

Record of Decision

KRY Site

Kalispell, Montana



Prepared By:

Montana Department of Environmental Quality

Remediation Division

Helena, Montana

June 2008

RECORD OF DECISION

Selected Remedy for the KRY Site

Kalispell, Montana

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June 2008

PART 1

DECLARATION OF RECORD OF DECISION

Declaration of Record of Decision

SITE NAME AND LOCATION

The Kalispell Pole and Timber (KPT), Reliance Refining Company (Reliance), and Yale Oil Corporation (Yale Oil) Facilities (collectively referred to as the KRY Site) are state Superfund facilities listed on the Montana Comprehensive Environmental Cleanup and Responsibility Act (CECRA) Priorities List. The Montana Department of Environmental Quality (DEQ) initially treated the KRY Site as three separate facilities. However, based on a number of facts, DEQ has determined that the facilities must be addressed comprehensively as one facility. The bases for this decision include: 1) the definition of a CECRA facility under Section 75-10-701, MCA which includes any site or area where a hazardous or deleterious substance has been deposited, stored, disposed of, placed, or otherwise come to be located; 2) the presence of commingled contamination; 3) the intertwined operational histories and co-extensive operations (e.g. the KPT Company operated at both KPT and Reliance and contamination from KPT is now located at Reliance); 4) many of the same hazardous or deleterious substances were used, stored, deposited, and disposed of at the facilities; 5) ensuring protectiveness of human health and the environment; and 6) allowing for cost-effective remediation.

STATEMENT OF BASIS AND PURPOSE

This decision document presents DEQ's selected remedial action for the KRY Site in Kalispell, Montana. This document is developed in accordance with CECRA and is not inconsistent with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP).

The remedial action set forth in the Record of Decision (ROD) is based on the administrative record, which are the documents DEQ cited, relied upon, or considered in selecting the remedy for the KRY Site. The administrative record was developed in accordance with Section 75-10-713, MCA, and is identified in Part 2, Section 14.0. The complete administrative record is available for public review at the offices of DEQ, Remediation Division, located at 1100 North Last Chance Gulch in Helena, Montana. A partial compilation of the administrative record is available at the Flathead County Library located at 247 1st Avenue East in Kalispell, Montana, and on DEQ's website at <http://deq.mt.gov/StateSuperfund/kpt.asp>.

ASSESSMENT OF THE SITE

DEQ is authorized to take remedial action whenever there has been a release or a threatened release of a hazardous or deleterious substance into the environment that poses or may pose an imminent and substantial endangerment to the public health, safety, or welfare, or the environment. Section 75-10-711, MCA. CECRA defines a hazardous or deleterious substance in Section 75-10-701(8), MCA. The primary contaminants that DEQ identified at the KRY Site are pentachlorophenol (PCP), dioxins/furans, petroleum hydrocarbons, and lead. Other contaminants are also present and described in Part 2 of the ROD. DEQ has determined that these contaminants are hazardous or deleterious substances under CECRA. Based on the administrative record, DEQ has determined that contaminants have been spilled, leaked,

pumped, poured, emitted, emptied, discharged, injected, escaped, leached, dumped, or disposed into the environment, which constitutes a release or threatened release under Section 75-10-701(19), MCA.

DEQ interprets “imminent and substantial endangerment to public health, safety, and welfare, or the environment” to mean contaminant concentrations in the environment exist or have the potential to exist above risk-based screening levels. Applying this interpretation, DEQ determined that contamination at the KRY Site exceeded risk-based screening levels. See Part 2, Section 7.0 of the ROD. Therefore, DEQ has determined that a release or a threatened release of hazardous or deleterious substances from the KRY Site poses or may pose an imminent and substantial endangerment to the public health, safety, or welfare, or the environment.

DESCRIPTION OF THE REMEDY

The remedy for the KRY Site consists of remediation of contaminated media to cleanup levels described in the ROD, with reliance on institutional controls. Numerous interim actions have occurred at the KRY Site. DEQ considered the interim remedial actions and integrated that information and actions into the remedy to the extent possible. Major components of the remedy are summarized below. Details of the remedy are provided in Part 2, Section 11.0 of the ROD.

Institutional Controls

Institutional controls in the form of groundwater use and land use restrictions are necessary as cleanup levels are based on commercial/industrial exposure and groundwater contamination is present above cleanup levels. To protect human health and limit migration of contaminants through pumping of groundwater, the remedy partially relies on institutional controls in the form of a controlled groundwater area to ensure that no additional wells (except for remediation purposes) are installed within or adjacent to the area of contamination associated with the KRY Site. DEQ will prepare and supply adequate supporting information to petition the Montana Department of Natural Resources and Conservation (DNRC) to establish a controlled groundwater area for the KRY Site. Groundwater monitoring will be used to track plume concentrations until cleanup levels are met. The remedy also requires restrictive covenants to prevent or limit groundwater withdrawals from the area, prohibit residential use, and restrict areas where engineered components of the remedy have been or will be constructed as provided in Section 75-10-727, MCA. These restrictive covenants will be placed on property impacted or potentially impacted by the KRY Site. Restrictive covenants and the controlled groundwater area will be in effect until DEQ determines they are no longer needed to ensure protection of human health. Changes to local zoning regulations may also be proposed.

Soils

The remedy includes excavation of contaminated soils throughout the KRY Site. This excavation will be completed in a phased approach to ensure that various contaminants are segregated to allow for different treatment processes, as described below. The following is a discussion of the components of the soil portion of the remedy:

Lead-Contaminated Soils: Lead-contaminated soil exists on the eastern portion of the KRY Site. The remedy includes excavation and disposal of the lead-contaminated soils at an offsite disposal facility. Some of the lead-contaminated soil may require stabilization to reduce toxicity and leachability before disposal can occur. Characterization sampling and a treatability study may be required during the design phase.

Petroleum Sludge: Petroleum sludge is present throughout the eastern portion of the KRY Site (both at the surface and at depth). The remedy is source removal of all petroleum sludge via excavation followed by recycling at an offsite facility, possibly in an asphalt batch plant. All known petroleum sludge at the KRY Site will be excavated. The sludge exists in varying degrees of viscosity and is intermixed with debris or soil. Sludge material that is mixed with debris and therefore not able to be recycled will be disposed of at an off-site facility, after stabilization, if required. Sludge material that cannot be separated from soils will be treated along with soils in a land treatment unit (LTU). Characterization sampling and a treatability study may be required during the design phase followed by treatment or disposal.

Dioxin/Furan-Contaminated Soils: Areas of dioxin/furan only-contaminated surface soils exist throughout the KRY Site, which are not classified as F032 listed hazardous waste. The remedy for soils contaminated with dioxins/furans only (no PCP) is consolidation into an onsite repository and capping. Placement of the dioxin/furan contaminated soil (no PCP) into the repository will reduce the volume of soil to be treated in the PCP LTU, which is appropriate since dioxins/furans may not be effectively treated to cleanup levels through bioremediation in an LTU. Dioxin/furan-contaminated soils co-located with PCP that are not treated to cleanup levels through bioremediation in an LTU will also be placed in the repository (see below). Institutional controls in the form of restrictive covenants, engineering controls, and long-term maintenance are needed to ensure the repository is not compromised.

PCP- and Petroleum-Contaminated Soils: The majority of excavated contaminated soils and contaminated soils excavated as part of the more-viscous free-product recovery component (see below) of the remedy will be treated using LTUs. The soils contaminated with PCP are classified as F032 listed hazardous waste. The remedy for treating the excavated soils contaminated with PCP, which are co-located with dioxins/furans, and petroleum hydrocarbons is bioremediation in an LTU. However, since dioxins/furans may not be effectively treated to cleanup levels through bioremediation, only dioxin/furan-contaminated soils that are also contaminated with PCP will be placed into an LTU. If after treatment in the LTU, all soils meet appropriate cleanup levels, except for dioxins/furans, the treated soil will be placed in the onsite dioxin/furan repository and capped (see above). Petroleum-contaminated soils will be placed into a separate LTU from the PCP and dioxin/furan-contaminated soils since the petroleum-contaminated soils are not hazardous waste. Treated soils that meet cleanup levels will be available for use onsite as backfill material, although the option of using clean fill will also be retained in order to allow for more rapid redevelopment of the KRY Site, if necessary. Treatability studies and/or pilot tests are required to optimize bioremediation.

Sawdust: Additional investigations in the sawdust area are necessary. Reducing conditions may be mobilizing some metals from the soil, resulting in the high levels of manganese seen in groundwater in the vicinity of the sawdust. In addition, buried sawdust can result in methane

generation at explosive levels, which may create a safety issue for on-site workers. Sampling of the soil gas in the sawdust area for methane and further characterization of a reducing environment are necessary before requiring excavation of the sawdust. Based upon the results of the sampling, DEQ will determine what actions are necessary for the sawdust present at the KRY Site.

Groundwater

Free product Removal: The remedy for removing less-viscous free product on groundwater from the western portion of the KRY Site includes the use of recovery technologies such as trenches or wells. The remedy for removal of more-viscous free product from the eastern portion of the KRY Site is excavation along with contaminated soils. Product remaining on the groundwater after excavation will be recovered, possibly using booms or skimming devices in the open excavation to ensure adequate removal of the source. Free product from the KRY Site that is found to contain PCP will be disposed of at an off-site facility as F032 RCRA listed hazardous waste. Free product that does not contain PCP will be recycled. Pilot tests are necessary to optimize the system design and will be conducted during remedial design.

Chemical Oxidation of Contaminated Groundwater Plume: The remedy for contaminated groundwater is in-situ chemical treatment to reduce the concentrations of PCP in groundwater to meet cleanup levels. Groundwater contaminated with PCP is classified as F032 listed hazardous waste. Chemical treatment will also likely decrease the concentrations of dioxins/furans in groundwater, but may not reduce concentrations enough to reach the cleanup level for dioxins/furans in groundwater. If dissolved petroleum contamination is present in this area, the chemical oxidation system will also be effective in treating that contamination. The oxidant will be injected into the groundwater throughout the PCP and dioxin/furan plumes, including injections into the deeper portion of the aquifer to address contamination at depth. The remedy will expand the current in-situ chemical oxidation system. Benchscale and/or pilot testing will be conducted to optimize system design and determine the most effective oxidant(s).

Monitored Natural Attenuation for Petroleum and Metals: The remedy relies on excavation of contaminated soils and sludge, and removal of free product on groundwater to eliminate the sources of dissolved-phase petroleum contamination and metals contamination in groundwater at the KRY Site. High concentrations of petroleum compounds, iron, manganese, and arsenic currently exist in groundwater at the KRY Site. The petroleum contamination is closely tied to the presence of free product in contact with the groundwater and the high levels of metals are likely due to the breakdown of free product and petroleum contaminated soils in these areas. Another area of high concentrations of iron and manganese exists in the vicinity of well KRY-103A, on the northwestern edge of the KRY Site. These increased concentrations may be related to the presence of buried sawdust in this area. Therefore, it is assumed that removal of the free product and overlying contaminated soil, followed by MNA, will significantly decrease the petroleum and metals concentrations in groundwater through time. Regular sampling as part of the long-term groundwater monitoring program will track the decline in the petroleum and metals concentrations in groundwater at the KRY Site.

Long-Term Monitoring: The remedy includes sampling of many of the existing monitoring, commercial/industrial, and residential wells that now includes 114 monitoring wells, 7 commercial/industrial wells, and 5 residential wells, and any additional wells that may be installed. The wells that will be included in the long-term monitoring network will be determined in the remedial design phase. At a minimum, monitoring of selected wells will be conducted on a semi-annual basis during high and low groundwater elevations for the first five years and with the frequency possibly reduced thereafter, until cleanup levels are achieved.

STATUTORY DETERMINATIONS

The selected remedy will attain a degree of cleanup that assures present and future protection of public health, safety, and welfare, and the environment, and complies with federal and state environmental requirements, criteria, and limitations (ERCLs) that are applicable or relevant to the remedial action and site conditions. The remedy mitigates risk, is effective and reliable in the short- and long-term, is practicable and implementable, uses treatment and resource recovery technologies and engineering controls, and is cost-effective. DEQ has considered all public comment received during the public comment period on the Proposed Plan and has responded to these comments in Part 3 of the ROD. DEQ has also considered the acceptability of the remedy to the affected community in determining the final remedy at the KRY Site.

AUTHORIZING SIGNATURE

(Original Signed Copy in DEQ Files)

(June 30, 2008)

Richard H. Opper
Director
Montana Department of Environmental Quality

Date

PART 2

DECISION SUMMARY

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Acronyms and Abbreviations

°F	Degrees Fahrenheit
ATSDR	Agency for Toxic Substances and Disease Registry
BER	Board of Environmental Review
bgs	Below ground surface
BNSF	BNSF Railway Company
CECRA	Montana Comprehensive Environmental Cleanup and Responsibility Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
COC	Contaminant of concern
COPC	Contaminant of potential concern
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
cy	Cubic yards
DAF	Dilution attenuation factor
DEQ	Montana Department of Environmental Quality
DNRC	Montana Department of Natural Resources and Conservation
DRO	Diesel range organics
EPA	U.S. Environmental Protection Agency
EPH	Extractable petroleum hydrocarbon
ERCLs	Environmental requirements, criteria, and limitations
ESD	Explanation of Significant Difference
FS	Feasibility Study
ft/day	Feet per day
gal	Gallons
gpm	Gallons per minute
HRS	Hazard Ranking Score
IARC	International Agency for Cancer Research
KPT	Kalispell Pole and Timber
KRY Site	Kalispell Pole and Timber (KPT), Reliance Refining Company (Reliance), and Yale Oil Corporation (Yale Oil) Facilities
LNAPL	Light non-aqueous phase liquid
LTU	Land-treatment unit
MCA	Montana Code Annotated
MCL	EPA Maximum Contaminant Level

MDHES	Montana Department of Health and Environmental Sciences, predecessor to DEQ
mg/kg	Milligrams per kilogram
MNA	Monitored natural attenuation
NAPL	Non-aqueous phase liquid
NCP	National Contingency Plan
ng/kg	Nanograms per kilogram
NPL	National Priorities List
O&M	Operations and maintenance
P&E	Proper and expeditious
PAH	Polycyclic aromatic hydrocarbon
PCP	Pentachlorophenol
pg/L	Picograms per liter
PLP	Potentially liable person
PM ₁₀	Fine particulate matter
ppb	Parts per billion
ppm	Parts per million
ppq	Parts per quadrillion
ppt	Parts per trillion
PRG	EPA Region IX Preliminary Remediation Goal
RAO	Remedial Action Objective
RBCA	DEQ Tier 1 Risk-Based Corrective Action Guidance
RBSL	Risk-based Screening level
RCRA	Resource Conservation and Recovery Act
RETEC	Remediation Technologies, Inc.
RI	Remedial Investigation
ROD	Record of Decision
RPP	Reinforced polypropylene
SCEM	Site Conceptual Exposure Model
SPLP	Synthetic Precipitation Leaching Procedure
SVOC	Semivolatile organic compounds
TCDD	Dioxins/furans
TEF	Toxicity equivalence factor
TEQ	Toxicity equivalence quotient
TPH	Total petroleum hydrocarbons
µg/dL	Micrograms per deciliter
ug/L	Micrograms per liter
VCP	Voluntary Cleanup Plan
VOC	Volatile organic compound
VPH	Volatile petroleum hydrocarbons
WHO	World Health Organization

Decision Summary

1.0 SITE NAME, LOCATION AND DESCRIPTION

The Kalispell Pole & Timber (KPT), Reliance Refining Company (Reliance), and Yale Oil Corporation (Yale Oil) Facilities (collectively referred to as the KRY Site) are located on the northeastern edge, but outside the city limits of the City of Kalispell in the community of Evergreen in Flathead County, Montana (Township 28 North, Range 21 West, Sections 5 and 8) (see Figure 1). The surficial boundaries of the KRY Site generally extend from the Stillwater River on the north and west, Highway 2 and the BNSF Railway Company (BNSF) railroad line on the east, Montclair Drive on the south, and Whitefish Stage Road on the west. The actual KRY Site boundaries are based on the extent of contamination, and groundwater contamination is known to extend to the southeast outside of these general boundaries and across Highway 2 (see Figure 2) and covers approximately 75 acres. The fenced area north of the junction of the mainline and spurline railroad tracks and adjacent to (east of) the railroad tracks is also part of the KRY Site. The KRY Site is adjacent to the Stillwater River and includes a residential area. DEQ initially treated the KRY Site as three separate facilities. However, based on a number of facts, DEQ has determined that the facilities must be addressed comprehensively as one facility. The bases for this decision include: 1) the definition of a CECRA facility under Section 75-10-701, MCA, which includes any site or area where a hazardous or deleterious substance has been deposited, stored, disposed of, placed, or otherwise come to be located; 2) the presence of commingled contamination; 3) the intertwined operational histories and co-extensive operations (e.g. the KPT Company operated at both KPT and Reliance and contamination from KPT is now located at Reliance); 4) many of the same hazardous or deleterious substances were used, stored, deposited, and disposed of at the facilities; 5) ensuring protectiveness of human health and the environment; and 6) allowing for cost-effective remediation.

2.0 SITE HISTORY AND ENFORCEMENT ACTIONS

This section presents an overview of the operational and property ownership history for the KRY Site. Current ownership of the individual parcels included within the KRY Site is summarized in Table 1 and historical property ownership is presented in Table 2. Vicinity land use and parcel identification are presented in Figure 3.

2.1 KALISPELL POLE & TIMBER

KPT is a former wood treating operation that operated from approximately 1945 to 1990. The surficial portion of KPT encompasses approximately 35 acres. Soils and groundwater were contaminated from spills or leaks of diesel-based wood treating oil that contained pentachlorophenol (PCP) and dioxins/furans from the treatment vats and aboveground storage tanks as well as drippage from treated wood. Contaminants include PCP, dioxins/furans, polycyclic aromatic hydrocarbons (PAHs), and petroleum hydrocarbons, including free product. Groundwater is also contaminated with dissolved metals associated with the breakdown of petroleum hydrocarbons and free product (TtEMI 2005, DEQ and TtEMI 2008a).

The KPT Company was incorporated on July 8, 1944. On October 8, 1945, KPT Company leased from the Great Northern Railroad Company a 300 feet by 200 feet space in or near the area where the pole plant was ultimately constructed. BNSF's predecessor companies (Burlington Northern Railroad Company; Burlington Northern, Inc.; and Great Northern Railroad Company) leased portions of the property to KPT Company beginning on June 1, 1947, and possibly as early as October 8, 1945, for the location and operation of a treating plant and storage yard. KPT Company also owned the property north of BNSF's spur line and this property was used for pole storage, among other things (TtEMI 2005). KPT Company owned and operated the pole plant for its entire operating life, from approximately 1945 through approximately May 1990. The KPT Company board of directors approved the dissolution of the corporation as of December 31, 1990. KPT Company was involuntarily dissolved by the state on December 6, 1991. When the pole treating operations ended, KPT Company dismantled and removed all treating vats and aboveground storage tanks and piping (HRA 1995). Upon dissolution, KPT Company sold its real property to Swank Enterprises and Montana Mokko. Swank Enterprises later sold part of the property to Klingler Lumber Company (Table 2) (TtEMI 2005).

Former KPT Company employees have provided details on the wood treating process used at the plant. First, PCP was mixed with hot oil (5 percent PCP by weight) in a vat using a steam process to create a "treating oil" that reached temperatures as high as 210 to 230 degrees Fahrenheit (°F). Then, the hot treating oil was added to a large vat that contained the wood to be treated for an average treatment time of about 10 hours per load. Sample drillings into the treated wood verified whether the preservative had sufficiently penetrated the wood (HRA 1995). "Foam overs" of the wood treating solution occurred when rain and snow reacted with heated oil in the treatment vats, resulting in releases of PCP to the ground. In addition, treated poles dripped and/or otherwise leaked treating solution during removal from the tanks and storage (BNSF v. KPTC 1999).

KPT Company treated poles at the pole plant using a butt vat (a vat where poles were treated sitting vertically in the tank so that just the ends were in the treating solution) and a full-length vat (the full length of the pole was placed horizontally in a tank for treatment). KPT Company added the full-length vat to its operation in 1957 (HRA 1995). The dimensions of the butt vat were 10 feet wide by 10 feet deep by 18 feet long. The capacity of the butt vat was 13,465 gallons of treating solution. The dimensions of the full-length vat were 10 feet wide by 10 feet deep by 70 feet long. The capacity of the full-length vat was 52,367 gallons of treating solution. The full-length vat was also used for mixing PCP and oil (BNSF v. KPTC 2000).

BNSF and its predecessors owned and BNSF currently owns a portion of the property where KPT Company operated and where the wood treatment facility was located. BNSF and its predecessors also operated at KPT. BNSF shipped freight via railcar to and from KPT. Freight shipped by BNSF to KPT included untreated poles, PCP, and oil. BNSF or its predecessors also transported treated poles from KPT (BNSF v. KPTC 2000).

BNSF and its predecessors have and BNSF is currently leasing property to lumber-processing companies. Klingler Lumber Company is operating either on or directly adjacent to the former

pole treating area. Montana Mokko/Stillwater Forest Products had operated adjacent to (west of) the former pole treating area, but these operations have ceased and a stone processing company (Glacier Stone Company) is now operating in its place (DEQ and TtEMI 2008a).

A number of regulatory events have taken place under DEQ's Hazardous Waste (Resource Conservation and Recovery Act – RCRA) Program for KPT, including:

- On August 16, 1980, KPT Company submitted the first U.S. Environmental Protection Agency (EPA) Notification of Hazardous Waste Activity Form (DEQ 1983).
- On August 10, 1983, the MDHES Hazardous Waste Program conducted an inspection of the KPT Company operation. No violations were noted in the Field Investigation Report and the KPT Company operation retained listing as a small quantity generator (DEQ 1983).
- On October 1, 1986, MDHES Hazardous Waste Program conducted an inspection of the KPT Company operation. No violations were noted in the Field Investigation Report (DEQ 1986).
- In February 1991, the DEQ Hazardous Waste Program RCRA project file was closed because KPT Company had ceased operations and dismantled the wood treatment facility (DEQ 1991a).
- In November 1994, BNSF submitted a Regulated Waste Activity Form for investigation-derived waste (purge water) and was classified as a Class II large quantity generator (BNSF 1994). This classification was later changed to Class I large quantity generator, which is still in effect. BNSF also began submitting annual generator reports.
- In April 2006, DEQ submitted a RCRA Subtitle C Site Identification Form for the KRY Site in order to obtain an EPA ID number for hazardous waste generated during the performance of the remedial investigation and feasibility study (RI/FS) for the KRY Site (DEQ 2006a). Hazardous waste generated included investigation-derived waste (wastes associated with the installation, development, and sampling of monitoring wells) associated with the KRY Site. DEQ was classified as a Class I large quantity generator, which is still in effect and began submitting annual generator reports (DEQ 2007a).

A number of non-RCRA regulatory events have taken place for KPT, including:

- In August 1980, KPT was listed on the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) list (EPA 2005a).
- In September 1993, Montana Mokko and Klingler Lumber Company agreed to stipulations with regard to the National Ambient Air Quality Standard for Particulate Matter and Montana Ambient Air Quality Standard for fine particulate matter (PM₁₀) after the Kalispell area was designated as a non-attainment area for particulate matter. The stipulations, signed by Montana Mokko and Klingler Lumber Company (as well as MDHES), were related to the overall plan to come into compliance with the standards. Both parties agreed to the following requirements (among others): not to cause or authorize emissions to be discharged into the outdoor atmosphere from equipment on the property, from access roads, parking lots, log decks, or the general plant property (with some specific opacity levels); to treat all unpaved portions of the haul roads, access roads, parking lots, log decks, and the general plant area with water or chemical dust

suppressant as necessary to maintain compliance; to operate and maintain all emission control equipment; and to submit an annual emission inventory to MDHES Air Quality Bureau for the listed emission points (BHES 1993a and 1993b).

- In 1995, DEQ noticed BNSF, KPT Company, and Montana Mokko as potentially liable persons (PLPs) under CECRA for KPT (DEQ 1995c, 1995d, and 1995e).
- In August 1998, BNSF submitted a petition to initiate the Controlled Allocation of Liability Act (CALA) to DEQ (BKBH 1998a).
- In November 1998, BNSF withdrew its CALA petition (BKBH 1998b).
- In December 1998, proper and expeditious (P&E) letters were sent, pursuant to Section 75-10-711(3), MCA, to the PLPs who had received notice letters asking them to undertake the work necessary at KPT. At this time, the noticed parties for KPT included BNSF, KPT Company, and Montana Mokko (DEQ 1998a).
- In October 2000, P&E letters were sent, pursuant to Section 75-10-711(3), MCA, to the PLPs who had received notice letters (BNSF, KPT Company, and Montana Mokko) asking them to undertake additional work at KPT (DEQ 2000c).
- In November 2001, DEQ noticed Klingler Lumber Company, Swank Enterprises, and the Montana Department of Natural Resources and Conservation (DNRC) as PLPs under CECRA for KPT (DEQ 2001a, 2001b, and 2001c).
- In July 2004, DEQ filed a lawsuit naming the noticed PLPs as defendants. In the lawsuit, DEQ requested reimbursement of its oversight costs and a court order requiring the defendants to conduct remedial actions to abate the imminent and substantial endangerment to public health, safety, or welfare or the environment posed by the KRY Site (DEQ v. BNSF et al 2004).
- In December 2007, DEQ issued the Proposed Plan for the KRY Site and announced a public comment period for the document, along with the Feasibility Study (FS) and Addendum to the FS (DEQ 2007b and 2007g). The comment period was later extended per requests from the public (DEQ 2007c and 2007g).

Investigations have been conducted at KPT, including:

- A 1985 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) preliminary assessment by MDHES noted the potential for PCP contamination at the facility (DEQ 1985a).
- A 1988 CERCLA Phase I site investigation by MDHES consultants found high levels of PCP and dioxins/furans in on-site soils and groundwater and elevated levels of some PAHs (MSE 1989).
- A 1989 CERCLA Phase II site investigation by MDHES consultants concluded that groundwater contamination was migrating off site to the east/southeast (MSE 1990).
- A 1991 CERCLA Phase III site investigation by MDHES consultants found no contamination in the Evergreen municipal wells or in most nearby residential wells, but found PCP in a downgradient residential well and very low levels of petroleum hydrocarbons in another downgradient irrigation well (MSE 1991). MDHES subsequently conducted semi-annual domestic well sampling until 1998.
- In 1991, Burlington Northern Railroad, at Montana Mokko's expense, expanded the spur line to access Montana Mokko's operation. The spur line was constructed very close to,

and possibly on top of, some of the worst known areas of soil contamination on the facility (Murray & Kaufman, P.C. 1992 and DEQ 2005a).

- In 1991, EPA consultants conducted a hydrogeologic investigation to better define groundwater movement and contamination in soil and groundwater. This investigation was the result of an MDHES request for EPA emergency removal action in 1990 (EPA 1992a).
- In 1992, consultants for a potential buyer of a property south of Highway 2 conducted a Phase I and II environmental site assessment to evaluate whether the property was affected by contamination from the three nearby CECRA facilities. Petroleum hydrocarbons and low levels of several PAHs were found in soil and groundwater on the property, but the source of contamination had not been identified. Several potential sources were noted to exist in the area (NTL 1992 and Spratt 1992).
- In 1994, MDHES consultants prepared a draft Hazard Ranking System (HRS) package for KPT and Reliance. An evaluation of KPT and Reliance indicated that both (in combination) were candidates for the National Priorities List (NPL). KPT and Reliance were never proposed for listing (DEQ 2005d).
- In 1994, consultants for BNSF completed an investigation at KPT to confirm the results of previous investigations, replace damaged monitoring wells, and collect additional data. Free product or a petroleum sheen was detected in most of the monitoring wells during most sampling events. The free product was generally less than one foot thick. A plume of dissolved PCP and dioxins/furans was also found (ReTec 1995).
- In 1995, BNSF canceled the lease of the potato warehouse and removed the building between mid-1995 and 1998 (DEQ 1995a and 1995b). The Site Investigation Report for KPT presents figures depicting the location of the potato warehouse (ReTec 1995). The Supplemental Remedial Investigation Report for KPT presents figures depicting the location of the former potato warehouse (ReTec, 1998a).
- In the mid-1990s, a small building located on the state-owned portion of KPT was removed. This building was located in the eastern portion of the property adjacent to Flathead Drive (DEQ 2005c and 2005e). The building is visible on the 1995 aerial photograph of the area. The building is not present on the 2004 aerial photograph. It appears the building was part of the oil refinery since the building is depicted and labeled on the 1950 and 1963 Sanborn Fire Insurance Maps as part of the Unity Petroleum Corporation refinery (TtEMI 2005).
- In 1996, BNSF consultants began additional investigations to delineate the contaminant plumes of PCP and free product (DEQ 1996a). Sampling of local domestic wells by DEQ found PCP and petroleum contamination (DEQ 1996b).
- In 1997 and 1998, BNSF consultants conducted a supplemental remedial investigation (RI). The purpose of this investigation was to fill data gaps identified during the investigation in 1994 and 1995; delineate the downgradient extent of the plume of dissolved PCP; characterize the western edge of free product contamination; calculate the direction of groundwater flow in the northern portion of KPT; calculate groundwater velocity during low-water periods, and assess the extent of surface PCP contamination in soil (Retec 1998a).
- In 2001, BNSF resumed sampling of groundwater monitoring wells associated with the facility to further define the magnitude and extent of contamination associated with KPT. Samples were analyzed for PCP, extractable petroleum hydrocarbons, semivolatile

organic compounds (SVOC), and dioxins/furans (Retec Group 2001). BNSF consultants have conducted semi-annual groundwater sampling of select wells since 2001.

- In November 2005, BNSF consultants conducted monitoring well installation, soil borings, and surface soil sampling at KPT and Reliance (BKBH 2006).
- Between July 2005 and July 2007, DEQ and its contractors completed a comprehensive RI and FS for the KRY Site (DEQ and TtEMI 2008a and 2008b).
- In October 2007, DEQ contractors conducted additional sampling of the Stillwater River to determine if contamination attributable to the KRY Site was impacting the river. The results of this sampling are discussed in Section 5.3.3 and the sampling is documented in Appendix G the FS (DEQ and TtEMI 2008b).

Numerous interim actions have occurred at KPT. DEQ considered the interim remedial actions and integrated that information and actions into the remedy to the extent possible. The interim actions conducted at KPT include the following:

- In 1996, BNSF consultants installed five new monitoring wells and began a pilot air-sparging program to evaluate the effectiveness of the technology on reducing concentrations of dissolved PCP (ReTec 1996a).
- In 1997, BNSF connected one local residence to the city water system after detecting PCP in the domestic well (ReTec 1996b).
- In April 1999, a one-time soil excavation was conducted by BNSF to remove PCP hot spots in shallow soils and transport them off site for disposal in a Subtitle C facility. This action occurred before the Phase IV Land Disposal Restrictions were promulgated that prohibited F032-contaminated soils and debris from land disposal. BNSF identified the PCP contamination as F032 listed hazardous waste, which is a RCRA hazardous waste designation for wastes from some wood preserving processes (40 CFR 261.31). BNSF consultants excavated approximately 470 cubic yards of contaminated soils from the former treatment area located at the facility. The contaminated soils were transported to and disposed of at Chemical Waste Management of the Northwest, Waste Management Industrial Services' Subtitle C landfill located in Arlington, Oregon (ThermoRetec 2000).
- In 1999, BNSF contractors expanded the air-sparging system and converted it to a pilot-scale ozonation system to partially remediate contaminated groundwater at the BNSF-owned portion of KPT (ReTec 1998b). This pilot test was conditionally-approved by DEQ (DEQ 1999).
- In 2004, BNSF upgraded the ozonation system to be a full-scale system without DEQ approval or oversight (BNSF 2004). DEQ reviewed and commented on the "as-built" report in April 2005 (ERM 2005 and DEQ 2005f).
- In September 2006, BNSF again modified the ozonation system without DEQ approval or oversight (ERM 2006).
- In May 2008, BNSF contractors performed a persulfate injection pilot test (chemical oxidation) without DEQ approval (ERM 2008a-c, DEQ 2008g-h).

2.2 RELIANCE REFINING COMPANY

Reliance is a former oil refinery that operated from 1924 to the 1960s. The surficial portion of Reliance encompasses approximately 7 acres. Onsite disposal of sludge, leaks of sludge and oil

from aboveground storage tanks, and releases of petroleum products from the operations of the refinery and the railroad contaminated the soil with petroleum hydrocarbons and some metals, notably lead. Groundwater beneath Reliance is contaminated with petroleum hydrocarbons, including free product, PCP, dioxins/furans, and PAHs. Groundwater is also contaminated with dissolved metals associated with the breakdown of petroleum hydrocarbons and free product (TtEMI 2005, DEQ and TtEMI 2008a).

The Reliance Refining Company was incorporated on November 14, 1923, after oil was discovered in the Kevin-Sunburst fields in north-central Montana in October 1923. The Reliance Refining Company owned and operated the refinery from 1924 to 1930. A fractionating oil refinery was constructed in about 9 months, and refining operations started by November 1924. By November 1925, the refinery was producing 20,000 gallons of gasoline daily. The refinery also produced kerosene, jet fuel, distillates, gas oil (diesel engine oil), transmission oil, floor oil, and other petroleum byproducts. The crude oil and petroleum products were stored in aboveground storage tanks and earthen dikes/barrow pits. In 1929, a cracking plant was installed at the facility (EPA FIT 1986a, EPA 1992a).

BNSF and its predecessors owned and currently own the property underlying the mainline railroad tracks on the east side of Reliance and the property underlying the spur line that intersects Reliance (DEQ v. BNSF et al 2008). BNSF and its predecessors operated these lines, transporting crude oil to the refinery and transporting refined petroleum products out of the refinery (DEQ 2008e).

The refinery property was sold for back taxes to the State of Montana at a public auction held on November 21, 1930; the final deed was issued on December 26, 1935. Boris Aronow, doing business as Unity Petroleum Corporation, leased the property from the state on December 5, 1930. The lease expired on November 26, 1935. The Reliance Refining Company was sold to Boris Aronow in February 1932. The Unity Petroleum Corporation was incorporated in March 1933. The Unity Petroleum Corporation leased and operated the refinery property from 1935 until 1969 (TtEMI 2005).

There are conflicting reports on the length of time the refinery operated. Unity Petroleum Corporation was listed in the Kalispell city directories between 1928 and 1944. However, there were no listings in the city directories between 1945 and 1956. The last two listings for Unity Petroleum were in 1957 and 1959. These two listings identified Tony Schumacher as a bookkeeper for Unity Petroleum (HRA 1995). Mr. Aronow reported that bulk storage operations continued at the site into the 1960s (State Board of Land Commissioners 1962). There are listings in the city directories from 1962 through 1969 for Schumacher's Evergreen Fuel Company. The 1963 Sanborn map contains a note that the oil refinery was no longer in operation and that only one person was working at the facility. The refinery was dismantled in 1970 (EPA FIT 1986a, EPA 1992a). The state involuntarily dissolved the Unity Petroleum Corporation in 1982 for failure to provide annual reports and fees (HRA 1995).

The State of Montana leased the property to KPT Company on August 13, 1969; the lease was terminated on January 28, 1994 (PTS 2000). KPT Company leased the property for storage of poles. In 1973, KPT Company requested permission from MDHES to cover an aboveground

storage tank with wood chips. The tank, which contained 16 inches of tar, had been cut off near the floor, leaving the bottom and lower sidewalls of the tank in place. MDHES granted KPT Company permission (DEQ 1973), and the tank bottom was covered with wood chips (EPA FIT 1986a).

KPT Company also owned the property north of BNSF's spur line and this property was used for pole storage. A KPT Company employee said that limited butt dipping in drums occurred on state-owned property at Reliance sometime between 1968 and 1973. The alleged treatment included cold soaking poles in drums of treating fluid (DNRC 1988). However, investigations conducted on state-owned property did not reveal levels of contamination that would indicate wood-treatment occurred, nor were drums or other evidence of treatment found. In 1988, the EPA constructed a security fence around the southern portion of Reliance. EPA also fenced a small area north of the junction of the spur-line and mainline railroad tracks and adjacent to (east of) the railroad tracks. The fences were constructed based on reports of children playing in sludge pits at those locations. KPT Company conducted operations on the property until May 1990. KPT Company's board of directors approved the dissolution of the corporation as of December 31, 1990. KPT Company was involuntarily dissolved by the state on December 6, 1991. Upon dissolution, KPT Company sold its real property to Swank Enterprises and Montana Mokko. Swank Enterprises later sold part of the property to Klingler Lumber Company (Table 2) (TtEMI 2005).

A number of regulatory events have taken place for Reliance, including:

- In January 1985, Reliance was listed on CERCLIS (EPA 2005a).
- In 1995, DEQ noticed BNSF, Klingler Lumber Company, and Swank Enterprises as PLPs under CECRA for Reliance (DEQ 1995f, 1995g, and 1995h).
- In September 2000, pursuant to Section 75-10-711(3), MCA, P&E letters were sent to the noticed PLPs asking them to undertake the work necessary at Reliance (DEQ 2000d).
- In October 2000, BNSF requested that DNRC be noticed as a PLP for Reliance (BKBH 2000). DNRC later also requested that it be noticed as a PLP for Reliance (DEQ and TtEMI 2008a).
- In November 2001, notice letters were sent to McElroy and Wilken, Inc. and to DNRC, identifying them as PLPs under CECRA for Reliance (DEQ 2001d and 2001f). When the company received the notice letter, McElroy and Wilken, Inc. characterized its portion of the facility to further evaluate the presence of contamination. Activities included installation of two groundwater monitoring wells and collection of soil samples. Soil and groundwater samples were evaluated for PCP, total petroleum hydrocarbons (TPH), and dioxins/furans (LWC 2002a). McElroy and Wilken, Inc. was granted a subsurface migration exclusion as a result of the additional investigations (DEQ 2002a).
- In October 2002, Klingler Lumber Company was removed from the PLP list for Reliance after it provided information indicating it had never owned property at Reliance (DEQ 2002b).
- In July 2004, DEQ filed a lawsuit naming the PLPs who had received notice letters as defendants (except McElroy and Wilken, Inc. and Klingler Lumber Company). In the lawsuit, DEQ requested reimbursement of its oversight costs and a court order to require the defendants to conduct remedial actions to abate the imminent and substantial

endangerment to public health, safety, or welfare or the environment posed by the KRY Site (DEQ v. BNSF et al 2004).

- In December 2007, DEQ issued the Proposed Plan for the KRY Site and announced a public comment period for the document, along with the FS and Addendum to the FS (DEQ 2007b and 2007g). The comment period was later extended per requests from the public (DEQ 2007c and 2007g).

