made very little progress in the 20+ years we have been on the site.

8. Do you have any suggestions on how to change the remedy to expedite achieving the remediation goals and/or to make it more cost effective?

Response: We are reviewing options.

9. Have there been any changes in state or federal environmental standards since the third five-year review period which may call into question the current protectiveness or effectiveness of the remedial action?

Response: No

10. Do you know of opportunities to optimize the operation, maintenance, or sampling efforts at the site, and have such changes been adopted?

Response: No

11. Do you feel well-informed about the sites activities and progress?

Response: Yes

Five-Year Review Interview Record Libby Ground Water Contamination Site Libby, Montana	**Interviewee: Lisa DeWitt – MDEQ** Title: Environmental Specialist email: lidewitt@mt.gov

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method**
Libby Ground Water Superfund Site	EPA ID: MT0000048611	7/10/09	email

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Kathryn Hernandez	EPA Region 8	303-312-6101	Hernandez.Kathryn@epa mail.epa.gov	1595 Wynkoop Street Denver, Colorado 80202
Rebecca Carovillano	CH2M HILL, as rep of EPA	720-286-2115	rebecca.carovillano@ch2m.com	9193 South Jamaica Street Englewood, Colorado 80112
Brad A. Woodard	CH2M HILL, as rep of EPA	720-286-0724	brad.woodard@ch2m.com	9193 South Jamaica Street Englewood, Colorado 80112

Interview Questions

1. What is your overall impression of the work conducted at the site since the third Five-Year Review period (i.e., after March 2005)?

Response: The work conducted since 2005 has been a continuation of the work previously conducted: continued land treatment of soils and continued operation of the bioreactor/ground water treatment system.

2. From your perspective, what effect has continued remedial operations at the site had on the surrounding community? Are you aware of any ongoing community concerns regarding the site or its operation and maintenance?

Response: While I believe that the remedial operations at the site are improving the area, Libby citizens, in response to drought conditions, rising city water costs and the inability to install private wells due to the city ordinance, revived their efforts to reinstate the "buy water" program wherein International Paper subsidized the costs of the operation of the city water plant.

3. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please describe purpose and results.

Response: No.

4. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, or anything that required emergency response from local authorities? If so, please give details.

Response: None that I am aware of.

7. Have there been any complaints, violations, or other incidents related to the site that required a response by your office? If so, please summarize the events and result.

Response: In 2007, a spill of recovered oil from the accumulation tank occurred and was reported to EPA and to the state of Montana. The spill was appropriately contained and cleaned up.

8. Are you aware of any problems or difficulties encountered since the third Five-Year Review that have impacted progress or resulted in a change in O&M procedures? Please describe changes and impacts.

Response: None that I am aware of.

7. What is your impression of how long it will take until the remediation goals are met, and do you have any concerns about the estimated length of time it will take to achieve the remediation goals?

Response: Soils remediation is likely to take 3 to 5 years. Ground water remediation, on the other hand, will take decades using the current remedial processes.

8. Do you have any suggestions on how to change the remedy to expedite achieving the remediation goals and/or to make it more cost effective?

Response: For the soil remedy, there is not much change to be made other than to continue with the land treatment process. For the ground water, any change would have to be a complete re-evaluation, and an assessment as to cost effectiveness would have to be part of the evaluation.

9. Have there been any changes in state or federal environmental standards since the third five-year review period that may call into question the current protectiveness or effectiveness of the remedial action?

Response: None that I am aware of.

10. Do you know of opportunities to optimize the operation, maintenance, or sampling efforts at the site, and have such changes been adopted?

Response: None specifically come to mind.

11. Do you feel well-informed about the sites activities and progress?

Response: While I receive the regular progress reports from International Paper and its contractors, other information is slow in being relayed on to DEQ.

12. Do you have any comments, suggestions, or recommendations regarding the site?

Response: No.

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Five-Year Review Interview Record Libby Ground Water Contamination Site Libby, Montana	**Interviewee: Tom Richardson – International Paper** Title: Remediation Project Manager email: tomrichardson@ipaper.com

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method**
Libby Ground Water Superfund Site	EPA ID: MT0000048611	6/25/09	

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Kathryn Hernandez	EPA Region 8	303-312-6101	Hernandez.Kathryn@epa mail.epa.gov	1595 Wynkoop Street Denver, Colorado 80202
Rebecca Carovillano	CH2M HILL, as rep of EPA	720-286-2115	rebecca.carovillano@ch2m.com	9193 South Jamaica Street Englewood, Colorado 80112
Brad A. Woodard	CH2M HILL, as rep of EPA	720-286-0724	brad.woodard@ch2m.com	9193 South Jamaica Street Englewood, Colorado 80112

Interview Questions

1. What is your overall impression of the work conducted at the site since the third Five-Year Review period (i.e., after March 2005)?

Response: Progress made as anticipated in the ROD and associated documents.

2. From your perspective, is the remediation system functioning as expected?

Response: Yes

3. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, or anything that required emergency response from local authorities? If so, please give details.

Response: No

4. Are you aware of any problems or difficulties encountered since the third Five-Year Review that have impacted progress or resulted in a change in O&M procedures? Please describe changes and impacts.