Investigations have been conducted at Reliance, including:

- A 1985 CERCLA preliminary assessment by MDHES noted the potential for contamination at Reliance. The preliminary assessment noted the presence of sludge pits on the ground surface and extending to depths of at least six feet below ground surface (bgs) based on test pits (DEQ 1985b).
- A 1986 CERCLA initial investigation by EPA contractors found dioxins/furans in on-site soils and free product on the groundwater (EPA FIT 1986a and 1986c).
- A 1988 CERCLA Phase I site investigation by MDHES consultants revealed high levels of total petroleum hydrocarbons (TPH), metals (primarily lead), and PAHs, and low levels of dioxins/furans at Reliance. PCP was found in one soil sample and in groundwater (MSE 1989).
- A 1989 CERCLA Phase II site investigation by MDHES consultants concluded that groundwater contamination was migrating off site and to the east/southeast (MSE 1990).
- A 1991 CERCLA Phase III site investigation by MDHES consultants found no contamination in the Evergreen municipal wells or in most nearby residential wells, but found PCP in a downgradient residential well and very low levels of petroleum hydrocarbons in another downgradient irrigation well (MSE 1991). MDHES subsequently sampled domestic wells semi-annually until 1998 (DEQ 1996b and 1998b).
- In 1992, consultants for a potential buyer of a property south of Highway 2 conducted a Phase I and II environmental assessment to evaluate whether the property was affected by contamination from the three nearby CECLA facilities. Petroleum hydrocarbons and low levels of several PAHs were found in soil and groundwater on the property, but the contaminant source had not been identified. Several potential sources were noted to exist in the area (NTL 1992 and Spratt 1992).
- In 1994, MDHES consultants prepared a draft HRS package for KPT and Reliance. An evaluation of the facilities indicated that both (in combination) were candidates for the NPL. KPT and Reliance were never proposed for listing (DEQ 2005d).
- In 1996 and 1997, DNRC applied for and received two grants for preparation and submittal of a Voluntary Cleanup Plan (VCP), which proposed removing, treating, and recycling approximately 20,000 cubic yards of petroleum-contaminated soils in an asphalt batch plant with the end product used for highway construction (DNRC 1996). These activities did not occur.
- In 1996, DEQ consultants completed a draft RI for a portion of Reliance (PTS 1997a). A Final Draft FS Report was prepared in December 1997 (PTS 1997b). The RI was finalized as a Phase I RI report in December 2000 (PTS 2000).
- In February 2000, DNRC submitted a report detailing the preliminary screening of remedial alternatives for the state-owned portion of Reliance. The report presented potential interim actions to address contaminants in soils on the DNRC-owned portion of

Reliance (LWC 2000). DEQ was unable to approve the document because the interim actions proposed were unlikely to be consistent with final cleanup (DEQ 2000a).

- In 2002, DNRC conducted an interim investigation at Reliance to address specific data gaps and to initiate groundwater remediation. Additional soil samples were collected to further characterize contamination in soil across the state-owned portion of Reliance. Routine groundwater monitoring was also initiated and was conducted in conjunction with monitoring for adjacent KPT (LWC 2002b). DNRC submitted a Phase II RI/FS to DEQ in December 2002 (LWC 2002c).
- In November 2005, BNSF consultants conducted monitoring well installation, soil borings, and surface soil sampling at KPT and Reliance (BKBH 2006).
- Between July 2005 and July 2007, DEQ and its contractors completed a comprehensive RI/FS for the KRY Site (DEQ and TtEMI 2008a and 2008b).
- In October 2007, DEQ contractors conducted additional sampling of the Stillwater River to determine if contamination attributable to the KRY Site was impacting the river. The results of this sampling are documented in Appendix G of the FS (DEQ and TtEMI 2008b).

Numerous interim actions have occurred at Reliance. DEQ considered the interim remedial actions and integrated that information and actions into the remedy to the extent possible. The interim actions conducted at Reliance include the following:

- In 1988, the EPA Emergency Removal Branch constructed a security fence around the southern portion of Reliance, and a small area north of the junction of the spur-line and mainline railroad tracks and adjacent to (east of) the railroad tracks. Hazard warning signs were posted on the fences. The interim action was conducted based on reports that children were playing in the sludge pits (EPA 1988).
- In July 2002, DNRC consultants installed two 12-inch diameter wells at Reliance. In August 2002, belt skimmers were installed in the wells to recover free product from the groundwater (LWC 2002b and 2002c). Interim recovery efforts are no longer occurring at Reliance.

2.3 YALE OIL CORPORATION

Yale Oil is a former petroleum bulk plant and product refinery that operated from 1938 to 1978. The surficial portion of Yale Oil encompasses approximately 2.3 acres. Leaks and possible spills from aboveground storage tanks contaminated on-site soils. Thermal desorption, using a permitted unit, was conducted on the soils to remove petroleum hydrocarbon contamination. However, groundwater beneath Yale Oil is contaminated with low-levels of PCP, dioxins/furans, and petroleum hydrocarbons (TtEMI 2005, DEQ and TtEMI 2008a).

Yale Oil Corporation used the property as a refinery and bulk plant in the 1930s. The first evidence that Yale Oil had established a business in Kalispell appears in the 1936 city directory (HRA 1995). The facility refined crude oil from the Kevin-Sunburst oil fields in north-central Montana, which were developed in 1923. Crude oil was delivered to Yale Oil by truck and rail. The refinery has been described as a small operation with a daily capacity of 500 barrels.

Tractor fuel (similar to diesel) and fuel oil were the primary products of the refinery. Crude oil and petroleum products were stored in aboveground storage tanks (DEQ and TtEMI 2008a).

Yale Oil Corporation owned and operated the business until 1944, when the property was sold to Carter Oil Company. Refining operations ceased shortly after. Operational features present on the 1927 Sanborn map are labeled as “not used” on the 1950 Sanborn Map. As early as 1945, Carter Oil leased the property to the T.J. Landry Oil Company, Inc., a petroleum products distributorship. Mr. Landry ran the distributorship until he turned over management of the operation to his son-in-law, Bill Roberts. Mr. Roberts managed the distributorship until 1978 when petroleum operations ceased (AES 1986a).

In 1960, Carter Oil merged with Humble Oil and Refining Company (AGM 1959). Humble Oil merged with Exxon Corporation on January 1, 1973 (DEED 1980). In February 1978, the bulk plant operations at Yale Oil were closed and the property was offered for sale (AES 1986b). The product inventory and all storage tanks, except the No. 5 fuel oil tank, were purchased by City Service Center and then moved to its property south of Kalispell (AES 1986a).

In February 1980, Exxon Corporation granted the property to the Exxon Education Foundation (DEED 1980). The property was sold to the National Development Corporation in December 1981 (DEED 1981). In 1982, the Pacific Iron and Steel Division of Pacific Hide and Fur dismantled the No. 5 fuel oil tank. The No. 5 fuel oil tank was cut off near ground level, leaving the tank bottom and lower sidewalls in place. Any product, sludge, or tank bottom that remained in the tank was left in place (AES 1986a). In October 1983, property ownership reverted to the Exxon Education Foundation (DEED 1983) and subsequently to Exxon Corporation in November 1988 (SWD 1988 and TtEMI 2005). The current property owner is Kalispell Partners LLC, and a commercial business currently exists at the location (DEQ and TtEMI 2008a).

A number of regulatory events have taken place for Yale Oil, including:

- In January 1985, Yale Oil was listed on CERCLIS (EPA 2005b).
- On February 24, 1993, a remediation contractor, GEM Division of Ryan Murphy, applied for and subsequently received an air quality permit to operate a thermal desorption unit at Yale Oil to treat petroleum contaminated soil. The State of Montana permit set an upper concentration limit of 1,300 mg/kg total petroleum hydrocarbons for soil allowed to be treated in the unit (DEQ 2005b).
- In August 1993, DEQ noticed Exxon Corporation as a PLP for Yale Oil (DEQ 1993).
- In July 2004, DEQ filed a lawsuit naming the noticed PLP as a defendant. In the lawsuit, DEQ requested reimbursement of its oversight costs and a court order requiring the defendants to conduct remedial actions to abate the imminent and substantial endangerment to public health, safety, or welfare or the environment posed by the KRY Site (DEQ v. BNSF et al 2004).
- In December 2007, DEQ issued the Proposed Plan for the KRY Site and announced a public comment period for the document, along with the FS and Addendum to the FS (DEQ 2007b and 2007g). The comment period was later extended per requests from the public (DEQ 2007c and 2007g).

Investigations have been conducted at Yale Oil, including:

- In 1985, petroleum product in the No. 5 fuel oil tank bottom left on site spilled onto the ground (AES 1985). Follow-up site investigations were conducted by EPA and Exxon Corporation (AES 1986a and 1986b).
- In 1986, MDHES completed a CERCLA preliminary assessment (DEQ 1985c).
- In February and March of 1986, EPA consultants and MDHES conducted a CERCLA site investigation to characterize the nature of groundwater contamination associated with Yale Oil and to characterize waste materials found in the sludge and contaminated soils. Sample results indicated high concentrations of PAHs, 2-methylphenol and 4-methylphenol (phenols) in on-site soils and sludges and contamination of the on-site shallow alluvial groundwater with phenols and petroleum hydrocarbons. PCP was detected in groundwater from a background monitoring well and may have originated from another source. Lead and zinc were detected at elevated concentrations in an onsite soil sample (EPA FIT 1986b). Split samples were collected by Exxon's consultant.
- In June 1986, a follow-up sampling event was conducted by EPA consultants and MDHES to identify and characterize the potential for dioxin/furan contamination in soils and waste material and determine the potential for direct contact with contamination (EPA FIT 1986d). Exxon's consultant collected split samples and reported detectable concentrations of dioxin/furan compounds in soil samples.
- In June 1989, EPA completed a site inspection decision sheet, which identified the waste type at Yale Oil as a nonhazardous substance under CERCLA and the nature of the release as observed but below the HRS release threshold. Yale Oil was determined to be "No Further Remedial Action Planned" under CERCLA (EPA 1989a).
- In 1989, Exxon consultants prepared a remediation plan and conducted a test burn to determine the safety and effectiveness of using thermal desorption on contaminated soils at Yale Oil (AES 1989).
- In January 1991, MDHES completed a site inspection decision sheet, which identified the waste type at Yale Oil as a known hazardous substance under CERCLA and the nature of the release as observed, with potential exposures/receptors. A revised Screening Site Inspection was requested for Yale Oil under CERCLA (DEQ 1991b).
- In June 1993, EPA consultants conducted a CERCLA site inspection prioritization to review existing data and identify whether data gaps exist with regard to HRS scoring and to provide sufficient documentation for a determination of potential human health and environmental impacts (PTS 1993).
- In 1994 and 1995, Exxon consultants conducted quarterly groundwater monitoring of onsite wells. Samples were analyzed for gasoline and diesel-range organic compounds, phenols, and SVOCs. Phenols were detected in samples from monitoring wells (SECOR 1995a, 1995b, and 1995c).
- In November 2000 and May 2002, Exxon consultants conducted groundwater monitoring of onsite wells. Samples were analyzed for extractable petroleum hydrocarbons (EPH) and volatile petroleum hydrocarbons (VPH) constituents. Some EPH and VPH constituents were detected above screening levels (DEQ 2004).
- Between July 2005 and July 2007, DEQ and its contractors completed a comprehensive RI/FS for the KRY Site (DEQ and TtEMI 2008a and 2008b).

- In October 2007, DEQ contractors conducted additional sampling of the Stillwater River to determine if contamination attributable to the KRY Site was impacting the river. The results of this sampling are documented in Appendix G of the FS (DEQ and TtEMI 2008b).

Numerous interim actions have occurred at Yale Oil. DEQ considered the interim remedial actions and integrated that information and actions into the remedy to the extent possible. The interim actions conducted at Yale Oil include the following:

- In 1993, Exxon conducted a voluntary cleanup action consisting of removing the tank bottom and the sludges within the tank bottom plus the contaminated soils associated with the tank bottom. Piping and stained soils associated with the piping were also excavated and thermally desorbed (AES 1994). More than 200 cubic yards of soil was not thermally desorbed because the TPH concentrations were above 1,300 parts per million (ppm), which was the maximum level allowed for thermal desorption by the DEQ-issued permit (DEQ 2005b). These soils were stockpiled on site.
- In 1997, the soils that were stockpiled in 1993 were removed to an unknown disposal facility. Confirmation samples taken from the area where the stockpiled soils were stored showed 423 ppm diesel range organics (DRO), which was above the DEQ-established screening level of 100 ppm (DEQ 1997). This screening level was used before DEQ established risk-based screening levels for petroleum in the Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases.

3.0 COMMUNITY PARTICIPATION

Public participation in the decision making process proceeded in accordance with Section 75-10-713, MCA, of CECRA. In addition, DEQ provided additional opportunities for public involvement not required by CECRA (including but not limited to seeking public comment on the RI Report and holding scoping meetings for the RI and FS with the liable persons). The public comment process followed here was also not inconsistent with CERCLA and the NCP.

The RI Report for the KRY Site in Kalispell, Montana was made available to the public in January 2007 and DEQ provided notice of the public comment period and public meeting via postcard mailings and a fact sheet distributed to the mailing list. A legal notice of the public comment period and public meeting was published in the Kalispell Daily Interlake and on DEQ's website (DEQ 2007g). DEQ held a public meeting on February 20, 2007 to discuss the findings of the RI and answer questions. A Responsiveness Summary, which provides a response to each comment submitted during the public comment period on the RI, was made available to those who provided comments and the general public on December 10, 2007 (DEQ 2007h). The Final Draft FS Report was made available to the public in July 2007. The Addendum to the FS and the Proposed Plan were made available to the public in December 2007. DEQ provided notice of the public comment period and public meeting/hearing associated with the FS, Addendum to the FS, and Proposed Plan via postcard mailings and a fact sheet distributed to the mailing list. A legal notice of the public comment period and public meeting/hearing was published on December 7-9, 2007 in the Kalispell Daily Interlake and on DEQ's website. DEQ held a public meeting/hearing on December 19, 2007 to present and discuss the Proposed Plan, FS, and FS

Addendum, answer questions, and to receive oral public comments. DEQ received requests to extend the public comment period and agreed to provide a one week extension. A legal notice of the extension of the public comment period was published in the Kalispell Daily Interlake on December 21-22, 2007 and on DEQ's website. A 37-day public comment period on the Proposed Plan, FS, and Addendum to the FS was held from December 7, 2007 through January 12, 2008 (DEQ 2007g).

Notice of the Record of Decision (ROD) for the KRY Site will be published and copies of the ROD will be available to the public for review at the information repositories and on DEQ's website. The ROD is accompanied by a discussion of any notable changes to the selected remedy presented in the Proposed Plan along with reasons for the changes. Also accompanying the ROD is a Responsiveness Summary, which provides a response to each of the comments received during the comment period (DEQ 2008a).

The administrative record that contains all of the documents related to the selection of the final remedy for the KRY Site (see Section 14.0) is located at:

Montana Department of Environmental Quality
Remediation Division
Hazardous Waste Site Cleanup Bureau
1100 North Last Chance Gulch
Helena, MT 59601
Telephone: (406) 841-5000

A partial compilation of the administrative record can be found on DEQ's website at <http://deq.mt.gov/StateSuperfund/kpt.asp> and at:

Flathead County Library
247 1st Avenue East
Kalispell, MT 59901
Telephone: (406) 758-5820

4.0 SCOPE AND ROLE OF REMEDIAL ACTION

The purpose of the KRY Site RI/FS was to collect data necessary to adequately characterize the site for developing and evaluating effective remedial alternatives that address human health and environmental risks at the site. The primary objectives of the RI/FS for the KRY Site include the following:

- Adequately characterize the nature and extent of releases or threatened releases of hazardous or deleterious substances;
- Allow the effective development and evaluation of alternative remedies to be included in the FS; and
- Allow an assessment of health and ecological risks and development of cleanup levels.

DEQ conducted a risk analysis and developed risk-based cleanup levels, including a qualitative evaluation of ecological risks. A site-specific fate and transport evaluation of how contaminants move through the soil to groundwater was also conducted using data gathered during the RI.

Based on findings from previous investigations and results of the RI, DEQ finds the data obtained is adequate for DEQ to evaluate and select an appropriate remedy for the KRY Site. However, data gaps identified during the RI, including installation and sampling of additional wells, will be evaluated and/or implemented during remedial design. The ROD contains cleanup levels for all known contaminants of concern (COCs).

The ROD documents the selected remedy for the KRY Site; it addresses the principal threats to public health, safety, and welfare and the environment posed by contaminated media and complies with applicable or relevant state and federal ERCLs.

DEQ anticipates that the remedy will be implemented using a phased approach, which will be evaluated during remedial design. Institutional controls will be implemented during and/or after the construction phase of the remedy, as identified during remedial design.

5.0 SITE CHARACTERISTICS

5.1 SITE CONCEPTUAL EXPOSURE MODEL (SCEM)

The SCEM (Figure 4) is the framework for understanding the receptors and exposure pathways included in the risk analysis and the fate and transport of the contaminants. It identifies the primary sources located at the KRY Site as the surface and subsurface soils. Contaminants migrate from the soil, sludge, and free product to the groundwater and flow with the groundwater to form contaminant plumes. Contaminants may also volatilize from the soil, sludge, free product, and shallow groundwater, forming vapors, which then permeate structures. Contaminants in surface soils, including sludge, may be resuspended as dust, may contribute to surface water contamination via runoff, and may be taken up by produce grown in contaminated soils. These primary sources and migration pathways result in potential exposures for humans through drinking or using contaminated groundwater or surface water, breathing the air inside buildings, inhalation of dust, or coming into direct contact with contaminated soil.

5.2 KRY SITE OVERVIEW

5.2.1 Geology

The KRY Site is located adjacent to or in proximity of the Stillwater River, just north of Kalispell, at an elevation of 2,920 feet above mean sea level (ThermoRetec 2001). The area in the vicinity of the KRY Site is a relatively flat, broad floodplain that is composed of Quaternary age materials ranging from clay- to cobble-sized materials (EPA 1992a). Lithologic materials at the KRY Site consist of a mixture of fine- to coarse-grained alluvial materials ranging in size from clay to cobbles. The dominant lithology at the KRY Site is sandy silty gravel and gravelly silty sand. Also present are intervals of clay, silt, silty fine- to medium-grained sand, and fine- to

coarse-grained sand. Cobbles are present throughout the KRY Site within various lithologies but are generally found within the sandy gravel and gravelly sand (DEQ and TtEMI 2008a).

Three distinctive hydrostratigraphic units are present at the KRY Site. From the ground surface downward, these units can be described as (1) an unconfined aquifer composed of unconsolidated alluvium with discontinuous lenses of clays and/or silts, (2) a low-permeability confining unit composed of clayey gravelly silt and silty clay at the base of the unconfined aquifer, and (3) a confined aquifer system composed of unconsolidated alluvium underlying the low-permeability unit. Drilling during the RI or previous investigations did not penetrate the top of the confined aquifer (DEQ and TtEMI 2008a).

5.2.2 Surface Water Hydrology

The Stillwater River is adjacent to portions of the KRY Site (Figure 2). The river generally flows from west to east. Currently, there are no nearby operational stream gauging stations (USGS 1996). The majority of the KRY Site is situated outside of the 100- and 500-year floodplains, except for a small area on the western edge of the KRY Site and a small area near the railroad tracks on the northeastern edge of the KRY Site (FEMA 2007). The Board of Environmental Review (BER) classifies the Flathead River drainage above Flathead Lake as B-1 and further classifies within the drainage the Whitefish River from the outlet of Whitefish Lake to the Stillwater River as B-2 (see Appendix A). These classifications indicate that waters should be suitable for drinking, culinary use, and food processing after conventional treatment; for bathing, swimming, and recreation; for growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and for agricultural and industrial water supply.

Groundwater and surface water are generally interconnected, with the surface water discharging to the groundwater in the vicinity of the KRY Site. Monthly surface water and groundwater elevation measurements were collected at the KRY Site from July 2006 through July 2007. Surface water elevations from KRY201, KRY202, and KRY203 were compared to nearby monitoring wells KRY100A, KRY105A, and KRY109A respectively. The surface water elevations at KRY201 and KRY203 are higher than the groundwater elevations at KRY100A and KRY109A for the period of measurement indicating recharge from the river to the unconsolidated aquifer. The surface water elevations at KRY202 are lower than the groundwater elevations at KRY105A for the period of measurement, possibly indicating discharge from the unconsolidated aquifer to the river in this area. However, monitoring well KRY105A is approximately 300 ft south of the location of KRY202 and may not be a good indication of surface water groundwater interaction. Regions of groundwater to surface water recharge are likely present upgradient or downgradient (or both) of the KRY Site and additional studies would be necessary to locate these regions (DEQ and TtEMI 2008b). However, locating these regions is not necessary for implementation of the selected remedy for the KRY Site.

5.2.3 Hydrogeology

Groundwater is present in an unconfined aquifer of sands, silts, and gravels. In general, unconfined groundwater is encountered at approximately 20 feet below ground surface and may

be from 80 to 125 feet deep in certain areas of the Site. Below the unconfined groundwater unit is a dense confining unit consisting of clays and gravelly silts. The confining unit was encountered from a depth of 80 feet down to 243 feet below ground surface at various locations throughout the KRY Site. The maximum depth and thickness of the confining unit was not determined during the RI. However, this confining unit appears to limit the deeper migration of contamination in the groundwater (DEQ and TtEMI 2008a).

Groundwater level measurements indicate that groundwater flow is generally toward the southeast in both the shallow and deeper portions of the unconfined aquifer (Figures 5A-D). However, there are two areas in the shallow portion of the unconfined aquifer that show steeper gradients and varying directions of groundwater flow. Groundwater in these areas moves radially away from these locations and eventually returns to the shallow groundwater flow system. Hydraulic conductivities of 17 to 326 feet per day (ft/day) were calculated from the results of an aquifer pumping test conducted in August 2006 as part of the RI (Table 3) (DEQ and TtEMI 2008a).

Residential and public water supply wells that supply drinking water and commercial wells that could supply drinking water are located adjacent to and within the KRY Site in the shallow groundwater (Figure 5) (DEQ and TtEMI 2008a).

5.3 KRY SITE CONTAMINATION

DEQ used appropriate existing data and conducted additional sampling during the RI to (1) identify sources of contamination, (2) determine the extent of contamination in soils, groundwater, surface water, and the solid material in the river bed, hereafter referred to as sediment, (3) collect data necessary to determine risks to human health and the environment; and (4) collect site-specific data necessary to develop and evaluate cleanup options. During the RI groundwater, surface soil, subsurface soil, surface water, and sediment were sampled. Sludge in soil and free product on groundwater were also included as part of the investigation.

The findings of the RI are summarized in the following sections (DEQ and TtEMI 2008a).

5.3.1 Groundwater

Groundwater at the KRY Site is contaminated with SVOCs including PCP and PAHs, dioxins/furans, volatile organic compounds (VOCs), petroleum hydrocarbons, and metals (Figure 7).

During the 2006 RI, groundwater was sampled from some monitoring wells, residential wells, industrial wells, and public water supply wells at the KRY Site and nearby areas. Low-levels of PCP were found in nearby residential wells; however, none of the levels in the residential wells exceeded EPA's drinking water standards or Montana's numeric water quality standards (DEQ 2006b). No contaminants were found in industrial or public supply wells at levels that exceed EPA drinking water standards or Montana's water quality standards.

Data from the monitoring wells sampled indicate that the groundwater is contaminated with chemicals at levels greater than both federal and state regulatory standards. The highest levels of PCP (detected at a maximum concentration of 16,300 micrograms per liter (ug/L)), dioxins/furans (maximum concentration of 1,346 picograms per liter (pg/L)), and SVOCs (for instance naphthalene, detected at a maximum concentration of 178 ug/L) in groundwater at the KRY Site were found to be associated with the western portion of the KRY Site. Lower levels of PCP, dioxins/furans, and SVOCs were found in other areas of the KRY Site. The extent of the contamination in the shallow (20-30 feet bgs) groundwater has generally been determined. However, the eastern edge of groundwater contamination is not well defined in the deeper (100+ feet bgs) groundwater near the Town Pump on Highway 2 East. The highest levels of petroleum contamination (for instance C5-C8 aliphatics, detected at a maximum concentration of 8,550 ug/L) at the KRY Site were found within the source areas on the eastern and western portions of the KRY Site. Lower levels were found in the southeastern portion of the KRY Site. The highest levels of metals contamination (for instance, iron and manganese detected at maximum concentrations of 18,990 ug/L and 12,570 ug/L, respectively) were found within the source area on the eastern portion of the KRY Site. Lower levels were found in other areas of the KRY Site. Additional information regarding minimum and maximum concentrations for individual chemicals detected in groundwater can be found in Table 4-1 of the RI.

A large area of free product overlies the groundwater on the eastern and western portions of the KRY Site and free product thicknesses are generally less than one foot (Figure 16). The free product present at the KRY Site consists of petroleum hydrocarbons and wood treating fluids, which were mixed with petroleum hydrocarbons. The free product on the western portion of the KRY Site is light brown in color with a strong chemical odor. Some of the free product on the eastern portion of the KRY Site is dark-brown to black in color, extremely viscous (almost tar-like) and has a strong petroleum odor. The remainder of the free product on the eastern portion of the KRY Site is similar to that on the western portion.

5.3.2 Soil

DEQ defines surface soil as that found 0-2 feet bgs and subsurface soil as that found greater than 2 feet bgs. Surface and subsurface soil samples were collected throughout the KRY Site and at nearby businesses and homes. Surface and subsurface soils at the KRY Site are contaminated with SVOCs (for instance naphthalene, detected at a maximum concentration of 260 milligrams per kilogram (mg/kg)) including PCP (maximum concentration of 6,900 mg/kg) and PAHs (for instance benzo(b)fluoranthene, detected at a maximum concentration of 5.47 mg/kg), dioxins/furans (maximum concentration of 171,510 nanograms per kilogram (ng/kg)), VOCs (for instance ethylbenzene, detected at a maximum concentration of 83 mg/kg), petroleum hydrocarbons (for instance C19-C36 aliphatics, detected at a maximum concentration of 402,000 mg/kg), and metals, most notably lead (maximum concentration of 44,300 mg/kg) (Figures 8A-B, 9A-B, 10A-B, 11A-B, and 12A-B). Additional information regarding concentrations for individual chemicals detected in soil can be found in Tables 4-2 and 4-3 of the RI.

Petroleum sludge is also present on the eastern portion of the KRY Site (Figure 13). One isolated surface sludge pit (approximately 40 feet long by 12 feet wide) is located within the fenced portion of the KRY Site near the northeast corner between BNSF's mainline and spur line

railroad grades. In addition to the previously mentioned sludge pit, several minor, very shallow surface expressions of sludge occur along the east fence line and north of the fenced area along the mainline track in the right-of-way. However, these deposits are not extensive in area or volume. Additionally, a few isolated areas of thin subsurface sludge layers were encountered in test pits along the eastern edge of the KRY Site. However, these deposits were sporadic and volumes were minimal. The sludge is not classified as a RCRA hazardous waste based on sample results.

An isolated area of buried sawdust exists in the vicinity of monitoring well KRY-103A, located in the northwestern corner of the KRY Site (Figure 5). Based on the well log for monitoring well KRY-103A, the sawdust extends to a depth of approximately 14 feet in this area.

5.3.3 Surface Water and River Sediments

During the RI, limited surface water and sediment samples were collected from the Stillwater River, which is adjacent to the KRY Site. Metals (for instance aluminum at 250 ug/L) and dioxins/furans (2.17 pg/L) were detected in background and downstream surface water samples. Metals (for instance aluminum at 11,300 mg/kg), dioxins/furans (0.5931 ng/kg), SVOCs (for instance fluoranthene, 0.26 mg/kg), and petroleum compounds (for instance C11-C22 aromatics at 15 mg/kg) were detected in background and downstream sediment samples. Dioxins/furans were detected at levels above background concentrations and screening criteria in surface water, but there were no chemicals detected in sediment samples at levels above sediment background concentrations or screening criteria. Additional information regarding concentrations for individual chemicals detected in surface water and sediment can be found in Tables 4-4 and 4-5 of the RI.

The presence of dioxins/furans in surface water above background concentrations and screening criteria showed potential impacts to the nearby Stillwater River. Dioxins/furans generally adhere strongly to soils and would be expected to be found in sediments at levels that correspond to those detected in surface water, but were not. Because the sediment concentrations were inconsistent with the surface water concentrations and because a limited number of surface water/sediment samples (three, plus a duplicate) were analyzed for dioxins/furans, DEQ contractors conducted additional sampling of the Stillwater River surface water in October 2007. As reported in the Addendum to the FS, this sampling demonstrated that there was no significant difference between dioxin/furan concentrations in the surface water at sample locations throughout the reach of the Stillwater River adjacent to the KRY Site (background/upstream versus downstream locations), regardless of flow conditions (DEQ and TtEMI 2008b). Therefore, DEQ has determined there are no COCs for surface water or sediments at the KRY Site and no additional investigation or cleanup of the river is necessary as part of the remedial action.

5.4 SUMMARY OF CONTAMINANT FATE AND TRANSPORT

Fate and transport for COCs at the KRY Site was discussed in detail in the RI report (DEQ and TtEMI 2008a). Site physical characteristics, contaminant characteristics, and an analysis of the fate and transport processes were combined in the evaluation of contaminant fate and transport.

The RI considered five COCs or groups of COCs as the most significant from a risk and remediation standpoint: PCP, dioxins/furans, PAHs, petroleum hydrocarbons, and lead.

5.4.1 Fate and Transport Modeling

DEQ performed chemical fate and transport modeling to develop site-specific cleanup levels for the soil leaching to groundwater pathway at the KRY Site. These cleanup levels are concentrations of COCs in surface and subsurface soils that are protective of groundwater. The modeling was performed to predict COC concentrations in groundwater directly beneath the contaminated soil source area. Concentrations of COCs in surface and subsurface soils at the KRY Site exceed these cleanup levels, and therefore cleanup is necessary to protect public health, safety, and welfare and the environment. The COCs and corresponding cleanup levels computed for the soil leaching to groundwater pathway are further discussed, along with direct contact cleanup levels, in Section 7.0 of this ROD. A Technical Memorandum for Chemical Fate and Transport Analysis of Soil Contaminants Leaching to Groundwater is provided in Appendix C of the FS (DEQ and TtEMI 2008b).

5.4.2 Modeling for Evaluation of Remedial Alternatives

Groundwater modeling to aid in the evaluation of remedial alternatives was also conducted for the FS, as presented in Appendix B of the FS (DEQ and TtEMI 2008b). The groundwater modeling evaluates monitored natural attenuation (MNA) and source area reduction for the two chemicals of concern at the KRY Site that are the most widespread and the most difficult to remediate: PCP and dioxins/furans. The objective of groundwater modeling was to estimate the time required for compliance with Montana's water quality standards at the KRY Site. This analysis was performed using computer software designed to generate screening-level predictions of chemical attenuation and compliance time frames for (1) source areas containing free product, and (2) dissolved plumes extending downgradient of the source areas. In the first case, the modeling considered two PCP free product source management scenarios, consisting of natural attenuation, and 90 percent free product source reduction by in-situ technologies. The time required for Montana's water quality standards to be achieved in the free product source area was calculated. In the second case, the amount of time for the dissolved PCP and dioxin/furan plumes to achieve compliance with Montana's water quality standards was modeled. Model results describe the amount of time required for the entire dissolved chemical plumes to achieve compliance with Montana's water quality standards after water quality at the source is remediated to the water quality standards.

PCP plume attenuation modeling results indicated that approximately 40 years are required for plume concentrations to reduce to cleanup levels when the source concentrations are treated to water quality standards by in-situ technologies. The modeling indicated that desorption of PCP from aquifer organic carbon provides a source of groundwater contamination throughout the length of the plume. Given these results, it is appropriate to consider the PCP sorbed to the aquifer within the plume footprint as a potential source of PCP contamination and factor this condition into the evaluation and design of the remediation technologies.

Dioxin/furan partitioning properties indicate this chemical is highly sorbed to aquifer organic carbon. Plume attenuation modeling results indicate that a time frame on the order of centuries is required for plume concentrations to decrease to cleanup levels when the source concentrations are treated to water quality standards by in-situ technologies. These results indicate that a proposed remediation method needs to consider the entire dioxin/furan plume as the source area.

The predicted time for the free product containing PCP to dissolve, assuming no remediation of the source material, ranged from 14 to over 100 years, depending on the modeled hydraulic conductivity of the aquifer. It should be noted that these results reflect a screening-level analysis. However, the modeling results demonstrate that the free product represents a potential long-term source of groundwater contamination, and indicate that highly effective free product remediation is required to achieve groundwater quality targets in a reasonable time frame. The modeling indicates that incomplete remediation of free product will result in an extended time period necessary for Montana's water quality standards to be achieved.

Fate and transport modeling was performed to evaluate the importance of chemical leaching from the vadose zone and the impact of that on predicted remediation time frames. Modeling results indicated that the PCP contamination present in the aquifer provides the primary source of the dissolved PCP plume. Sources of PCP contamination include free product containing PCP and PCP sorbed to aquifer organic carbon. However, model results indicated that PCP present in the vadose zone will also impact groundwater quality over an extended time frame if vadose zone PCP concentrations are not reduced.

6.0 CURRENT AND POTENTIAL FUTURE LAND AND WATER USES

6.1 LAND USES

The KRY Site is located on the northeastern edge but outside the city limits of the City of Kalispell in the community of Evergreen in Flathead County, Montana (Figure 1). The area is zoned a mixture of heavy industrial, business, and residential according to the Flathead County Planning Department (Flathead 2006a) (Figure 3). Land use near the KRY Site includes a mix of residential, commercial, industrial, and open space. Examples of commercial and light-industrial businesses in the area include lumber processing, open-cut gravel mining, recycling, retail stores, storage, and a motel. There are approximately 89 residential properties adjacent to or within the KRY Site (DEQ and TtEMI 2008b).

While a large portion of the KRY Site is vacant, there are some portions that are actively operated. Lumber processing and stone-cutting operations exist on the western portion of the KRY Site, and a retail store is located on the southeastern portion (DEQ and TtEMI 2008b). In addition, various entities have expressed a desire to use some of the properties for commercial use (DEQ 2008a).

DEQ determined reasonably anticipated future use by assessing the four statutory factors outlined in Section 75-10-701 (18), MCA: 1) local land and resource use regulations, ordinances, restriction, or covenants; 2) historical and anticipated uses of the facility; 3) patterns of

development in the immediate area; and 4) relevant indications of anticipated land use from the owner of the facility and local planning officials. The properties that make up the KRY Site are zoned for commercial/industrial use (with the exception of the residential area, which is likely to remain residential) and have historically been used for commercial/industrial purposes (Flathead 2006a). However, the current zoning does allow some limited residential use (Flathead 2006b). Development in the general area is for commercial/industrial use, and due to the availability of residential building sites in other areas of the Flathead Valley, there is unlikely to be additional residential development in the vicinity of the KRY Site. DEQ contacted BNSF, DNRC, JTL, Inc., Kalispell Partners, Klingler Lumber Company, Montana Mokko, Stillwater Forest Products, and Swank Enterprises and asked them to provide information on their anticipated land use and each indicated their property was expected to remain as commercial/industrial use (DEQ 2007i). Local planning officials have also expressed interest in using various portions of the KRY Site for commercial use. Through this assessment, DEQ has determined that the reasonably anticipated future use of the areas of the KRY Site not already developed for residential use is commercial/industrial. Restrictive covenants limiting the future use of these portions of the KRY Site to commercial/industrial are required as part of the remedy. Additional zoning changes for the properties that make up the KRY Site may also be proposed.

6.2 GROUNDWATER AND SURFACE WATER USES

A well inventory was prepared by DEQ contractors to identify monitoring wells, domestic wells, and public water supply wells in the vicinity of the KRY Site. A one-half-mile area around the properties used for historical operations was examined. The well inventory for this defined area located 179 wells, including several wells located within the historical operation properties. A comprehensive well inventory for all monitoring wells, residential wells, industrial wells, and public water supply wells at the KRY Site and within the half-mile buffer is provided on Table B-1 in Appendix B of the Data Summary Report (TtEMI 2005).

Seven public water supply wells were identified in the well inventory. However, upon further discussion with personnel at the Evergreen Water and Sewer District, only four of the seven wells were located near the KRY Site. The Evergreen Water and Sewer District operates two wells located just northeast of the KRY Site on Flathead County shop property (Figure 5). One well was installed in 1967, is reportedly 85 feet deep, and has a water right for 2,000 gallons per minute (gpm). The second well was installed in 1975, is reportedly 143 feet deep, and has a water right for 3,000 gpm. Both wells are currently in operation (DEQ and TtEMI 2008a). DEQ's website provides information on public water supplies including operator information, water quality analyses (arsenic, radiums combined, gross alpha, inorganics, nitrate/nitrite, synthetic organic chemicals [SOCs], and VOCs), sample collection dates, and violation dates (if any). Evergreen Water and Sewer District supply wells are sampled at the entry point, not individually. No organic COCs have been detected in samples from these wells and other detected constituents have been reported below drinking water standards. Two other public water supply wells are located south of the KRY Site and south of the gravel pit: 1) the Conrad Athletic Complex well (also listed as the Conrad Cemetery well) and 2) the Greenwood Corporation RV and Mobile Home Park Well #1. The Conrad well is reportedly 391 feet deep and yields 1,500 gpm. It supplies irrigation water for use at the athletic complex. The Conrad well is routinely sampled for only nitrate/nitrite and coliform. No information regarding the installation or completion was found on the Greenwood Corporation well. No organic COCs

have been detected in samples from the Greenwood Corporation well and other detected constituents have been reported below drinking water standards (DEQ 2008b).

One residential well servicing a residential property in the northern portion of the KRY Site was closed and the residence was connected to the public water supply by BNSF in 1997 due to low-level (below safe drinking water standards) detections of PCP. Potable wells in the vicinity of the KRY Site, whether residential, commercial, industrial, or public water supply wells, were sampled as part of the RI (Figure 5). A subset of these wells, specifically some of the residential wells, were sampled quarterly for one year after the RI, due to low-level (below safe drinking water standards) detections of PCP in two residential wells north of the KRY Site during the RI sampling event (DEQ and TtEMI 2008a and 2008b). In order to ensure protection of public health, DEQ has determined some of the residential wells will be sampled semi-annually as part of the selected remedy.

To protect human health and limit migration of contaminants through pumping, the selected remedy will partially rely on institutional controls in the form of restrictive covenants and a controlled groundwater area to ensure that no additional wells, with the exception of those installed as part of the remedial action, are installed within or adjacent to the area of groundwater contamination associated with the KRY Site (Figure 7). While there are drinking water wells currently in operation in the vicinity of the KRY Site, the Evergreen Water District supplies public water to the majority of homes and businesses in the area. Therefore, prohibition of additional wells, with the exception of wells installed as part of the remedial action, is reasonable since an additional source of water is available. The selected remedy includes long-term monitoring of nearby existing residential and commercial wells to ensure that contaminant concentrations do not exceed safe drinking water standards in the future.

7.0 HUMAN HEALTH AND ECOLOGICAL RISK ANALYSIS

DEQ compared the COC concentrations at the KRY Site with generic screening levels and approved site-specific cleanup levels from the Missoula White Pine Sash (MWPS) CECRA facility in Missoula, Montana (DEQ 2001e). Based upon this evaluation, DEQ determined that the COC concentrations at the KRY Site represent unacceptable risks. DEQ then developed site-specific cleanup levels for the COCs at the KRY Site. The fact that COCs exceed these cleanup levels further supports DEQ's determination that unacceptable risk to public health, safety, and welfare and the environment exist and that abatement of these risks through remediation is necessary.

DEQ developed risk-based cleanup levels generally using the approach employed for the MWPS Facility, including a qualitative evaluation of ecological risks. DEQ chose this approach because of the similarities between the KRY Site and the MWPS Facility. In general, both the KRY Site and the MWPS Facility have similar types of contamination, geology/hydrogeology, demographics, climate, and ecology. A site-specific fate and transport evaluation was also conducted using data gathered during the RI. The complete risk analysis memorandum, including qualitative evaluation of ecological risks, the addendum to the risk analysis memorandum, and the fate and transport evaluation are provided in Appendix C of the FS (DEQ and TtEMI 2008b). Contaminant fate and transport is also discussed in Section 5.4 of this ROD.

The remedial actions selected in this ROD are necessary to protect public health, safety, and welfare and the environment from actual or threatened releases of hazardous or deleterious substances into the environment and to abate the imminent and substantial endangerment those releases pose.

7.1 HUMAN HEALTH RISKS

Current and future land and groundwater use were evaluated as part of the risk analysis. The current land use is commercial/industrial except for one area that is residential. DEQ has determined that the reasonably anticipated future use of the areas of the KRY Site not already developed for residential use is commercial/industrial and restrictive covenants limiting the future use of these portions of the KRY Site to commercial/industrial are required as part of the remedy. Additionally, restrictive covenants will be required and a controlled groundwater area will be proposed for the KRY Site to prohibit the installation of wells, with the exception of those installed as part of the remedial action, until such time as the groundwater meets water quality standards. Additional zoning changes for the properties that make up the KRY Site may also be proposed. See Sections 6.1 and 6.2 for more information.

Populations that required evaluation because they could potentially be exposed to contamination at the KRY Site include current and future residents, current and future commercial/industrial workers, current and future trespassers, future construction workers, current and future Stillwater River recreators, and current and future ecological receptors.

These populations could have the potential to come in contact with contaminants through dermal contact with contaminated soil, groundwater, and surface water; ingestion of soil, groundwater, surface water, produce grown in contaminated soil, and breast milk; and inhalation of contaminated dust, volatiles released during use of groundwater, and volatiles released from groundwater into indoor air.

DEQ has conducted an evaluation of receptors and pathways and determined that some of the previously mentioned pathways are not complete or do not need to be quantitatively evaluated. These pathways are: 1) exposure to soil by future residents; 2) exposure of current residents via the vapor intrusion pathway; 3) inhalation of volatiles during use of groundwater by current and future commercial/industrial workers; 4) current and future trespassers; 5) current and future Stillwater River recreators; and 6) current and future ecological receptors. Additional details regarding the justification for elimination of the above pathways can be found in Appendix C of the FS (DEQ and TtEMI 2008b).

7.1.1 Determination of COCs and Cleanup Levels

DEQ determined which COCs should be retained from the list of COPCs presented in the Final Remedial Investigation Report (DEQ and TtEMI 2008a). The primary COCs for the KRY Site are PCP, dioxins/furans, petroleum compounds, and lead, although other compounds have been retained as COCs as well. The following sections provide a discussion of COCs for each media along with the established cleanup levels, and a discussion of health effects for the primary

COCs. More information about the process used to determine COCs and calculate cleanup levels is provided in DEQ's Risk Analysis Technical Memorandum and Addendum to the Risk Analysis Technical Memorandum (see Appendix C of the FS) (DEQ and TtEMI 2008b).

DEQ updated the Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases (RBCA) in 2007 because some of the toxicity information for the compounds reflected in RBCA had recently changed and because other changes to RBCA were also necessary (DEQ 2007d). DEQ used this newer information in the screening of the COPC list to ensure that the most recent information was used in the screening process. Additionally, for soils, DEQ used the direct contact and leaching Risk-Based Screening Levels (RBSLs) from the Master Table of All Potential Tier 1 RBSLs for Soil (see Appendix C of the FS) from the RBCA guidance. This table shows the various RBSLs calculated for different purposes, unlike Tables 1 and 2 from within the RBCA Guidance, which only show the most conservative RBSLs. DEQ did not utilize the levels calculated for beneficial use, as they are a reflection of aesthetic properties of soils (e.g., appearance and odor). After the removal of free-product to the maximum extent practicable and excavation of contaminated soils to address direct contact and leaching to groundwater risks, the beneficial use criteria will be adequately addressed. Additionally, given that this analysis was conducted to calculate cleanup numbers, and not as an initial screening, the direct contact and leaching numbers are most appropriate to use.

EPA released Regional Screening Levels in May 2008 (EPA 2008) that replaced, among other things, the Region 9 Preliminary Remediation Goals document (EPA 2004a) that DEQ had previously used for screening purposes. The release of the Regional Screening Levels prompted DEQ to compare the list of COPCs to these new screening levels, using the same approach and assumptions outlined in DEQ's Risk Analysis Technical Memorandum (see Appendix C of the FS), to ensure that revised screening levels did not change the list of COCs at the KRY Site. The re-screening effort ultimately resulted in the elimination of some compounds as COCs for the KRY Site, which required that DEQ change the proposed cleanup levels. Specifically, aluminum and iron were eliminated as COCs for surface soil. Aluminum was eliminated as a COC for subsurface soil, and 1,2,4-trimethylbenzene was retained as a COC for leaching from subsurface soil. The compound 1,3,5-trimethylbenzene was eliminated as a COC for groundwater and vapor intrusion, and n-butylbenzene was eliminated as a COC for groundwater because there is no longer accepted toxicity information available for these compounds. Lastly, the slope factor for dioxin was revised, which also required that DEQ change the proposed dioxin/furan cleanup levels (DEQ 2008e).

The re-screening process is documented in the Addendum to the Risk Analysis Technical Memorandum, which is also provided in Appendix C of the FS (DEQ and TtEMI 2008b), and the revised cleanup levels have been included in Tables 4 and 5 of the ROD. The selected remedy did not need to be revised to meet the revised cleanup levels. These cleanup levels will reduce the public health risk associated with exposure to soil contaminants to an acceptable level, and minimize migration of contaminants into the groundwater, which reduces the risk to the environment. Ecological risk is evaluated in Section 7.2.

7.1.1.1 Groundwater

For compounds that have them, Montana's numeric water quality standards are the applicable cleanup level (DEQ 2006b). To simplify dioxin/furan analysis, a toxicity equivalence (TEQ) using WHO 1998 toxicity equivalence factors (TEFs) is calculated for each sample, per Montana's water quality standards (WHO 1998). The dioxin/furan concentrations are a sum total of the many different chemical compounds (congeners); this TEQ concentration is calculated by adjusting the concentrations of several of the dioxin/furan compounds to account for their toxicity and then adding all of the adjusted concentrations. For dioxins/furans and metals, DEQ took into account concentrations from the newly installed background monitoring well (KRY-101A) and when the background concentration exceeds Montana's water quality standard, the background concentration is used as the cleanup level. These particular compounds are found naturally in the environment and DEQ accounted for that using the background concentrations for the cleanup level, where appropriate. DEQ will also apply RBCA risk-based screening levels (RBSLs) for petroleum compounds and EPA Regional Screening Levels for tap water for compounds that do not have water quality standards or RBSLs. DEQ has determined it is appropriate to utilize existing screening levels (RBSLs and tap water screening levels) as cleanup levels, rather than calculating site-specific cleanup levels because the assumptions used to calculate the water quality standards and these screening levels are the same; therefore, the calculated levels would be the same. The COCs for groundwater, along with their corresponding cleanup levels, are provided in Table 4.

7.1.1.2 Soils

Direct contact cleanup levels were calculated for soils using equations developed by the EPA (EPA 2004a). Compounds were separated based on their effect (i.e., non-carcinogenic or carcinogenic). Cleanup levels for non-carcinogenic compounds in each media (surface and subsurface soil) were calculated to ensure that the total hazard index for compounds with the same target organs or critical effects does not exceed 1 for any organ or effect. Cleanup levels for carcinogenic compounds in each media (surface and subsurface soil) were calculated to ensure that the cumulative cancer risk does not exceed 1×10^{-5} . The most recent toxicity information was used to calculate cleanup levels, including updates that have been incorporated into RBCA.

DEQ has developed site-specific target levels for the soil leaching to groundwater pathway at the KRY Site. These site-specific target levels are concentrations of COCs in surface and subsurface soils that are protective of groundwater.

The COCs for each media (surface soil and subsurface soil) for dermal contact and leaching to groundwater are provided in Table 5, along with their corresponding cleanup levels. The cleanup level for sludge is based on visual observation, and all visible sludge must be removed from the soil at the KRY Site. To simplify dioxin/furan analysis, a TEQ using WHO 2005 TEFs is calculated for each sample and compared to a TEQ cleanup level (WHO 2005). DEQ also calculated a cleanup level representing a total carcinogenic polycyclic aromatic hydrocarbon (cPAH) concentration using the approach outlined in EPA Guidance (EPA 1993a). This concentration is based on the toxicity of benzo(a)pyrene. The relative toxicity of each cPAH

compound relative to benzo(a)pyrene is used to adjust its concentration. Following this adjustment, the resulting concentrations are summed. The summed concentration must not exceed the total cPAH cleanup level. Cleanup levels for PAHs that are non-carcinogenic are included with the other noncarcinogenic compounds.

To ensure protection of human health and the environment, the most protective of the leaching to groundwater cleanup levels or the direct contact cleanup levels will be used. Additionally, for compounds with a leaching number for both surface soil and subsurface soil, the cleanup level for surface soil will be used where there is only surface soil contamination. If subsurface soil contamination exists, the subsurface soil leaching cleanup level will apply to both the surface and subsurface soil in that area. Lastly, for compounds where the leaching to groundwater cleanup level is not the most protective and where the excavation cleanup level is lower than the commercial cleanup levels, surface soil will be cleaned up to excavation cleanup levels.

7.1.1.2.1 Determination That Soil Cleanup Levels Have Been Met

To determine whether a lift of soil from the LTU has been treated to the appropriate cleanup level for direct contact, an appropriate number of samples will be collected from the lift, and a 95% upper confidence level (UCL) will be applied on the mean concentration of those samples. If the 95% UCL is at or below appropriate cleanup levels for direct contact, the soil in that lift will be determined to be clean and can be removed from the LTU, except as noted below. The determination of appropriate cleanup levels will depend upon the proposed depth and location where the soil will be placed after removal from the LTU and upon whether appropriate exposure areas can be determined. However, this does not apply to COCs with cleanup levels based on leaching to groundwater, for which the use of a 95% UCL is not appropriate. DEQ will also provide the option of applying this approach to the excavation of contaminated soils, assuming that appropriate exposure areas can be determined.

DEQ recognizes the benefits and limitations of vadose zone modeling and has determined it is appropriate to provide the option of allowing the use of the Synthetic Precipitation Leaching Procedure (SPLP) to determine compliance with remediation goals for contaminants with a leaching to groundwater risk (DEQ 2008d). SPLP (also known as EPA Method 1312) is used to evaluate the potential for contaminants in soil to leach into groundwater. This method provides a realistic assessment of contaminant mobility under actual field conditions (i.e. what happens when precipitation percolates through the soil). SPLP is an appropriate method of evaluating fate and transport of contaminants at some sites and has good application to the fate and transport study conducted at the KRY Site. Because the leaching tests are conducted with actual soil samples taken from the site and consider media and waste constituent properties (i.e., solubility and mobility), results developed using this test are expected to be representative of site conditions. Therefore, DEQ has determined it is appropriate to use these results for establishing compliance with cleanup levels (DEQ 2008d). DEQ will provide the option for using SPLP in the following manner:

1. Confirmation sampling must be provided to DEQ so that DEQ may ensure that the site-specific human health cleanup levels are met. This will allow DEQ to make a contained-in determination based on concentrations of hazardous constituents from listed hazardous

wastes being below health-based levels as required by the contained-in policy (EPA 1998b). Consistent with this policy, contained-in determinations will be made based on the site-specific health-based cleanup levels developed by DEQ as well as the results of the SPLP analysis or groundwater cleanup levels discussed below. (This ensures that both human health and groundwater protection concerns are addressed in making the determination that the media no longer contains hazardous waste.)

2. DEQ will then confirm compliance with the land disposal restriction (LDR) treatment standards (40 CFR § 268.49(c)(1)(C)), which requires that contaminated soil to be land disposed be treated to reduce concentrations of the hazardous constituents by 90 percent or meet hazardous constituent concentrations that are ten times the universal treatment standards (UTS) (found at 40 CFR §268.48), whichever is greater. The LDR paperwork requirements found in 40 CFR § 268.7 will also be met.
3. Once the site-specific human health cleanup levels and LDR requirements are met, DEQ will allow the option of collecting an appropriate number of samples to have analyzed for SPLP in order to determine a leachate concentration. If the samples demonstrate that leachate concentrations do not pose a leaching to groundwater risk when compared to the appropriate groundwater cleanup level with a site-specific dilution attenuation factor (DAF) of 30 (DEQ 2008c), then DEQ will allow the soil to be removed from the LTU even if the leaching to groundwater cleanup level has not been met.

Using PCP as an example, the LTU soils could be analyzed for SPLP once the site-specific human health cleanup level of 98 mg/kg for surface soil and 650 mg/kg for subsurface soil, depending on where the soil will be placed once it is removed, and the LDR treatment standards are met. If the leachate resulting from the sample demonstrates that it is below the groundwater cleanup level with a DAF of 30 (which results in a level of 30 ug/L in this case), the soils may be removed from the LTU.

DEQ will also allow the option of applying this strategy to the excavation of contaminated soils, where soils are excavated until confirmation sampling (via SPLP and other methods) shows that the remaining soils do not pose either a human health or a leaching to groundwater risk. If use of the SPLP option is not selected by the person conducting the remedial activities, cleanup to the site-specific cleanup levels for direct contact and the soil leaching to groundwater pathway at the KRY Site will be required. DEQ has determined that this strategy is appropriate because real world results may differ from modeled results. DEQ has also determined that this approach complies with RCRA (DEQ 2008d).

Surface Soils (0-2 feet bgs)

Two different exposure scenarios were used for calculating cleanup levels in surface soil: a commercial scenario and a residential scenario. The residential scenario applies only to properties currently under residential use. Since dioxins/furans were the only compounds detected in residential yards that exceeded screening levels, dioxins/furans are the only compounds for which a residential cleanup level was calculated. Based on the RI data, the dioxin/furan contamination in residential areas does not exceed the site-specific cleanup level.

Table 5 lists COCs and their corresponding cleanup levels for these two scenarios based on direct contact or soil leaching potential.

Subsurface Soils (greater than 2 feet bgs)

Table 5 lists the COCs for subsurface soil and their corresponding cleanup levels based on direct contact for construction workers or soil leaching potential.

Surface Water and Sediments

As stated previously, limited surface water and sediment samples were collected from the Stillwater River during the comprehensive RI. Dioxins/furans were detected at levels above screening criteria in surface water, but there were no chemicals detected in sediment samples at levels above sediment screening criteria. DEQ contractors conducted additional sampling of the Stillwater River surface water in October 2007. This sampling demonstrated that there was no significant difference between dioxin/furan concentrations in the surface water at sample locations throughout the reach of the Stillwater River adjacent to the KRY Site, regardless of flow conditions (DEQ and TtEMI 2008b). Therefore, DEQ has determined that there are no COCs for surface water or sediments at the KRY Site and no additional investigation or cleanup of the river will occur as part of the remedial action.

7.1.1.3 Health Effects

The primary COCs for the KRY Site are PCP, dioxins/furans, lead, and petroleum compounds, although there are other COCs for which site-specific cleanup numbers were calculated. Health effects of these primary contaminants are discussed below:

- PCP: According to the Agency for Toxic Substances and Disease Registry (ATSDR), PCP is a manmade chemical that does not occur naturally. It was widely used as a pesticide and wood preservative but the purchase and use of PCP has been restricted to certified applicators since 1984. Therefore, it is no longer available to the general public although it is still used industrially. PCP can be found in the air, water, and soil. Studies in workers show that exposure to high levels of PCP can cause the cells in the body to produce excess heat. When this occurs, a person may experience a very high fever, profuse sweating, and difficulty breathing. The body temperature can increase to dangerous levels, causing injury to various organs and tissues, and even death. Liver effects and damage to the immune system have also been observed in humans exposed to high levels of PCP for a long time. The EPA has determined that PCP is a probable human carcinogen and the International Agency for Cancer Research (IARC) considers it possibly carcinogenic to humans (ATSDR 2001a).
- Dioxins/furans: According to ATSDR, dioxins are a family of 75 chemically-related compounds commonly known as chlorinated dioxins. These compounds are referred to as congeners and one congener, 2,3,7,8-TCDD, is the most toxic and therefore, is the most studied. Dioxins may exist naturally due to the incomplete combustion of organic material by forest fires or volcanic activity. Dioxins are not intentionally manufactured by industry, except in small amounts for research purposes; however, industrial, municipal, and domestic incineration and combustion processes can produce dioxins. They can occur in the manufacture of certain organic chemicals, including PCP. The most noted health effect in

people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, discoloration, and excessive body hair. Liver damage and changes to metabolism and hormone levels are also seen in people. In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure. Exposure to lower levels can cause a variety of effects in animals, such as weight loss, liver damage, and disruption of the endocrine system, weakening of the immune system, reproductive damage and birth defects. EPA considers dioxins and furans to be probable human carcinogens, while the World Health Organization considers them to be known human carcinogens (ATSDR 1998).

- Petroleum hydrocarbons: Health effects from exposure to petroleum hydrocarbons depend on many factors, including the type of chemical compounds in the petroleum hydrocarbons, how long the exposure lasts, and the amount of the chemicals contacted. Little is known about the toxicity of many petroleum hydrocarbon compounds. Until more information is available, information about health effects of petroleum hydrocarbons must be based on specific compounds or on data for petroleum products that have been studied. According to ATSDR, the compounds in some petroleum hydrocarbon fractions can affect the blood, immune system, liver, spleen, kidneys, developing fetus, and lungs. Certain petroleum hydrocarbon compounds can be irritating to the skin and eyes and can cause neurological affects consisting primarily of central nervous system depression. Other petroleum hydrocarbon compounds, such as some mineral oils, are not very toxic and are used in foods (ATSDR 1999).
- Lead: According to ATSDR, human exposure to lead occurs primarily through diet, air, drinking water, dust, and paint chips. The efficiency of lead absorption depends on the route of exposure, age, and nutritional status. Adult humans generally ingest less lead than children. Lead exposure in humans affects almost every organ and system in the human body. The most sensitive system is the central nervous system, particularly in children. Irreversible brain damage occurs at blood lead levels greater than or equal to 100 micrograms per deciliter ($\mu\text{g}/\text{dL}$) in adults and at 80 to 100 $\mu\text{g}/\text{dL}$ in children; death can occur at the same blood levels in children. Children who survive these high levels of exposure may suffer permanent, severe mental retardation. Lead also damages kidneys and the reproductive system. The effects are the same whether it is breathed or swallowed. At high levels, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may also cause anemia, a disorder of the blood. EPA has evaluated inorganic lead and lead compounds for carcinogenicity. The data from human studies are inadequate for evaluating the potential carcinogenicity of lead. Data from animal studies, however, are sufficient based on numerous studies showing that lead causes tumors in animals (ATSDR 2007).

7.1.2 Evaluation of Uncertainties

This section evaluates uncertainties associated with the risk analysis, which are discussed below.

- Investigations have been conducted for soil, groundwater, and surface water/sediment of the Stillwater River on and near the KRY Site and a large database is available. COPC concentrations and distributions in soil, groundwater, and surface water/sediment appear to be adequately characterized, with the exception of the data gaps outlined in the RI. While unlikely, it is possible that COPCs may be screened out and therefore not evaluated as COCs as a result of these data gaps.
- The EPA vapor intrusion modeling, which is used to estimate releases of volatile COPCs from groundwater and subsurface soil into indoor air, is not applicable to situations where free product is present on groundwater (EPA 2004d). Free product has been observed in numerous wells at the KRY Site. Volatilization of COPCs from the aquifer could theoretically be underestimated in areas where free product is present.
- Significant controversy exists concerning human health risk assessment for dioxins/furans. EPA has not yet finalized its dioxin reassessment (EPA 2000a). The current July 2000 EPA Draft Dioxin Reassessment states, "EPA will not use the conclusions of the draft dioxin reassessment for regulatory purposes until the science peer reviews are completed." The September 2000 reassessment states, "Notice: These documents are preliminary drafts. They have not been formally released by the US Environmental Protection Agency and should not at this stage be construed to represent agency policy or factual conclusions. These documents are being provided now for review to EPA's Science Advisory Board. They should not be cited or referred to as EPA's final assessment of dioxin risks." DEQ will not use the reassessment for quantitative risk assessment purposes until it is finalized. DEQ therefore relies on the previously established California EPA cancer slope factor for 2,3,7,8-TCDD in the risk analysis. This slope factor differs slightly from the slope factor included in the Health Effects Assessment Summary Tables (EPA 1997c) and the California EPA slope factor was recently accepted by EPA for use in the Regional Screening Tables.

The new cancer slope factor for dioxin/furans which is proposed in the draft dioxin reassessment is approximately seven times higher than the current cancer slope factor for dioxins/furans. If the new value was used in the risk analysis conducted for the KRY Site, the cleanup levels could potentially be seven times lower than those presented. This would mean that the cleanup levels that currently meet DEQ's 1×10^{-5} cancer risk level requirement would be above this level. Thus, additional cleanup may be required.

Since the draft dioxin reassessment was issued, the National Academy of Science and others have reviewed the document and had significant comments. At the current time, it is unclear when the final dioxin reassessment might be issued or what it might say. Therefore, DEQ has determined that it is appropriate to use the existing toxicological information in the ROD.

- Non-cancer health effects from dioxins/furans were not evaluated in the risk analysis because standard, non-cancer toxicity criteria for dioxins/furans are not currently available and the dioxin reassessment (EPA 2000a), which outlines alternative approaches, has not yet been finalized. DEQ will not use the reassessment for quantitative risk assessment purposes until it is finalized. Since there is evidence that non-cancer health effects may occur at very low

exposure levels, there is uncertainty associated with the lack of evaluation of non-cancer health effects for dioxins/furans.

Since the draft dioxin reassessment was issued, the National Academy of Science and others have reviewed the document and had significant comments. At the current time, it is unclear when the final dioxin reassessment might be issued and what it might say. Therefore, DEQ has determined that it is appropriate to go forward with the ROD without evaluating non-cancer health effects from dioxins/furans.

- Multiple COCs may have synergistic effects (i.e., they increase or decrease the toxicity of other chemicals) or they may have no effect on the toxicity of other chemicals. The potential for synergism or antagonism of chemicals was not evaluated in the risk analysis because there is little information regarding such effects. DEQ has previously conducted literature searches to obtain information regarding synergistic and antagonistic effects of COCs, and was not able to find any relevant information (DEQ 2001e). For media for which PCP and dioxins/furans are the only COCs, potential additive effects are already taken into account. Since dioxins/furans are impurities in PCP, toxicity criteria for PCP should already incorporate synergistic effects that may be associated with the impurities.

7.2 ECOLOGICAL RISK EVALUATION

The KRY Site is located in an urban industrial/residential area and is unlikely to significantly impact any ecological resources currently or in the future. The main areas of contamination are partially or wholly fenced or covered with weeds. Small rodents and birds may live onsite. These organisms may visit the contaminated areas and inhale dust or ingest contaminated soil periodically. However, there is nothing particularly attractive about the contaminated areas of the KRY Site over the surrounding area that would cause birds, rodents, or other animals to visit the contaminated areas preferentially. The level of human activity near and throughout the KRY Site is likely to discourage significant use by wildlife, although an occasional deer or other large mammal may cross the KRY Site. In addition, no designated wetlands exist on or within a mile of the KRY Site. No populations of designated federal or Montana species of concern exist on the KRY Site or surrounding area and no threatened or endangered species exist primarily within four miles of the KRY Site (DEQ and TtEMI 2008b). Lastly, there is no detected contamination of the Stillwater River attributable to the KRY Site. Cleanup levels protective of human health would also reduce any limited ecological exposure that may occur.

8.0 REMEDIAL ACTION OBJECTIVES

DEQ has established Remedial Action Objectives (RAOs) for each contaminated medium. RAOs are general descriptions of what DEQ strives to accomplish in order to protect public health, safety, and welfare and the environment against unacceptable risk, consistent with reasonably anticipated land use and beneficial use of groundwater. RAOs were not developed for surface water or river sediment as there are no COCs present in sediment that exceeded screening levels and recent sampling of the surface water for dioxins/furans shows that there are no impacts attributable to the KRY Site. RAOs were not developed for ecological receptors

because there are relatively few ecological receptors at the KRY Site and the cleanup levels protective of human health will also reduce any limited ecological exposure that may occur.

8.1 GROUNDWATER

The following RAOs are defined for groundwater at the KRY Site:

- Meet groundwater cleanup levels for COCs in groundwater throughout the KRY Site.
- Comply with ERCLs for free product and COCs in groundwater.
- Reduce potential future migration of free product and contaminated groundwater plume.
- Prevent exposure of humans to free product and to COCs in groundwater at concentrations above cleanup levels.

8.2 SOIL

The following RAOs are defined for soil at the KRY Site:

- Prevent migration of COCs that would potentially leach from soil to groundwater.
- Prevent exposure of humans to free product/sludge and to COCs in soil at concentrations above cleanup levels.
- Meet soil cleanup levels for COCs.
- Comply with ERCLs for free product/sludge in soil.

9.0 DESCRIPTION OF ALTERNATIVES

A brief description of the cleanup alternatives DEQ evaluated in the FS are set forth below (DEQ and TtEMI 2008b). Estimated volumes of contaminated media are provided in Tables 7, 8, and 9.

9.1 COMPONENTS OF ALTERNATIVES

All remedial alternatives, except No Further Action, have site-wide elements. These site-wide elements are described here and are not repeated in the descriptions of alternatives that follow. These elements include institutional controls, engineering controls, and long-term monitoring. The following assumptions are provided for the site-wide elements.

Institutional controls: Institutional controls are non-engineering measures, such as administrative or legal controls, that help minimize the potential for human exposure to residual contamination and protect the integrity of a remedy by limiting land or resource use. Although institutional controls do nothing to remediate the contamination at the site, they can serve to manage human exposure to contaminants. The effectiveness of institutional controls depends on the mechanisms used and the durability of the institutional control, as well as long-term monitoring and enforcement, if necessary, to ensure compliance with the control. Institutional controls may be layered to improve effectiveness. Institutional controls are considered inexpensive and easy to implement. Specific institutional controls that are necessary at the KRY Site are listed below.

Land Use Controls: Additional zoning requirements for the properties that make up the KRY Site may be proposed. DEQ determined reasonably anticipated future use as discussed in Section 6.1. Through this assessment, DEQ has determined that the reasonably anticipated future use of the areas of the KRY Site not already developed for residential use is commercial/industrial and restrictive covenants limiting the future use of these portions of the KRY Site to commercial/industrial are required as part of the remedy.

Groundwater Use Restrictions: DEQ will petition for a controlled groundwater area for the KRY Site to prohibit the installation of wells in the surficial aquifer until such time as the groundwater meets water quality standards. The restrictive covenants referenced above will also include this prohibition. A model restrictive covenant document is included as Appendix C.

Engineering Controls: Engineering controls are measures that are capable of managing environmental and health risks by reducing contamination levels or limiting exposure pathways. Engineering controls encompass a variety of engineered remedies (e.g., soil capping, fencing) to contain and/or reduce exposure to contamination and/or physical barriers intended to limit access to property. Although engineering controls do nothing to remediate the contamination at the site, they can serve to manage exposure to contaminants. The effectiveness of engineering controls depends on the mechanisms used and the durability of the engineering control. The initial cost of some engineering controls can be high, and generally engineering controls require some long-term maintenance. Specific engineering controls that are necessary at the KRY Site include fencing or other site security measures. Fencing or other security measures will be required during implementation of the selected remedy to prevent unintentional use of or exposure to contaminated media. Additionally, fencing or other security measures will be required to protect against injury to workers or others that may enter work areas where heavy equipment is operating or where open excavations are present. Finally, fencing or other security measures will be required to protect the integrity of the onsite repository once it is complete.

Long-Term Monitoring: A long-term monitoring program is critical to evaluate the effectiveness of any remediation. The long-term monitoring program for the KRY Site will include sampling of many the existing monitoring well network that now includes 114 wells (Figure 5), or any additional wells that may be installed during remedial design. Monitoring will also include some or all of the existing nearby residential or commercial/industrial wells to ensure that nearby public and private wells do not become contaminated above drinking water standards. At a minimum, monitoring will be conducted on a semi-annual basis during high and low groundwater elevations for the first five years and at a reduced frequency thereafter, until cleanup levels are achieved.

9.1.1 Alternative 1 – No Action

The No Action Alternative provides a baseline against which other options are compared. No further cleanup or monitoring is considered under this alternative. Contamination would remain onsite and would continue to migrate.

9.1.2 Alternative 2 – Multi-Phase Extraction and Disposal

Multi-phase extraction is a combination of bioventing and vacuum-enhanced free product recovery. A high vacuum system is applied to simultaneously remove various combinations of contaminated groundwater, free product, and hydrocarbon vapors from the subsurface. The system would be operated until cleanup levels were achieved and extracted groundwater would be treated using carbon adsorption and discharged onsite. Institutional and engineering controls, as well as long-term groundwater monitoring, would also be included as previously discussed.

Multi-phase extraction and offsite disposal of free product would significantly reduce the source area and assist in the cleanup of contaminated groundwater underlying the KRY Site (see Tables 6 and 7). Some free product and contaminated groundwater contains a RCRA listed hazardous waste (F032) that requires special handling, treatment, and disposal procedures. However, contaminated groundwater and soil, including sludge, would remain at levels above cleanup criteria.

9.1.3 Alternative 3 – Free product Extraction and Disposal

This technology involves removing free product from wells or trenches under ambient pressure. Free product can be extracted through the use of hydraulic pumps (such as bladder pumps), or with passive or active skimmers. The system would be operated until cleanup levels were achieved and extracted groundwater would be treated using carbon adsorption and discharged onsite. Institutional and engineering controls, as well as long-term groundwater monitoring, would also be included as previously discussed.

Extraction of free product and offsite disposal would significantly reduce the amount of free product source, which would assist in the cleanup of contaminated groundwater underlying the KRY Site (see Tables 6 and 7). Some free product and contaminated groundwater contains a RCRA listed hazardous waste (F032) that requires special handling, treatment, and disposal procedures. However, contaminated groundwater and soil, including sludge, would remain at levels above cleanup criteria.

9.1.4 Alternative 4 – Extraction, Ex-Situ Treatment and Discharge of Groundwater

A combination of collection, treatment, and discharge, also called pump-and-treat, is used to provide hydraulic containment and to reduce groundwater contaminant levels in a portion of the plume. An extraction system is used to remove contaminated groundwater from the affected aquifer. Extraction is followed by groundwater treatment, if required, and the groundwater is then discharged or reinjected into the aquifer or discharged to the surface water. The system would be operated until cleanup levels were achieved and associated extracted groundwater would be discharged onsite after treatment. Institutional and engineering controls, as well as long-term groundwater monitoring, would also be included as previously discussed.

Extraction of contaminated groundwater and ex-situ treatment using bioreactors and carbon adsorption would significantly reduce the amount of contaminated groundwater at the KRY Site (see Table 7). Some contaminated groundwater contains a RCRA listed hazardous waste (F032)

that requires special handling, treatment, and disposal procedures. However, free product on the groundwater and contaminated soil, including sludge, would remain at levels above cleanup criteria under this alternative.

9.1.5 Alternative 5 – In-Situ Bioremediation of Groundwater and Soil

Bioremediation is the breaking down of contamination by naturally-occurring organisms present in groundwater and soils. Bioremediation can occur in either aerobic (oxygen present) or anaerobic (minimal amounts of oxygen present) conditions. Bioremediation can be enhanced by the addition of oxygen or nutrients. The system would be operated until cleanup levels were achieved and would require regular injections of nutrients/amendments for optimal operation. Institutional and engineering controls, as well as long-term groundwater monitoring, would also be included as previously discussed.

In-situ bioremediation would significantly reduce contaminant concentrations of petroleum hydrocarbons and PCP in soil and groundwater site-wide (see Tables 7 and 8). However, this alternative may not address dioxin/furan and metals contamination and would not address free product on the groundwater and sludge in the soils at the KRY Site.

9.1.6 Alternative 6 – In-Situ Chemical Treatment of Groundwater and Soil

In-situ chemical oxidation involves injection of a chemical oxidant into the groundwater to treat both contaminated groundwater and soil. BNSF is currently using ozone to treat some groundwater on the western portion of the KRY Site. The system would be operated until cleanup levels were achieved and would require one or more injections of chemical oxidant, depending on the oxidant chosen. Institutional and engineering controls, as well as long-term groundwater monitoring, would also be included as previously discussed. Potential difficulties may be encountered in delivering the oxidant due to the heterogeneous nature of the geology at the KRY Site.

In-situ chemical treatment of soil and groundwater would significantly reduce contaminant concentrations of PCP and petroleum hydrocarbons in groundwater and soil site-wide (see Tables 7 and 8). Based on site-specific data from the operation of the current ozonation system, dioxin/furan concentrations are likely to decrease in groundwater; however, this alternative's ability to treat dioxins/furans in soil is uncertain and it is unlikely that metals contamination in soil would be addressed. Additionally, free product would remain in groundwater and sludge would remain in soil under this alternative.

9.1.7 Alternative 7 – Soil Barriers

Soil barriers, also called caps, reduce the infiltration of precipitation through contaminated soils and potentially prevent recharge to groundwater in source areas. An impermeable cap over contaminated soil areas could be constructed of clay, asphalt, concrete, or by using synthetic liners. Caps can also be used to prevent contact with contamination. The soil barrier would require monitoring and maintenance in perpetuity. Institutional and engineering controls, as well as long-term groundwater monitoring, would also be included as previously discussed.

Soil barriers would limit the mobility of contamination in the vadose zone (see Figures 7A-B, 8A-B, 9A-B, 10A-B, 11A-B, and 12 for extent of contamination in soils). However, contamination would remain in the soil, including sludge, and in site-wide groundwater. Free product would remain on the groundwater and fluctuating groundwater would continue to mobilize contaminants from the soils.

9.1.8 Alternative 8 – Excavation and Offsite Disposal

Under this alternative, soil would be excavated within the contaminated areas identified at the KRY Site and then disposed of off-site (see Figures 8A-B, 9A-B, 10A-B, 11A-B, 12A-B, and 13). Institutional and engineering controls, as well as long-term groundwater monitoring, would also be included as previously discussed.

Excavation and off-site disposal would significantly reduce the amount of contamination in soil (see Table 8). However, contaminated groundwater and free product would remain, unless the excavation is deep enough to reach groundwater and free product is removed during that process. In addition, some soil contains a RCRA listed hazardous waste (F032) that is precluded from land disposal; therefore, it would have to be taken to an incinerator. Excavation would remove all contaminants in the soil that exceed cleanup levels, including sludge, lead, and dioxins/furans.

9.1.9 Alternative 9 – Excavation, Ex-Situ Treatment, and Backfill

Under this alternative, soil would be excavated within the contaminated areas identified at the KRY Site (see Figures 8A, 8B, 9A, 10A, 11A, 12A). Excavated soil would be treated on-site (using liners) and the treatment system would continue to operate until cleanup levels were achieved. The treatment system would require regular maintenance and monitoring, including addition of amendments, nutrients, and moisture. Once treated, the soil would be available for use as backfill material onsite. Institutional and engineering controls, as well as long-term groundwater monitoring, would also be included as previously discussed.

Excavation, ex-situ treatment, and backfill would significantly reduce the amount of contamination in soil. However, contaminated groundwater and free product would remain, unless the excavation is deep enough to reach groundwater and free product is removed during that process. In addition, some soil contains a RCRA listed hazardous waste (F032) that would require special handling for onsite treatment. Excavation would remove all contaminants in the soil that exceed cleanup levels, including sludge, lead, and dioxins/furans. Subsequent ex-situ treatment would reduce the toxicity and volume of some contaminants in the soil. It is uncertain if ex-situ treatment will reduce dioxin/furan concentrations to acceptable levels. If contaminated soil is treated to cleanup levels it would be available for use as backfill material at the KRY Site.

9.1.10 Alternative 10 – Monitored Natural Attenuation

MNA refers to the use of natural processes to breakdown contamination and thereby achieve site-specific remedial objectives once contaminant sources are removed and/or controlled. Under favorable conditions, the natural attenuation processes, in association with source control

or removal, act without human intervention to reduce mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. These in-situ processes include biodegradation; dispersion; dilution; sorption; volatilization; and the chemical or biological stabilization, transformation, or destruction of contaminants. Depending on the contaminant, natural attenuation may ultimately transform the contaminants into harmless byproducts. Monitoring is essential to evaluate the effectiveness of natural attenuation.

Natural attenuation modeling was performed during the FS to aid in evaluation of remedial alternatives. This modeling indicates that MNA alone will not achieve cleanup objectives within a reasonable timeframe. The modeling results demonstrate that the free product represents a potential long-term source of groundwater contamination, and indicate that highly effective free product remediation is required to achieve cleanup levels in a reasonable timeframe. The modeling indicates that incomplete free product remediation may result in an extended time period necessary for Montana's water quality standards to be achieved. Therefore, MNA will be used as a follow-up to other, more aggressive, remediation efforts. Institutional controls and long-term monitoring will also be included, as previously discussed.

9.2 SHARED AND DISTINGUISHING FEATURES

9.2.1 Environmental Requirements, Criteria and Limitations (ERCLs)

None of the alternatives are expected to meet all applicable or relevant federal and state ERCLs individually. However, various combinations of the alternatives will comply with all ERCLs. Appendix A contains the complete list of ERCLs.

9.2.2 Long-Term Reliability of Remedy

With the exception of Alternative 1, all of the alternatives rely on institutional controls for protection from residual risks at the KRY Site over the long term. Institutional controls are considered moderately reliable because they rely on human actions. All technology options being considered in the alternatives are considered reliable over the long term but each depends upon proper design, implementation, and maintenance.

9.2.3 Untreated Waste and Treatment Residuals

Alternatives 1 and 7 would leave all of the waste untreated in the environment and would not result in any residual treatment waste. Alternatives 2 and 3 would leave all waste untreated in the soil with some remaining groundwater contamination, and would generate residual waste in the form of free product and granular activated carbon. Alternative 4 would leave all of the waste untreated in soil, treat groundwater, and would generate residual waste in the form of granular activated carbon. Alternatives 5 and 6 would treat soil and groundwater in place and would not generate residual waste. Alternative 8 would leave waste untreated in the groundwater and would remove contaminated soil, resulting in generation of residual waste in the form of soil. Alternative 9 would leave waste untreated in the groundwater and would remove and treat soil, potentially resulting in residual waste in the form of dioxin/furan-contaminated soil that is not able to be treated to the cleanup level. Alternative 10 assumes that

one of the other alternatives is used to control the sources of contamination, and would rely on natural processes to treat groundwater in place; therefore, it would not generate residual waste.

9.2.4 Estimated Time for Design and Construction

All components within each alternative could be designed within one year or less and could be constructed within two years or less.

9.2.5 Estimated Time to Reach Cleanup Levels

Cleanup levels will not be met in the short-term or long-term for either groundwater or soil under any of the alternatives individually. However, in various combinations, it is possible to meet cleanup levels for both soil and groundwater in the long-term at the KRY Site. Please see Section 11.2, which is the discussion of the selected remedy, for specifics on timeframes for cleanup.