Response: No

5. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since the third Five-Year Review? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

Response: No

6. Do you know of opportunities to optimize the operation, maintenance, or sampling efforts at the site, and have such changes been adopted? Please describe changes and desired cost savings or improved efficiency.

Response: Possible targeted reductions in sampling/analytical frequency and requirements.

7. Do you have any suggestions on how to change the remedy to expedite achieving the remediation goals and/or to make it more cost effective?

Response: Possibly concentrate on product removal; MNA for dissolved ground water plume and abandonment of biological treatment.

8. Is the City Ordinance restricting water wells from being installed in the City Limits being enforced and are there measures in place to ensure the previously installed water wells are not being used for drinking purposes?

Response: As far as I know it is being enforced. One additional previously installed well was abandoned by IP at request of the owner and the owner was compensated.

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Not at this time. More detailed targeted discussion with the EPA may be productive however.

Five-Year Review Interview Record Libby Ground Water Contamination Site Libby, Montana	**Interviewee: Dave Cosgriff – Arrowhead Engineering** Site O&M Staff 406-293-1011 email: david@aelibby.com

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method**
Libby Ground Water Superfund Site	EPA ID: MT0000048611	6/26/09	

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Kathryn Hernandez	EPA Region 8	303-312-6101	Hernandez.Kathryn@epa mail.epa.gov	1595 Wynkoop Street Denver, Colorado 80202
Rebecca Carovillano	CH2M HILL, as rep of EPA	720-286-2115	rebecca.carovillano@ch2m.com	9193 South Jamaica Street Englewood, Colorado 80112
Brad A. Woodard	CH2M HILL, as rep of EPA	720-286-0724	brad.woodard@ch2m.com	9193 South Jamaica Street Englewood, Colorado 80112

Interview Questions

1. What is your overall impression of the work conducted at the site since the third Five-Year Review period (i.e., after March 2005)?

Response: The work has been completed in compliance with design documents and O&M Manuals.

2. From your perspective, is the remediation system functioning as expected?

Response: Yes

3. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, or anything that required emergency response from local authorities? If so, please give details.

Response: No

4. Are you aware of any problems or difficulties encountered since the third Five-Year Review that have impacted progress or resulted in a change in O&M procedures? Please describe changes and impacts.

Response: No

5. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since the third Five-Year Review? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts. **Response:** No
6. Do you know of opportunities to optimize the operation, maintenance, or sampling efforts at the site, and have such changes been adopted? Please describe changes and desired cost savings or improved efficiency. **Response:** Yes, the biological component of SAETS could be discontinued. Cost savings could be around $40,000/year.
7. Do you have any suggestions on how to change the remedy to expedite achieving the remediation goals and/or to make it more cost effective? **Response:** See response #6.
8. Do you have any comments, suggestions, or recommendations regarding the site? **Response:** See comment #6.

Attachment 4

Site Inspection Checklist

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Libby Ground Water Contamination Site
Libby, Lincoln County, Montana
Five-Year Review Site Inspection Checklist

Please note that "O&M" is referred to throughout this checklist. At sites where long-term response actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program. N/A means "not applicable".

I. SITE INFORMATION

Site Name: Libby Ground Water Contamination Site	EPA ID: MTD980502736
City/State: Libby, Montana	Date of Inspection: June 25-26, 2009
Agency Completing 5 Year Review: EPA	Weather/temperature: Sunny, 80 degrees

Remedy Includes: (Check all that apply)
- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Ground water pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: Source soil treatment (land treatment unit operations)

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. Site Operations:
   Name: Tom Richardson
   Title: Remediation Project Manager , International Paper
   Date: 6/25/09
   Interviewed: ☒ at site ☐ at office ☐ by phone Phone Number: 901-419-3878
   Problems, suggestions: ☒ Additional report attached (if additional space required).

2. Local regulatory authorities and response agencies (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

   Agency: Montana Department of Environmental Quality
   Contact:
   Name: Lisa DeWitt
   Title: Environmental Specialist
   Date: 7/10/09
   Phone Number: 406-841-5037
   Problems, suggestions: ☒ Additional report attached (if additional space required).

Agency: Environmental Protection Agency
Contact:
Name: Kathryn Hernandez
Title: Remedial Project Manager
Date: 7/13/09
Phone Number: 303-312-6101
Problems, suggestions: ☒ Additional report attached (if additional space required).

Agency:
Contact:
Name:
Title:
Date:
Phone Number:
Problems, suggestions: ☐ Additional report attached (if additional space required).

Agency:
Contact:
Name:
Title:
Date:
Phone Number:
Problems, suggestions: ☐ Additional report attached (if additional space required).

3. Other interviews (optional) ☐ N/A ☒ Additional report attached (if additional space required).

David Cosgriff (Environmental Engineer) – Arrowhead Engineering - O&M Staff (406)-293-9387

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. O&M Documents

☒ O&M Manuals	☒ Readily available	☐ Up to date	☐ N/A
☒ As-Built Drawings	☒ Readily available	☐ Up to date	☐ N/A
☒ Maintenance Logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks:

2. Health and Safety Plan Documents

☒ Site-Specific Health and Safety Plan	☒ Readily available	☒ Up to date	☐ N/A
☒ Contingency plan/emergency response plan	☒ Readily available	☒ Up to date	☐ N/A

Remarks:

3. O&M and OSHA Training Records ☒ Readily available ☐ Up to date ☐ N/A
Remarks:
O&M and OSHA Training Records maintained at laboratory/office located at the site.

4.	Permits and Service Agreements			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
	☐ Other permits	☐ Readily available	☐ Up to date	☒ N/A
	Remarks:			
5.	Gas Generation Records	☐ Readily available	☐ Up to date	☒ N/A
	Remarks:			
6.	Settlement Monument Records	☐ Readily available	☐ Up to date	☒ N/A
	Remarks:			
7.	Ground water Monitoring Records	☒ Readily available	☒ Up to date	☐ N/A
	Remarks: Monitoring Records maintained at laboratory/office.			
8.	Leachate Extraction Records	☒ Readily available	☒ Up to date	☐ N/A
	Remarks: Leachate Records maintained at laboratory/office.			
9.	Discharge Compliance Records	☐ Readily available	☐ Up to date	☒ N/A
	Remarks:			
10.	Daily Access/Security Logs	☐ Readily available	☐ Up to date	☒ N/A
	Remarks:			

IV. O&M Costs ☒ Applicable ☐ N/A

1. O&M Organization
   ☐ State in-house ☐ Contractor for State
   ☒ PRP in-house ☐ Contractor for PRP
   ☐ Other: Contractor for USEPA

2. O&M Cost Records
   ☐ Readily available ☒ Up to date ☐ Funding mechanism/agreement in place
   Original O&M cost estimate: ☒ Breakdown attached

Total annual cost by year for review period if available

From (Date):	To (Date):	Total cost:	
	2004	279,104	☐ Breakdown attached
From (Date):	To (Date):	Total cost:	
	2005	289,135	☐ Breakdown attached
From (Date):	To (Date):	Total cost:	
	2006	256,237	☐ Breakdown attached
From (Date):	To (Date):	Total cost:	
	2007	307,450	☐ Breakdown attached
From (Date):	To (Date):	Total cost:	
	2008	380,992	☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period ☐ N/A
   Describe costs and reasons: In 2004, IP purchased the remaining pumps from the supplier's inventory because the special pumps were not going to be produced any longer.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

1. Fencing

1. Fencing damaged ☐ Location shown on site map ☒ Gates secured ☐ N/A
   Remarks: Chain link fence surrounds the entire property. Access is limited to 3 gates.

2. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☐ N/A
   Remarks: Signs displayed at numerous locations warning of the dangers present at the site.

3. Institutional Controls

1. Implementation and enforcement
   Site conditions imply ICs not properly implemented: ☐ Yes ☐ No ☒ N/A
   Site conditions imply ICs not being fully enforced: ☐ Yes ☐ No ☒ N/A
   Type of monitoring (e.g., self-reporting, drive by):
   Frequency:
   Responsible party/agency:
   Contact:
   Name:

Title:
Date:
Phone Number:
Reporting is up-to-date: ☐ Yes ☐ No ☒ N/A
Reports are verified by the lead agency: ☐ Yes ☐ No ☒ N/A
Specific requirements in deed or decision documents have been met: ☐ Yes ☐ No ☒ N/A
Violations have been reported: ☐ Yes ☐ No ☒ N/A
Other problems or suggestions: None. ☐ Additional report attached (if additional space required).

2. Adequacy ☐ ICs are adequate ☐ ICs are inadequate ☒ N/A
Remarks:

4. General

1. Vandalism/trespassing ☐ Location shown on site map ☒ No vandalism evident
Remarks:

2. Land use changes onsite ☒ N/A
Remarks:

3. Land use changes offsite ☒ N/A
Remarks:

VI. GENERAL SITE CONDITIONS

1. Roads ☐ Applicable ☒ N/A

1. Roads damaged ☐ Location shown on site map ☐ Roads adequate ☒ N/A
Remarks:

2. Other Site Conditions

Remarks:

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

1. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident
Areal extent: Depth:
Remarks:

2. Cracks ☐ Location shown on site map ☐ Cracking not evident
Lengths: Widths: Depths:
Remarks:

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent: Depth:
Remarks:

4. Holes ☐ Location shown on site map ☐ Holes not evident
Areal extent: Depth:
Remarks:

5. Vegetative Cover
☐ Cover properly established ☐ No signs of stress ☐ Grass ☐ Trees/Shrubs
Remarks:

6. Alternative Cover (armored rock, concrete, etc.) ☐ N/A
Remarks:

7. Bulges ☐ Location shown on site map ☐ Bulges not evident
Areal extent: Height:
Remarks:

8. Wet Areas/Water Damage ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent:
☐ Ponding ☐ Location shown on site map Areal extent:
☐ Seeps ☐ Location shown on site map Areal extent:
☐ Soft subgrade ☐ Location shown on site map Areal extent:
Remarks:

9. Slope Instability ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent:
Remarks:

2. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay
Remarks:

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay
Remarks:

	Letdown Channels	☐ Applicable ☒ N/A	
1.	Settlement Areal extent: Remarks:	☐ Location shown on site map Depth:	☐ No evidence of settlement
2.	Material Degradation Material type: Remarks:	☐ Location shown on site map Areal extent:	☐ No evidence of degradation
3.	Erosion Areal extent: Remarks:	☐ Location shown on site map Depth:	☐ No evidence of erosion
4.	Undercutting Areal extent: Remarks:	☐ Location shown on site map Depth:	☐ No evidence of undercutting
5.	Obstructions Type: Areal extent: Remarks:	☐ Location shown on site map Height:	☐ N/A
6.	Excessive Vegetative Growth ☐ Evidence of excessive growth ☐ Location shown on site map Remarks:	☐ No evidence of excessive growth ☐ Vegetation in channels but does not obstruct flow Areal extent:	
4.	Cover Penetrations	☐ Applicable ☒ N/A	
1.	Gas Vents ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Evidence of leakage at penetration Remarks:	☐ Routinely sampled ☐ Functioning ☐ Needs O& M	☐ N/A ☐ Good condition
2.	Gas Monitoring Probes ☐ Routinely sampled ☐ Properly secured/locked ☐ Evidence of leakage at penetration Remarks:	☐ Functioning ☐ Needs O&M	☐ N/A ☐ Good condition
3.	Monitoring Wells (within surface area of landfill) ☐ Routinely sampled ☐ Properly secured/locked ☐ Evidence of leakage at penetration Remarks:	☐ Functioning ☐ Needs O&M	☐ N/A ☐ Good condition

4. Leachate Extraction Wells ☐ N/A
☐ Routinely sampled
☐ Properly secured/locked ☐ Functioning ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M
Remarks:

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks:

5. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities ☐ N/A
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs O& M
Remarks:

2. Gas Collection Wells, Manifolds and Piping ☐ N/A
☐ Good condition ☐ Needs O& M
Remarks:

3. Gas Monitoring Facilities (e.g., gas monitoring of adjacent homes or buildings) ☐ N/A
☐ Good condition ☐ Needs O& M
Remarks:

6. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A
Remarks:

2. Outlet Rock Inspected ☐ Functioning ☐ N/A
Remarks:

7. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation ☐ Siltation evident ☐ N/A
Areal extent: Depth:
Remarks: The Fire Pond located on the site is maintained by the Port Authority for fire suppression.

2. Erosion ☐ Erosion evident ☐ N/A
Areal extent: Depth:
Remarks:

3. Outlet Works ☐ Functioning ☐ N/A
Remarks:

4. Dam ☐ Functioning ☐ N/A
Remarks:

8. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement: Vertical displacement: Rotational displacement:
Remarks:

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks:

9. Perimeter Ditches/Off-site discharge ☐ Applicable ☒ N/A

1. Siltation ☐ Location shown on site map ☐ Siltation not evident
Areal extent: Depth:
Remarks:

2. Vegetative Growth ☐ Location shown on site map ☐ Vegetation does not impede flow
Areal extent: Type:
Remarks:

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent: Depth:
Remarks:

4. Discharge Structure ☐ Location shown on site map ☐ N/A
☐ Functioning ☐ Good Condition
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident
Areal extent: Depth:
Remarks:

2. Performance Monitoring ☐ N/A
☐ Performance not monitored
☐ Performance monitored Frequency:
☐ Evidence of breaching Head differential:
Remarks:

IX. GROUND WATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

1. Ground water Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical ☐ N/A
☐ All required wells located ☒ Good condition ☒ Needs O& M
Remarks: Two well house sheds had damaged roofs from heavy snow. The buildings are temporarily covered with tarps.

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances ☐ N/A
☒ System located ☒ Good condition ☐ Needs O& M
Remarks: Underground piping not observed.

3. Spare Parts and Equipment ☐ N/A
☒ Readily available ☒ Good condition
☐ Requires Upgrade ☐ Needs to be provided
Remarks: Specialty pumps purchased from supplier due to there production being discontinued.

2. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical ☐ N/A
☐ Good condition ☐ Needs O& M
Remarks:

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances ☐ N/A
☐ Good condition ☐ Needs O& M
Remarks: Not observed.

3. Spare Parts and Equipment ☐ N/A
☐ Readily available ☐ Good condition
☐ Requires Upgrade ☐ Needs to be provided
Remarks:

3. Treatment System ☒ Applicable ☐ N/A

1. Treatment Train (Check components that apply)
☐ Metals removal ☒ Oil/water separation ☒ Bioremediation
☐ Air stripping ☐ Carbon adsorbers ☐ Filters (list type):
☒ Additive (list type, e.g., chelation agent, flocculent): liquid fertilizer
☐ Others (list):
☐ Good condition ☐ Needs O&M
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☒ Quantity of ground water treated annually (list volume): Approximately 5.0E6 gallons in bioreactors,5.5 E6 gallons in the coalescing separator and 5.1E6 gallons in the gravity separator
☐ Quantity of surface water treated annually (list volume): 0
Remarks:

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A
☒ Good condition ☐ Needs O& M
Remarks:

3. Tanks, Vaults, Storage Vessels ☐ N/A
☒ Good condition ☒ Proper secondary containment ☐ Needs O&M
Remarks:

4. Discharge Structure and Appurtenances ☒ N/A
☐ Good condition ☐ Needs O& M
Remarks:

5. Treatment Building(s) ☐ N/A
☒ Good condition (esp. roof and doorways) ☐ Needs Repair
☒ Chemicals and equipment properly stored
Remarks: All treatment buildings are in good condition.