9.2.6 Cost

The cost estimate for each alternative is based on estimates of capital costs as well as operation and maintenance costs. Section 10.7 details the comparison of alternative costs. Table 10 details the estimated costs associated with each alternative, including the number of years of operation. A three percent discount rate is used in the cost estimates (Bugni, 2007).

9.2.7 Use of Presumptive Remedies

A presumptive remedy is a technology that EPA has determined, based upon its experience, generally will be the most appropriate remedy for a specified type of site. EPA establishes presumptive remedies to accelerate site-specific analysis of remedies by focusing feasibility study efforts. EPA expects that a presumptive remedy, when available, will be used for all CERCLA sites except under unusual circumstances. Although the KRY Site is not a CERCLA site, DEQ considered the presumptive remedy guidance during the alternatives analysis.

Incineration is a presumptive remedy for remediation of organics associated with wood treating sites (PCP, dioxins/furans, PAHs, and petroleum compounds) in soil and is a component of Alternatives 8 and 9. Bioremediation and thermal desorption are presumptive remedies for organics associated with wood treating sites in soil and are components of Alternative 9 (EPA, 1995a). Pump-and-treat is a presumptive remedy for contaminated groundwater and is a component of Alternative 4 (EPA 1996c). Alternatives 1, 2, 3, 6, 7, and 10 do not include a presumptive remedy.

9.3 EXPECTED OUTCOMES

Currently, direct contact with contaminated soils is considered a risk to human health. Risk-based cleanup levels developed for surface soils at the KRY Site are based on a commercial/industrial use scenario. Risk-based cleanup levels developed for subsurface soils at the KRY Site are based on an excavation/construction worker scenario. Therefore, for all

alternatives, with the exception of Alternative 1, land use will be restricted and the primary properties that make up the KRY Site (which are not already residential) will not be available for residential use in the future. These include property owned by BNSF, Montana Mokko, Stillwater Forest Products, Swank Enterprises, Klingler Lumber Company, and DNRC.

Ingestion and direct contact with contaminated groundwater pose current and future risks to human health. No alternatives will allow groundwater to be restored to cleanup levels for the COCs in a reasonable timeframe. Groundwater use will be regulated through the establishment of a controlled groundwater area and restrictive covenants until groundwater is remediated to cleanup levels for the COCs. Once DEQ determines cleanup levels are met for groundwater, the controlled groundwater area and restrictive covenants may be modified or removed. The decision regarding the controlled groundwater area rests with DNRC, with input from the public. Restrictive covenants may also be placed on the properties to prevent specified use of the groundwater and possible expansion of the plume caused by extracting groundwater near the plume.

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives are evaluated in the following section using seven cleanup criteria required by Section 75-10-721, MCA. These criteria are used to evaluate the different alternatives individually and against each other in order to select a remedy. The first two criteria, protectiveness and compliance with ERCLs, are threshold criteria that must be met in order for a remedy to be selected. The next five criteria are balancing criteria which must be evaluated to provide the best balance in selecting the remedy. Table 11 provides the comparison of remedial alternatives for the KRY Site to these criteria. In addition to these criteria, DEQ considered the acceptability of the selected remedy to the affected community, as indicated by comments from community members and local government during the public comment period on the Proposed Plan.

A list of the alternatives and their corresponding numbers is also provided to aid in this analysis.

- Alternative 1: No Action
- Alternative 2: Multi-Phase Extraction and Disposal
- Alternative 3: Free product Extraction and Disposal
- Alternative 4: Extraction, Ex-Situ Treatment and Discharge
- Alternative 5: In-Situ Bioremediation of Groundwater and Soil
- Alternative 6: In-Situ Chemical Treatment of Groundwater and Soil
- Alternative 7: Soil Barriers
- Alternative 8: Excavation and Off-site Disposal
- Alternative 9: Excavation, Ex-Situ Treatment, and Backfill
- Alternative 10: Monitored Natural Attenuation

10.1 PROTECTIVENESS

Overall protection of public health, safety, and welfare and the environment addresses whether an alternative provides adequate short-term and long-term protection from unacceptable risks.

This may be achieved by eliminating, reducing, or controlling exposure to unprotective levels of hazardous or deleterious substances present at the KRY Site. DEQ has determined that none of the alternatives used alone will provide adequate protection of public health, safety, and welfare and the environment in the short-term and long-term. Institutional controls and monitoring are necessary for short-term and long-term protectiveness no matter what alternatives are selected.

DEQ has determined that Alternatives 1, 2, and 3 would not provide adequate protection of public health, safety, and welfare and the environment in the short-term or long-term because people would continue to be exposed to unacceptable levels of contamination in the soil and contaminants would continue to leach to groundwater for over 100 years. Alternative 4 only addresses groundwater contamination, and therefore cannot provide adequate protection in the short-term and long-term because it leaves other sources of contamination in place which will continue to pose a risk to public health, safety, and welfare and the environment. Alternatives 5 and 6 address contamination in soil and groundwater; however, neither is likely to effectively treat dioxin/furan and metals contamination, although Alternative 6 may decrease dioxin/furan concentrations.

Alternatives 5 and 6 also do not address free product in the groundwater or sludge in the soils. Alternative 7 reduces contact with contaminated soil and may reduce infiltration through contaminated soil. However, Alternative 7 leaves all of the contamination in place in both soil and groundwater, including sludge in the soil and free product in the groundwater, allowing fluctuating groundwater to continue to mobilize contamination. Alternative 8 addresses all of the contamination in soil through excavation and disposal off-site, but does not address contaminated groundwater or free product in groundwater. Alternative 9 also removes all of the contaminated soil through excavation, but requires treatment of the soil to reduce the toxicity and/or volume of contamination. Treatment options are available to treat most of the contaminants in soil to cleanup levels, with the exception of dioxins/furans, which may be unable to be treated to cleanup levels.

Free product could be addressed in Alternatives 8 and 9 if the excavation was deep enough to intersect the water table, thereby allowing the free product to be recovered. If free product were recovered, Alternatives 8 and 9 would continue to pose a risk for 40 to 100 years while the groundwater cleaned up through natural attenuation. One hundred plus years are required for groundwater to reach cleanup levels assuming complete source removal followed solely by monitored natural attenuation. Therefore, Alternative 10 would not provide adequate protection of public health, safety, and welfare and the environment because it relies only on slow natural processes to breakdown groundwater contamination. None of the alternatives provide adequate protection in the short-term and long-term unless multiple alternatives are combined to address the risks posed by all of the contaminated media at the KRY Site, which would also decrease cleanup timeframes.

10.2 COMPLIANCE WITH ERCLs

This criterion evaluates whether each alternative will meet applicable or relevant state and federal ERCLs.

DEQ has determined that none of the alternatives used alone will comply with ERCLs. Alternative 1 does not address contamination in soils or groundwater, including sludge and free product and is not expected to reach groundwater cleanup levels for more than 100 years. When compared to other alternatives this is not a reasonable timeframe. Alternatives 2 and 3 will comply with ERCLs for removal of free product in groundwater, but do not address groundwater or soil contamination, including sludge in soil, and therefore cannot reduce contaminant concentrations to at or below Montana's water quality standards and other cleanup levels. Alternatives 2 and 3 would not meet ERCLs for 40 to 100 years. Alternative 4 would reduce contaminant concentrations to at or below groundwater cleanup levels in approximately 10 years as long as free product was removed. However, Alternative 4 does not address free product in groundwater or sludge in soils and thus does not meet ERCLs.

Alternatives 5 and 6 address contamination in soil and groundwater, but do not address sludge in soil or free product in groundwater; therefore, Alternatives 5 and 6 do not comply with ERCLs for free product removal. Alternative 7 does not address contamination in soil or groundwater, including sludge in soil and free product in groundwater, resulting in groundwater concentrations that would continue to exceed cleanup levels. Alternative 7 would not meet ERCLs for over 100 years.

Alternatives 8 and 9 would address contamination in soil, including sludge, and would also address issues associated with PCP-contaminated soils after excavation, which are banned from land disposal, by disposing off-site and treating, respectively. Alternatives 8 and 9 would not address contaminated groundwater, and would not address free product in groundwater unless the excavation was deep enough to encounter groundwater and free product was recovered. Alternatives 8 and 9 would not meet ERCLs for 40 to 100 years. Alternative 10 would not meet ERCLs for over 100 years. Alternatives 2 through 10 will comply with ERCLs when combined with other alternatives. Any combination of alternatives that would remove free product and sludge to the maximum extent practicable, reduce groundwater concentrations to at or below cleanup levels, and treat PCP-contaminated soils that are banned from land disposal to site-specific cleanup levels (including soil cleanup numbers based on the leaching to groundwater pathway will comply with ERCLs.

10.3 MITIGATION OF RISK

This criterion evaluates mitigation of exposure to risks to public health, safety, and welfare and the environment to acceptable levels.

DEQ has determined that none of the alternatives used alone mitigate all risks. Under Alternative 1, free product, sludge in soil, and contaminated soils and groundwater would remain at the KRY Site. Unacceptable risk would exist and would not be mitigated by this alternative. Alternatives 2 and 3 do not mitigate all risk because residual sludge, soil, and groundwater contamination would remain. Some mitigation of risk would occur as a result of removing free product that continues to release contaminants to groundwater. Alternative 4 mitigates some risks posed by groundwater contamination because it treats contaminated groundwater. However, it does not mitigate risk associated with sludge in soil, free product on the groundwater, or soil contamination.

Alternative 5 mitigates some risks because it treats PCP and petroleum contamination in soil and groundwater. However, it is unlikely that this alternative would be effective at treating free product, sludge, dioxins/furans or metals and therefore would not mitigate risk associated with those compounds. Alternative 6 mitigates some risks because it treats PCP, petroleum and may treat dioxins/furans. It would not effectively treat free product, sludge or metals. Alternative 7 mitigates some direct exposure to contaminated soils but contamination would remain in soil and fluctuating groundwater would continue to mobilize contaminants from soil and free product. Stringent institutional controls and long-term maintenance would be needed to ensure the integrity of the barrier and prevent direct contact with contamination. Alternative 8 would mitigate risks posed by contaminated soils because they would be excavated and removed from the KRY Site. Also, if the excavation is not deep enough and free product is not recovered, contaminated groundwater would remain and people may be exposed to contaminants.

Alternative 9 would mitigate some risk because all contaminants in the soil would be removed and treated. However, it is uncertain if this alternative will reduce dioxin/furan concentrations to acceptable levels. Also, if the excavation is not deep enough and free product is not recovered, a continuing source of contamination to groundwater would remain and there may be a continued risk of exposure to contaminants. Under Alternative 10, free product, sludge in soil, and contaminated soils would remain at the KRY Site; risk from groundwater would not be mitigated for decades if Alternative 10 is used alone. Unacceptable risk would exist and would not be mitigated by this alternative. Alternatives 2 through 10 have the potential to mitigate all risks when combined with other alternatives in the right combinations.

10.4 EFFECTIVENESS AND RELIABILITY

Each alternative is evaluated, in the short-term and the long-term, based on whether acceptable risk levels are maintained and further releases are prevented.

DEQ has determined that none of the alternatives alone are effective and reliable at addressing all of the COCs and contaminated media. Alternative 1 is not effective and reliable in the short-term and long-term because unacceptable levels of contamination would remain and contaminants would continue to be released to the environment. Alternatives 2 and 3 are effective and reliable for removing free product but other alternatives would be needed to address residual soil and groundwater contamination. Alternative 4 would be effective on the contaminants in the groundwater at the KRY Site, but may require separate treatment methods for different contaminants. A pilot study would be necessary to better evaluate the effectiveness of this alternative. Alternative 5 would be effective for PCP and petroleum, but is not expected to be effective for treating dioxins/furans or metals. Pilot testing would be needed to define reaction rates and identify enhancements that would be needed to improve efficiency.

Site-specific tests demonstrate that ozonation, which could be a component of Alternative 6, is effective at treating dissolved petroleum, PCP and to a limited extent dioxins/furans. However, it is unlikely to be effective on metals contamination or free product. It is also uncertain if this alternative would achieve dioxin/furan cleanup levels in soils and groundwater. Pilot testing would be needed to determine the effectiveness of this alternative on soils at the KRY Site and to

evaluate the effectiveness of other oxidants. Alternative 7 is somewhat effective at preventing people from directly contacting contaminated soils in the short-term. However, barriers are susceptible to weathering and may crack, reducing the effectiveness of the barrier in the long-term. Maintenance of the barrier in perpetuity would be required. Because contaminated soil would remain and fluctuating groundwater would continue to mobilize contaminants, this alternative is not effective on its own for free product and site wide groundwater contamination. Alternative 8 is effective in the short-term and long-term at removing contaminated soil up to 30 feet below ground surface. Short-term effectiveness could be increased through construction and waste management practices such as fencing, dust suppression, and air monitoring. Because contaminated soil would be disposed of at a licensed engineered off-site facility, regulatory requirements for the off-site facility would effectively control contaminants in the long-term. This alternative by itself is not effective for treating free product or groundwater contamination.

Alternative 9 is effective in the short-term and long-term at removing contaminated soil up to 30 feet below ground surface. Again, construction and waste management practices could be used to increase short-term effectiveness. Subsequent ex-situ treatment would reduce the toxicity and volume of some contaminants in the soil, and construction and waste management practices could be used during active management of contaminated soils during treatment to increase short-term effectiveness. The effectiveness of ex-situ treatment at reducing dioxin/furan concentrations to acceptable levels is uncertain. This alternative by itself is not effective for treating free product, unless it is removed as part of the excavation process, nor is it effective at treating groundwater contamination. Alternative 10 is not effective and reliable in the short-term and long-term because unacceptable levels of contamination would remain for more than 100 years and contaminants would continue to be released to the environment.

10.5 PRACTICABILITY AND IMPLEMENTABILITY

Under this criterion, alternatives are evaluated with respect to whether this technology and approach could be applied at the site.

DEQ has determined that all of the alternatives are technically practicable and implementable at the KRY Site. However, there may be difficulties with implementation of Alternative 6 due to the heterogeneous nature of the geology at the KRY Site.

10.6 TREATMENT OR RESOURCE RECOVERY TECHNOLOGIES

This criterion addresses use of treatment technologies or resource recovery technologies, if practicable, giving due consideration to engineering controls. These technologies are generally preferred to simple disposal options (see Section 75-10-721(2)(c)(iv), MCA).

DEQ has determined that Alternatives 1 and 7 do not use treatment or resource recovery technologies. The remaining alternatives include some form of treatment or resource recovery technology. Alternatives 2 and 3 recover free product from the groundwater and treat extracted groundwater with carbon adsorption. Alternative 4 extracts contaminated groundwater from the aquifer and treats it using a bioreactor and carbon adsorption. Alternative 5 uses bioremediation to treat contaminated soils and groundwater. Alternative 6 uses chemical oxidation to treat

contaminated soils and groundwater. Alternative 8 treats contaminated soils via incineration at an off-site disposal facility. Alternative 9 treats contaminated soils in an on-site treatment cell, and allows for the potential reuse of the treated soil as backfill material. Alternative 10 treats some of the groundwater contamination via natural processes. All alternatives that require onsite treatment will require fencing of portions of the KRY Site to ensure protection of human health in the short-term. Dust suppression and air monitoring activities may also be necessary during excavation and soil treatment activities.

10.7 COST EFFECTIVENESS

Under Section 75-10-721, MCA, cost-effectiveness is determined through an analysis of incremental costs and incremental risk reduction and other benefits of alternatives considered, taking into account the total anticipated short-term and long-term costs of remedial action alternatives considered, including the total anticipated cost of operation and maintenance activities.

DEQ has determined that under this criterion Alternatives 1 through 4 are less costly than the other alternatives. However, alternatives 1 through 4 by themselves do not sufficiently reduce risks associated with contaminated soils. Alternative 4 may require separate treatment methods for different contaminants in the groundwater, which will increase the cost. Alternative 5 or Alternative 6 combined with either free product recovery alternative (2 or 3) provides substantial risk reduction and requires less long-term care than Alternative 7. Alternatives 5 and 6 are less costly than Alternative 8 but require more operation and maintenance and provide less risk reduction because they treat contamination in place while Alternative 8 removes the soil contamination from the KRY Site through excavation and offsite disposal. Alternative 7 provides for risk reduction by preventing direct contact with contaminated soils. However, it does not reduce risk associated with free product or contaminated groundwater. Long-term costs associated with Alternative 7 are included in the estimated cost. Next to Alternatives 1 and 10, Alternative 7 is the least costly alternative. However, with the exception of Alternatives 1 and 10, Alternative 7 also provides the least amount of risk reduction.

Alternative 8 combined with Alternative 4, or the groundwater component of Alternatives 5 or 6, and either free product recovery alternative (2 or 3) provides greater risk reduction than other alternatives, but any of these alternatives combined with Alternative 8 are the most costly. Alternative 9 combined with Alternative 4, or the groundwater component of Alternatives 5 or 6, and either free product recovery alternative (2 or 3) provides substantial risk reduction and requires less operation and maintenance than Alternative 7. However, it may be cost effective to use Alternative 7 for small areas, rather than for the entire aerial extent of contaminated soils. Alternative 10 is less costly than other alternatives, but does not reduce risks associated with contaminated soils, sludge, free product on groundwater, or contaminated groundwater (as long as contaminant concentrations exceed cleanup levels). Alternative 10 combined with any combination of alternatives that removes source materials in soil and groundwater provides some risk reduction at a negligible increase in cost over the cost associated with the other alternatives.

The estimated present worth costs for the alternatives, not including the No Action alternative, range from approximately \$4.6 million for Alternative 10 to approximately \$121 million for Alternative 8. Cost summaries for each alternative can be found on Table 10.

11.0 SELECTED REMEDY

11.1 SUMMARY OF THE RATIONALE FOR THE SELECTED REMEDY

DEQ's selected remedy for the KRY Site is a combination of alternatives set forth below.

- Free product extraction and disposal (Alternative 3): The selected remedy for less viscous free product on the groundwater in the western and eastern portions of the KRY Site utilizes recovery methods such as trenches or recovery wells, and off-site disposal of the recovered product. Pilot tests are necessary to optimize system design, which may include, but are not limited to, evaluation of various types of pumps and skimmers available for use in trenches and recovery wells. These pilot tests will be conducted during remedial design.
- Chemical oxidation of groundwater (Alternative 6): In-situ chemical oxidation is the selected remedy for treatment of dissolved-phase contaminated groundwater. Pilot testing will be conducted to optimize system design and determine the most effective oxidant(s) during remedial design. Optimization may include, but is not limited to, an evaluation of different oxidants, oxidant concentration, injection rate and frequency, and spacing of injection points.
- Excavation and offsite disposal (Alternative 8): Excavation of soil down to the water table to allow for recovery of free product in the groundwater, possibly using booms or skimming devices, is the selected remedy for more-viscous free product in the eastern portion of the KRY Site. Recovered product will be recycled, if possible. Visible sludge in soil will be excavated and recycled in an asphalt batch plant, or as industrial fuel. Characterization sampling for disposal purposes and a treatability study to determine if the sludge is appropriate for use in an asphalt batch plant may be required during the design phase. Lead-contaminated soils will be excavated and stabilized, if necessary, and disposed of off-site. Characterization sampling for disposal purposes and a treatability study to determine the appropriate additives and the ratios of additives for stabilization may be required prior to disposal.
- Excavation, ex-situ treatment, and backfill (Alternative 9): Excavation of contaminated soils followed by treatment in a land treatment unit (LTU) (equipped with a liner and leachate collection system, if necessary) is the selected remedy for soils contaminated with PCP (by itself, or in combination with dioxins/furans), petroleum hydrocarbons, and PAHs. Upon excavation, PCP-contaminated soils must be handled as RCRA listed waste; therefore, more than one LTU will be constructed to ensure proper segregation of PCP-contaminated soils. Once treated, soils will be available for use as backfill material onsite, although clean fill may also be brought in to allow for more rapid redevelopment of the KRY Site. Bench scale testing or pilot testing will be conducted during remedial design to optimize system design. Optimization may include, but is not limited to, determining appropriate amendments, the rate and frequency of adding amendments, and calculating treatment timeframes.
- Soil Barriers (Alternative 7): The soils contaminated with dioxins/furans only (no PCP) are not F032 listed hazardous waste. Therefore, excavated soils contaminated with dioxins/furans only will be consolidated and capped in an onsite repository. In addition, if the dioxin/furan-contaminated soils treated in the LTU are unable to be treated to at or below

dioxin/furan cleanup levels, those soils will also be included in the repository and capped. Institutional controls in the form of restrictive covenants, engineering controls, and long-term maintenance are needed to ensure the repository is not compromised.

- Monitored Natural Attenuation for Petroleum and Metals (Alternative 10): High concentrations of petroleum hydrocarbons and metals (arsenic, iron, and manganese) in groundwater exist near the source areas on the eastern and western portions of the KRY Site. This contamination is closely tied to the presence and breakdown of petroleum hydrocarbons and sludge in soils and free product on the groundwater, which creates chemical conditions that allow metals to be removed from soil, at which point they become dissolved in groundwater. The selected remedy relies on removal of the free product and overlying contaminated soils to remove the source of contamination, at which point concentrations of dissolved petroleum hydrocarbons and metals attributable to these sources will decrease through natural processes.
- Institutional Controls: The selected remedy relies on institutional controls in the form of land use restrictions (restrictive covenants) and a controlled groundwater area. Land use will be restricted to commercial/industrial use and no additional wells, with the exception of those installed as part of the remedial action, will be installed within or adjacent to the KRY Site through a controlled groundwater area and restrictive covenants.
- Engineering controls: Engineering controls such as fencing will be necessary during implementation of the remedy, in order to protect workers from onsite businesses from open excavations and/or heavy equipment, as well as to restrict access to the LTUs, stockpiled soils, and the onsite repository. Dust suppression activities will also be utilized during implementation of the remedy.
- Long-Term Monitoring: Monitoring is necessary to evaluate the effectiveness of the remedy and to ensure that adjacent residential, commercial, and public water supply wells do not become contaminated. At a minimum, monitoring of selected wells will be conducted on a semi-annual basis for the first 5 years and at a reduced frequency thereafter, until cleanup levels are achieved.

Costs and assumptions used in calculating the total present value of the selected remedy are provided in Appendix B. In compliance with CECRA requirements, and considering public comment received, DEQ has determined that the selected alternatives set forth herein comprise the appropriate remedy for the KRY Site.

The selected remedy will reduce risks to public health, safety, and welfare and the environment through the following:

- The selected remedy will meet both threshold criteria: overall protection of public health, safety, and welfare and the environment, and compliance with ERCLs. The remedy accomplishes overall protection through removal and destruction of contaminants in soils, removal of free product and sludge, in-situ destruction and attenuation of contaminants in groundwater, and implementation of institutional controls.
- The selected remedy mitigates risk to public health, safety, and welfare and the environment to an acceptable level because contaminated soils, sludge, groundwater, and free product will be removed, disposed of, or treated, thereby reducing the potential for exposure or impact.

- The selected remedy provides short-term and long-term effectiveness and reliability because accessible contaminated soil will be excavated and disposed of offsite, treated ex-situ through bioremediation, or consolidated and capped onsite; contaminants in vadose zone soils will be removed and disposed of offsite, treated in-situ through chemical oxidation, or consolidated and capped onsite; and contaminated groundwater will be treated in-situ through chemical oxidation. Free product in groundwater and sludge in soil will also be removed. Contaminated groundwater plumes will be reduced in magnitude and extent through source removal and treatment using chemical oxidation.
- The selected remedy is technically practicable and readily implementable. The selected cleanup technologies have been successfully implemented at other Superfund facilities. Pilot tests and or treatability studies will be conducted to optimize the selected technologies during remedial design, as appropriate.
- The selected remedy uses treatment as a principal element of the remedy; it reduces the toxicity, mobility, or volume of hazardous or deleterious substances through treatment. The selected remedy also proposes resource recovery technologies, if practicable, for sludge and free product. The use of engineering controls including a soil barrier, and fencing or other security measures are also included in the selected remedy.
- The selected remedy is cost-effective and balances incremental costs and incremental risk reduction, focusing on on-site treatment as opposed to off-site disposal for the majority of contaminated soils and in-situ treatment of contaminated groundwater as opposed to ex-situ treatment, which is more expensive.

Based on the available data and using DEQ's expertise, DEQ finds that the selected remedy best meets the selection criteria and provides the appropriate balance considering site-specific conditions and criteria identified in CECRA. Some of the public comments on the preferred remedy presented in the Proposed Plan were related to the desire to redevelop the property. The selected remedy provides that option for a large portion of the KRY Site.

11.2 DETAILED DESCRIPTION OF THE SELECTED REMEDY

The selected remedy is detailed below. The remedy may change somewhat as a result of remedial design and remedial action (construction) processes. Changes to the remedy will be documented using a technical memorandum, an explanation of significant difference (ESD), or an amendment to the ROD. DEQ has previously identified data gaps for the KRY Site. These data gaps will be filled, as necessary, during remedial design, along with the treatability studies and pilot tests identified as part of the selected remedy.

DEQ selected a combination of alternatives to cleanup soil and groundwater and address free product and sludge. These include free product recovery methods (such as trenches or recovery wells) for less viscous free product on groundwater and excavation for more viscous free product, chemical oxidation for treatment of the dissolved organic-COC plume in groundwater, MNA for inorganics and petroleum in groundwater, excavation of contaminated soils combined with ex-situ treatment (LTU, stabilization of lead-contaminated soils) and off-site disposal (lead-contaminated soils and sludge in soils), capping (dioxin/furan-contaminated soils repository), institutional controls, and long-term monitoring. Engineering controls (fencing and dust control

measures) will be included as necessary during implementation of the remedy. Air monitoring will also be performed, as needed, during implementation of the remedy.

Pilot testing will be performed to optimize the design of the various components of the remedy, as appropriate. Certain components of the remedy must happen before other components can begin. Therefore, the selected remedy will be implemented using a phased approach. This phased approach will be outlined in the remedial design work plan to be issued after the ROD.

11.2.1 Site-Wide Elements

Long-Term Monitoring

The selected remedy includes monitoring site media during remedy construction and long-term operation and maintenance. This plan will be developed during remedial design, is subject to DEQ approval, and will include sampling and analysis to: confirm the satisfactory performance of the remedy; to ensure protection of public health, safety, and welfare, and the environment during remedy implementation; to verify attainment of cleanup levels; to confirm achievement of remedial action objectives; and to verify compliance with ERCLs. The plan will also include inspection and maintenance of the soil barrier for dioxin/furan contaminated soils, operation of the LTUs, and inspection and maintenance of the fencing and vegetation.

Monitoring will include sampling of some of the following: existing monitoring wells (currently 114 wells), additional wells that may be installed as part of remedial design or remedy, and existing nearby residential or commercial wells. DEQ will determine the appropriate sampling locations during remedial design. At a minimum, select wells will be monitored semi-annually during high and low groundwater elevations for the first five years to monitor contaminant levels for PCP, dioxins/furans, SVOCs, EPH, VPH, VOCs, PAHs, and metals (arsenic, iron, manganese). Other analyses may be included to evaluate the effectiveness of chemical oxidation. The monitoring frequency will then be re-evaluated and may be decreased to annually or another frequency that DEQ determines is appropriate, until cleanup is achieved. Select wells may also be monitored for MNA parameters (redox potential, nitrate, plus nitrite, ammonia, dissolved oxygen, ferrous or soluble iron, and sulfate) at a frequency determined appropriate by DEQ. Water levels in monitoring wells will also be measured semi-annually during high and low groundwater elevations. Should detections of contaminants occur in residential or commercial wells at levels at or in excess of cleanup levels, DEQ will require immediate resampling of the well. Should the initial detected concentration be verified, DEQ will require immediate connection of the residence or business to the public water supply provided through the Evergreen Water District.

Free product thicknesses will be monitored to evaluate the effectiveness of the remedy at a frequency to be determined during remedial design.

The cap and its vegetation, as well as the fencing around the LTUs, will be inspected and maintained to ensure the integrity of the remedy.

Air monitoring will be conducted, as needed, during implementation of the remedy to ensure protection of public health, safety, and welfare, and the environment. Dust suppression will also be used to ensure that particulate levels do not become elevated.

Institutional Controls:

The following institutional controls will be implemented:

- Groundwater Use Restrictions (controlled groundwater area): To protect human health and limit migration of contaminants through pumping, the selected remedy partially relies on institutional controls in the form of a controlled groundwater area to ensure that no additional wells, except for remediation purposes, are installed within or adjacent to the area of contamination associated with the KRY Site (Figure 7). While there are domestic and commercial/industrial use wells currently in operation in the vicinity of the KRY Site, the Evergreen Water District supplies public water to homes and businesses in the area. Therefore, the impact of prohibition of additional wells is limited since an additional source of water is available.

DEQ will prepare and supply adequate supporting information for a petition to the DNRC to establish a controlled groundwater area under Sections 85-2-501, et seq., MCA, for the KRY Site. The basis of the petition will be that excessive groundwater withdrawals would cause contaminant migration and that water quality within the groundwater area is not suited (for example, contaminant concentrations are above Montana's numeric water quality standards, EPA Maximum Contaminant Levels (MCLs), EPA Regional Screening Levels, or DEQ Risk Based Screening Levels (RBSLs)) for a specific beneficial use. The proposed controlled groundwater area will extend past the outer extent of the contaminant plume to create a buffer zone to ensure the plume does not expand through significant withdrawals of groundwater near the plume boundaries and to provide a zone of protection. Groundwater monitoring will be used to track plume concentrations until cleanup levels are met. If granted, DNRC will enforce its corrective control provisions as set forth under Section 85-2-507, MCA. DEQ will evaluate sampling results and model potential contaminant migration as necessary. Control provisions will remain until cleanup levels are met within the KRY Site.

- Land Use Restrictions (Restrictive Covenants): The selected remedy includes a requirement that the property owners of the contaminated properties and properties where engineered components of the remedy have been or will be constructed restrict property use through the placement of restrictive covenants under Section 75-10-727, MCA, satisfactory to DEQ. A model restrictive covenant is provided in Appendix C. These restrictive covenants will be placed on property impacted or potentially impacted by the KRY Site and include but are not necessarily limited to property owned by BNSF, DNRC, Klingler Lumber Company, Montana Mokko, Stillwater Forest Products, and Swank Enterprises. Restrictive covenants for residential use and a prohibition on groundwater use will be in effect until DEQ determines they are no longer needed to ensure protection of human health. Changes to local zoning regulations may also be proposed. The remedy calls for capping of the dioxin/furan-contaminated soils in an onsite repository. Once the repository is complete, it will be surveyed and restrictions

will be placed on the repository property to restrict access, development, excavation of contaminants, or excavation or use of the capped soil necessary to ensure the integrity of the cover.

11.2.2 Soil

Excavation of contaminated soils, in combination with stabilization, off-site disposal/recycling, and ex-situ bioremediation in LTUs will reduce contaminant concentrations to levels that no longer pose a risk to human health and groundwater. Additionally, these activities will eliminate the direct contact risk to workers in a commercial/industrial scenario. Short-term exposure risks will be minimized through use of construction management techniques to limit dust, odors, and exposure to contaminated media. Monitoring will be used to document effectiveness. The following is a discussion of the components of the soil portion of the selected remedy:

Excavation of Contaminated Soils

The selected remedy requires excavation of approximately 132,822 cubic yards of contaminated soils throughout the KRY Site, including soils contaminated with PCP (and co-located dioxins/furans), dioxins/furans (where not co-located with PCP), and petroleum hydrocarbons (Figures 8A-B, 9A-B, 10A-B, 12A-B, and Table 8). This excavation will be completed in a phased approach to ensure that various contaminants are segregated as they will be handled differently. Methods of stabilizing the excavation sites, as well as fencing or other security/safety measures, will be used as needed. Any debris encountered during excavation will be disposed of properly and utilities will be located and avoided, protected, or relocated.

Stabilization and Disposal of Lead Contaminated Soils

Approximately 3,472 cubic yards of lead-contaminated soil exists on the eastern portion of the KRY Site (Figures 8A-B, 11A-B, and Table 8). The selected remedy includes excavation and disposal of the lead-contaminated soils at an offsite disposal facility. Some of the lead-contaminated soil may require stabilization to reduce toxicity and leachability before disposal can occur. Concerns about toxicity and leachability, as well as the relatively small volume of lead-contaminated soil, preclude disposal in an onsite repository. Characterization sampling for disposal purposes and a treatability study to determine the appropriate additives and the ratios of additives for stabilization may be required during the design phase.

Recycling of Petroleum Sludge

An estimated 3,126 cubic yards of petroleum sludge is present throughout the eastern portion of the KRY Site (Figure 13 and Table 9), both at the surface and at depth. The sludge exists in varying degrees of viscosity and is intermixed with debris or soil. The sludge will be recycled, possibly in an asphalt batch plant. Some sludge is present in surface "pits," which may be easily recyclable. However, in some places debris is mixed with the sludge, which might preclude recycling of the product. Other areas of sludge are intermixed with soils, and will not be easily separated. Sludge material that is mixed with debris and therefore not able to be recycled, will be disposed of at an off-site facility. Some stabilization or solidification may be required for this option. Sludge material that is intermixed with soil that cannot be recycled will be treated along with other petroleum contamination in an LTU. Characterization sampling for disposal purposes

and a treatability study to determine if the sludge is appropriate for use in an asphalt batch plant may be required during the design phase.

Consolidation and Capping of Dioxin/Furan-Contaminated Soils

Approximately 19,859 cubic yards of excavated dioxin/furan only-contaminated soils (surface soils; see Figures 8A-B and Table 8) which are not classified as F032 listed hazardous waste will be consolidated and capped in an onsite repository. Placement of the dioxin/furan contaminated soil (no PCP) into the repository will reduce the volume of soil to be treated in the PCP LTU, which is appropriate since dioxins/furans may not be effectively treated to cleanup levels through bioremediation in an LTU. Dioxin/furan-contaminated soils co-located with PCP that are not treated to cleanup levels through bioremediation in an LTU will also be placed in the repository (see below). Without the presence of a carrier solution, the dioxins/furans will not leach to groundwater. An appropriate cap, consisting of at least 18 inches of clean fill and 6 inches of topsoil which has been successfully vegetated, will be required to mitigate the direct contact risk. Institutional controls, engineering controls, and long-term inspection and maintenance will be put in place so the repository will not be compromised.

Ex-situ Bioremediation of Soils using LTUs

The majority of excavated soils (approximately 280,970 cubic yards, including soils contaminated with PCP, which is classified as F032 listed hazardous waste (and which may be co-located with dioxin/furans) (as identified in Figures 8A-B and 9A-B) will be treated through bioremediation in an LTU. In addition, petroleum hydrocarbons (as identified in Figures 8A-B and 12A-B), and contaminated soils excavated as part of the free product excavation on the eastern portion of the KRY Site (see Section 11.2.3, below)) will be placed in a separate LTU. The estimated treatment timeframe for PCP-contaminated soils based on the average detected PCP concentration at the KRY Site is 9 years or less. This does not take into account the addition of water and nutrients, which will decrease the treatment timeframe. Petroleum constituents and PAHs are more easily treated through bioremediation than PCP, and therefore will have quicker treatment timeframes. However, dioxins/furans may not be effectively treated to cleanup levels through bioremediation. If after treatment, soils contain dioxins/furans above cleanup levels, the treated soil will be placed in the onsite dioxin/furan soils repository and capped (see previous section). Treated soils that meet cleanup levels will be available for use onsite as backfill material, although the option of using clean fill is also retained in order to allow for more rapid redevelopment of the KRY Site.

Figure 14 shows the conceptual locations and design of the two LTUs for the KRY Site that were used for cost estimating purposes. This is strictly a conceptual design and the final LTU configuration will be determined during remedial design. If necessary, the LTUs will be lined with a reinforced polypropylene (RPP) liner and leachate collection systems will be included. Leachate will be recycled and used for irrigation of the LTU (in combination with other water sources). Additionally, nutrients and water will be added to enhance biodegradation within the LTUs. Treatability studies and/or pilot tests are required to optimize bioremediation including, but not limited to, determining appropriate amendments, the rate and frequency of adding amendments, and calculating treatment timeframes.

11.2.3 Groundwater

Natural attenuation modeling was performed during the FS to aid in evaluation of remedial alternatives. This modeling demonstrated that with complete PCP and dioxin/furan source removal (both free product and contamination in the soil overlying the groundwater), it will take approximately 40 years for the PCP plume to meet the groundwater cleanup level, and more than 100 years for the dioxin/furan plume to meet the groundwater cleanup level. This timeframe is not reasonable given that alternatives exist to actively treat the groundwater plume to speed up the cleanup process. Removing contamination from soil, in combination with active treatment of the contaminated groundwater plume and free product recovery, will achieve established groundwater cleanup levels much more quickly. The following is a discussion of the components of the groundwater portion of the selected remedy:

Free product Removal

Removal of free product from groundwater is an important step in meeting groundwater cleanup levels. As mentioned in previous sections, there are two types of free product on groundwater at the KRY Site. A heavier, more viscous product is present on the eastern portion of the KRY Site and the remaining product at the KRY Site is a lighter, less viscous product that contains PCP (and is considered F032 listed hazardous waste) (Figure 15). Field observations of the heavy, viscous product indicate that it is not very mobile and has characteristics similar to that of tar. This heavy, viscous product is present in the vicinity of lower-permeability soils, and therefore may be difficult to recover using methods like trenches or wells.

The selected remedy will utilize free product recovery methods, including but not limited to, trenches or recovery wells to remove the less viscous free product from the groundwater. Trenches or wells are more effective at removing less viscous free product. An estimated 81,921 gallons of the less viscous free product is present (Table 6). Once recovered, the product determined to contain PCP through sampling will be disposed of as a hazardous waste. Pilot tests are necessary to optimize system design and will be conducted during remedial design. Optimization may include, but are not limited to, evaluation of various types of pumps and skimmers available for use in trenches and recovery wells.

Free product recovery methods are unlikely to be efficient at removing the more viscous free product due to its viscosity and the presence of product in areas of low permeability soils. The more viscous free product, estimated to be approximately 82,176 gallons (Table 6), is more localized in the eastern portion of the KRY Site. Therefore, this product will be excavated along with contaminated soils to ensure adequate removal of the source. Product remaining on the groundwater after excavation will be recovered, possibly using booms or skimming devices in the open excavation. The product that does not contain PCP, as confirmed through sampling, will be disposed of through a used oil recycler.

Free product must be removed from the groundwater to the maximum extent practicable. Based on the ERCLs analysis found in Appendix A, DEQ has determined that “maximum extent practicable” means removing free product until a threshold thickness of 1/8 inch or less of free product is present over a two year, semi-annual monitoring period. After free product recovery efforts have been conducted, DEQ may determine that in certain soils and in certain

circumstances, recovery to 1/8" is not practicable. This highlights the importance of the design, installation, and optimization of the free product recovery system.

Chemical Oxidation of Contaminated Groundwater Plume

Groundwater contaminated with PCP is an F032 listed hazardous waste. In-situ chemical treatment of groundwater will significantly reduce contaminant concentrations of PCP and petroleum hydrocarbons in groundwater. Data from the operation of the ozonation system currently operating on a portion of the KRY Site demonstrates that dioxin/furan concentrations are likely to decrease in groundwater, which will decrease the overall treatment timeframe. However, given that dioxins/furans are difficult to remediate, the ability of chemical oxidation to treat dioxins/furans to the cleanup level listed on Table 4 is uncertain.