6. Monitoring Wells (pump and treatment remedy) ☐ N/A
☐ All required wells located ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled
☒ Good condition ☐ Needs O&M
Remarks: The majority of site wells were discovered. All wells observed in good condition and protected with bollards.

4. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells (natural attenuation remedy) ☒ N/A
☐ All required wells located ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled
☐ Good condition ☐ Needs O&M
Remarks:

5. Long Term Monitoring ☒ Applicable ☐ N/A

2. Monitoring Wells ☐ N/A
☐ All required wells located ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled
☒ Good condition ☐ Needs O&M
Remarks:

X. OTHER REMEDIES ☐ Applicable ☒ N/A

XI. OVERALL OBSERVATIONS

1. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedial objectives, as stated in the ROD for OU2, are to minimize further migration of the contaminant plume and to restore the ground water to its expected beneficial use as a drinking water supply where applicable. The remediation goals for the ground water are based on maximum contaminant levels and risk-based cleanup levels for the chemicals of concern.

The initial treatment phase for soils was conducted in the waste pit area. The contaminants were further biodegraded after transfer to the onsite Land Treatment Units (LTUs). An ELF was constructed to expedite the soil treatment process and the treatment of soils is currently conducted on the ELF. Based on the time it takes for soils to reach existing cleanup levels, it is expected to take 3 to 5 years to treat the remaining contaminated soils.

The SAETS system on average is effectively recovering NAPL from the source area near the former waste pit area. According to the 1999 TI Evaluation Report, if the system is to operate at the current performance level (i.e. 1,000 to 2,000 gallons of NAPL recovery per year), recovery of NAPL would take decades. This would also leave residual NAPL in place that would continue to act as a long term source of dissolved phase contamination.

Based on the site inspection, all components of the remedy appear to be functioning as designed.

2. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Operations and Maintenance (O&M) activities at the site includes O&M of the SAETS, LTU, ELF and long-term ground water monitoring. An on-site physical inspection of the LTUs is currently performed daily, and long-term monitoring is performed annually.

Ground water monitoring data demonstrates that the SAETS appears to be removing PAH (and NAPL) and PCP from the source area. Due to the high concentrations and large amounts of NAPL the system could be expected to remove thousands of pounds of NAPL from the source area over the next 5 years. The effectiveness of this system is primarily due to the mobility of NAPL in the coarse sand and gravels within the extraction interval.

There have been no significant operational issues associated with the SAETS since the last 5-year review.

3. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

There are no operational issues or observations that would suggest that the protectiveness of the remedy may be compromised in the future from improper O&M of the remedial systems.

4. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The long-term monitoring program is assessed annually to evaluate which monitor wells are critical for evaluating the current extent of contamination at the site and to assess remedy performance.

Libby Ground Water Superfund Site Inspection – Inspection Team Roster
Date of Site Inspection – June 25-26, 2009

Name	Organization	Title
Kathryn Hernandez	USEPA, REGION 8	Remedial Project Manager
Tom Richardson	INTERNATIONAL PAPER	Remediation Project Manager
Lisa DeWitt	MDEQ	Environmental Specialist
Brad A. Woodard	CH2M HILL, INC.	Environmental Engineer
Dave Cosgriff	ARROWHEAD ENGINEERING, INC.	Environmental Engineer

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Attachment 5

Site Inspection Photographs

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Photo 1: Looking southeast at Source Area Extraction and Treatment System Building.

Photo 2: Looking northwest at Source Area Extraction and Treatment System building and recovered product tank.

Photo 3: Inside Source Area Extraction and Treatment System building.

Photo 4: Inside Source Area Extraction and Treatment System building.

Photo 5: Looking south-southeast across Land Treatment Unit 2.

Photo 6: Looking south-southeast across Expanded Landfarm (near Lots 2 & 3).

Photo 7: Looking northwest across former Waste Pit.

Photo 8: Looking west across former Waste Pit. Extraction well 9009 in foreground.

Photo 9: Looking northeast at Intermediate Injection System building.

Photo 10: System components inside the Intermediate Injection System building.

Photo 11: On-site laboratory equipment.

Photo 12: On-site laboratory equipment.

Photo 13: Looking west at Boundary Injection System building.

Photo 14: Looking west at Boundary Injection System building.

Photo 15: Components of Boundary Injection System.

Photo 16: Components of Boundary Injection System.

Photo 17: Typical signage on the property.

Photo 18: Looking north at the main entrance to the Site.

Photo 19: Onsite monitoring well 8005, showing protective bollards.

Photo 20: Looking southeast at the Fire Pond.

Photo 21: Looking southwest at the Libby Creek Diversion Canal.

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Attachment 6

City of Libby Well Permit Ordinance

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Section 5. Effective Date.

This resolution shall become effective immediately upon its passage and approval.

Passed and Approved by Governing Body of the City (Town) of Libby, Montana this 6th day of October, 1986.

Mayor

Attest:

Virginia McNeil
Clerk

ORDINANCE NO. 1353

AN ORDINANCE PROVIDING FOR THE ENACTMENT OF AN ORDINANCE PLACING RESTRICTIONS ON THE USE OF GROUNDWATER IN THE CITY OF LIBBY, MONTANA.