The selected remedy expands the current in-situ chemical oxidation system. Benchscale testing and/or pilot testing will be conducted during remedial design to optimize system design and determine the most effective oxidant(s). Optimization may include, but is not limited to, an evaluation of different oxidants, oxidant concentration, injection rate and frequency, and spacing of injection points. Figure 16 shows the conceptual design of the chemical oxidation system used for cost estimation purposes, which uses ozone gas as the oxidant. The oxidant will be injected into the groundwater throughout the PCP and dioxin/furan plumes, including injections into the deeper portion of the aquifer to address contamination at depth. Due to previous detections of PCP in nearby residential wells and historic data indicating exceedances of Montana's water quality standards in the northern portion of the KRY Site, groundwater monitoring will continue. If PCP concentrations consistently exceed Montana's water quality standard for PCP, then the chemical oxidation system will be expanded to treat contaminated groundwater in the deeper portion of the aquifer in the northern portion of the KRY Site. If dissolved petroleum contamination is present in this area, the chemical oxidation system will also be effective in treating that contamination. The conceptually designed chemical oxidation system would inject oxidant on a cyclical basis and is estimated to remain in place for approximately ten years. Regular sampling will measure the effectiveness of the system.

Monitored Natural Attenuation for Petroleum and Metals

High concentrations of petroleum compounds currently exist in groundwater at the KRY Site (Figure 7). However, this contamination is closely tied to the presence of free product in contact with the groundwater. Therefore, removal of the free product and overlying contaminated soil will significantly decrease the petroleum concentrations in groundwater through time. The selected remedy for groundwater contaminated with petroleum hydrocarbons relies on excavation of contaminated soils and removal of free product on groundwater to eliminate the source of the dissolved-phase petroleum contamination followed by MNA. Regular sampling as part of the long-term groundwater monitoring program will track the decline in the petroleum and metals concentrations in groundwater at the KRY Site. Sampling of MNA parameters may also be conducted.

High levels of iron, manganese, and arsenic exist in the groundwater near the source areas at the KRY Site (Figures 17 A-C). These high levels of metals are likely due to the breakdown of free product and petroleum contaminated soils in these areas. Another area of high concentrations of iron and manganese exists in the vicinity of well KRY-103A, on the northwestern edge of the

KRY Site. These increased concentrations may be related to the presence of buried sawdust in this area. For the eastern portion of the KRY Site, the selected remedy relies on excavation of the contaminated soils, the more viscous free product, and the sludge to remove the source of the petroleum contamination. MNA will then be used to remedy the metals issue in groundwater over time. For the remainder of the KRY Site, excavation of contaminated soils and free product removal, followed by MNA to remove the source of the petroleum contamination, will decrease the high concentrations of metals in groundwater over time. For the sawdust area, additional information on the reduction/oxidation potential and soil gas in the sawdust area is necessary before a determination can be made of whether the material can be left in place. Therefore, sampling of the soil gas in the sawdust area for methane and further characterization of a reducing environment are included as part of the remedy, on a schedule to be determined during remedial design. Based upon the results of the sampling, DEQ will determine what actions are necessary, if any, through a technical memorandum, an ESD, or a ROD amendment. Regular sampling as part of the long-term groundwater monitoring program will measure the decline in the metals concentrations in groundwater at the KRY Site.

11.2.4 Remedial Action Objectives and Performance Standards

DEQ has established its remedial action objectives for each contaminated media in Section 8.0.

Cleanup levels for soil and groundwater are provided in Tables 4 and 5. Section 7.0 details the development of site-specific cleanup levels for the KRY Site.

11.3 COST ESTIMATE FOR THE SELECTED REMEDY

Table 12 summarizes capital and operation and maintenance costs for the selected remedy. Table 13 summarizes the present value analysis. Appendix B presents detailed summaries of the costs and assumptions for each component of the selected remedy.

The total present worth value of the selected remedy is approximately \$32,062,368. DEQ developed these cost estimates based on the best available information regarding the anticipated scope of the remedy and cost information presented in the FS and Proposed Plan. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the selected remedy. This is a feasibility-level engineering cost estimate expected to be within plus fifty to minus thirty percent of the actual project cost.

11.3.1 Cost Uncertainties

Remedial design will play a critical role in determining final costs for the KRY Site remedy and will be more reflective of actual costs than the estimated costs presented in the ROD. Treatability studies and pilot testing during remedial design will provide the information necessary to refine cost estimates. Uncertainties that may affect the costs of the selected remedy include:

- The time required for monitoring may increase or decrease the costs of the monitoring.

- Increases or decreases in the number of monitoring wells to be monitored as part of long-term groundwater monitoring may increase or decrease the costs of monitoring.
- Volume estimates were not revised after cleanup levels were changed. Cleanup levels increased after the change, which suggests that volume estimates would likely decrease. Decreased volume estimates may decrease the cost estimates.
- Volume estimates include a multiplier of 1.8 to account for the experience of and approach used by Montana’s Petroleum Tank Release Compensation Board to account for the likely increase in the volume of excavated soil from that originally estimated (DEQ 2008f). Depending on the volume of material ultimately excavated, the costs may increase or decrease.
- Cost estimates for stabilization of lead-contaminated soils assumed that 50% of the soils would require stabilization. Increases or decreases in the percentage of soils to be stabilized may increase or decrease the costs of the stabilization.
- Sampling to determine the reduction/oxidation potential and methane generating ability of the sawdust material may increase costs if the sawdust must be treated or removed because it is a source of methane or because reducing conditions cause exceedances of cleanup levels.
- Costs associated with provision of alternate water to nearby residences and/or businesses were not included in the cost estimates. If domestic or commercial/industrial use wells are impacted and alternate water supplies are required, costs may increase.
- Costs associated with confirmation sampling were not included in the cost estimates. Costs associated with these samples may increase the cost of the selected remedy.
- Costs associated with agency oversight of the remedial action(s) were not included in the cost estimates for the selected remedy. Costs associated with agency oversight may increase the cost of the selected remedy.

11.4 ESTIMATED OUTCOMES OF SELECTED REMEDY

The selected remedy uses a combination of institutional controls, engineering controls, removal of free product/sludge and contaminated soils, and soil and groundwater treatments to control exposures and protect public health, safety, and welfare and the environment over the long term. The remedy will reduce contaminant concentrations through a combination of technologies that cleanup soils in the source areas and accelerate cleanup of the contaminated groundwater. The difficult-to-treat dioxin/furan contaminated soils will be consolidated and capped on-site. The technologies selected by DEQ to meet the remedy requirements include a combination of free product recovery, excavation, on-site and off-site disposal, in-situ chemical oxidation, and ex-situ bioremediation. Successful excavation and treatment of contaminated soil and removal of free product will reduce the cost and timeframe required to operate and maintain the in-situ chemical oxidation system for groundwater, as there will be no continuing source of contamination to contribute to groundwater concentrations. After completion of both soil and

groundwater treatments, soil contaminant concentrations will be below levels of concern for protection of human health and groundwater. Groundwater concentrations are expected to be at or below cleanup levels, with the possible exception of dioxin/furan concentrations, which may not be completely treated through in-situ chemical oxidation. Institutional and engineering controls, along with monitoring and maintenance, will prevent or mitigate exposures to contaminated soils that are disposed of onsite in perpetuity, and to groundwater until cleanup levels are achieved.

It will likely take two years for remedial design and construction. After designs are complete and remedial components are constructed, current estimates indicate that the soil biological treatment will take at least 30 years¹ due to the volume of soil and size of conceptually designed LTUs. This timeframe may be revised based on the results of pilot testing and the potential use of SPLP analysis in place of cleanup levels to determine if LTU soils are at risk for leaching to groundwater. The chemical oxidation system will operate for approximately 10 years. This timeframe may be revised based on the results of pilot testing.

Land uses are not expected to change as a consequence of the remedial action. Land use is expected to remain industrial and commercial at the KRY Site with some limited residential use in areas currently used as residential. Institutional controls in the form of restrictive covenants will ensure that the properties formerly used for historical operations associated with the KRY Site are restricted to commercial/industrial uses and may be used to limit use of contaminated groundwater. Institutional and engineering controls will preclude the use of the area of the onsite dioxin/furan-contaminated soils repository.

Groundwater use will be restricted by institutional controls described in this ROD and these restrictions will remain in effect until cleanup levels are achieved. Groundwater use restrictions are necessary to prevent use of contaminated groundwater and to minimize migration of contaminated groundwater that could occur by pumping adjacent or nearby groundwater. After groundwater cleanup levels are achieved, groundwater will again be available for unrestricted use. The timeframe for achieving groundwater cleanup levels throughout the plume is uncertain but these levels are expected to be met within 50 years. Portions of KRY Site contaminated groundwater outside of the property boundaries of historical operations may meet cleanup levels sooner than source areas. Unrestricted use of groundwater outside source areas may be allowed prior to complete cleanup of the source areas if these uses would not cause adverse effects.

Final cleanup levels for soil and groundwater are presented in Tables 4 and 5.

Contamination associated with the KRY Site was not found to pose an unacceptable risk to ecological receptors, but the removal and/or destruction of contaminants in groundwater and soils is expected to produce a positive effect for those receptors.

¹ Table 13 includes an estimate of 50 years for soil biological treatment because that timeframe was used for cost-estimating purposes in the event that treatment takes longer than expected.

12.0 STATUTORY DETERMINATIONS

Under Section 75-10-721, MCA, of CECRA, DEQ must select a remedy that will attain a degree of cleanup of the hazardous and deleterious substance and control of a threatened release or further release of that substance that assures protection of public health, safety, and welfare and of the environment. In approving or carrying out remedial actions performed under Section 75-10-721, MCA, DEQ must require cleanup consistent with applicable state and federal ERCLs, and may consider substantive state and federal ERCLs that are relevant to site conditions. In addition, DEQ must select a remedy considering present and reasonably anticipated future uses, giving due consideration to institutional controls. The selected remedy must mitigate risk, be effective and reliable in the short- and long-term, be practicable and implementable, and use treatment or resource recovery technologies, if practicable, giving due consideration to engineering controls. The selected remedy must also be cost effective.

The selected remedy is protective of public health, safety, and welfare and the environment, complies with ERCLs, mitigates risk, is effective in the short- and long-term, is practicable and implementable, uses treatment and resource recovery technologies, and is cost-effective.

The following sections discuss how the selected remedy meets the CECRA statutory requirements.

12.1 PROTECTION OF PUBLIC HEALTH, SAFETY, AND WELFARE AND THE ENVIRONMENT

CECRA requires present and future protection of public health, safety, and welfare and the environment as a threshold criterion. DEQ has determined that the selected remedy appropriately protects public health, safety, welfare and the environment through the following:

- Excavation of contaminated soils and sludge, followed by disposal offsite, treatment, or capping and placement of institutional controls eliminates the incidental ingestion and dermal contact pathways for both surface and subsurface soils and sludges.
- Excavation of contaminated soils, followed by disposal offsite, treatment, or capping and placement of institutional controls, and utilization of engineering controls such as dust suppression eliminates the inhalation of dust pathway in both the short-term and the long-term.
- Excavation of contaminated soils and sludge, removal of free product in groundwater, and treatment of groundwater eliminate potential sources of contamination that would contribute to the ingestion of contaminated produce pathway.
- Excavation of contaminated soils and sludge, removal of free product in groundwater, treatment of groundwater, placement of institutional controls such as restrictive covenants, and a controlled groundwater area, in combination with long-term monitoring of existing residential and commercial wells to ensure they do not exceed cleanup levels, eliminate the potential sources of contamination that would contribute to the ingestion of groundwater and

breast milk pathways, as well as the dermal contact with groundwater and inhalation of volatiles during use of groundwater pathways.

- Excavation of contaminated soils and sludge, removal of free product in groundwater, and treatment of groundwater eliminate the potential sources of contamination that would contribute to the inhalation of volatiles released from subsurface soil and groundwater into the indoor air pathway.
- Excavation of contaminated soils and sludge, and use of construction management practices to ensure that contaminated soils and/or surface water runoff from the KRY Site do not enter the Stillwater River, eliminate the incidental ingestion and direct contact pathways associated with surface water of the Stillwater River.
- The potential risk of methane generation is addressed by additional sampling to determine whether explosive levels of methane are present. Based upon the results of the sampling, DEQ will determine what actions are necessary to eliminate the risk of explosion, if any, through a technical memorandum, an ESD, or a ROD amendment.
- Implementation of the final remedy will ensure protection of the limited ecological receptors at the KRY Site.

12.2 COMPLIANCE WITH ERCLS

The final determination of ERCLs is listed in Appendix A of this ROD. The selected remedy will comply with all applicable and relevant ERCLs. Some significant ERCLs compliance issues are discussed below.

For the COCs in groundwater, the contaminant-specific ERCLs for the remedial action are the standards specified in Montana's numeric water quality standards. The federal maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) are also relevant to the remedial action.

Certain actions (removal of contaminated soils and free product), coupled with treatment of the contaminated groundwater plume with chemical oxidation, will lead to compliance with Montana's water quality standards within a reasonable timeframe.

For sludge in soil and free product in groundwater, ERCLs require removal of free product to the maximum extent practicable as determined by DEQ.

The selected remedy calls for excavation and treatment of PCP-contaminated soils and recovery and off-site disposal of PCP-contaminated free product. The various media and wastes contaminated by PCP at the KRY Site are FO32 listed hazardous wastes once they are excavated or removed. This triggers certain RCRA requirements that are applicable for the treatment, storage, and disposal of these wastes. Properly implemented, the selected remedy complies with RCRA subtitle C requirements.

12.3 MITIGATION OF RISK

The selected remedy for soil was selected over other alternatives because it is expected to achieve substantial and long-term risk reduction through excavation and treatment/disposal of contaminated soils, removal of free product/sludge, and treatment of contaminated groundwater. For dioxin/furan-contaminated soils capped onsite, institutional controls and long-term maintenance will ensure the integrity of the barrier and prevent direct contact with contamination.

12.4 EFFECTIVENESS AND RELIABILITY

The selected remedy is effective in that it reduces the risk and allows the KRY Site to be used for the reasonably anticipated future land use, which is primarily commercial/industrial. The selected remedy also provides for the long-term reliability of the remedy. For dioxin/furan-contaminated soils capped onsite, institutional controls and long-term inspection and maintenance will ensure the integrity of the barrier and prevent direct contact with contamination.

The selected remedy will comply with all federal and state safety laws. Short-term effectiveness of the remedy, including consideration of the risks involved to workers and the community as the remedy is being implemented, will be mitigated through the use of fencing, best management practices, adequate dust control, and other safety measures, as necessary. Some safety measures are set forth in Section 11, Selected Remedy, of the ROD.

12.5 PRACTICABILITY AND IMPLEMENTABILITY

The selected remedy is technically practicable and implementable at the KRY Site because all of the technologies are routinely used successfully in the environmental field and the materials necessary are widely available. In addition, the presence of an operating railroad line increases options for transportation of materials to and from the KRY Site.

12.6 USE OF TREATMENT OR RESOURCE RECOVERY TECHNOLOGIES

The selected remedy is expected to achieve substantial risk reduction through removal and/or recovery of free product/sludge from groundwater and soil, and treatment of contaminants in groundwater and soil. Recovered free product will be recycled if possible, with sludge material being utilized in an asphalt batch plant and some free product going to a used oil recycler. The remedy for soils contaminated with only dioxins/furans is consolidation in an onsite repository and capping, which is an engineering control.

12.7 COST EFFECTIVENESS

The selected remedy is cost-effective, taking into account the total short- and long-term costs of the actions, including operations and maintenance activities for the entire period during which the activities will be required. The selected remedy provides overall risk reduction proportionate to the costs. To the extent that the estimated cost of the selected remedy exceeds the costs of the

other alternatives, the difference in cost is reasonably related to the greater overall reduction in risk provided by the selected remedy. The detailed evaluation of the balance of these criteria among the alternatives considered is set forth in the FS and in Section 10, Comparative Analysis of Alternatives, of this ROD.

13.0 DOCUMENTATION OF NOTABLE CHANGES FROM PREFERRED ALTERNATIVE OF PROPOSED PLAN

The Proposed Plan for the KRY Site was released for public comment on December 7, 2007. The Proposed Plan identified a combination of Alternative 3 (free product extraction and disposal), Alternative 6 (chemical oxidation), Alternative 8 (excavation and offsite disposal), Alternative 9 (excavation, ex-situ treatment, and backfill), and possibly Alternative 7 (soil barriers) as the preferred remedy. The preferred remedy also included institutional controls and long-term monitoring. DEQ has reviewed all written and oral comments for the Proposed Plan submitted during the public comment period. DEQ made the following specific changes to the selected remedy set forth in the Proposed Plan.

- **Sawdust:** The Proposed Plan required excavation of the buried sawdust. DEQ has determined that additional information on the reduction/oxidation potential and soil gas in the sawdust area is necessary before a determination can be made of whether the material should be excavated. The ROD includes sampling of the soil gas in the sawdust area for methane and further characterization of a reducing environment. Based upon the results of the sampling, DEQ will determine what actions are necessary, if any, through a technical memorandum, an ESD, or a ROD amendment. This revision significantly reduced the cost estimate for the sawdust component of the remedy.
- **Dioxin/Furan Only-Contaminated Soil:** The Proposed Plan required treatment of dioxin/furan contaminated soils in the LTU along with PCP-contaminated soil. DEQ has determined that it is appropriate to excavate, consolidate, and cap the dioxin/furan-contaminated soils that exist separately from PCP-contaminated soils since bioremediation in an LTU may not treat dioxin/furan concentrations in soil to at or below site-specific cleanup levels. This will reduce the volume of soil to be treated in the LTU and will decrease the timeframe for overall treatment in the LTU.
- **Estimated Volume of Contaminated Soil:** The Proposed Plan included volumes of contaminated soil based on figures in the Draft Final FS Report. These figures were revised as a result of public comments received on the FS and the revision resulted in reduced soil volumes for individual contaminants. However, DEQ determined it was appropriate to use a multiplier of 1.8 to account for the experience of and approach used by Montana's Petroleum Tank Release Compensation Board to account for the likely increase in the volume of excavated soil from that originally estimated (DEQ 2008f). Incorporation of this multiplier increased the revised soil volumes to slightly less than the original volume estimates used in the Proposed Plan. Additionally, the decision to remove soils contaminated only with dioxins/furans from treatment in the LTU also revised the volume of soil to be treated. These revisions to the soil volumes resulted in revisions to the cost estimates.

- **Estimated Volume of Free Product:** The Proposed Plan included volumes of free product based on figures in the Final Draft FS Report. The Final Draft FS Report included volume estimates based on free product thickness measurements from June 2006 through February 2007. The free-product volume estimates in the ROD were revised based on an evaluation of the monthly thickness measurements collected from July 2006 through July 2007, which resulted in a decrease in the estimated volumes. Cost estimates were revised based on these revised volumes.
- **Estimated Extent of Dioxin/Furan-Contaminated Groundwater:** The Proposed Plan included the estimated extent of dioxin/furan contaminated groundwater from the Final Draft FS, which was based on dioxin/furan groundwater data collected during the RI sampling event. DEQ determined that it was appropriate to include dioxin/furan groundwater data from BNSF's semi-annual groundwater monitoring events from January 2004 (post-installation of BNSF's full-scale ozonation system, which likely changed contaminant concentrations) through October 2007 because not every well was sampled for dioxins/furans during the RI sampling event to ensure no duplication of effort. This increased the data set that DEQ used to evaluate the extent of the dioxin/furan contaminated groundwater and ultimately resulted in an increased aerial extent of dioxin/furan contaminated groundwater, which is depicted in Figure 7, and increased the overall estimated cost of the groundwater remedy (chemical oxidation).
- **Changes to the Chemical Oxidation Cost Estimate:** Public comments received on the Proposed Plan suggested that the labor costs assigned to the geologist for oversight of drilling activities was too low. Public comments also suggested that the design of the injection points should be changed to use stainless steel piping and Swagelok compression fittings. DEQ revised the labor costs for geologist oversight as a result of this comment. DEQ also reevaluated the design of the injection points as a result of these comments and the cost estimate now includes the use of stainless steel piping and Swagelok compression fittings, and also includes wellhead assemblies. These changes resulted in an increase to the overall cost estimate. Additionally, the increased estimated extent of dioxin/furan-contaminated groundwater resulted in an increased number of injection points in the conceptually designed chemical oxidation system, which increased the estimated cost.
- **MNA:** The Proposed Plan included MNA as a component of the preferred remedy as part of the Common Elements cost estimate. Based on public comment, the ROD clarifies that MNA is a separate remedy for petroleum and metals in groundwater. DEQ anticipates that long-term monitoring and MNA would occur simultaneously to maximize efficiency and reduce costs. Therefore, the cost estimate in the ROD for long-term monitoring (see MNA and Site-Wide Elements) includes sampling associated with the MNA component of the remedy.
- **Use of Clean Backfill:** The Proposed Plan required the use of treated soil for backfilling the excavations. The ROD allows for use of clean soil for backfill material to allow for more rapid redevelopment of the property. Cost estimates were not revised for this change, but the option is provided within the text.

- **Alternate Water Supply:** The Proposed Plan did not discuss the contingency for potential contamination of adjacent residential or commercial wells during the remedial action. The ROD includes a provision for alternate water to be provided via attaching the residence or business to the Evergreen Water System supply if individual wells are determined to be contaminated above cleanup levels. Cost estimates were not revised for this change.
- **Cleanup Level Determination:** The Proposed Plan required excavation of soils and treatment of those soils based on the established cleanup level for the particular chemical. The ROD includes the option of using SPLP analysis in place of the leaching to groundwater cleanup level, for chemicals that have such a cleanup level, to demonstrate that leachate concentrations do not pose a leaching to groundwater risk. Cost estimates were not revised for this change. However the use of SPLP has the potential to significantly reduce costs associated with the treatment of soil in the LTUs.
- **Rescreening of Compounds and Changes to Cleanup Levels:** EPA released Regional Screening Levels in May 2008 (EPA 2008) that replaced some screening levels that DEQ had previously used for screening purposes. The release of the Regional Screening Levels prompted DEQ to compare the list of COPCs to the new screening levels to ensure that revised screening levels did not change the list of COCs at the KRY Site. The re-screening effort ultimately resulted in the elimination of some compounds as direct contact COCs and the addition of one compound as a leaching as COCs for the KRY Site, which required that DEQ change the proposed cleanup levels. New toxicological information was also provided for some compounds, which required that DEQ change the proposed cleanup levels. The re-screening process is discussed in Section 7.0 and is documented in the addendum to the risk analysis technical memorandum provided in Appendix C of the FS (DEQ and TtEMI 2008b). The revised cleanup levels have been included in Tables 4 and 5 of this ROD.

14.0 ADMINISTRATIVE RECORD REFERENCES

DEQ cited, relied upon, or considered the following documents in selecting the remedy for the KRY Site. It does not include legal citations such as those found in the Montana Code Annotated, Administrative Rules of Montana, United States Code, and Code of Federal Regulations. Any document, model, or other reference identified in the Data Summary Report, Remedial Investigation, and Feasibility Study are also incorporated herein as part of the administrative record.

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PART 3

RESPONSIVENESS SUMMARY

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1.0 INTRODUCTION

The Montana Department of Environmental Quality (DEQ) solicited public comment on the July 2007 Final Draft Feasibility Study Report (FS), the December 2007 Addendum to the FS, and the Proposed Plan for the Kalispell Pole and Timber (KPT) facility, Reliance Refining Company (Reliance) facility, and Yale Oil Corporation (Yale) facility (collectively referred to as the KRY Site) in Kalispell, Montana during a public comment period that ran from December 7, 2007 through January 12, 2008. (The public comment period was originally scheduled to end on January 5, 2008, but based on requests from the public, DEQ extended the comment period by one week. DEQ also held a public meeting and hearing in Kalispell on December 19, 2007. DEQ received oral comments from one organization at the public hearing. DEQ also received written comments from a number of individuals or businesses during the public comment period, one of whom had also provided oral comments.

1.1 Community Involvement Background

It is the intent of DEQ that the citizens of Montana have the opportunity to be actively involved in the DEQ decision-making process with respect to state Superfund sites. DEQ has made a concerted effort to involve the community, including local officials and residents, in all aspects of the investigation and cleanup. DEQ has conducted community involvement activities for the KRY Site in accordance with state law and has conducted more outreach and opportunity for public comment than is required. For example, DEQ held scoping meetings with the liable persons on the remedial investigation (RI) work plan and the initial alternatives screening document for the FS, sought public comment on the RI, held a public meeting to discuss it, prepared a written responsiveness summary, and made changes to the RI based on public comment. DEQ also sought public comment on the feasibility study (FS) and Proposed Plan, prepared this written responsiveness summary, and made changes to the FS and the ROD based on public comment.

1.1.1 Notification of Public Comment Period

Press releases were sent to newspapers, television stations, and radio stations to announce public comment periods for the FS, Addendum to the FS, and Proposed Plan. Public meetings were also announced in the local newspaper and occasionally on the local television or radio stations. Printed notices were published in the Kalispell Daily Interlake, a daily newspaper, and on DEQ's website. DEQ sent notice of the public comment period and meeting to the approximately 83 people on its mailing list for the KRY Site. DEQ sent letters regarding the opportunity for public comment to the Flathead County Commissioners, the Kalispell City Council, the Flathead County Health Department, the Governor's Office, the Environmental Quality Council, area legislators, and the liable persons. DEQ also posted the documents and notice of the public comment period and public meeting on its website. When DEQ extended the public comment period as noted in Section 1.0, DEQ sent notice of the extension to the Flathead County Commissioners, the Kalispell City Council, the Flathead County Health Department, the Governor's Office, the Environmental Quality Council, area legislators, and the liable persons and also published notice in the Kalispell Daily Interlake and on DEQ's website.

1.1.2 Administrative Record

The administrative record is the set of documents DEQ considered or relied upon when determining the selected remedy. References to the administrative record are found in Part 2, Section 14.0 of the Record of Decision (ROD). The complete files for the KRY Site, including the documents making up the administrative record for the remedy, are available for public review at the DEQ offices in Helena. A partial compilation of files, including major documents related to the site, is available for public review at the Flathead County Library in Kalispell, and on DEQ's website at <http://deq.mt.gov/StateSuperfund/kpt.asp>.

1.1.3 Document Repositories

The administrative record contains the documents cited, relied upon, or considered in selecting the final remedy for the KRY Site, and is provided in Part 2, Section 14.0 of the ROD. It does not include legal citations such as those found in the Montana Code Annotated, Administrative Rules of Montana, United States Code, and Code of Federal Regulations. Any document, model, or other reference identified in the Data Summary Report, Remedial Investigation, and Feasibility Study are also incorporated herein as part of the administrative record.

The complete administrative record is located at:

Montana Department of Environmental Quality
Remediation Division
Hazardous Waste Site Cleanup Bureau
1100 North Last Chance Gulch
Helena, MT 59601
Telephone: (406) 841-5000

A partial compilation of the administrative record can be found on DEQ's website at <http://deq.mt.gov/StateSuperfund/kpt.asp> and at:

Flathead County Library
247 1st Avenue East
Kalispell, MT 59901
Telephone: (406) 758-5820

1.1.4 Updates

To keep citizens updated about site activities during the RI/FS, DEQ published informational mailings. These reports contained information on recently released documents, upcoming activities and meetings, completion of activities, sampling results and other information. Informational updates were sent to individuals on the mailing list for the KRY Site and local media, as well as city and county officials, the Environmental Quality Council, the Governor's office, and liable persons. Informational updates will continue during remedial design and implementation.

1.1.5 Toll-free Hotline

DEQ maintains an in-state toll-free number (1-800-246-8198) for people who want to contact DEQ about the KRY Site or other Superfund sites. DEQ Remediation Division staff members direct calls to appropriate project officers. The toll-free number is answered in person during business hours. In addition, DEQ maintains a website at <http://deq.mt.gov>.

1.1.6 Mailing List

DEQ maintains a private mailing list that is periodically updated. DEQ has actively solicited additions to the mailing list in informational updates and at public meetings. In accordance with state law, the mailing list is generally not released to the public.

1.2 Explanation of Responsiveness Summary

All comments received during the public comment period on the FS, Addendum to the FS, and Proposed Plan have been reviewed and considered by DEQ in the decision making process and are addressed in this Responsiveness Summary. To assist in developing responses, DEQ added its own numbering to comments where appropriate to add clarity. Each specific oral and written comment is stated verbatim. In order to avoid duplication of some responses, similar comments are usually addressed only once for the first occurrence of the comment and thereafter referenced to the appropriate response. Written comments on the Proposed Plan and Feasibility Study and the transcript from the December 19, 2007 public hearing are part of the administrative record and are referenced in Part 2, Section 14.0 of the ROD. In addition, all other documents cited in DEQ's responses are part of the administrative record and are also referenced in Part 2, Section 14.0 of the ROD.

2.0 RESPONSES TO ORAL COMMENTS

2.1 Comments from Dave Smith, representing BNSF Railway Company

I'm Dave Smith. I'm Manager of environmental remediation for BNSF Railway. I'm located in Helena, Montana, and I'm here to provide a short verbal comment on behalf of BNSF Railway. And we will follow up with written comments as well. We see some positive and encouraging things in the proposed plan that was discussed tonight. We have some technical questions that we'd like to have clarified. And we see some things in the plan that cause us concerns about the feasibility and cost of MDEQ's plan. One of these concerns is the ability to undertake this cleanup over a five to ten-year, or longer period if I heard tonight, without foreclosing industrial development on all of these properties. As we understand the state's proposed plan, it would preclude redevelopment of the site in the near future and eliminate the options of moving Cenex Harvest States and others from downtown to the site. BNSF's technical consultants are meeting with DEQ staff this month, as a matter of fact tomorrow, in an effort to clarify some of these questions so that BNSF can better understand the proposal; how it could be implemented, what it would cost, and how other parties in the lawsuit will share that cost. BNSF believes that there are alternative plans that would be protective of human health and the environment and would also accommodate the relocation of Cenex and others to the site. BNSF did not cause the

pollution here, but understands its responsibility as a landowner. Our goal is to reach a fair and equitable agreement with DEQ and all the interested parties on a cost-effective cleanup plan to avoid future litigation. We will be submitting detailed written comments to DEQ before the end of the comment period in January. Thank you for the opportunity to share these verbal comments.

Response: As stated in the FS and Proposed Plan, DEQ is required to evaluate its cleanup alternative using the seven cleanup criteria provided in Section 75-10-721, Montana Code Annotated (MCA). These criteria are protectiveness of human health, safety, and welfare and the environment; compliance with applicable or relevant state and federal environmental requirements, criteria and limitations (ERCLs); mitigation of risk; effectiveness and reliability (short-term and long-term); practicability and implementability; use of treatment or resource recovery technologies; and cost-effectiveness. The first two criteria, protectiveness and compliance with ERCLs, are threshold criteria that must be met in order for a remedy to be selected. The next five criteria are then evaluated to provide the best balance in selecting the remedy. DEQ evaluated all of the retained remedial alternatives against these criteria in the FS, Proposed Plan, and ROD and it has selected the remedy for cleaning up the KRY Site which best balances these criteria. Please refer to Section 10.0, *Summary of Comparative Analysis of Alternatives*, and Section 12.0, *Statutory Determination* of the ROD.

The comment states that DEQ's preferred remedy, as presented in the Proposed Plan, would preclude redevelopment of the property in the near future. DEQ finds that its preferred remedy will ensure that the property in question is available for redevelopment as commercial/industrial property in the future, and does so in a way that ensures protection of public health, safety, and welfare and the environment. DEQ is aware of the redevelopment potential of the property and will coordinate with owners, operators, and developers to the extent possible through the remedial design process, staging of phases of cleanup, and location of land treatment units (LTUs) or repositories. The remedy does not preclude redevelopment.

The commenter is correct that there are other alternatives available for the KRY Site that would be protective and allow for more immediate redevelopment. One such alternative would be excavation of all contaminated soils and disposal at an off-site facility, followed by backfilling using clean fill. This alternative would be protective, and would also be the quickest to implement, and therefore allow for more rapid redevelopment. However, this alternative would also be the most expensive, in excess of \$120 million. As mentioned previously, DEQ chose the remedy as a result of careful evaluation and balancing of the seven criteria required by statute, and finds that it provides the best balance. DEQ met with BNSF's technical staff on December 20, 2007 to answer questions and discuss BNSF's issues and concerns on the Proposed Plan.

The commenter states that BNSF did not cause the pollution. The KRY Site is being addressed under CECRA which provides joint and several liability for a number of different categories of persons. BNSF currently owns and operates a large portion of the KRY Site and owned and operated it at the time hazardous substances were disposed.

BNSF also has independent liability as an arranger and a transporter to the KRY Site. Under CECRA, liability is not causation based. There is an ongoing lawsuit, initiated by DEQ, to determine how the remediation costs will be paid and DEQ expects the lawsuit will resolve this issue.

Based on this comment, DEQ has modified the preferred alternative to allow for backfill with clean fill upon excavation of contaminated soils rather than waiting to backfill with treated soil from the LTU. This would facilitate more rapid redevelopment of the KRY Site since waiting for backfill material to fill excavation areas from the LTUs would not be necessary.

3.0 RESPONSES TO WRITTEN COMMENTS

3.1 Comments from Greg Barkus, resident of Kalispell and Montana State Senator representing SD4 (the district in which the site lies)

I wish to submit the following comment as public comment on the proposed plan of remediation for the KPT, Reliance and Yale Oil site, collectively referred to as the KRY site.

- 1. It is my opinion that this site has been studied too much. This is the third time public funds have been expended to drill holes, purchase monitoring equipment and utilize a lot of personnel time in looking at a problem that has yet to cause any problems. There is little or no evidence that there is any pollution in the Stillwater and I personally believe that the penetration of the surface at 114 locations in a 50 acre site has caused penetration of any contaminants that may have been lingering on the surface that could and should have been removed following the first study in the early 90's. In fact, the DEQ could potentially face a negligence action for failure to act when the problem was first noticed and studied. The penetration could also be the cause of the seepage further into the aquifer.*
- 2. I encourage the department to work for a cooperative agreement to create an industrial site that would be attractive to CHS for a relocate of their elevators and the PLP's could kick in sufficient funds to make the move attractive to the Co-op while making downtown Kalispell a much more attractive place to work and live.*
- 3. Extension of the comment period was appreciated, but I am not sure enough people are aware of the issue as I haven't seen much in the way of notice, other than interested persons.*
- 4. Should Contract work be deemed necessary and approved, PLP's should be given first chance at fulfilling the requirements. I understand the department has it's list of approved contractors, but I question the arm's length nature of the relationships.*

Thank you for the opportunity to comment.

Response: 1). DEQ understands the frustrations associated with the number of investigations undertaken at the KRY Site and the perceived completeness of those investigations. However, those previous investigations were conducted by a number of parties without looking at the KRY Site in a comprehensive manner with an eye toward gathering the information necessary to make final cleanup decisions. The most recent investigation, the RI, which was undertaken by DEQ and its contractors, was necessary to gather the information necessary to progress the KRY Site through the CECRA process towards cleanup. DEQ was able to complete the RI because of a legislative appropriation in 2005. Through this investigation, DEQ determined the Stillwater River was not impacted by the KRY Site, and determined the extent of the groundwater and soil contamination. DEQ also determined that groundwater contamination attributable to the KRY Site is present at depth across Highway 2. DEQ built on the previous investigations when scoping the RI to ensure the best use of resources; of the 114 wells referenced by the commenter, 57 were installed by DEQ during the RI and the others were already in place. The monitoring wells are necessary to adequately characterize the nature and extent of contamination. Installation of monitoring wells is a widely accepted and routine action in the environmental industry and steps are taken during the installation to ensure that the wells will be helpful, and not harmful, to the surrounding area. The monitoring wells were installed in compliance with State law and regulations (Administrative Rules of Montana (ARM) 36.21.801 et seq) by water well contractors licensed under ARM 36.21.101 et seq. Well logs were filed in accordance with Section 85-2-516, MCA. In addition, DEQ's consultants employed safeguards to ensure that contamination from one well did not impact another (cross-contamination) during drilling, development, or sampling. Therefore, it is highly unlikely that the installation of monitoring wells at the KRY Site has negatively impacted the KRY Site or surrounding area and DEQ has seen no evidence that this has occurred.

The commenter mentions that the KRY Site has not caused "any problems." DEQ is required to act when there has been a release or threatened release of a hazardous or deleterious substance that may pose an imminent and substantial endangerment to the public health, safety, or welfare or the environment. The primary hazardous substances for the KRY Site include, but are not limited to, pentachlorophenol (PCP), dioxins/furans, petroleum compounds, and lead. Other contaminants of concern (COCs) are discussed in the ROD. Long-term exposure to PCP has been shown to cause liver effects and damage to the immune system. The EPA has determined that PCP is a probable human carcinogen and the International Agency for Cancer Research (IARC) considers it possibly carcinogenic to humans. Exposure to dioxins/furans can cause a severe skin disease with acne-like lesions that occur mainly on the face and upper body or other negative effects to the skin. Dioxin/furan exposure can also cause liver damage and changes to metabolism and hormone levels. EPA considers dioxins/furans to be probable human carcinogens, while the World Health Organization (WHO) considers them to be known human carcinogens. Health effects from exposure to petroleum hydrocarbons depend on many factors and can include affects to the blood, immune system, liver, spleen, kidneys, developing fetus, and lungs. Certain petroleum hydrocarbon compounds

can cause neurological affects consisting primarily of central nervous system depression. Lead exposure in humans affects almost every organ and system in the human body. The most sensitive system is the central nervous system, particularly in children. Irreversible brain damage occurs at blood lead levels greater than or equal to 100 micrograms per deciliter ($\mu\text{g}/\text{dL}$) in adults and at 80 to 100 $\mu\text{g}/\text{dL}$ in children; death can occur at the same blood levels in children. Children who survive these high levels of exposure may suffer permanent, severe mental retardation. Lead can also damage the kidneys and the reproductive system. Section 7.1.1 of the ROD contains a detailed discussion of the potential health effects of exposure to these compounds. Health effects may not be observed until several years after the exposure occurs. Based on this information, DEQ finds that an imminent and substantial endangerment exists that poses a risk to public health, safety and welfare and the environment. The suggestion that DEQ must wait to require remediation at the KRY Site until there is actual harm to persons or the environment is not consistent with CECRA. Progress at the KRY Site has been slow in the past, due to a number of factors. However, since receiving the funding from the Legislature in July 2005 to complete the comprehensive RI/FS for the KRY Site, DEQ has made great strides in moving the KRY Site through the CECRA process and into the design and cleanup phase.

2. DEQ prefers to work cooperatively with the liable persons at CECRA facilities. At the KRY Site, DEQ tried unsuccessfully for many years to convince the liable persons to conduct the comprehensive RI but such efforts were futile. When it became clear that the liable persons were not going to voluntarily address the KRY Site in a proper and expeditious manner, DEQ initiated litigation (discussed above) and requested funding from the legislature. The decision on the selected remedy for cleaning up the KRY Site ultimately lies with DEQ. The liable persons have been provided the opportunity to have input in the decision making process at many points throughout the CECRA process including providing input on the RI, FS, and Proposed Plan. As evidenced by responses to comments in this Responsiveness Summary, DEQ has taken those comments into consideration and has incorporated changes into the remedy as appropriate. Without proper remediation, moving in new businesses to operate on the KRY Site will only exacerbate existing problems, and may cause more harm than good. DEQ understands that there is a desire to move the Cenex Harvest States grain elevator, and possibly other businesses, to the KRY Site so that their former locations can be redeveloped for use in downtown Kalispell and DEQ took this into consideration in determining the “reasonably anticipated future use” of the KRY Site. However, as stated in the previous comment response, DEQ has a number of statutory criteria it must take into consideration when making the cleanup determination, and while the desire to redevelop the property was taken into consideration, it cannot be the only factor considered. Cleaning up the KRY Site will make it attractive for redevelopment in the future.