Whereas, on July 21, 1986, the City Council of the City of Libby, Montana, passed Emergency Ordinance Number 1344; and

Whereas, it is the desire and intention of the City Council of the City of Libby, Montana, to propose said Emergency Ordinance as a permanent ordinance of the City of Libby, Montana;

NOW THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF LIBBY, MONTANA, that the following ordinance be enacted as an ordinance of the Municipal Code of the City of Libby, Montana, to read as follows:

Section 1 -- Application, Investigation, Permit and Fee. Any person desiring to drill, dig, or excavate for a water well within the corporate limits of the City must first apply to the City of Libby, or its designated representative and agent, for a permit therefor and must advise the City of Libby, or its designated representative and agent, of the exact location, size, and purpose of the proposed water well. The application for such permit must contain:

A) That the permittee will submit to annual inspection of wells by the City of Libby, or its designated representative and agent, on or before the anniversary date of the original permit to permittee, and the payment of an inspection fee of Fifteen Dollars ($15.00) to the City of Libby must be paid on or before the date of inspection.

The applicant will pay a Fifteen Dollar ($15.00) fee for the permit upon the City of Libby's, or its designated representative or agent, determination that it conforms with the plan submitted.

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Section 2 -- Wells for human consumption and irrigation. No water well shall be authorized for the purpose of human consumption or irrigation.

Section 3 -- Review. The refusal of the City of Libby, or its designated representative or agent, to grant any such application is subject to review by the City Council of the City of Libby, Montana.

Section 4 -- Control Valves. Any water well drilled, dug or excavated pursuant to a permit granted hereunder must be equipped with adequate shut-off valves or control valves for the purpose of controlling the flow of water from the water well and for the protection of the City water system in the event of pollution or other hazards.

Section 5 -- Marking. The issuance of a water well permit may be conditioned on marking the water well in a manner to be designated by the City of Libby, or its designated representative or agent, for the purposes of identification, location, and for inspection by the City of Libby, or its designated representative of agent, at reasonable times and as may be required.

Section 6 -- Violations And Penalties. Any person, whether as principal, agent, employee or otherwise, who violates any of the provisions of this Chapter shall be subject to a fine not to exceed Five Hundred Dollars ($500.00) and imprisonment not in excess of six (6) months in jail.

PASSED BY THE CITY COUNCIL and approved by the Mayor of the City of Libby this 20th day of October, 1986.

Mayor

ATTEST:

Virginia McGee
City Clerk

First Reading: Oct 6, 1986

Second Reading: Oct 20, 1986

Attachment 7

Exposure Assumptions, Toxicity Data and ARARs

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TABLE 1
Toxicity Factors Used in Risk-based Calculations of Cleanup Levels in 1995 Compared to Current Guidance.
Libby Ground Water Site Five-Year Review

Contaminants of Concern	1995 Five-year Review Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Unit Risk $(ug/m^3)^{-1}$	1995 Five-year Review Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	1995 Five-year Review Oral Reference Dose (mg/kg-day)	Oral Reference Dose (mg/kg-day)	Inhalation Reference Concentration (mg/m^3)	1995 Five-year Review Inhalation Reference Dose (mg/kg-day)	Inhalation Reference Dose (mg/kg-day)	1995 Five-year Review TEF[a]	TEF[a]	ABS	RPF
Benzo(a)pyrene	7.3	7.3	1.10E-03	NA	3.85E+00	NA	NA	NA	NA	NA	NA	NA	0.13	1
Benzo(a)anthracene	7.3	0.73	1.10E-04	NA	3.85E-01	NA	NA	NA	NA	NA	NA	NA	0.13	0.1
Benzo(b)fluoranthene	7.3	0.73	1.10E-04	NA	3.85E-01	NA	NA	NA	NA	NA	NA	NA	0.13	0.1
Benzo(k)fluoranthene	7.3	7.30E-02	1.10E-04	NA	3.85E-01	NA	NA	NA	NA	NA	NA	NA	0.13	0.1
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.13	NA
Chrysene	7.3	7.30E-03	1.10E-05	NA	3.85E-02	NA	NA	NA	NA	NA	NA	NA	0.13	0.01
Dibenzo(a,h)anthracene	7.3	7.3	1.20E-03	NA	4.20E+00	NA	NA	NA	NA	NA	NA	NA	0.13	1
Indeno(1,2,3-cd)pyrene	7.3	0.73	1.10E-04	NA	3.85E-01	NA	NA	NA	NA	NA	NA	NA	0.13	0.1
Acenaphthene	NA	NA	NA	NA	NA	6.00E-02	6.00E-02	NA	NA	NA	NA	NA	0.13	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.13	NA
Anthracene	NA	NA	NA	NA	NA	3.00E-01	3.00E-01	NA	NA	NA	NA	NA	0.13	NA
Fluoranthene	NA	NA	NA	NA	NA	4.00E-02	4.00E-02	NA	NA	NA	NA	NA	0.13	NA
Fluorene	NA	NA	NA	NA	NA	4.00E-02	4.00E-02	NA	NA	NA	NA	NA	0.13	NA
Naphthalene	NA	NA	3.40E-05	NA	1.19E-01	4.00E-02	2.00E-02	3.00E-03	NA	0.000857143	NA	NA	0.13	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.13	NA
Pyrene	NA	NA	NA	NA	NA	3.00E-02	3.00E-02	NA	NA	NA	NA	NA	0.13	NA
Pentachlorophenol	1.20E-01	1.20E-01	NA	NA	NA	3.00E-02	3.00E-02	NA	NA	NA	NA	NA	0.25	NA
Benzene	--	5.50E-02	7.80E-06	--	2.73E-02	--	4.00E-03	3.00E-02	--	0.008571429	NA	NA		NA
Arsenic	--	1.50E+00	4.30E-03	--	1.51E+01	--	3.00E-04	3.00E-05	--	8.57143E-06	NA	NA	0.03	NA
Furans[b]:														
tetra (2,3,7,8)	1.50E+05	1.30E+05	3.80E+01	1.50E+05	1.33E+05	NA	NA	NA	NA	NA	0.1	0.1	0.1	NA
tetra (non-2,3,7,8)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0.1	NA
penta (1,2,3,7,8)	1.50E+05	1.30E+05	3.80E+01	1.50E+05	1.33E+05	NA	NA	NA	NA	NA	0.05	0.03	0.1	NA
penta (2,3,4,7,8)	1.50E+05	1.30E+05	3.80E+01	1.50E+05	1.33E+05	NA	NA	NA	NA	NA	0.5	0.3	0.1	NA
penta (other)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0.1	NA
hexa (2,3,7,8)	1.50E+05	1.30E+05	3.80E+01	1.50E+05	1.33E+05	NA	NA	NA	NA	NA	0.1	0.1	0.1	NA