The commenter also suggests that the liable persons could provide funding to make moving to the KRY Site more attractive for Cenex Harvest States. Under CECRA, DEQ is not able to require PLPs to provide funding to entice businesses to relocate to the KRY Site.

3. Please see Section 1.1.1 of this responsiveness summary, which discusses the public comment period at issue. DEQ has made a concerted effort to notify the people of Kalispell about the presence and status of the KRY Site. DEQ has been in contact with neighboring businesses and residents, has provided updates via the mail to members of the mailing list, including local legislators and other local government officials, and has provided updates via door-to-door visits to neighboring residences. DEQ hosted two public meetings in Kalispell, along with a separate meeting to provide information to local legislators, and has attended meetings with local officials. Additionally, DEQ has published numerous press releases and legal ads associated with the progress at the KRY Site. Numerous newspaper articles have been written about the KRY Site as a result of these press releases and meetings. DEQ will continue to notify the community of the progress at the KRY Site throughout the remainder of the CECRA process.

4. DEQ understands the concern regarding the contract/bidding process and can provide assurance that the process protects against the risk of contractors making more work for themselves. DEQ invites the commenter to look further at DEQ's contracting process which fully complies with state procurement laws. Under CECRA, DEQ can either choose to perform the cleanup work itself, with the assistance of a contractor, or it may allow the liable persons to perform the work while DEQ acts in an oversight role. If DEQ conducts the cleanup work, DEQ will comply with all legal obligations required through the state procurement process to obtain any contracted services. Additionally, DEQ does not have "approved" lists for construction contractors; rather those types of contracts are competitively based on an "invitation for bid" process, which would allow any experienced contractor to submit a bid for consideration.

3.2 Comments from Dean Swank, President of Swank Enterprises

1. *My first comment to the Kalispell Pole & Timber, Reliance Refinery and Yale Oil Facilities proposed plan is that the \$28,496,175 price is totally ridiculous. This amount will cause financial hardship to many of the potentially liable parties, perhaps driving them into bankruptcy.*

The contamination at the DRY site dates back to the 1930's and during those 70 or so years no illnesses to anyone have been attributed to the pollution. Also contaminants in the ground water have not been found in the neighborhood wells or the Stillwater River. The DEQ has been testing and studying the site for at least 17 years with no clean-up action so I assume the potential for health threat is quite minimal. Given these facts there can be no justification to spend over \$28 million dollars cleaning up this site that at present is not harming anyone.

I would also comment that when DEQ personnel came to Swank Enterprises office to negotiate the 2% consent decree they told me that the Burlington Northern Santa Fe had indicated that clean-up could cost \$10 million but the DEQ was confident it would cost considerably less than this. For the DEQ to come back now with \$28.5 million is not ethical because if we had been aware the potential liability was this great we would not have agreed to 2%.

There have been other suggestions for containment from earlier studies that could serve the purpose in combination with commitment from PLP's for future use of the property. Future use of the property should play an integral part in establishing necessary clean-up procedures. It is reasonable to assume the property Owners would agree to any restrictions suggested to reduce the cost.

Response: As mentioned in previous comment responses, DEQ must take into consideration seven remedy selection criteria required by CECRA. Cost-effectiveness is one of these criteria. However, DEQ cannot choose the least expensive remedy simply because it is the least expensive. Rather, DEQ must evaluate all seven of the criteria to determine the best remedy. There were other cleanup options considered that would have met all of the cleanup criteria, but would have been far more expensive to implement than DEQ's chosen remedy. Therefore, because cost-effectiveness is one of the cleanup criteria, the selected remedy set forth in the ROD was chosen because it provided the best balance of all the cleanup criteria at the lowest cost.

Determining health impacts from exposure to contamination can be very difficult to establish. Therefore, the lack of knowledge of health impacts associated with the KRY Site does not necessarily mean there are none. For this reason, DEQ relies on contaminant-specific toxicity information for assistance in determining which chemicals pose risks to human health and the environment. Many of the contaminants present at the KRY Site are cancer-causing and nearly all of the contaminants present have potential health effects. Please see responses to previous comments regarding health effects of the hazardous substances found at the KRY Site. Also, Section 7.1.1.3 of the ROD provides information regarding the potential health effects associated with the contaminants found at the KRY Site. Therefore, DEQ has determined that cleanup is necessary to abate the imminent and substantial endangerment to public health, safety, and welfare and the environment.

The meeting discussed in the comment was a meeting to discuss settlement of a judicial action filed by DEQ against the liable persons for the KRY Site, which is separate from the remedy selection portion of the CECRA process. In the early part of the process, when the meeting in question took place, DEQ did not know the cost to clean up the KRY Site and therefore provided the potentially settling parties an estimate prepared by an expert for BNSF in a previous judicial action that BNSF was involved in at the site, as well as DEQ's expertise. That 1999 expert report provided a range of \$9.7 million to \$21.5 million for cleaning up the KPT Facility, a portion of the overall KRY Site (Sterrett 1999). DEQ's expertise indicated cleanup would likely be in the \$10 million to \$60 million range for the KRY Site. These ranges were provided to all parties DEQ discussed settlement with at that time, to give some idea of what magnitude of costs could be expected. DEQ did not state that it thought the costs would be significantly less than the estimates provided. This uncertainty over future costs was clearly stated in all settlement discussions and was a risk that the settling parties were well aware of when determining whether to settle with DEQ. In addition, paragraph 49 of the Consent Decree between DEQ and Swank Enterprises provides "This Consent Decree and its appendix constitute

the final, complete and exclusive agreement and understanding between DEQ and Swank with respect to the settlement embodied in this Consent Decree. Swank and DEQ acknowledge that there are no representations, agreements or understandings relating to the settlement other than those expressly contained in this Consent Decree.”

DEQ fully evaluated the reasonably anticipated future uses of the KRY Site based on the requirements of Section 75-10-701(18), MCA, which is necessary in order to determine appropriate cleanup levels. Based on this evaluation, DEQ has determined that commercial/industrial use of the property (other than that which is already in residential use) is the reasonably anticipated future use. The ROD clarifies that restrictions on property and resource use are required under the selected remedy, and the commenter has already agreed to implement those restrictions. Paragraph 38 of the Consent Decree between DEQ and the commenter provides "Swank acknowledges that Institutional Controls may be necessary as part of selecting and implementing final or interim remedies for the Facilities. Upon issuance of the Record of Decision for the Facilities, DEQ will specify those Institutional Controls, if any, which will apply to the property owned or controlled by Swank. Swank agrees to use its best efforts to implement, maintain, and comply with each Institutional Control specified by DEQ for the Facilities in the future." Similar language regarding institutional controls is incorporated in all other settlement agreements for the KRY Site and the ROD specifies that institutional controls are required to ensure protectiveness.

2. One final comment on your Kalispell Pole and Timber, Reliance Refinery and Yale Oil Facilities plan. After looking at the plan, I do not think that you can be successful in cleaning the groundwater. The quantity is simply too great and too widespread to be treated. In as much as this groundwater has had no harmful effect on anyone or anything it would seem the best solution to just leave it alone.

Response: Please see previous responses regarding the imminent and substantial endangerment posed by the hazardous and deleterious substances at the KRY Site. DEQ has a statutory obligation to require cleanup of the “great” and “widespread” groundwater contamination, as ARM 17.30.1006 provides water quality standards that must be met in state groundwater. Although there is significant contamination at the site, appropriate remedial alternatives exist to address the contamination. DEQ cannot ignore the requirement to abate the imminent and substantial endangerment to public health, safety, and welfare and the environment even if it may be difficult or expensive to address.

3.3 Comments from Flathead Area Legislators Bill Beck (HD-6), Mark Blasdel (HD-10), George Everett (HD-5), Verdell Jackson (SD-5), Bill Jones (HD-9), Jerry O’Neil (SD-3), Jon Sonju (HD-7), Janna Taylor (HD-11), and Craig Witte (HD-8)

As you could gather from the public hearing held on the proposed cleanup plan for the Kalispell Pole and Timber Company, the Flathead area legislative delegation is very

concerned about the proposed plan put forth by the Department of Environmental Quality.

It is our understanding that the proposed plan has an estimated cost of approximately \$28 million, but in reality could actually cost more than that to implement. The Department of Natural Resources and Conservation (DNRC) has apparently signed a settlement agreement with DEQ that obligates it to pay 27.5% of whatever the final cleanup costs might be. Assuming that the \$28 million is a close approximate, that means the taxpayers of Montana will be paying \$7.7 million to cleanup this former industrial site and the State of Montana did nothing but inherit the property and lease it for refining purposes.

While it is necessary and required that public health and the environment be protected, the thought of the State of Montana paying \$7.7 million to cleanup this site is beyond anything reasonably imagined. As legislators who are responsible for making decisions on behalf of the people of Montana including those taxpayers, we think that the Department needs to reevaluate and modify the plan to put forth a far less expensive plan than the one proposed.

You are also aware that the city and community of Kalispell are interested in having the rail line, which goes through the KPTC site, removed from the downtown area. Such removal will have many benefits to Kalispell and the surrounding area. The community is working toward locating a performing arts center downtown. In addition, the city is striving toward locating low income housing in that area. Beyond that, removal of the rail lines would significantly decrease a safety problem in downtown Kalispell because the crossing of Hwy 93 would be eliminated and several rail crossings could be removed, which would allow unrestricted access to the performing arts center.

In order to accomplish these goals, it is necessary for two current businesses, Cenex Harvest States and Northwest Drywall, to be relocated somewhere else along rail access. We know that discussions have been held about the possibility of relocating those businesses to the KPTC site and the community would like to see that done. There must be some way to implement a far less expensive plan that will protect the environment and public health and that will allow for timely redevelopment of the site and relocation of those businesses to the site. We encourage the Department to find that solution and to move in that direction. We also request the Department keep the Kalispell legislative delegation informed as to its intentions as it moves through the decision making process.

Response: DEQ understands and appreciates the concerns regarding the costs that will be the responsibility of the Department of Natural Resources and Conservation (DNRC). DEQ and DNRC signed a consent decree which provides for DNRC to pay 27.5% of remedial action costs. In coming to that agreement, DNRC was provided the same information as other parties (see above). DNRC's liability was based on its status as a current owner of a portion of the KRY Site and an owner at the time of disposal of hazardous or deleterious substances. (DNRC acquired the property in the early 1930s through a Sheriff's sale and subsequently leased the property for refining activities and

pole storage.) DEQ believed the settlement to be fair, equitable, and in the public interest and the Court agreed when it approved the settlement.

DEQ cannot select a remedy based solely on costs; rather, cost-effectiveness is one of seven criteria that must be taken into consideration. The ROD clarifies that other options, which may be cheaper, would not provide adequate protection of public health, safety, and welfare and the environment, nor would other options be in compliance with ERCLs. These are the two threshold criteria that must be met before DEQ can choose a remedy. For purposes of responding to this comment, DEQ has assumed that soil barriers (capping) are being referred to when referencing other, less expensive plans for remediating the KRY Site. A soil barrier would not adequately address the exposure pathway for dioxin/furan contaminated soils that are co-located with PCP, as PCP contamination would remain in place and continue to leach to groundwater (depending on the barrier material), and would continue to be mobilized due to the natural fluctuations in the water table. For dioxin/furan contaminated soils that are not co-located with PCP-impacted soils, a soil barrier may address the exposure pathway, which is why DEQ will use a soil barrier if these soils are unable to be treated in the LTU to the cleanup levels. However, capping all these soils in place would require an extensive surface area barrier that would withstand the current and future industrial use at the KRY Site and would require maintenance in perpetuity to ensure the integrity of the remedy. A large capped area at the KRY Site would limit future development potential because institutional controls would preclude utility corridors and excavation in the capped area to ensure long-term protectiveness. It is possible that the dioxin/furan contaminated soils cannot be treated to below cleanup levels via bioremediation in an LTU and this would increase the amount of soil that must be handled in the LTU. Therefore, based on this comment, DEQ reevaluated its preferred alternative for dioxin/furan contaminated soils and determined that although dioxin/furan contaminated soils co-located with PCP contamination will be excavated and treated in the LTU, soils contaminated with dioxins/furans alone will be excavated and placed into an on-site repository, rather than being treated in the LTU. As a result, the volume of PCP and dioxin/furan contaminated soil to be treated in the LTU is reduced, which may decrease both the cleanup timeframe and the overall cost. Excavation, consolidation and covering the repository with a soil cap meets the CECRA cleanup criteria for dioxin/furan contaminated soils because these compounds do not readily leach to groundwater; the compounds are not prohibited from land disposal; and operation, maintenance, and institutional controls that preclude disturbance of the soil barrier will be easier to assure for a smaller area of the KRY Site. The ROD reflects this revision to the remedy and includes revised costs.

Please refer to previous responses to comments regarding the redevelopment of or relocation of businesses to the KRY Site for additional information on this topic. DEQ will keep the legislators apprised of developments at the KRY Site as DEQ has done throughout this process.

Finally, DEQ notes that the commenters reference an interest in “having the rail line, which goes through the KPTC site, removed from the downtown area.” For purposes of responding to this comment, DEQ assumed that the commenters meant they were

interested in having the rail line, which goes through the downtown area, removed rather than removal of the rail line that serves the KRY Site.

3.4 Comments from Representative George Everett, House District 5

I want to comment on the proposal as presented to us in Kalispell. I am not qualified to speak to the mitigation data presented by the state's water technicians; however, I do question the method and cost to complete the environmental cleanup.

This problem started in 1924(Reliance Refinery) and was increased by other companies (Kalispell Pole Yard 1945) with products being spilled or deposited on this property. The investigation started in 1980 and for the last 27 years there has been business and residential activity in and around the property. Some wells have signs of contamination, but no one has come forward to claim sickness or death to humans or animals. To my knowledge, and I questions DEQ personnel about this, there have been NO reports of death or injury to fish/aquatic life, wildlife, domestic animals or human beings.

The area of contamination seems to be contained, Evergreen Water System is available to the surrounding businesses and residents, the City of Kalispell and Flathead County would like to develop this property for commercial purposes and citizens common park area. I believe all the PLP's would be in agreement to formulate a plan which would work in conjunction with the contamination clean-up.

Since the area of contamination seems to be contained, I believe it would be more economical for the taxpayers of Montana and more efficient for Flathead County as well as the PLP's to look at a feasibility development plan and NOT have to spend another \$28,496,174. THIS IS EXCESSIVE! I believe there should be a meeting with all parties and have another private environmental consulting company, at the expense to the PLP's, to review the DEQ data. There maybe new development technologies and mitigation that would utilize the property for it's highest and best use without a \$30 MILLION PRICE TAG, just for the clean-up.

Thank you for your time and service.

Response: Please see previous responses to comments regarding the hazardous or deleterious substances found at the KRY Site and the imminent and substantial endangerment posed by the contamination. Where possible, CECRA requires DEQ to act prior to actual harm occurring to the public health, safety, or welfare or the environment. DEQ is not required to wait until there are reports of physical harm to people before it requires remediation. The area of contamination is widespread and has moved outside of the boundaries of the properties used for the historic operations associated with the KRY Site. There is no existing data to indicate the contaminated groundwater plume is stable and no longer expanding. There are no restrictions on use of the contaminated groundwater. While the Evergreen Water District is available to provide water to area businesses and residents, the Evergreen Water District extracts its supply water from the same aquifer that is contaminated by the KRY Site and the supply wells are located in the

vicinity of the KRY Site. DEQ has sampled these supply wells, as does the Evergreen Water District, and to date the contamination has not migrated to the wells. However, this contamination cannot be ignored. Additionally, as mentioned in previous responses to comments, DEQ has a statutory obligation to require cleanup of the groundwater contamination to Montana's water quality standards.

The decision for selecting the remedy to clean up the KRY Site ultimately lies with DEQ. The liable persons are provided the opportunity for input in the decision making process at many points throughout the CECRA process. See Sections 1.1 and 1.1.1 of this responsiveness summary for a discussion of the public comment opportunities offered at this site. As evidenced by responses to comments in this Responsiveness Summary, DEQ has taken those comments into consideration and has incorporated changes into the remedy as appropriate. The ROD clarifies these changes. The liable persons will continue to have the opportunity to be involved in the CECRA process throughout the design phase and into cleanup. In addition, BNSF's consultant has reviewed DEQ's data and provided substantial comments on DEQ's proposed remedy. See responses to ENSR Corporation's comments. In addition, please see previous responses to comments on redevelopment at the KRY Site.

3.5 Comments from ENSR Corporation, Inc. on behalf of BNSF Railway Company

Enclosed please find comments on MDEQ's KRY site Final Draft Feasibility Study Report and Proposed Plan, Proposed Cleanup Alternative for the Kalispell Pole & Timber, Reliance Refinery, and Yale Oil Corporation State Superfund Facilities, Kalispell, Montana prepared on behalf of BNSF.

BNSF Comments on Final Draft KRY Feasibility Study Report (July 2007)

General Comments

- 1. The FS does not provide a recommended alternative or combination of alternatives based on the analysis. This is not consistent with the EPA Feasibility Study (FS) guidance. The FS appears to stack technologies in order to meet ERCLs/PRAOs. The FS should consider/recommend alternatives that are specific to the changes (physical and chemical) of the COCs and take into consideration changes in the hydrogeologic conditions (e.g., excavation and offsite disposal of lead impacted soil and capping of dioxin hot spots). The effective solution may include two to three technologies each at KPT and Reliance.*

Response: The EPA *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988a), to which DEQ assumes the commenter is referring, addresses procedures taken under the federal Superfund law, the Comprehensive Environmental Response, Compensation, and Liability Act

(CERCLA). Under CECRA, DEQ chooses the preferred remedy in the Proposed Plan, which is a separate document; DEQ has followed this process and is not bound by EPA guidance. However, in Section 6.3 (Post-RI/FS Selection of the Preferred Alternative) of the above-referenced guidance document, the following statement is made: “Following completion of the RI/FS, the results of the detailed analysis, when combined with the risk management judgments made by the decision-maker, become the rationale for selecting a preferred alternative and preparing the proposed plan.” DEQ agrees that a combination of technologies is needed to achieve an effective cleanup. The FS states that it is anticipated that various technologies will be combined for the final cleanup. Subsequent text throughout the descriptions and analysis of alternatives further explains the need to combine technologies in order to meet the CECRA cleanup criteria. Table 6-1 in the FS summarizes the effectiveness of the different technologies on the various contaminants. DEQ considered the different contaminant characteristics and localized hydrogeological conditions when it combined various alternatives in its preferred remedy outlined in the Proposed Plan. The ROD clarifies this approach. For example, hot spots of lead contaminated soils will be excavated and stabilized (if necessary), and disposed of off-site. PCP-contaminated soils will be excavated and placed in an engineered cell (LTU) on-site and bioremediated. These technologies in combination with other alternatives will achieve the cleanup that meets CECRA cleanup criteria found in Section 75-10-721, MCA.

- 2. There are major shortcomings in the application of the leaching model application to the KPT site. See Appendices B and C comments below. These differences could have large implications on the implementability and cost of the remedy due to very low cleanup levels derived from this modeling work.*

Response: The approach used in the modeling represents the range of characteristics affecting the fate and transport of COCs. The calculated cleanup levels are protective of groundwater quality, and DEQ does not concur that major shortcomings exist in the modeling effort. Please see subsequent responses to comments on specific aspects of the modeling efforts for more information. Additionally, subsequent comments also discuss the optional approach of using SPLP in place of the calculated leaching to groundwater cleanup levels, which is discussed in detail in Section 7.1.1.2.1 of the Record of Decision.

- 3. The remedial investigation conclusions are still misleading. For example, MDEQ still points to groundwater mounding in the shallow unconfined aquifer in the vicinity of Reliance and Yale. Rather, groundwater appears to be perched above fine-grained lacustrine (lake) sediments. Under this condition, the saturated aquifer thickness is greatly reduced below Reliance relative to the 40-foot average noted in the text. This would have significant cost implications on the volume of groundwater that is estimated to require treatment. Actual saturated thickness below much of Reliance appears to range from 0 to 5 feet.*

Response: DEQ disagrees that groundwater is “perched” above fine-grained sediments (identified in the RI as finer-grained materials dominated by silt, silty clay, or clay) on the eastern portion of the KRY Site. The term “perched” as used by ENSR in this and later comments (i.e. Text Comments #2 and #4, Figure Comments #1 and #4, and Proposed Plan – Figure Comment #3) appears to be consistent with the standard definition of “perched ground water” as: “unconfined groundwater separated from an underlying main body of groundwater by an unsaturated zone” (AGI 2005). Several lines of evidence refute the notion that the groundwater mounded under the eastern portion of the KRY Site is separated and unconnected from the main body of groundwater present in the unsaturated aquifer beneath the KRY Site. These lines of evidence are as follows: (1) regional groundwater flow measurements from both the shallow and deeper portions of the aquifer across the entire site reflect a general gradient from the highest groundwater levels in the northwest to the lowest groundwater levels in the east. All water levels, including the lowest levels present in the eastern portion of the KRY Site, have been measured at elevations higher than the bottom of ENSR’s assumed confining layer indicating that the aquifer is fully saturated beneath the silty clay layer and an unsaturated zone does not exist beneath this layer; (2) two nested pairs of shallow and deep monitoring wells exist in the groundwater mound under the southeastern portion of the KRY Site (KRY 125A/B and KRY 129A/B), and one nested pair exists in the groundwater mound beneath the northeastern portion of the KRY Site (KPT-17/18). The deeper well of all three pairs measures a water table level within or above the assumed perching layer indicating that an unsaturated zone cannot exist beneath the perching layer; (3) in addition to evidence that the aquifer below the assumed confining layer is fully saturated up to the base of the silty clay layer, the boring logs from monitoring well KRY135A and KPT-18 and monitoring information indicate that the clay layer itself is also saturated with groundwater; and (4) petroleum staining and the presence of NAPL in KRY135A and dissolved contamination (C9 – C10 aromatics above the cleanup level) in KPT-18 indicates that the finer-grained soils beneath the northeastern portion of the KRY Site are permeable to petroleum as well as groundwater. While DEQ disagrees with the commenter that the groundwater is perched, DEQ notes that the distinction between perched or mounded groundwater does not effect DEQ’s selection of a remedy at this site.

DEQ agrees that the underlying layers of finer-grained silty clay exhibit lower permeability and slow the downward movement of groundwater through those layers. This characteristic produces the observable groundwater mound above these layers. However, the data supports DEQ’s conclusion that these finer-grained soils transmit water and contaminants, albeit slower than surrounding layers exhibiting higher permeabilities. DEQ did not revise the estimated volume of contaminated groundwater that will be treated based upon this comment.

4. *The RI/FS reports did not include product mobility or recoverability studies to support LNAPL recovery potential.*

Response: These types of studies are typically conducted as part of the treatability study/pilot testing portion of the CECRA process and the ROD requires that this information be collected during remedial design. Based upon the results of the test(s), DEQ will determine the specific free product recovery method(s) that will be employed to recover free product from the western portion of the KRY Site.

5. *We agree with MDEQ that resampling of MW129B is necessary before “specific design could be developed for this portion of the aquifer”.*

Response: The text referred to in this comment actually states the following: “Additional sampling of the lower aquifer was recommended during the RI and would be required before a specific design could be developed for this portion of the aquifer.” The statement is not specific to monitoring well KRY-129B. Additionally, the RI also recommended additional monitoring wells be installed to further define contamination at depth, which would further aid in designing a remediation system for the deeper portion of the aquifer. Re-sampling of monitoring well KRY-129B was conducted by RETEC/ENSR (now known as ENSR and referred to as ENSR throughout the document) personnel in September 2007, which confirmed the RI results and indicate that PCP contamination is present in the lower portion of the aquifer at a concentration significantly above the Montana water quality standard/cleanup level (ENSR 2007b, DEQ 2007j). Therefore, DEQ has determined that sufficient information is available indicating cleanup is necessary in the lower portion of the aquifer near well KRY-129B. The ROD clarifies that additional wells and sampling may be included as part of remedial design.

6. *The LNAPL plume between KPT and Reliance is not continuous. Additionally, there are chemical and physical differences between LNAPL in these areas along with differences in the hydrogeologic settings. These differences would affect recoverability and treatment, thereof.*

Response: The LNAPL plumes on the eastern and western portions of the KRY Site are commingled and DEQ does not agree that they are not continuous. There are some physical and chemical characteristics of the LNAPL between the two that are different. DEQ has revised the figure showing the extent of LNAPL in response to this comment and it is included in the Final FS and the ROD.

DEQ considered the hydrogeologic, chemical, and physical differences across the KRY Site in selecting the proposed remedy. As a result, DEQ determined that excavation to the water table and potentially use of absorbent material will be used to cleanup free product on the eastern portion of the KRY Site where free-product is more viscous while free product recovery via wells or trenches will occur on portions of the KRY Site where free-product is less viscous. Section 11.2.3 of the ROD clarifies this approach.

7. *Lower unconfined aquifer impacts and volumes are estimated based on one sample at (KRY-129B). The FS assumes 40-foot saturated thickness at the base of the aquifer. It's unclear how this determination could be supported, particularly from one sample.*

Response: DEQ's method for determining the contaminated thickness of the aquifer is explained in the Final Draft FS and the Final FS. DEQ estimated the deeper impacted aquifer thickness at 40 feet, which is approximately half the thickness of the measured aquifer. Although chemical impacts exceeding cleanup levels are only measured at the base of the aquifer (~110-130 feet deep) in monitoring well KRY-129B, deep level impacts have also been measured in KRY-121B, an upgradient deep well. Additionally, PCP data from deeper monitoring wells (KPT-13 and KPT-14) in the northern portion of the KRY Site and nearby residential wells, which are screened at deeper intervals than the shallow monitoring wells, demonstrates that the lower portion of the aquifer has also been impacted in this area. Although the number of monitoring wells in the deeper portion of the aquifer is limited, wells completed at depth indicate the presence of PCP in the deeper portion of the aquifer. While the actual volume of contaminated groundwater may differ slightly, a 40 foot thickness of contamination at the bottom of the aquifer is reasonable to estimate volumes of contaminated groundwater for estimating costs of remedial options. Further, variations in total volumes of contaminated groundwater will only incrementally effect the estimated cost of cleanup, and do not effect the selection of the remedy. In addition, the RI identified the need for additional wells screened in the intermediate portion of the aquifer upgradient of well KRY-129B. Installation of these wells may aid in refining volume estimates. The ROD provides for the filling of data gaps identified in the RI during remedial design, if necessary.

8. *Solidification/stabilization was dropped from the Alternatives in Section 6. While this alternative may not be effective across the entire KRY site, it could be very effective at the Reliance property where metals are present and LNAPL is perched and likely difficult to recover. We would recommend this alternative be retained.*

Response: Solidification/stabilization is discussed in two places in the Final Draft FS, Section 4.2.12.2, which is ex situ soil treatment, and Section 4.2.14.2, which is in situ soil treatment. The discussion of the technology is brief in Section 4.2.12.2 (ex situ soil treatment) and the technology was not "dropped" from consideration. Section 4.2.14.2 (in situ soil treatment) includes a lengthy discussion of the technology, and ultimately its conclusion eliminates the technology from further consideration. DEQ acknowledges that this technology may have application for select areas or COCs on the KRY Site, and should be retained. Based on this comment, DEQ has lengthened the discussion of the technology in Section 4.2.14 (ex situ soil treatment), and clarified that it is retained. However, in Section 4.2.16 (in situ soil treatment), the discussion has been modified to provide clarification for why the technology should not be retained for in situ use, and it is eliminated from further consideration. With regard the commenter's reference to perched LNAPL, DEQ has previously indicated its disagreement that the groundwater is perched. Irrespective of that, any difficulty in recovering free product is due to the presence of clays and

gravelly silts and the viscosity of the product and not whether the groundwater is perched or mounded.

Text Comments

1. *Page 5, Section 1.4.2, last paragraph. There are two incomplete sentences.*

Response: Comment noted. Text revised.

2. *Page 9, Section 2.1.3.2, fourth paragraph. Note that groundwater in the sand and gravel unit fluctuates 1.5 feet while groundwater in the “mounded zones fluctuates only 0.5 feet. This suggests these are different aquifers – unconfined and perched.*

Response: As stated in the response to General Comment #3, a perched aquifer does not exist separate and unconnected from the main unconfined aquifer beneath the KRY Site. DEQ agrees that the differences in water table fluctuations may be due to the presence of underlying lower permeable finer-grained materials in the mounded areas, but data suggest this groundwater is fully connected and interacting with the rest of the unconfined aquifer.

3. *Page 15, Section 2.3, last paragraph. Modeling results point to NAPL as a primary source of PCP contamination, but also indicates that vadose impacts may also contribute to groundwater as well. RETEC modeling does not show that vadose impacts will leach to groundwater above the DEQ-7 standard of 1 ug/L for PCP.*

Response: The ENSR modeling effort is discussed in the Risk Assessment that was submitted to the Court on behalf of BNSF in August 2007 (ENSR 2007A). DEQ performed a review of the ENSR modeling effort. While that review was limited because model input and output files documenting the ENSR model were not submitted to DEQ, prohibiting the performance of a comprehensive review, enough information was provided to conclude ENSR’s model was based on fatally flawed inputs. Specifically, DEQ’s review of the ENSR model found that model results are based on an assumption which is not consistent with the site-measured data. PCP concentrations reported in the RI indicate that the length of contaminated soils in the direction of groundwater flow is approximately 400 feet. The ENSR model assumes that this length is approximately 56 feet. DEQ’s model incorporates the 400 foot long source, which is necessary to be protective of groundwater quality at the KRY Site. Sensitivity analysis performed by the EPA indicated that the size of the contaminated source area is one of the most sensitive parameters in modeling soil leaching to groundwater (EPA, 1994). DEQ finds the ENSR model does not represent the full extent of PCP contamination, and cannot be used to calculate soil cleanup levels protective of Montana’s water quality standards.

Additionally, DEQ has determined that it will provide the option, once LTU soils have reached the direct contact cleanup level for commercial/industrial exposure of 98 mg/kg for surface soil or 650 mg/kg for subsurface soil, depending on where the treated soil will be placed after removal from the LTU and universal treatment

standards are met, of collecting an appropriate number of samples to have analyzed for SPLP in order to determine a leachate concentration. If DEQ determines that the SPLP samples demonstrate that leachate concentrations do not pose a leaching to groundwater risk, then DEQ will allow the soil to be removed from the LTU even if the leaching to groundwater cleanup level of 0.43 mg/kg has not been reached. DEQ will also provide the option of applying this strategy to the excavation of contaminated soils, where soils are excavated until they meet direct contact cleanup levels and SPLP confirmation sampling shows that the remaining soils do not pose a leaching to groundwater risk. DEQ finds this strategy is appropriate because real world results may differ from modeled results and the ROD incorporates this approach.

4. *Page 27, Section 3.3.2, second paragraph. Impacted aquifer is estimated at 40 feet (one-half the aquifer thickness). The basis for this thickness is not understood as RI data do not define a vertical extent of contamination. Furthermore, the saturated thickness in the perched zone below Reliance is on the order of 0 to 5 feet, much less than the 40 feet. The lower portion of the aquifer near KRY-129B (Figure 3-1) is assigned an area of 30,000 square feet and also a saturated thickness of 40 feet. This assumption is based on only one data point. Overall, the impacted groundwater volume appears to be overestimated.*

Response: The 40 foot estimated thickness of contaminated groundwater in the upper portion of the aquifer on the northeast portion of the KRY Site is supported by site data and based on reasonable assumptions. As stated in response to General Comment #3, the presence of a disconnected perched aquifer is not supported by site data, and therefore the assertion that the contaminated thickness of this perched groundwater is only 0-5 feet thick is also not supported. Rather, site data indicates that the finer-grained silty clay layer present in the shallow aquifer is fully saturated with groundwater which contains significant contamination at depth. Monitoring well KPT-18 shows an exceedance of C9 – C10 aromatics above the cleanup level and this well is screened to a maximum depth of 28 feet beneath the water table. Because contamination is present at least 28 feet below the water table, it is reasonable to conclude a total thickness of 40 feet for estimating the volume of contaminated groundwater for this portion of the KRY Site. Further, variations in total volumes of contaminated groundwater will only incrementally effect the cost of cleanup, and do not effect the selection of the remedial alternative. See response to General Comment #7 for a detailed discussion of the estimated thickness of contaminated groundwater at the bottom of the aquifer near KRY-129B.

5. *Page 28, and Table F-7 – soil volumes. Page 28 states that the total volume of contaminated surface soil is 21,000 cy. The total volume of contaminated subsurface soil is 114,000 cy. Table F-7 states that a total of 73,000 cy of petroleum contaminated soil is shipped offsite for disposal, and 69,000 cy of dioxin contaminated soil is shipped offsite for disposal – a total of 142,000 cy. The total listed on F-7 (142,000 cy) is greater than the totals listed on page 28 (135,000 cy). Page 28 is also missing the details regarding soil volumes for different COCs. Page*

66 in the report states that the total amount of soil removal and disposal is 142,000 cy.

Response: As the commenter notes, the use of soil volumes was not consistent throughout the Final Draft FS. DEQ corrected the estimated volumes in the Final FS. Additionally, estimated soil volumes have changed as a result of new figures depicting the extent of soil contamination, which were generated as a result of comments made on the FS and Proposed Plan. Discussions of estimated soil volumes were revised throughout the FS to reflect the most current information, and the revised figures were included in the Final FS. The ROD includes the revised volume and cleanup cost estimates.

6. *Page 28, Section 3.3.2, last paragraph, it appears the LNAPL volume is based on LNAPL thickness observed in wells. This approach could overestimate the volume of LNAPL because the oil saturation in the formation, depending on the location of the LNAPL, is likely less than the thickness measured in the well.*

Response: DEQ agrees that the LNAPL thickness measured in monitoring wells may over-estimate the thicknesses of LNAPL present in the formation. Although text in Section 3.3.2 and in Table 3-5 states that the calculated volumes are “worst case,” DEQ added additional clarification to the FS text, the table, and the revised LNAPL figure (Figure 3-7 in the Final FS).

7. *Page 34, first paragraph. The text states that natural attenuation of PCP is limited. Figure 1 (attached to the Proposed Plan comments) illustrates that degradation of PCP in groundwater is occurring at this site and that concentrations have decreased on the order of 100 to 1000 times as indicated by the past 10 to 20 years of groundwater monitoring at the site. See General Comments on the Proposed Plan for more details.*

Response: DEQ agrees that natural attenuation is occurring to some degree. However, it is misleading to refer to the decrease in PCP concentrations (noted in the comment as being on the order of 100 to 1000 times) in ENSR’s Figure 1 as being the result of natural attenuation. Five of the six monitoring wells are either directly down gradient or within the zone of influence of the chemical oxidation system that has operated since the late 1990s (both pilot-scale and full-scale). Other activities that occurred during the study period depicted on ENSR’s Figure 1 that may have reduced groundwater concentrations include ceasing pole treating operations, dismantling the wood treating equipment, removal of vats containing PCP, and excavation of some PCP-contaminated soils. It is more likely that the significant decreases noted in PCP concentrations are due to the presence and continued operation of the chemical oxidation system and the other interim activities noted above rather than solely natural attenuation.

8. *Page 42, Section 4.2.9.1, second paragraph. The fourth sentence is an incomplete sentence.*

Response: This sentence is not incomplete and no change will be made.

9. *Page 43, Section 4.2.9.1, last paragraph. Third to last sentence is an incomplete sentence.*

Response: This sentence is not incomplete and no change will be made.

10. *Page 51, Section 4.2.14.2, Solidification/Stabilization. This technology was not further retained because of “its limited effectiveness on most of the COCs and the KRY site”. It is our experience that insitu solidification using primarily a cement-based grout can be effective in reducing the mobility of organic wastes. There are a number of successful case histories where the technology has been used on wood treating sites, refineries and manufactured gas plant sites, all with organic contaminants. Insitu solidification also has been shown effective for inorganic contaminants. The technology may not be effective on all contaminants on the combined KRY site, but the technology should be considered for use on portions of the site.*

Response: As detailed in the response to General Comment #8 above, DEQ agrees that solidification/stabilization may have application for select areas or COCs on the KRY Site, and it will be retained for ex situ soil treatment. The technology has not been retained for in situ soil treatment as implementation could be complicated due to the following factors: 1) potential difficulties in adequately delivering agent throughout the subsurface due to the variable lithologies; 2) difficulties associated with determining extent of contamination in subsurface soils; 3) presence of multiple COCs in potential areas of application; and 4) difficulties associated with sampling and testing of solidified/stabilized material. The Final FS has been revised as indicated in the response to General Comment #8. No additional cost estimates were generated as a result of retaining solidification/stabilization, as the technology falls under the category of ex situ soil treatment, and a separate technology (landfarming) was used to develop a cost estimate for this category. The Proposed Plan and ROD include costs specific to ex situ solidification/stabilization of lead contaminated soils.

11. *Page 57, Section 5.3.1. last paragraph discusses the array of wells needed for LNAPL extraction on KPT and Reliance. In BNSF’s experience, recovery of LNAPL by pumping will likely not be effective due to the low transmissivity of the LNAPL on the KPT site. Skimming systems were not able to pump LNAPL effectively; a great deal of water was produced without LNAPL. We expect the LNAPL transmissivity to be lower on the Reliance site due to the more viscous nature of the LNAPL found there (bunker C oil vs. diesel on the KPT site) and LNAPL extraction by pumping wells would be ineffective.*

Response: DEQ recognizes that the success of free product recovery may be based on many different variables. DEQ’s experience demonstrates that the design, installation, and optimization of a free product recovery system are critical factors for successfully

removing free product from the water table. With the proper design, system installation, and post-installation optimization, free product can be recovered and cleanup standards met. DEQ acknowledges that product recovery may vary across different portions of the KRY Site. The remedy for the more viscous free product and sludge (DEQ does not agree that it is Bunker C) on the northeast portion of the KRY Site is excavation along with contaminated soils to ensure adequate removal of the source, including but not limited to the use of booms or skimmers to remove any product which is floating on the surface of the groundwater. However, for other portions of the KRY Site, it is premature to determine that extraction by pumping wells would be ineffective. The ROD requires pilot tests to optimize system design for free product recovery at the KRY Site. Based on the results of the pilot tests, DEQ will determine the most effective method(s) that will be employed to recover the less viscous free-product at the KRY Site. DEQ revised the FS to indicate that the potential for optimal recovery of more viscous free product is less favorable. Pilot testing is required to determine the most favorable design for recovering the less viscous free-product. Free-product must be removed from the groundwater to the maximum extent practicable. DEQ has determined this means removing free-product until a threshold thickness of 1/8 inch or less of free-product is present over a two year, semi-annual monitoring period. The requirement to remove free product to the maximum extent practicable is a requirement of the ERCLs, including the Underground Storage Tanks and Water Quality standards, as well as the requirement for the remedy to protect public health, safety, and welfare and the environment. DEQ's determination that the removal to 1/8 inch or less is required for free product is from two UST regulations: 40 CFR 280.64 provides that where investigations in connection with leaking underground storage tanks reveal the presence of free product, owners and operators must remove free product to the maximum extent practicable as determined by the implementing agency. The equivalent state regulation is found at ARM 17.56.602(1)(c). Also, 40 CFR 280.43 specifies groundwater monitoring requirements for underground storage tanks and requires that the monitoring methods used be able to detect the presence of at least 1/8 of an inch of free product on top of the groundwater in the monitoring wells. The equivalent state regulation is found at ARM 17.56.407(1)(f)(vi). In addition, to meet water quality standards, including groundwater standards and the prohibition on pollution of State waters, and be protective of the environment, removal of free product to the maximum extent practicable is necessary.

Part of the selected remedy includes MNA after source removal for petroleum contamination. DEQ considered EPA's guidance document, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action and Underground Storage Tank Sites*, to evaluate when natural attenuation is an appropriate alternative for corrective action (EPA 1999b). The natural attenuation guidance states, "[MNA] alone is generally not sufficient to remediate petroleum release sites. Implementation of source control measures in conjunction with [MNA] is almost always necessary. Other controls (e.g., institutional controls), in accordance with applicable state and federal requirements, may also be necessary to ensure protection of human health and the environment."

DEQ recognizes that what is practicable is not certain until after free product recovery efforts have been conducted. Therefore, DEQ has included a provision in the ROD that

allows DEQ to determine, after recovery efforts, that in certain soils and in certain circumstances, recovery to 1/8" may not be practicable. This highlights the importance of the design, installation, and optimization of the free product recovery system.

12. *Page 58, Section 5.3.2, second paragraph. Discussion of trench needed to a 20 feet depth for LNAPL extraction is too deep. On most of Reliance, depth to LNAPL is 10 to 15 feet where the LNAPL is perched on the clay material across most the Reliance site.*

Response: Table 2-2 of the FS indicates that LNAPL was present at depths of 20.90 feet, 20.84 feet, 18.06 feet, and 20 feet in wells KRY-136, KRY-138, GWRR-5, and GWRR-9, respectively for the February 2007 measuring event. Using these measurement depths, and subtracting for maximum well stick-up of approximately 3 feet, results in LNAPL depths in these wells range from approximately 15 to 18 feet bgs. With product detected at these depths (up to 18 feet bgs), an approximate 20 feet deep trench would be required. The ROD clarifies that the remedy for the more viscous free product and sludge is excavation along with contaminated soils to ensure adequate removal of the source, including but not limited to the use of booms or skimmers to remove any product that is floating on the surface of the groundwater in the open excavation.

13. *Page 64, Section 5.4.3 second paragraph in section. The "rebound" of PCP is a function of the LNAPL and residual hydrocarbons downgradient of the current treatment system and not a function of the system's ineffectiveness. The PCP concentrations have been decreasing in this area indicating that PCP source control at the KPT site is effective. The proposed configuration of approximately 950 injection points across KRY (paragraph three) is excessive.*

Response: Page 64, Section 5.4.3 of the Final Draft FS states that "...PCP concentrations appear to be reduced in the immediate vicinity of the ozone injection barrier and that these reduced levels may reflect the destruction of PCP in the dissolved phase by the ozone treatment." The FS further states that "...LNAPL is still present downgradient of the barrier, as evidenced by free product measurements in downgradient monitoring wells" and acknowledges that the PCP concentrations in downgradient wells may result from the solubilization of PCP from the LNAPL into the dissolved phase downgradient of the barrier. As indicated by responses to other comments, contaminated vadose zone soils are also a continuing source of contamination to groundwater.

DEQ recognizes that PCP concentrations appear to be decreasing as a result of treating part of the source west of Flathead Drive. DEQ selected chemical oxidation as the remedy for cleaning up the dissolved phase contaminated groundwater and the ROD clarifies that pilot testing is required to determine the most appropriate oxidant, the site-specific treatment timeframe, and to optimize system design. DEQ will utilize the results of the pilot test to determine the most effective design parameters for addressing the dissolved phase contaminated groundwater plume. The design

parameters noted in the Final Draft FS (950 injection points and two ozone systems) were developed for cost estimating purposes. DEQ revised the conceptual design during development of the Proposed Plan, which resulted in a different conceptual design with revised costs. DEQ revised the FS to incorporate the Proposed Plan conceptual design and costs.

14. Page 65, Section 5.5.1, last paragraph, second sentence. A cap would reduce the mobility of COCs. The third sentence in the paragraph explains this mechanism for reduction in mobility. The second sentence should be modified so that it does not disagree with the third sentence in the paragraph.

Response: To address this comment, DEQ will revise the second sentence to read as follows: “Installation of a permanent cap does not reduce the toxicity or volume of hazardous waste, but may partially reduce the mobility of a hazardous waste.” Please see previous responses to comments on soil barriers.

15. Page 66, Section 5.5.3. The discussion of 142,000 cubic yards disagrees with the volume on Figure 3-2B.

Response: The discussion and volumes have been revised in the Final FS. Please see previous comment responses regarding soil volumes.

16. Page 66. The text references Table 5-1 for associated assumptions for excavation and offsite disposal. Table 5-1 could not be located.

Response: Table 5-1 was inadvertently left out of the Final Draft FS, although the information provided in the table is also provided in the detailed descriptions of alternatives in Section 5.0. Table 5-1 has been included in the Final FS.

17. Section 6.3.6. Cost of \$14,211,400 – is this in addition to existing system or does it take into account the existing system?

Response: The cost listed for the conceptually designed system does not take into account costs associated with the current ozonation system installed by BNSF. However, the conceptual design does assume that the current system will continue to operate as shown in the conceptual design figure (Proposed Plan Figure 11 and ROD Figure 16).

Figure Comments

1. Figures 2-7, 2-8, and 2-9. The groundwater flow of the unconfined aquifer should be defined by wells constructed within it. Wells completed across much of Reliance and Yale measure perched aquifer. The upper unconfined aquifer flow direction (Figures 2-7 and 2-9) mimics the southeasterly flow of the lower unconfined aquifer as mapped on Figure 2-8. The flow direction of perched water more likely is driven by the topography of the clay beds beneath Reliance and Yale.

Response: As noted in the response to General Comment #3, a perched aquifer does not exist separate and unconnected from the main unconfined aquifer beneath the KRY Site. DEQ agrees that the underlying layers of finer-grained materials exhibit lower permeability and slows, but does not prevent, the downward movement of groundwater through those layers. This characteristic produces the observable groundwater mounds above these layers and the outward radial flow of groundwater on the flanks of these mounds. This radial flow may be influenced to a minimal degree by the upper topography of the lower-permeability silty clay that underlies the mounds, but groundwater flow in unconfined aquifers is dominantly controlled by the water table topography. Because this mounded groundwater is connected and directly interacting with the rest of the groundwater and associated contaminants in the unconfined aquifer below the KRY Site, DEQ finds it is appropriate to include groundwater information from all the monitoring wells in Figures 2-7, 2-8, and 2-9. To clarify the average site groundwater flow directions, DEQ will add the following as a note on Figures 2-7, 2-8, 2-9, as well as new Figure 2-10: “The primary flow direction in the aquifer is toward the southeast; however, mounding that is evident in several areas may cause localized flow patterns that are different from the primary aquifer flow direction.”

2. *Figure 3-1. The dioxin distribution around KRY-129B, KRY-123A, and GWY-10 seem to be outliers based on information from single sample points and no obvious nearby sources. Same comment for hydrocarbons and PCP at KRY-129B.*

Response: DEQ does not agree that there are no obvious nearby sources of contamination for the dioxin/furan detections in these wells. The proximity of these wells to other contaminated wells, the historic presence of contamination in GWY-10 and other nearby wells (GWY-12, GWY-13, GWY-14, GWY-4, and CLCW-1), and/or their location on the KRY Site all aid in identifying the source of contamination. KRY-129B includes PCP at a concentration significantly above Montana’s water quality standard, and the detection of dioxins/furans in that well is likely tied to the presence of PCP (ATSDR, 2001a). PCP was also detected in well KRY-121B and other upgradient wells, which connects contamination emanating from the former woodtreating area to the contamination in well KRY-129B. Additionally, the wells on the southeastern portion of the KRY Site, including well GWY-10, have historically had detections of PCP and/or dioxins/furans; therefore, the dioxin/furan detection in that well is not an outlier. KRY-123A is located on the northeastern portion of the KRY Site near residential wells where PCP has been periodically detected. Petroleum hydrocarbons are not depicted in the figure as being above cleanup levels at well KRY-129B. Subsequent sampling of well KRY-129B in September 2007 confirmed the presence of PCP and dioxins/furans. No revisions were made to Figure 3-1.

3. *Figure 3-2A. The extent of impacted surface soil, particularly for PCP and petroleum hydrocarbons is based on samples dating back to 1989. Given probable weathering/degradation effects, current conditions may not exceed cleanup levels everywhere shown. Also Figure 3-2B shows PCP exceedances over the area*

backfilled following excavation in 1999 (one pre-excavation and one post excavation sample).

Response: DEQ compiled all available useable data in the Data Summary Report (DSR) when possible to avoid duplication of previous sampling efforts (TtEMI 2005). Older data was used, if valid, and additional samples were collected during the RI to further define the nature and extent of contamination, and to confirm current conditions, where needed. Therefore, areas of contamination depicted in the figure may include a combination of older data and new data. While it is possible that the concentrations depicted by the older data may be slightly lower today than when the samples were originally collected, the exceedances in the newer RI samples that are located in the vicinity provide evidence that exceedances still exist in the area, and therefore DEQ determined it is appropriate to use the older data to help depict the area of contamination. DEQ did take into account the interim action conducted on behalf of BNSF in 1999 in the former woodtreating area and samples collected in that area prior to excavation (i.e., samples collected from soils that were later excavated) were not used to define the extent of contamination. During the RI, DEQ collected additional samples from former woodtreating area to characterize the current conditions in the area of the excavation, since the excavation was not meant to be a final cleanup and some contaminated soils were expected to remain. Given the presence of surface soil contamination surrounding the backfilled area, DEQ suspected that the surface soils in the backfilled area may have been recontaminated as a result of property use and traffic. RI sampling confirmed that contamination existed at concentrations exceeding cleanup levels both below and within the backfilled material. DEQ noted that sample location SS-9-A-98, a sample collected prior to the interim action and subsequently excavated, was inadvertently included in Figures 3-2A and 3-2B of the FS. These figures were revised to remove this sample location, which does not change the extent of contamination depicted in the figures as the sample location is surrounded by other samples that demonstrate exceedences of cleanup levels. These revised figures are also included in the ROD.

4. *Figure 3-4. The LNAPL plume from KPT across Reliance is not continuous as shown on the figure. There are distinct differences in the physical and chemical nature of the LNAPL between these areas (i.e., KPT is a fuel oil with PCP, Reliance is weathered crude/bunker oil). Additionally, the geology changes from KPT to Reliance from predominantly unconfined aquifer consisting of sand and gravel to a perched water table system above a thick clay at the Reliance site. These conditions lend themselves to different remedial alternatives. It should also be noted that some of the northern Reliance property north of the RR tracks contains perched hydrocarbons in the smear zone not portrayed on the figure.*

Response: The LNAPL plumes on the eastern and western portions of the KRY Site are commingled and DEQ does not agree that they are not continuous. There are some physical and chemical characteristics of the LNAPL between the two that are different. DEQ does not agree that the viscous product present at the KRY Site is bunker C. DEQ also does not agree that a perched groundwater system exists. Please

see responses to General Comments #3 and #6. DEQ considered the hydrogeologic, chemical, and physical differences across the KRY Site in selecting the proposed remedy. As a result, DEQ determined that excavation to the water table and potentially use of absorbent material will be used to cleanup free product on the eastern portion of the KRY Site where free-product is more viscous while free product recovery via wells will occur on portions of the KRY Site where free-product is less viscous. DEQ revised the figure in the FS and ROD to better reflect areas where commingling of free-product occurs and the LNAPL north of the railroad tracks has been included.

Table Comments

1. *Table 3-2. Methylene Chloride, listed as a soil COC, is a common laboratory artifact.*

Response: DEQ understands that methylene chloride is commonly used in laboratories. However, following the National Functional Guidelines for Superfund Organic Methods Data Review (EPA 2007), DEQ cannot screen out methylene chloride as a laboratory artifact without evidence to support that conclusion, and the data validation process did not identify it as a laboratory contaminant (see Appendix H of the RI).

2. *Table 3-7. The average thickness for LNAPL at the KRY site is used in the LNAPL volume calculations. Actual volumes of LNAPL are likely much lower.*

Response: DEQ agrees that the LNAPL thickness measured in monitoring wells may over-estimate the thicknesses of LNAPL present in the formation. Although text in Section 3.3.2 and in Table 3-5 states that the calculated volumes are “worst case,” DEQ added additional clarification to the text and the table in the Final FS and ROD.

3. *Table 6-1. No cost is listed for Alternative #9 – excavation, ex-situ treatment, and backfill.*

Response: The costs for this alternative were left out of the Draft Final FS, but the cost information was calculated and included in the Proposed Plan. In addition, the revised table is included in the Final FS and ROD.

Appendix B

1. *The modeling effort described in the FS included the use of a variety of sophisticated models including:*

- *NAS (Natural Attenuation Software). Includes dissolution and biodegradation of NAPL and includes the numerical model SEAM3D*
- *ATRANS (analytical solutions)*
- *VS2DT*
- *HELP*

NAS includes both source zone degradation and dissolved plume degradation. Its focus is on predicting the time to clean up both the source zone and plume, but does not simulate the behavior of the downgradient plume. ATRANS is used to simulate the plume.

Basically, the numerous input parameters are derived from both the literature and some site-specific values, when they exist. They generally look fine for this type of modeling effort. The modeling done in the FS is clearly stated to be a screening level effort and the assumptions are clearly presented.

This type of modeling is good for an FS level of conceptual engineering design, but is not recommended for use to make full-scale engineering design decisions that are likely to be multi-million dollar decisions. These models do not include:

- Calibration to actual site conditions, just sensitivity analyses were done.*
- Inclusion of spatial and temporal variability to parameters like variations in hydraulic conductivity in the vadose zone and aquifer or changes in time of say recharge.*
- Model predictions that can be tested.*
- Predictive error analysis.*
- Calibrations under uncertainty.*

The models used are very sophisticated in that they include many physical processes. But if the models aren't calibrated to the site conditions then how does one know how good the models fit the site conditions or how good the conceptual understanding of the site is? Even something seemingly simple as the distribution of LNAPL containing PCP can have a large impact on the plume behavior. A predictive error analysis can indicate if this is an important feature of the model that needs to be better addressed and a calibration can tell us how well the model matches actual measured site conditions. Also, if more data are necessary to make a better remediation decision, then a calibration under uncertainty can tell us the worth of collecting that data. In many instances, the worth of the additional data does not justify the cost of its collection.

In this instance, making predictions about time to reach cleanup levels at both source zones and the plume has so much uncertainty associated with it that to design and implement a large and costly engineering solution is almost certain to be over engineered.

Page B-8 of the text notes that "The partitioning behavior of PCP and the modeling results indicate that PCP sorbed to the aquifer sediment may continue to impact groundwater when the source areas are remediated. The NAPL source attenuation modeling results indicate that incomplete NAPL source removal does not provide significant improvement in source well concentrations for the conditions simulated."

In other words, source removal will not clean up the aquifer any faster than no source removal due to presence of the NAPL at the water table. Page B-10 text goes on to say that “These results indicate that the PCP contamination present in the aquifer provides a major source of groundwater contamination.”

If a groundwater model is going to be used to evaluate questions concerning remedy selection and costing, then these models need to be applied in a defensible manner. An important aspect of defensible modeling is to follow a protocol such as ASTM or USGS modeling protocols. While portions of the modeling included some of these protocols, major features were not completed including:

- The models were not calibrated to steady-state or transient conditions*
- Not enough site-specific field data was collected as input into these models. Too many important input parameters relied on either literature values, simple calculations, or output from other models as input into these models (HELP model used to generate recharge rates)*

Response: The USGS Natural Attenuation Software (NAS) and the Analytical Solutions for Three-Dimensional Solute Transport (ATRANS) models were used to estimate compliance time frames following the remediation of the contaminant sources in groundwater. The modeling was intended to provide screening-level predictions of chemical attenuation and cleanup time frames. As described in Appendix B of the FS, NAS was calibrated to PCP and dioxin/furan concentrations measured at the KRY Site using regressions performed by the NAS model. The modeling illustrates the changes in plume concentrations which occur following the remediation of source area concentrations to comply with Montana water quality standards.

At the KRY Site, PCP and dioxin/furan source area concentrations have currently not been remediated to Montana water quality standards. Model calibration to existing conditions has been performed, but model calibration to actions which have not occurred is not possible.

DEQ has determined that screening level modeling is appropriate for the current analysis. The modeling was performed to generate a general assessment of cleanup time frames for the KRY Site.

The measured organic carbon content of the subsurface soils at the KRY Site, combined with the partitioning behavior reported for PCP, indicate that PCP within the contaminated plume sorbs to aquifer soils (EPA, 1996). As groundwater is remediated, PCP sorbed to aquifer sediments may desorb and provide a source of groundwater contamination. This behavior is indicated in the DEQ modeling and the technical guidance provided by the USGS (USGS, 2003).

The NAPL source attenuation modeling indicated that incomplete NAPL source removal does not provide significant improvement in source well concentrations for

the conditions simulated. This result is consistent with contaminant behavior measured at facilities at which partial source removal has been performed.

The estimation of plume remediation time frames was performed using guidance developed by the USGS (USGS, 2003). Using this protocol, site-measured information was incorporated to describe the hydraulic conductivity, hydraulic gradient, aquifer thickness, percent organic matter, redox chemistry, and contaminant concentrations in groundwater. A steady-state calibration using measured PCP and dioxin/furan concentrations was performed using NAS.

The modeling described in Appendix B was intended to provide a general assessment of groundwater remediation time frames following active remedial efforts. As provided for in EPA guidance, DEQ performed the modeling using data that is typically collected during remedial investigations and literature values were used when site- or chemical-specific data were not available (EPA, 1998). Chemical specific parameters, including the coefficient describing chemical partitioning between groundwater and the organic carbon present in soils were taken from EPA tabulated values (EPA, 1996 and EPA 2004b). These data sources are widely used, and allow chemical-specific properties to be estimated using the database compiled by EPA.

DEQ used the models as tools to support the investigation and remediation of the KRY Site. DEQ's decision to require cleanup of the groundwater plume is based on current and historical site assessment data, and statutory requirements, including the cleanup criteria specified in Section 75-10-721, MCA. The modeling results have been incorporated into the decision making, but did not provide the sole basis for requiring groundwater remediation at the KRY Site

Soil Leaching Model Appendix D

- 1. The soil leaching model study involved using a number of sophisticated models (VS2DT and HELP, mainly) to generate dilution attenuation factors (DAF), which were then used to develop site-specific cleanup levels (SSCLs) for numerous compounds. VS2DT was used primarily to develop the DAFs. VS2DT modeling included using a high and low value for five model parameters that are supposed to represent parameters that are both sensitive and uncertain across a range of plausible conditions.*

MDEQ's effort focused on vadose zone leaching to groundwater and included simulation of numerous compounds as well as an extensive sensitivity analysis. In MDEQ's simulations, the vadose zone was considered to be impacted from either the ground surface to just above the water table or just near the ground surface. Hypothetical wells were placed on the downgradient edge of the overlying impacted soils. Predictions were made of expected concentrations near the top of the water table. This type of analysis is often referred to as an engineering "what if" type of analysis because the model is not calibrated to site conditions but instead a variety of likely model inputs are investigated and likely outcomes are predicted. An important

conclusion made by MDEQ is that PCP soil concentrations above 0.43 mg/kg will cause leaching to groundwater above the DEQ-7 water quality standard.

The major critique of this modeling investigation is that while the approach taken is adequate for a screening level exercise, it is not adequate for making multi-million dollar remediation decisions. Because of the magnitude of the financial decisions being made based on the results of this modeling effort, these models need to be applied in a defensible manner using a widely accepted protocol. Specific points of contention include:

- The VS2DT model was not calibrated to steady-state or transient site conditions. By not calibrating the model, we don't really know whether or not this model is even capable of simulating the observed conditions. Also, we don't know if the predictions made using this model, like the SSCL value for PCP, is valid or not.*
- The setup of the subsurface scenario whereby a PCP source is placed 1 meter or so above the water table appears overly conservative, as leaching to groundwater becomes almost a forgone conclusion with this setup. If PCP is located just above the water table, it likely is trapped there in the capillary fringe and got there dissolved in an LNAPL. If PCP is located near the water table, in all likelihood the groundwater is already impacted with LNAPL containing PCP trapped as residual product in the upper portions of the aquifer. If the aquifer is already impacted with LNAPL containing PCP far above 1 µg/L, then why would there be concern about leaching of low concentrations from the vadose zone into already impacted groundwater? The smear zone and LNAPL on the water table should be emphasized for clean up because, as stated in the FS, these are the primary sources to groundwater impacts.*
- Many of the model input parameters are literature or calculated values, instead of field measured values. For instance, recharge is input from results of a separate modeling effort using HELP, dispersion relies on an equation, adsorption relies on a few measurements of organic carbon fraction (2) and estimates of the partitioning coefficient (K_{oc}), Henry's Law constant, water filled porosity, air filled porosity, bulk density, etc., and biodegradation rates are literature estimates reduced by a scaling factor that supposedly better equates laboratory results to the field.*
- Even the initial concentration of contaminant in the vadose zone pore water, one of the most basic of the parameters is not known, but instead was calculated based on the soil concentration and an assumed equilibrium partitioning model.*
- No spatial variability of parameters such as hydraulic conductivity (K) is included, but instead one zone of constant K is assumed.*

- *The derivation of the SSCL is itself a calculation using a simplistic equation assuming equilibrium partitioning. Inputs to this equation are for the most part not measured field data but estimates of bulk density, partitioning coefficients, etc. along with the model derived DAF values. In summary, this model remains untested, and hence, its reliability to make accurate predictions is unknown.*

Response: The leaching to groundwater modeling determines concentrations of COCs in vadose zone soils which will not result in the contamination of groundwater above Montana's water quality standards. This modeling supports the development of cleanup criteria for vadose zone soils. These levels represent concentrations which are not anticipated to contaminate groundwater which has been remediated or is undergoing remediation.

First bullet: The scenario defined for the leaching model is consistent with guidance developed by ASTM and EPA (ASTM 1995; EPA 1996a and 1996d). In these guidance documents, soil leaching to groundwater targets are calculated to be protective of an uncontaminated aquifer. The comment discussion of calibration of the soil leaching to groundwater model is inconsistent with the condition of multiple sources of groundwater contamination at the KRY Site. The leaching model does not represent the additional sources of contamination present at the KRY Site, such as the presence of NAPLs in the aquifer or the presence of contaminated aquifer soils. Given this condition, measured chemical concentrations in groundwater (which include the effect of multiple sources of contamination) cannot be used to calibrate the leaching model.

Second bullet: The existence of multiple sources of groundwater contamination does not provide a valid argument for neglecting any of the individual sources of groundwater contamination. Montana's water quality standards are an applicable ERCL and a threshold requirement for remedy selection is compliance with ERCLs. Therefore, the emphasis in the modeling was placed on the protection of groundwater quality. Accordingly, the modeling incorporates assumptions regarding complex processes which affect the fate and transport of the chemical of concern and estimates regarding the rate of chemical biodegradation in vadose zone soils were employed. DEQ has included appropriate protective assumptions in the soil leaching to groundwater modeling to ensure that the soil cleanup levels are protective of groundwater quality.

The depiction of the extent of PCP contamination in the vicinity of the water table was interpreted directly from measured PCP concentrations presented in the RI report. Soil sample KRY 658SB003 (collected from 14 to 15.5 feet bgs) contained 318 mg/kg PCP, sample KRY659SB003 (collected from 15.5 to 17 feet bgs) contained 206 mg/kg PCP, sample KRY662SB003 (collected from 15.5 to 17 feet bgs) contained 112 mg/kg PCP, and sample KRY659SB003 (collected from 17 to 18.5 feet bgs) contained 141 mg/kg PCP. Several samples from 20 feet bgs also

contained elevated concentrations of PCP. Additionally, monitoring well KPT-2, located immediately downgradient of these soil borings, contains PCP at concentrations substantially above the groundwater cleanup level. The existence of significant contamination detected in the aquifer underlying the KRY Site is not consistent with the existence of a mechanism trapping or immobilizing PCP at the capillary fringe as suggested. As indicated in the RI, multiple sources of contamination are present, which require remediation to restore groundwater quality. **Third bullet:** The modeling was performed using data that is typically collected during remedial investigations and appropriate literature values were used when site or chemical specific data were not available. Site specific data were used for model parameters including:

- Hydraulic conductivity;
- Hydraulic gradient;
- Dimensions of vadose zone soil contamination;
- Soil pH, porosity, and specific gravity (used to compute soil density)
- Local precipitation data (used to estimate infiltration rate)
- Soil fraction of organic carbon (foc)

DEQ found that the data generated by the multiple investigations performed at the KRY Site were adequate to proceed with the calculation of cleanup levels and the evaluation of remedial alternatives.

Fourth bullet: The assumption of equilibrium chemical partitioning is consistent with EPA guidance (EPA 1996a and 1996d), and is incorporated in computer models developed by USGS (VS2DT, NAS) and EPA (Bioscreen, Bioplume III, Biochlor). The alternative to equilibrium partitioning models is a more complicated approach that attempts to represent the kinetics of the chemical partitioning reactions. Modeling guidance developed by the USGS (Hill 1998) states the importance of using mathematical models which are only as complex as is needed for the system being considered. DEQ concurs with this assessment, and determined that the use of the equilibrium partitioning assumption was appropriate.

DEQ's review of the ENSR model, submitted to the Court in the Risk Assessment dated August 2007, indicates that equilibrium partitioning is assumed in that modeling effort (ENSR 2007A). The ENSR model did not provide an alternate approach to the equilibrium partitioning assumption.

Fifth bullet: The representation of hydraulic conductivity as a uniform zone is consistent with guidance developed by ASTM (ASTM 1995) and EPA (EPA 1996a and 1996d). The leaching to groundwater modeling incorporated the range (low and high values) in measured hydraulic conductivity values. This bounding approach was identified by EPA (EPA 1996a) as a mechanism to estimate the effects of likely parameter ranges on model results. A preliminary review of the ENSR model, submitted to the Court in the Risk Assessment dated August 2007, indicates that one zone of constant K is employed in the modeling effort (ENSR 2007A). The ENSR

model did not provide an alternate approach in the representation of spatial variability.

Sixth bullet: The assumption of equilibrium chemical partitioning is consistent with EPA guidance (EPA 1996a and 1996d). A preliminary review of the ENSR model, submitted to the Court in the Risk Assessment dated August 2007, indicates that equilibrium partitioning is assumed in the modeling effort (ENSR 2007A). The ENSR model did not provide an alternate approach to the equilibrium partitioning assumption.

DEQ's modeling was performed using site-measured data identified in EPA guidance for modeling the leaching to groundwater pathway (EPA 1996a and 1996d). The use of EPA-tabulated values for chemical-specific partitioning coefficients is consistent with the technical protocol for assessing chlorinated and petroleum compounds (EPA 1996a and 1996d; EPA 1998a; AFCEE 1999). EPA has compiled data on chemical characteristics to support modeling and risk assessments at contaminated facilities. DEQ has utilized this source of information, and has not identified any reason to replicate these data characterizing chemical properties.

The modeling was performed to calculate cleanup levels that are protective of human health and the environment. The types of data collected and the modeling approach employed are consistent with EPA guidance for the calculation of soil cleanup levels. DEQ did not make any changes to the model based on this comment.

Appendix C (Risk Assessment) Comments

General Comments

1. *DEQ used the risk assessment only to calculate action levels for receptors; they did not compare the action levels to the site data in the risk assessment. They did the comparison in the FS.*

Response: Comment noted. DEQ determined the COCs for the KRY Site using a comparison of generic screening levels to site-specific data. DEQ calculated site-specific risk-based cleanup levels in the risk analysis. Comparison of the risk-based cleanup levels to data collected from the KRY Site was performed in the FS.

2. *RETEC took the action level and compared it to the exposure point concentrations (EPCs), a statistical estimate of the average (95% UCL). DEQ compared the action level to each individual sample location. This is overly conservative as it assumes that the receptor has all of their contact at that location only. EPA's method assumes more appropriately that people move around within their area. This could have a big effect on the soil volume estimates.*

Response: DEQ disagrees with some of the assumptions used in ENSR's risk assessment (ENSR 2007A). In particular, ENSR makes incorrect assumptions about future land use by determining that it will remain the same as the current use (i.e., some

properties are vacant and/or fenced to control access). This is inappropriate given that BNSF and local government officials have provided information to DEQ suggesting plans to redevelop portions of the KRY Site for use by new businesses (i.e., grain elevator and/or drywall business). Additionally, ENSR's risk assessment selected COCs using background samples collected from an actively operated portion of the KRY Site, as opposed to samples collected in an undisturbed area, as is the usual practice (ENSR 2007A). DEQ consistently applies this approach at CECRA facilities. Additionally, DEQ has determined that this is an appropriate approach for calculating cleanup levels at the KRY Site. As remediation progresses and more knowledge is gained about future use of the property, DEQ may calculate 95% upper confidence limits (UCLs) for confirmation sample results, if DEQ deems it appropriate.

Specific Comments

1. *Page 3 – Tables 1-3 are not included. They provide the rationale for COPC selection but the data are not located in the FS document and need to be included.*

Response: These tables are included in the hard-copies of the FS maintained in DEQ's files and at the Flathead County Library (which is the local repository) for public review. In converting the Draft Final FS document to publish on the DEQ website, the document was corrupted and pages were placed in the wrong order or removed. DEQ was unaware of this problem until it received this comment. DEQ will ensure that this problem is addressed when it posts the Final FS to its website. Additionally, as is the usual practice, complete original hard-copies of the document will be maintained in DEQ's files and the local repository.

2. *Screening of COC – DEQ used RBSLs and new RBCA tables that were not provided and should be. Since the rational tables are not provided it is hard to follow what was done for COC selection.*

Response: These tables are included in Appendix A of the DEQ risk analysis, which is included as Appendix C to the Draft Final FS and is included in the Final FS. The location of these tables is identified in the text of the risk analysis in the first partial paragraph on page 4, where the reader is referred to Appendix A. Please see the response to the previous specific comment regarding corruption of electronic files.

3. *DEQ calculated a cPAH TEF total and then calculated total CPAH risk, the tables with these calculations were not provided and should be.*

Response: The toxicity equivalency factors (TEFs) are provided in the text of the risk analysis. As with all other compounds, the maximum detected concentration was used to calculate the toxicity equivalence and that number was used in the cleanup level calculation. The cleanup level calculation is provided in Appendix B of the risk analysis, which is included as Appendix C to the Draft Final FS, as specified in the text. In response to this comment, DEQ also included the cPAH TEQ calculation spreadsheet in the Final FS.

Kalispell Pole & Timber, Reliance Refinery, and Yale Oil Corporation State Superfund Facilities, Kalispell, Montana,

BNSF Comments on Proposed Plan (December 2007)

Summary

1. *The Proposed Plan contains approaches for cleanup of the KRY site that are site specific and chemical specific. We find the following features of the plan to be positive for the site from the standpoints of protectiveness, implementability, effectiveness and cost:*
 - *Continuation of ozonation or similar technology to treat groundwater*
 - *More focused collection of LNAPL using oil skimmers in wells*
 - *Monitored natural attenuation for lower concentrations of chemicals downgradient of source zones*
 - *Installing a soil barrier for dioxin-impacted soils that do not lend themselves to treatment by bioremediation and for PCP-impacted soils where not co-located with dioxin soils, thus allowing for beneficial reuse of the site*
 - *Excavation of sludge on the Reliance Refinery for on-site treatment and/or off-site disposal, whichever is determined to be the most cost-effective option during remedial design*
 - *Collection of treatability data on the viability of reaching PCP cleanup goals with bioremediation*

Response: DEQ appreciates the commenter's agreements with some components of the remedy. However, the commenter did not accurately summarize all of the proposed alternative. The Proposed Plan did not specify that oil skimmers would be used to collect LNAPL from wells. Rather the plan calls for pilot testing of various recovery technologies, one of which may be skimmers, to optimize system design. The Proposed Plan did not specify that MNA would be selected to address contamination downgradient of source areas. Rather, the proposal recommended MNA for petroleum compounds and metals after source removal. While the Proposed Plan does state that a soil barrier may be installed for dioxin-impacted soils if bioremediation of these soils in an LTU is unsuccessful, the plan does not propose to cap in place PCP-impacted soils. The Proposed Plan states that sludge present on the northeastern portion of the KRY Site will be excavated and disposed of offsite with a preference for recycling, if possible. With the exception of sludge material that is unable to be separated from soil, which would be excavated and treated in an LTU, the plan does not suggest that sludge would be treated onsite. Lastly, the Proposed Plan identifies the need for treatability testing for the LTUs to determine site-specific treatment timeframes and to optimize system design but does not propose the need for

treatability testing on the viability of the option. The ROD confirms that this treatability testing will occur during remedial design and sets forth the remedy for the different contaminant sources identified in the comment.

2. *We recommend that MDEQ consider the following to address groundwater impacts:*
 - *Use ozone (or enhanced oxidant) treatment of groundwater to achieve DEQ-7 standards in a reasonable period of time (i.e., use this technology to aggressively treat the smear zone soils that are the greatest contributors to dissolved PCP in groundwater)*

Response: DEQ's selected remedy includes use of a chemical oxidation system to treat groundwater to Montana's water quality (DEQ-7) standards after excavation of contaminated source area soils in the former wood treatment area down to the water table. This excavation down to the water table will remove the contaminated soils, including those at the smear zone, and follow-up with chemical oxidation will help remediate any contamination remaining in smear zone soils not removed by excavation. Outside of the former woodtreating area, where overlying soils are not contaminated above cleanup levels, the chemical oxidation system will be used to treat the smear zone soils. Additionally, free product recovery will be performed to remove the product that continues to act as a source of contamination to smear zone soils and groundwater.

General Comments

1. *There are many areas of agreement with the MDEQ Proposed Plan for cleanup and approach to cleanup that BNSF presented to MDEQ in early November, 2007 (see Appendix A).*

Specifically, these areas include:

- a. *Combination of remedial alternatives to address the area and types of chemicals of concern present in soil and groundwater in those areas. For example, lead is only found in soil at the southern end of Reliance and it is appropriate to address the lead separately from, say, the PCP impacts in surface soil at the KPT property as MDEQ has described in the plan.*

Response: Comment noted.

- b. *Ozonation treatment of groundwater – BNSF has found that within the area of influence of the north and south in situ ozonation system (ISOS) barriers, concentrations of PCP and petroleum hydrocarbons have decreased to below the PCP DEQ-7 standard in numerous wells and over 99% in many other wells during three years of ozone treatment at the KPT site. The semi-annual and interim monitoring results indicate the technology is effective at reducing the mass of PCP in the dissolved phase of groundwater in the source zones. The feasibility of enhancing the in situ ozonation technology using liquid oxidants was*

evaluated by recent drilling technology pilot testing and oxidant bench scale testing. The pilot and bench testing have shown to be effective and BNSF would like to use that technology during the summer of 2008 to further treat smear zone hot spots at the KPT site. More information on these tests is provided below.

Response: DEQ agrees that the current chemical oxidation system operating on the western portion of the KRY Site has demonstrated effectiveness at reducing dissolved phase contaminant concentrations in groundwater within its area of influence. DEQ will consider the results of the recent drilling technology pilot testing and oxidant bench scale testing and DEQ will determine the pilot test design required as part of remedial design.

c. LNAPL removal in the source area – BNSF is currently removing LNAPL in the source area at the KPT site using passive absorbent socks. MDEQ suggests enhanced recovery with additional wells using belt skimmers (as described by MDEQ during a December 20, 2007, meeting between BNSF and MDEQ). BNSF has used belt skimmers at the site with limited success so the use of different belts is considered a good approach for free product removal.

Response: The ROD clarifies that free-product recovery pilot testing using, for example, wells or trenches will be conducted as part of remedial design and DEQ will determine the most effective approach to employ during remedial design of the free product recovery system for the less viscous product at the KRY Site. In the December 2007 meeting referenced above, DEQ suggested that one type of skimming device may be pilot tested, among other technologies. DEQ appreciates BNSF sharing its experience with belt skimmers at the KRY Site and will take this into consideration when evaluating the design of the pilot test. However, it is important to note that recovery rates may be increased when groundwater gradients are increased toward pumping locations, which will also be evaluated during the pilot testing.

d. Bioremediation of petroleum hydrocarbon sludges and soils – this is a proven technology and is used at many sites and BNSF agrees with its use for petroleum hydrocarbon sludges and soils. Our experience with land treatment of pentachlorophenol-impacted soils is that land treatment can be effective but target cleanup goals proposed by MDEQ may not be achievable and treatment goals should be tied to results of treatability testing.

Response: The development of cleanup levels is driven by the requirement in CECRA to protect public health, safety, and welfare and the environment. It is not appropriate to manipulate cleanup levels based on concerns with respect to the limits of certain technologies as is suggested by the commenter. The ROD requires treatability testing for the LTUs to optimize system design and confirms that this testing will be done during remedial design. Please refer to other responses regarding achieving soil cleanup levels through land treatment. Additionally, DEQ has determined that it will provide the option, once LTU soils

have reached the direct contact cleanup level for commercial/industrial exposure of 98 mg/kg for surface soil or 650 mg/kg for subsurface soil, depending on where the treated soil will be placed after removal, from the LTU and universal treatment standards are met, of collecting an appropriate number of samples to have analyzed for SPLP in order to determine a leachate concentration. If DEQ determines that the SPLP samples demonstrate that leachate concentrations do not pose a leaching to groundwater risk, then DEQ will allow the soil to be removed from the LTU even if the leaching to groundwater cleanup level of 0.43 mg/kg has not been reached. DEQ will also provide the option of applying this strategy to the excavation of contaminated soils, where soils are excavated until cleanup levels for direct contact are met and SPLP confirmation sampling shows that the remaining soils do not pose a leaching to groundwater risk. This approach recognizes that real world results may differ from modeled results. DEQ finds this strategy is appropriate and the ROD incorporates this approach.