TABLE 1
Toxicity Factors Used in Risk-based Calculations of Cleanup Levels in 1995 Compared to Current Guidance.
Libby Ground Water Site Five-Year Review

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hexa (non-2,3,7,8)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0.1	NA
hepta (2,3,7,8)	1.50E+05	1.30E+05	3.80E+01	1.50E+05	1.33E+05	NA	NA	NA	NA	NA	0.01	0.01	0.1	NA
hepta (non-2,3,7,8)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0.1	NA
Octa	1.50E+05	1.30E+05	3.80E+01	1.50E+05	1.33E+05	NA	NA	NA	NA	NA	0.001	0.0003	0.1	NA
Dioxins[b]:														
tetra (2,3,7,8)	1.50E+05	1.30E+05	3.80E+01	1.50E+05	1.33E+05	NA	1.00E-09	NA	NA	NA	1	1	0.03	NA
tetra (non-2,3,7,8)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0.03	NA
penta (2,3,7,8)	1.50E+05	1.30E+05	3.80E+01	1.50E+05	1.33E+05	NA	NA	NA	NA	NA	0.5	1	0.03	NA
penta (non-2,3,7,8)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0.03	NA
hexa (2,3,7,8)	1.50E+05	1.30E+05	3.80E+01	1.50E+05	1.33E+05	NA	NA	NA	NA	NA	0.1	0.1	0.03	NA
hexa (non-2,3,7,8)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0.03	NA
hepta (2,3,7,8)	1.50E+05	1.30E+05	3.80E+01	1.50E+05	1.33E+05	NA	NA	NA	NA	NA	0.01	0.01	0.03	NA
hepta (non-2,3,7,8)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0.03	NA
Octa	1.50E+05	1.30E+05	3.80E+01	1.50E+05	1.33E+05	NA	NA	NA	NA	NA	0.001	0.0003	0.03	NA

Notes:

-Toxicity values are from the 2008 Regional Screening Level Table.

[a]Van den Berg M, Birnbaum LS, Denison M, De Vito M, Farland W, Feeley M, Fiedler H, Hakansson H, Hanberg A, Haws L, Rose M, Safe S, Schrenk D, Tohyama C, Tritscher A, Tuomisto J, Tysklind M, Walker N, Peterson RE. The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds. Toxicol Sci. 93(2):223-41, 2006.

[b] The toxicity values for 2,3,7,8-TCDD were used for all of the dioxin/furan congeners.

NA - not available

Yellow highlighting denotes factors used in 1995; values in red font have changed since 1995.

TABLE 2
Exposure Assumptions Used for Construction Worker Risk Scenario (Soil)

Input Parameter	1995 5-Year Review	2010
Body Weight (kg)	70	70 (1)
Averaging Time - carcinogens (days)	25550	25550 (1)
Averaging Time - noncarcinogens (days)	365	365 (2)
Exposure Frequency (days/yr)	86	86 (3)
Exposure Duration (yr)	70	1 (2)
Exposure Time (hr/day)	8	8 (3)
Ingestion rate of soil (mg/d)	480	330 (4)
Inhalation rate (m^3/hr)	5.3	5.3 (3)
Particulate Emission factor (m^3/kg)	4.63E+09	4.63E+09 (3)
Ingestion rate of water (L/day)	NA	NA
Age-adjusted Ingestion factor for water (L-yr/kg-day)	NA	NA
Adherence factor of soil to skin (mg/cm^2-event)	Not considered	0.302 (5)
Skin surface area available for contact (cm^2)	Not considered	2479 (5)

Notes:

NA: Not applicable

(1) United States Environmental Protection Agency, Risk Assessment Guidance for Superfund (Part A),December, 1989

(2) United States Environmental Protection Agency, Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual, Standard Default Exposure Parameters, December 1991.

(3) United States Environmental Protection Agency, Libby Ground Water Superfund Site Five-Year Review, January, 1995.

(4) United States Environmental Protection Agency, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. December, 2002.

(5) United States Environmental Protection Agency, Risk Assessment Guidance for Superfund (Part E Supplemental Guidance for Dermal Risk Assessment). December 2004.

TABLE 3
Exposure Assumptions Used for Adult Resident Risk Scenario (Ground Water)

Input Parameter	1995 5-Year Review	2010
Body Weight (kg)	70	70 (1)
Averaging Time - carcinogens (days)	25550	25550 (1)
Averaging Time - noncarcinogens (days)	10950	10950 (1)
Exposure Frequency (days/yr)	350	350 (1)
Exposure Duration (yr)	30	24 (2)
Exposure Time (hr/day)	NA	NA
Ingestion rate of soil (mg/d)	114	NA
Inhalation rate (m^3/hr)	15	NA
Particulate Emission factor (m^3/kg)	4.63E+09	NA
Ingestion rate of water (L/day)	2	2 (2)
Age-adjusted Ingestion factor for water (L-yr/kg-day)	Not considered	1.09 (calculated)
Adherence factor of soil to skin (mg/cm^2-event)	NA	NA
Skin surface area available for contact (cm^2)	NA	NA

Notes:

NA: Not applicable

(1) United States Environmental Protection Agency, Libby Ground Water Superfund Site Five-Year Review, January 1995.

(2) United States Environmental Protection Agency, Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual, December 1991.

ARARs included in the 1988 ROD for soils/source areas:

Executive Order 11990, 40 CFR Part 6
Clean Water Act, Section 404, 40 CFR Parts 230 & 231
Endangered Species Act, 50 CFR Parts 200 and 402
Resource Conservation and Recovery Act (RCRA), 40 CFR 264, Subparts F, G, K, L, M, N (old & new units)
RCRA, 40 CFR 264.111
RCRA, 40 CFR 268 & RCRA Section 3004
Occupational Safety and Health Act, 29 CFR 1926 Subpart P and 1910
Ambient Air Quality, Administrative Rules of the State of Montana (ARM) 16.8.807, 809, 811, 814-822
Prevention of Significant Deterioration of Air Quality ARM 16.8.925, 933, 928, 931
Visibility Impact Assessment ARM 16.8.1003, 1004, 1007, 1008
Air Quality Permit ARM 16.8.1105 (only substantive requirements)
Emissions Standards ARM 16.8.1427
General Air Quality Montana Code Annotated (MCA) 75-2-102, 201 (policy statement)
Non-Game and Endangered Species, ARM 12.5.201
Non-Game and Endangered Species, ARM 87-5-501 (policy statement)
Historical Preservation, ARM 12.8.501 (policy statement)
Historical Preservation, ARM 12.8.505, 506
Historical Preservation, MCA 22-3-433, 435
Solid and Hazardous Waste Management ARM 16.14.505, 520, 521
Solid and Hazardous Waste Management ARM 16.42.101, 102
Solid and Hazardous Waste Management ARM 16.44.106, 107, 112, 113, 124 (only substantive requirements)
Solid and Hazardous Waste Management ARM 16.44.303, 310, 311, 321, 322, 323,324, 330, 333, 416, 511, 512, 702
Hazardous Waste Act MCA 75-10-101, 102, 202 (policy statement)
Hazardous Waste Act MCA 75-10-212, 214
Hazardous Waste Act MCA 75-10-402, 414, 416, 601, 711

ARARs included in the 1988 ROD for upper and lower aquifer ground water:

Executive Order 11990, 40 CFR Part 6
Clean Water Act, Section 404, 40 CFR Parts 230 & 231
Endangered Species Act, 50 CFR Parts 200 and 402
Safe Drinking Water Act, 40 CFR Part 141
Underground Injection Control Act, 40 CFR Part 144
Occupational Safety and Health Act, 29 CFR 1926 Subpart P and 1910
RCRA, 40 CFR 264, Subpart J (old & new tanks)
Nondegradation of Water Quality ARM 16.20.702, ARM 16.20.703 (only substantive requirements)
Pollution Discharge Elimination System, ARM 16.20.916
Ground water Pollution Control System, ARM 16.20.1002, 1003, 1010, 1011
Ground water Pollution Control System, ARM 16.20.1013, 1015, 1016 (only substantive requirements)
Public Water Supplies, ARM 16.20.201 (only substantive requirements)
Public Water Supplies, ARM 16.20.203, 204, 205, 207
Public Water Supplies, MCA 75-6-101 (only substantive requirements)
Public Water Supplies, MCA 75-6-112
Water Well Standards, ARM 36.21.635, 638, 640-662, 664-679
Water Use, ARM 36.12.103
Water Use, MCA 85-2-101 (policy statement)
Water Use, MCA 85-2-301
Water Use, MCA 85-2-306 (only substantive requirements)
Water Use, MCA 85-2-317
Water Use, MCA 85-2-401 through 418 (only substantive requirements)
Water Use, MCA 85-2-505, 506, 507
Solid and Hazardous Waste Management ARM 16.44.335
Non-Game and Endangered Species, ARM 12.5.201
Non-Game and Endangered Species, ARM 87-5-501 (policy statement)
Historical Preservation, ARM 12.8.501 (policy statement)
Historical Preservation, ARM 12.8.505, 506