- e. *Monitored Natural Attenuation in groundwater – the attached Figure 1 shows degradation of PCP over time in six wells up and downgradient of the KPT site. The well data show that PCP is naturally degrading anaerobically in the aquifer with concentration reductions on the order of 100 to 1,000 times in several wells. These data prove that natural attenuation is occurring at the site. In addition, Western Research Institute (WRI) concluded in the MDEQ RI report (Appendix A, Page 9): “The analysis of baseline microbiology of groundwater collected from all of the monitoring wells demonstrates the existence of a diversity of anaerobic bacteria...” and “dehalococcoides sp. was detected in groundwater collected from wells on the PCP contaminated sites (GWY-10 and KPT-1) indicating possible active dechlorination of PCP. Based on the data gathered to date, it appears the denitrification is a preferred microbial pathway to be enhanced to degrade constituents of concern onsite”. RETEC/ENSR’s degradation studies completed on groundwater samples collected in November 2005 and analyzed by Microbial Insights for molecular biochemical analysis showed that PCP biodegradation metabolic indicators were detected in the samples from GWY-12, GW-5 and KPT-5. This remedial alternative to monitor groundwater for these natural PCP reductions is an effective remedy and BNSF supports its application to the site.*

Response: DEQ agrees that natural attenuation is occurring to some degree, as stated in the Final FS. However, it is more likely that the significant decreases noted in PCP concentrations are due to the interim actions at the KRY Site, including the chemical oxidation system and other noted activities rather than natural attenuation. Further, the chemical oxidation system injects ozone as the chemical oxidant, which is a highly concentrated compound of pure oxygen. It is expected that this introduction of oxygen leads to increasing dissolved oxygen in the groundwater, making it unsuitable for anaerobic bacterial degradation as proposed in the comment. The monitoring wells referenced by ENSR routinely report levels of dissolved oxygen greater than 0.5 mg/l, which is the maximum level where anaerobic bacteria can generally function (EPA 1998a). The ROD

identifies the remedy for PCP-contaminated groundwater as active treatment using a chemical oxidation system, not MNA. Rather, DEQ has selected MNA for petroleum hydrocarbons and metals contamination in groundwater. Active treatment is recommended for PCP due to results of modeling which show that after source removal, PCP concentrations will continue to exceed Montana's water quality standard for approximately 40 years. This length of time is unreasonable given that active treatment will speed up the process considerably.

The presence of the metals plume in the aquifer is primarily the result of free-product present at the KRY Site creating reducing conditions which mobilize metals present in the soils. Therefore, once the source of free product is removed, the reducing conditions will be removed, and the metals concentrations will decrease. Lastly, the dissolved petroleum plume does not extend much outside of the boundaries of the free product plume in the northeastern portion of the KRY Site; therefore, removal of the free product will substantially reduce the dissolved petroleum concentrations in groundwater. For the reasons stated above, MNA is an appropriate remedy for metals and petroleum contaminated groundwater, after removal of free product, but is not appropriate for PCP contaminated groundwater.

- f. Long-term monitoring – many Superfund sites currently use monitoring for evaluating performance of remedial alternatives and to confirm that remedies are protective of human health and the environment. BNSF currently monitors groundwater wells at this site on a semiannual basis and reports the data to MDEQ and agrees that collection of groundwater data over the long term is important to determine remedy effectiveness.*

Response: The ROD specifies that performance monitoring will occur and the monitoring plan will be developed during remedial design.

- 2. The Proposed Plan will be implemented in a phased approach to be determined during the Remedial Design. BNSF agrees that a phased approach for implementation of remedial measures at a complex site such as KRY is critical to success.*

Response: Comment noted. This approach has been incorporated into the ROD and will be further developed during remedial design.

- 3. In the Scope of the Preferred Remedy section (starting on page 26) there are statements that recommend possible treatability testing prior to remedy implementation for these alternatives: stabilization of lead soil; ex-situ bioremediation; free-product removal; and chemical oxidation. We strongly agree that treatability testing would be beneficial not only for developing design criteria, as described by MDEQ, but more importantly to evaluate of the applicability of the technology to the chemicals of concern and as a tool for setting realistic treatment goals for the technology.*

Normally these treatability studies are conducted as part of the RI/FS stage and not part of the remedial design phase at Superfund sites (USEPA 1988). Specifically, guidance states on page 1-9 that treatability studies are performed early in the RI process. There are potential pitfalls in issuing a ROD with treatment goals that may be difficult or impossible to realistically achieve (as we believe may be the case with current PCP goals.) If a remedy is listed in the ROD as the remedy of choice for a specific chemical and media and the treatability study shows that the remedy is no longer appropriate as proposed, what course of action will MDEQ take? Will the ROD be amended? Will ROD amendments results in a more costly cleanup? Will other remedy options be presented as contingencies? Wouldn't these other remedies be required to be presented for public comment?

We are familiar with RODs that speak to the very issue of uncertainty that bioremediation can achieve the required cleanup goals at the time the ROD is issued. The ROD for the USEPA site "Land Treatment at the Bonneville Power Administration Ross Complex" contains a multi tiered approach to the remedy where a treatment goal of 8 mg/kg PCP results in unrestricted backfill of the treated soil. If treatment is shown to be effective to achieve PCP levels between 126 and 8 mg/kg, the soil can be used as backfill with a protective soil barrier. Final results determined that the cleanup goal of 8 mg/kg could not be achieved, and the site was successfully closed with a permanent gravel barrier that was agreed upon in the ROD. Decision criteria were also included in the ROD so that it would be clear how the decision would be made.

There are ongoing treatability studies for groundwater that could be used to refine the groundwater remedy without delay. LNAPL recovery can be enhanced with oil skimmers in wells. These actions would address the groundwater receptors and LNAPL and smear zone source of PCP to groundwater and address the greatest source of PCP to the environment.

Response: DEQ evaluated the applicability of the various technologies to the chemicals of concern as part of the FS. Only technologies that are applicable to the KRY Site were retained in the FS. Data from other woodtreating sites indicates that the PCP soil cleanup level established for the KRY Site in the ROD can be achieved. For example, at the EPA Beaverwood Products site in Columbia Falls, Montana, soil concentrations were remediated from a range of 13-190 ppm down to all samples having detections of less than 1 ppm in a matter of one month (ACE 2005). This demonstrates that significant reductions in concentrations are possible. The ROD requires bench testing or pilot testing for bioremediation of contaminated soils in an LTU. Based on the results of these studies, DEQ will determine the most effective method(s) that will be employed to bioremediate the contaminated soils at the KRY Site.

If, in the future, DEQ determines that a modification to the ROD is required, DEQ intends to follow the procedures outlined in EPA's *Guide to Preparing Superfund*

Proposed Plans, Records of Decisions, and Other Remedy Selection Decision Documents. This guidance document provides various options for documenting changes to the ROD, depending on the nature of the modification. Specifically, options may include preparing a memorandum to the file, an explanation of significant difference (ESD), and a ROD amendment. DEQ will determine if additional public comment is required based upon the specifics of any modification.

DEQ researched the ROD for the EPA Bonneville Power Administration Ross Complex (Ross Site). It was implemented in the mid-1990s, before the Resource Conservation and Recovery Act (RCRA) banned land disposal of PCP contaminated soils. Soils were treated via enhanced bioremediation for approximately one year, and even then, only about 30% of the treated soils did not reach the cleanup level. With slightly more time spent in treatment, it is possible that all of the soils would have been able to reach the established cleanup level. Conditions at the Ross Site differ from the KRY Site. At the Ross Site, the PCP-contaminated soils were at the surface only, and groundwater was not impacted. At the KRY Site, subsurface soils are also contaminated with PCP, groundwater levels fluctuate approximately two feet seasonally, and groundwater is contaminated with PCP. DEQ considered the site-specific conditions at both the KRY Site and the Ross Site and determined that the Ross Site remedy is not appropriate for the KRY Site. However, the ROD for the KRY Site does provide for a multi-tiered approach for cleanup levels by allowing higher levels of PCP-contaminated soils to remain in areas where only surface soil is impacted (12 mg/kg) and the subsurface soil is not contaminated.

Additionally, DEQ has determined that it will provide the option, once LTU soils have reached the direct contact cleanup level for commercial/industrial exposure of 98 mg/kg for surface soil or 650 mg/kg for subsurface soil, depending on where the treated soil will be placed after removal, from the LTU and universal treatment standards are met, of collecting an appropriate number of samples to have analyzed for SPLP in order to determine a leachate concentration. If DEQ determines that the SPLP samples demonstrate that leachate concentrations do not pose a leaching to groundwater risk, then DEQ will allow the soil to be removed from the LTU even if the leaching to groundwater cleanup level of 0.43 mg/kg has not been reached. DEQ will also provide the option of applying this strategy to the excavation of contaminated soils, where soils are excavated until cleanup levels for direct contact are met and SPLP confirmation sampling shows that the remaining soils do not pose a leaching to groundwater risk. This approach recognizes that real world results may differ from modeled results. DEQ finds this strategy is appropriate and the ROD incorporates this approach.

DEQ understands that BNSF is undertaking additional investigations and treatability studies that may provide useful information for remedial design. DEQ will utilize the available information as appropriate in the remedial design phase.

1. *On Page 8, the plan states that “A large area of free product overlies groundwater on both the KPT and Reliance facilities...”. Figure 10 shows the extent of the LNAPL and average thickness. As stated on page 4, in 1994, free product or a product sheen was detected in most of the monitoring wells at the KPT site. During the semi-annual sampling event in October 2007, only 3 wells had measurable thickness of free product, none thicker than 0.72 inch. Based on our observations during the in situ ozonation system well installation and expansion and review of the subsurface soil sampling data from the April to August 2006 MDEQ RI field work, it appears that the LNAPL extent shown on Figure 10 might better be described as the extent of a “smear zone” of adsorbed contaminants. A smear zone also presents much different remediation challenges than an accumulation of LNAPL on groundwater.*

Response: The presence of free-product versus adsorbed residual product will be evaluated during the pilot testing for free product recovery, which will be conducted as part of remedial design. Although measurable free product was only present in three wells during the October 2007 sampling event, DEQ considers these lower measurements a seasonal response to water table fluctuations. DEQ has collected monthly water level and free product thickness measurements from wells throughout the KRY Site from July 2006 through July 2007. DEQ’s monitoring events included a larger number of wells. DEQ observed free product in significantly more wells throughout different times of the year (see Table 3-4 of the Final FS). Figure 10 of the Proposed Plan depicts an overall free product aerial extent based upon DEQ’s full year of monthly monitoring. Therefore, DEQ has reasonably assumed that LNAPL extends between wells with documented occurrences. The appropriateness of this approach is supported by the smooth and regular pattern of contour lines that are generated from the LNAPL thickness data in Figure 10 of the Proposed Plan. DEQ has added the following note to figures depicting LNAPL in the Final FS and ROD: “Note: LNAPL presence is inferred in the areas between wells with documented LNAPL occurrences.”

DEQ agrees that residual product presents different remediation challenges than an accumulation of LNAPL on groundwater. If there are limited LNAPL accumulations, then enhanced recovery techniques may be warranted and will be evaluated during the pilot testing for LNAPL removal strategies. Based upon pilot test results, DEQ will determine the most appropriate method that will be employed to recover LNAPL.

2. *Figure 10. LNAPL presence in the soil is governed by fluctuating water tables, geologic complexities and LNAPL saturation variations in the soil (RTDF, 2005). The contouring completed in Figure 10 assumes that LNAPL is present between all wells that contain LNAPL and that the LNAPL has a thickness that forms a evenly formed pancake on the water table such that it can be contoured. A more likely scenario is that the LNAPL is present at saturations where its thickness can be measured in certain areas and is not present in saturations that can be measured in wells in other areas dependant on lithology, water table elevation, etc.. A more accurate figure would show thickness at each well without contouring the data.*

Response: As indicated in the previous response, DEQ has reasonably assumed that LNAPL extends between wells with documented occurrences. The appropriateness of this approach is supported by the smooth and regular pattern of contour lines that are generated from the LNAPL thickness data in Figure 10. The presence of free-product versus residual product will be evaluated as part of the pilot tests that are necessary to optimize the system design, as specified in the ROD. In addition, a figure showing thickness at each well without contouring the data would only present information at individual monitoring points and would not demonstrate for the public the potential extent of contaminants nor provide the basis for conservative volume estimates.

In response to this comment, DEQ has added the following note to figures depicting LNAPL in the Final FS and ROD: “Note: LNAPL presence is inferred in the areas between wells with documented LNAPL occurrences.”

Page 10, Summary of Human Health and Ecological Risk Analysis

1. Areas of Agreement

- a. BNSF agrees that current and future land use for the site is primarily commercial and industrial use and it is unlikely that residential land use will move into this area. BNSF also agrees that groundwater will not be used as a drinking water source until the time when groundwater meets water quality standards.*
- b. The receptors evaluated in the risk assessment by MDEQ are the same as those evaluated by BNSF in the RETEC/ENSR risk assessment prepared in August 2007.*
- c. BNSF also agrees with MDEQ on use of the background groundwater concentration for dioxin (5.58 pg/L).*
- d. Ecological habitat is not significant.*

Response: a) Existing zoning currently allows for some residential use of the properties (Flathead 2006a and 2006b). Additionally, groundwater is already being used as a potable water source and there are no current restrictions on groundwater use. Therefore, it is imperative that institutional controls be placed on the properties within the KRY Site to ensure that residential development is prohibited and that no additional wells are installed until cleanup levels are met. It is also important to continue sampling existing residential, commercial, and industrial wells to ensure that they are not contaminated above cleanup levels.

b) DEQ and ENSR did not evaluate all of the same receptors. The most significant difference between DEQ’s risk analysis and ENSR’s risk assessment is the assumptions regarding future land use. ENSR’s risk assessment evaluates future exposures based on the assumption that future land use will stay the same as current land use (i.e., land currently vacant and/or fenced to control access will remain vacant and/or fenced to control access) (ENSR 2007A). BNSF stated in its comments a

desire to redevelop the property for beneficial use. Such development would invalidate ENSR's risk assessment exposure assumptions and the results of the risk assessment. In contrast to the assumptions used in ENSR's risk assessment, DEQ's risk analysis assumed that all property would likely be used for commercial/industrial purposes and proposed placement of institutional controls on the property to eliminate the possibility of future residential use. Additionally, ENSR's risk assessment provided no evaluation of exposure to groundwater, surface water, or volatilization of compounds from soil or groundwater to indoor air, as was done in DEQ's risk analysis. ENSR's risk assessment also did not evaluate the potential exposure of current residents via ingestion of breastmilk or produce. DEQ's risk analysis evaluated exposure to surface soil by commercial/industrial workers while ENSR's risk assessment splits this category into two types of workers: a maintenance worker (with very little exposure) and an outdoor worker. Lastly, ENSR's risk assessment only evaluates the excavation worker's exposure to subsurface soils, ignoring the fact that this worker would be required to dig through surface soil to reach subsurface soil. These are significant differences that must be noted. DEQ will provide specific comments on the ENSR risk assessment under separate cover.

c) Comment noted.

d) DEQ has determined that the risk-based cleanup levels protective of human receptors will also be protective for the type of limited ecological use the KRY Site receives.

Page 10, 2nd paragraph

- 1. The text states a site-specific fate and transport evaluation was conducted using data gathered during the RI. This is not true; most of the parameters used in the fate and transport model were not site-specific but instead literature values, that led to a very conservative evaluation, which actually has little to do with this site. The leaching evaluation conducted by ENSR/RETEC indicated that vadose zone soil is a minor source to groundwater impacts. This is an area that could use further refinement. There are more comments on the leaching evaluation below.*

Response: The modeling was performed using site-measured data identified in EPA guidance for modeling the leaching to groundwater pathway (EPA 1996a). Site specific data were used for model parameters including:

- Hydraulic conductivity;
- Hydraulic gradient;
- Dimensions of vadose zone soil contamination;
- Soil pH, porosity, and specific gravity (used to compute soil density);
- Local precipitation data (used to estimate infiltration rate); and
- Soil fraction of organic carbon (foc)

Literature values were used to model several chemical-specific properties, including the organic carbon-water partitioning coefficients (Koc), the aqueous diffusion

coefficients, and biodegradation rate constants. The use of EPA-tabulated values for modeling partitioning behavior and aqueous diffusion is consistent with the technical protocol for assessing chlorinated and petroleum compounds (EPA 1996a and 1996d; EPA 1998a; AFCEE 1999). EPA has compiled data on chemical characteristics to support modeling and risk assessments at contaminated facilities. DEQ utilized this source of information, and has not identified any reason to replicate these data characterizing chemical properties. The approach in modeling biodegradation was based on peer-reviewed scientific literature, including laboratory experiments and field case studies. DEQ used conservative estimates regarding the rate of chemical biodegradation in vadose zone sediments in the modeling to ensure that the soil cleanup levels are protective of groundwater quality. Please see the previous response regarding the soil leaching model, which refers to ENSR's use of literature values in its modeling.

Multiple sources of groundwater contamination have been identified at the KRY Site. Each of the sources of contamination, including the leaching of COCs to groundwater, must be addressed in order to remediate water quality to Montana's water quality standards.

Page 13, Soils

- 1. The text indicates that cancer risks were calculated for carcinogenic compounds in each media (surface and subsurface soil) to ensure that the total cancer risk does not exceed 1×10^{-5} or for noncarcinogens a hazard quotient of 1. However, MDEQ did not calculate cancer risk or hazard quotients, they calculated cleanup levels set at these target risk levels.*

Response: The referenced text is referring to risks associated with the cleanup levels, not the current concentrations. The cleanup levels are calculated so that the risks do not exceed 1×10^{-5} for carcinogens or a hazard index of 1 for non-carcinogens. Based on this comment, the text in the Final FS has been clarified.

- 2. The MDEQ risk assessment used a target risk level of 10^{-6} for carcinogens and a hazard quotient of 0.33 for noncarcinogens in the leaching spreadsheets attached to the risk assessment. This is inconsistent with the approach on page 13 of the Proposed Plan.*

Response: As stated on page 13 of the Proposed Plan, to ensure that cumulative risks from multiple COCs present at the KRY Site do not exceed 1×10^{-5} or a hazard index of 1, risks and hazard quotients for individual compounds must be less than 1×10^{-5} according to the number of carcinogenic compounds present or less than a hazard index of 1 for non-carcinogenic compounds according to target organs. Additionally, this approach is discussed in detail in the risk analysis, which is included in the FS as Appendix C. This approach of accounting for cumulative risks is discussed in DEQ's Voluntary Cleanup and Redevelopment Act (VCRA) Guide (DEQ 2002c), RAGS Volume 1 Part A (EPA 1989b), and RAGS Volume 1 Part B (EPA 1991). Based on this

comment, DEQ has revised the risk analysis text to further clarify this approach. The revised text is included in the Final FS and is used in the ROD.

3. *Discrepancies between the MDEQ Risk Assessment of July 20, 2007 are shown below:*

Table 3:

<i>Surface Soil COC (mg/kg)</i>	<i>RA 7/20/07</i>	<i>Proposed Plan 12/07</i>
<i>Aluminum</i>	<i>324,219</i>	<i>120,209</i>
<i>C11-C22 Aromatics</i>	<i>96,162</i>	<i>33,445</i>
<i>C9-C18 Aliphatics</i>	<i>4,782</i>	<i>2,107</i>
<i>Iron</i>	<i>202,894</i>	<i>46,868</i>

Table 4

<i>Subsurface Soil COC (mg/kg)</i>	<i>RA 7/20/07</i>	<i>Proposed Plan 12/07</i>
<i>Chromium</i>	<i>Empty cell</i>	<i>99 (leaching #)</i>

Response: With the exception of chromium in Table 4, these are not discrepancies. As stated in the risk analysis memorandum, “to ensure protection of human health and the environment, the most conservative of the leaching to groundwater cleanup levels or the direct contact cleanup levels will be used for compounds that have both. Additionally, for compounds with a leaching number for both surface soil and subsurface soil, the cleanup level for surface soil will be used where there is only surface soil contamination. If subsurface soil contamination exists, the subsurface soil leaching cleanup level will be used for both the surface and subsurface soil. Lastly, for compounds where the leaching to groundwater cleanup level is not the most conservative and where the excavation cleanup level is lower than the commercial cleanup levels, surface soil will be cleaned up to excavation cleanup levels.” While the cleanup levels for the various scenarios (direct contact, leaching) were provided in the text, the reader was referred to the tables for the applicable cleanup levels (taking into account the statements quoted above). For the “Surface Soil COCs” listed in the comment, the tables in the risk analysis identify the values listed in the “Proposed Plan 12/07” column as the applicable cleanup levels, due to the fact that the excavation cleanup level was more conservative than the commercial cleanup level.

DEQ assumes that the commenter mistakenly referenced chromium in the “Subsurface Soil COCs” column. The cleanup levels for chromium is correctly listed in the risk analysis and Proposed Plan as 150 ppm in surface soil and 20 ppm in subsurface soil. DEQ assumes the comment was meant to reference carbazole, whose leaching cleanup level was left blank in the risk analysis and a cleanup level of 99 ppm was provided in the Proposed Plan. DEQ noted the oversight in the risk analysis and the cleanup level was published in the Proposed Plan. It is included in the Final FS as well.

Page 14, Subsurface Soils

1. *The text refers the soil leaching potential to arrive at a subsurface soil cleanup level. The cleanup level for PCP is 0.43 ppm (as referred to in Table 4). The problems that we find with this leaching number calculation include:*
 - *It is based on a screening level model not calibrated to site conditions,*
 - *It assumes that in a worst case, leaching occurs from contaminated vadose zone soils immediately above the water table (not substantiated with site data),*
 - *RETEC/ENSR's leaching model evaluation (sent to MDEQ in August 2007) was calibrated to site data. These simulations indicated that the concentrations of PCP in vadose zone soils needed to account for the observed groundwater concentrations in downgradient wells would have to be much higher than what is observed in the field,*
 - *The FS report (page 15) stated that the reason for the elevated levels of PCP in groundwater was the presence of LNAPL on the water table,*
 - *Concentrations of PCP in soil at the water table are likely skewed due to LNAPL presence. Additional soil sampling could provide more reliable soil data if collected above the water table,*
 - *A screening level model was used to develop a remedial alternative costing approximately \$5 million. This is not considered appropriate from a technical standpoint for target cleanup level development.*

More details on our leaching model evaluation are in the Feasibility Study comments on Appendices B and C.

Response: First bullet: DEQ does not agree that the soil leaching to groundwater modeling was a screening level effort. The EPA developed a screening level model for chemical leaching to groundwater using equations that require a small number of soil and hydrogeologic parameters (EPA 1996a and 1996d). These equations incorporate conservative simplifying assumptions, including an infinite source of contamination, and the absence of chemical attenuation due to degradation and sorption. Soil screening levels computed by the EPA for PCP leaching to groundwater are 0.001 mg/kg and 0.03 mg/kg, using dilution attenuation factors of 1 and 20 deemed appropriate for deriving generic soil screening levels (EPA 1996a; EPA 1996d). These screening levels are significantly more conservative than the 0.43 mg/kg calculated by the more sophisticated model using site-specific data where appropriate.

The site data collected during the RI facilitated the development of a site-specific model. A finite source of PCP-contaminated soil was defined based on the soil sampling results. Chemical attenuation mechanisms, including sorption and biodegradation, were included in the DEQ model using site-measured data and a

review of scientific literature. A numerical modeling approach was utilized, and multiple model executions were performed to characterize the range in model predictions due to variations in facility and chemical characteristics. A statistical analysis of model predictions was employed to determine an upper confidence limit on predicted groundwater contaminant concentrations. The calculated site-specific cleanup level of 0.43 mg/kg for PCP exceeds the generic soil screening levels computed by the EPA. This condition reflects the use of site-specific information in the DEQ model, and the modeling approach which allowed the finite source of contamination and chemical attenuation mechanisms to be incorporated into the calculation of the cleanup level. This approach results in a cleanup level which is higher than the EPA soil screening level, yet still protective of groundwater quality.

The scenario defined for the leaching model is consistent with guidance developed by ASTM and EPA (ASTM 1995; EPA 1996a and 1996d). In these guidance documents, soil leaching to groundwater targets are calculated to be protective of an uncontaminated aquifer. The calibration of the soil leaching to groundwater model is inconsistent with the condition that multiple sources of groundwater contamination have been identified at the KRY Site. The leaching model does not represent the additional sources of groundwater contamination, such as the presence of NAPLs in the aquifer or the presence of contaminated aquifer soils. Given this condition, measured chemical concentrations in groundwater (which include the effect of multiple sources of contamination) cannot be used to calibrate the leaching model.

Second bullet: DEQ disagrees; site data from the RI does substantiate the presence of contaminated soils immediately above the water table. Soil sample KRY658SB003 (collected from 14 to 15.5 feet bgs) contained 318 mg/kg PCP, KRY659SB003 (collected from 15.5 to 17 feet bgs) contained 206 mg/kg PCP, sample KRY662SB003 (collected from 15.5 to 17 feet bgs) contained 112 mg/kg PCP, and soil sample KRY659SB003 (collected from 17 to 18.5 feet bgs) contained 141 mg/kg PCP. Several samples from 20 ft bgs also contained elevated concentrations of PCP. Additionally, monitoring well KPT-2, located immediately downgradient of these soil borings, contains PCP at concentrations substantially above the groundwater cleanup level.

Third bullet: DEQ performed a preliminary review of the ENSR modeling effort. Model input and output files documenting the ENSR model were not submitted to DEQ, prohibiting DEQ's performance of a comprehensive review. The preliminary review determined that the ENSR model is not consistent with PCP data collected at the KRY Site. The ENSR model incorporates the assumption that the lateral extent of contaminated soils is 17 meters (approximately 56 feet). The extent of PCP contamination in subsurface soils interpreted from site-measured data is illustrated in Figures 4-11A and 4-11B of the RI report. The length of contaminated soils in the direction of groundwater flow (from the northwest to southeast) is approximately 400 feet. DEQ's model incorporates the 400 foot long source, which is necessary to be protective of groundwater quality. Sensitivity analysis performed by EPA indicated that the size of the contaminated source area is one of the most sensitive parameters

in modeling chemical leaching to groundwater (EPA 1994). The ENSR model does not represent the full extent of PCP contamination revealed by the site-measured data, and cannot be used to calculate soil targets protective of Montana's water quality standards.

Fourth bullet: The existence of multiple sources of groundwater contamination does not provide a valid argument for neglecting any of the individual sources of groundwater contamination. DEQ's modeling presented in the FS indicated that PCP contamination present in the aquifer provides the major source of groundwater contamination. As indicated in the RI, multiple sources of contamination are present, which require remediation to restore groundwater quality. DEQ revised the FS to clarify that there are multiple sources of groundwater contamination, not just the LNAPL.

Fifth bullet: Approximately 254 samples have been collected from subsurface soils at various depths and analyzed for PCP. DEQ found that this data set was adequate to characterize the extent and magnitude of PCP contamination for the purpose of modeling the soil leaching to groundwater pathway and does not believe the presence of NAPL is skewing soil sample results. In a 2/24/06 letter from GeoLex, on behalf of BNSF, DEQ's proposed subsurface soil sampling plan was referred to as being "excessive" (GeoLex 2006). More soil sampling is not needed for modeling purposes.

Sixth bullet: The modeling simulates the major processes, including chemical advection, dispersion, partitioning, and biodegradation, which are anticipated to affect the fate and transport of the COCs at the KRY Site. The modeling represents flow and transport processes in the vadose zone and saturated zone using numerical modeling methods. The model utilizes site-specific data and provides DEQ with sufficient information to determine cleanup levels that are protective of human health and the environment.

DEQ is using the model as a tool to support the investigation and remediation approaches for the KRY Site. DEQ's decision to require cleanup of the groundwater plume is based on current and historical site assessment data, and statutory requirements, including the cleanup criteria specified in Section 75-10-721, MCA. The modeling results have been incorporated into the decision making, but did not provide the sole basis for requiring remediation at the KRY Site.

However, DEQ has determined that it will allow the option of demonstrating that soils treated in the LTU no longer pose a leaching to groundwater risk with field data through the use of SPLP. Once soils treated in the LTU have reached the direct contact cleanup level for either commercial/industrial exposure or excavation exposure, depending on where the soil will be placed and at what depth, upon removal from the LTU, and universal treatment standards are met, an appropriate number of samples can be collected and analyzed for SPLP in order to determine a leachate concentration. If DEQ determines the SPLP samples demonstrate that

leachate concentrations do not pose a leaching to groundwater risk, then DEQ will allow the soil to be removed from the LTU even if the leaching to groundwater cleanup level has not been reached. DEQ will also provide the option of applying this strategy to the excavation of contaminated soils, where soils are excavated until cleanup levels for direct contact are met and SPLP confirmation sampling shows that the remaining soils do not pose a leaching to groundwater risk. This approach recognizes that real world results may differ from modeled results. DEQ finds this strategy is appropriate and the ROD incorporates this approach.

2. *The text on page 10 states “DEQ compared the COC concentrations at the KRY site with generic screening levels and approved site-specific cleanup levels from other CECRA facilities,” so it appears that DEQ considered other sites when evaluating KPT risks. Other wood treating RODs in Region 8 have PCP soil cleanup levels averaging 40 ppm (Montana Pole, Idaho Pole and Broderick). Why would DEQ’s cleanup levels at KRY be so different from these other sites?*

Response: DEQ evaluated EPA’s PCP soil cleanup levels for Montana Pole (34 ppm) and Idaho Pole (48 ppm), which are two CERCLA sites in Montana. The cleanup levels for those two sites were established in 1993 and 1992, respectively (EPA 1993c, EPA 1992b). For human health, DEQ allows cleanup levels calculated based on cumulative risk levels less than or equal to a total excess cancer risk of 1×10^{-5} for cancer causing compounds or a total hazard index less than or equal to 1 for non-cancer causing compounds. All exposure assumptions must be acceptable to DEQ. EPA allows an acceptable risk range for cancer causing compounds of an increased cancer risk of 1×10^{-4} through 1×10^{-6} . It is possible that the cleanup levels EPA establishes under CERCLA will not meet the 1×10^{-5} excess cancer risk or may not be protective of leaching to groundwater. At both Montana CERCLA sites, EPA required pump and treat systems to contain and cleanup contaminated groundwater. Both pump and treat systems are continuing to operate, even though the majority of soil cleanup is complete and the soil cleanup levels EPA established were met, and will continue to operate for quite some time. This may be the result of cleanup levels not being protective of the leaching to groundwater pathway. The ROD estimated cleanup costs for Montana Pole and Idaho Pole were \$29.6 to \$54.7 million and \$9.1 million (which assumed the pump and treat system would only operate for 2 years), respectively. Those costs were calculated over 15 years ago. For comparison purposes, the FS for the KRY Site evaluated a pump and treat option (groundwater extraction and biotreatment with carbon filter polish). The costs for the pump and treat option alone at the KRY Site is approximately \$37 million. DEQ is not required to use cleanup levels that EPA has established at other sites, nor is it required to select the same remedy. Each agency evaluates site-specific conditions and makes its own risk management decisions regarding cleanup on a site-specific basis. The ROD for the KRY Site identifies the remedy that DEQ has determined best meets the CECRA cleanup criteria specified in Section 75-10-721, MCA, at a total estimated cost of approximately \$32,062,368.

3. *MDEQ’s risk assessment arrived at a subsurface soil PCP level of 650 mg/kg that would be protective of excavation workers, ENSR/RETEC’s risk assessment (sent to*

MDEQ in August 2007) arrived at a subsurface soil PCP cleanup level of 7,285 mg/kg that would be protective of excavation workers. The point here is that if not for the application of a screening level model, the PCP soil cleanup levels would be much different from a risk assessment standpoint, i.e., at least 650 mg/kg or greater.

Response: The modeling effort was not a screening level model; please refer to earlier responses to comments. Inclusion of the leaching to groundwater pathway, which results in more stringent cleanup levels, is appropriate. In order to meet the cleanup criteria specified in Section 75-10-721, MCA, DEQ must take into account the leaching to groundwater pathway. PCP is known to leach from soil to groundwater, and DEQ is required to ensure protectiveness of the groundwater and ensure that PCP concentrations are not present in excess of the 1 part per billion Montana water quality standard.

- 4. MDEQ should collect actual site data upon which to base their leaching model such as lysimeter samples recommended in USEPA guidance (1986) for unsaturated zone monitoring for land treatment units before requiring excavation of tens of thousands of yards of soil for ex-situ treatment or off-site disposal.*

Response: The comment indicates that lysimeter data should be used to evaluate soil leaching to groundwater modeling results. However, no specific examples or case studies in which a lysimeter network was designed and utilized to evaluate COC leaching to groundwater were identified. Data required for modeling chemical leaching to groundwater include contaminant concentrations, soil characteristics (soil texture, dry bulk density, soil organic carbon, and pH), and an estimate of the area and depth of contamination (EPA, 1996a). These data have been collected at the KRY Site, and used in the calculation of site-specific cleanup levels. SPLP analyses were performed on site soils, and indicate that soil leachate concentrations were several orders of magnitude above Montana's water quality standard for PCP. The existing data provide sufficient information to allow DEQ to establish appropriate cleanup levels that are protective of groundwater. The ROD provides the cleanup levels DEQ has determined for the KRY Site.

However, DEQ has determined that it will provide the option, once LTU soils have reached the direct contact cleanup level for commercial/industrial exposure of 98 mg/kg for surface soil or 650 mg/kg for subsurface soil, depending on where the treated soil will be placed after removal, from the LTU and universal treatment standards are met, of collecting an appropriate number of samples to have analyzed for SPLP in order to determine a leachate concentration. If DEQ determines that the SPLP samples demonstrate that leachate concentrations do not pose a leaching to groundwater risk, then DEQ will allow the soil to be removed from the LTU even if the leaching to groundwater cleanup level of 0.43 mg/kg has not been reached. DEQ will also provide the option of applying this strategy to the excavation of contaminated soils, where soils are excavated until cleanup levels for direct contact are met and SPLP confirmation sampling shows that the remaining soils do not pose a leaching to groundwater risk. This approach recognizes that real world results may

differ from modeled results. DEQ finds this strategy is appropriate and the ROD incorporates this approach.

Page 17, Monitored Natural Attenuation

1. *The text should also refer to the WRI evaluation of biomass in groundwater because it supports the presence of microbes that degrade PCP.*

Response: DEQ has determined that the WRI information is not necessary here as the section is meant to provide a brief description of natural attenuation and long-term monitoring and how they might be incorporated into the various alternatives. Based on this and other similar comments, the FS was amended to remove MNA from the common elements discussion and include it as a separate alternative. MNA is an alternative that is retained, but is not considered part of all alternatives as it is not appropriate in all instances. Long-term monitoring is retained as a common element and will be included in all alternatives. The ROD clarifies this approach.

Page 18, Alternative 2 – Multi-Phase Extraction and Disposal

1. *Paragraph 2. A sentence states “This technology is technically and administratively implementable at the KRY site. “ A similar statement is also found at the top of page 19, first partial paragraph. BNSF disagrees with these statements as they apply to the heavy Bunker C oil on the Reliance site. Multiphase extraction (MPE) involves simultaneous extraction of soil vapor and groundwater to remediate both types of contaminated media. The SVE technology is employed to facilitate mass removal of residual and vapor phase COCs located in the vadose zone. The application of vacuum can enhance groundwater recovery. Groundwater pump and treat involves pumping wells with ex-situ treatment and disposal. Groundwater extraction seeks to reduce the mass of dissolved and non-aqueous phase constituents and to reduce mobility of contaminant plumes by hydraulic containment. MPE addresses contamination by remediating dissolved, vapor, residual and non-aqueous phases of contamination.*

The applicability of MPE is governed by the volatility or vapor pressure of the contaminants. Therefore, MPE is most applicable to VOCs such as petroleum hydrocarbons (benzene, toluene, ethylbenzene, and xylenes) and chlorinated and nonchlorinated solvents and degreasing agents (e.g., PCE and TCE). (U.S. EPA, 1999).

In addition, the MPE technology was developed to enhance soil vapor extraction by temporarily dewatering soils below the groundwater surface and exposing these soils for enhanced vapor extraction. At sites with fine-grained, low permeability soils near the groundwater surface, a large amount of dewatering can be accomplished with a minimum amount of groundwater pumping, thus optimizing the amount of vapor extracted and the reduced groundwater treatment costs. Therefore, from a cost effectiveness perspective, the MPE technology is better suited to fine-grained, low

permeability lithology than to the coarse grained, highly permeable lithology encountered at most of the KRY site.

US Army Corps of Engineers (1999) points out that LNAPLs with a dynamic viscosity greater than 10 centistokes (including #4 and #6 fuel oil) may flow too slowly to MPE wells and therefore MPE is not considered an appropriate technology for these fuel oils (Bunker C and No. 6 fuel oil dynamic viscosity range from 100 to 660 centistokes).

Response: DEQ agrees that multi-phase extraction is not as effective with respect to PCP and hydrocarbons with higher dynamic viscosity values. Thus, DEQ chose not to include this alternative in the proposed remedy. DEQ revised the FS to clarify that the potential for optimal recovery using MPE would be less favorable for the more viscous product (DEQ does not agree that it is Bunker C) than potential recovery of the less viscous LNAPL at the KRY Site.

Page 21, Alternative 7 – Soil Barriers

- 1. Related to soil barriers, paragraph 2 contains a statement “People could still be exposed to contaminated soil and groundwater.” Soil barriers are effective at preventing exposures to people according to ASTM guidance (ASTM 1996) that states: “The user may use remediation processes to reduce concentrations of the chemical(s) of concern to levels below or equal to the target levels or to achieve exposure reduction (or elimination) through institutional controls..., or through the use of engineering controls, such as capping or hydraulic control.”*

Based on our experience, soil barrier remedial alternatives are currently used at dozens of Superfund and RCRA sites in the United States. Protective soil barriers are effectively used on sites with residential development, industrial development and commercial development, and sites without development. In all cases, there is a responsible entity named in the legal documents that is responsible for periodic scheduled inspections, and associated maintenance of the. The soil barrier monitoring and maintenance plan also spells out exactly how soil is handled in the event that the soil barrier needs to be breached for any reason. Mechanisms are put in place and attached to the property transfer documents so that responsibility for soil barrier inspections and maintenance is transferred to any new property owners. BNSF would like to have the ability for beneficial use of the site, and a barrier that allows development is desired. We suggest that the ROD include soil barriers, and further, that the makeup of the soil barrier be open enough so that future beneficial site development is viable. This can be accomplished by stating performance requirements for a barrier rather than stating prescriptively the exact components of the barrier.

Response: Please see previous responses to comments regarding soil barriers. Long-term effectiveness and reliability of barriers is difficult to ensure because of issues with maintenance. DEQ’s experience with barriers indicates that they are appropriate in certain circumstances to protect against direct contact risks when leaching to

groundwater is not an issue. Proper long term maintenance of the barrier is critical to long-term success which becomes problematic when property transfers occur or when the barrier is very large. DEQ does not typically allow a liable person, such as BNSF, to transfer its maintenance responsibility to a new owner. Additionally, a remedy that is based solely on installation of barriers to protect against direct contact risks, leaching risks, etc., would not meet all of the CECRA cleanup criteria at the KRY Site. DEQ understands that BNSF prefers to have its property available for beneficial use and the ROD provides options that will allow for more rapid reuse; however, this more rapid development may increase overall cleanup costs. Conducting a thorough cleanup of the KRY Site is the best way to enhance future beneficial use options. A soil barrier is included in the ROD for dioxin/furan-contaminated soils, which will be excavated and placed into an onsite repository. Consolidation of the dioxin/furan contaminated soils into one specific area will limit the aerial extent of the soil barrier that will prevent direct contact. In turn, the long-term maintenance and inspection needs will be limited to a smaller area rather than a large portion of the KRY Site, thus minimizing long-term operation and maintenance costs and helping ensure maintenance of the integrity of the cap over the long term. Excavation, consolidation and covering the repository with a soil barrier meet the CECRA cleanup criteria for dioxin/furan contaminated soils because these compounds do not readily leach to groundwater; the compounds are not prohibited from land disposal; and operation, maintenance, and institutional controls that preclude disturbance of the soil barrier will be easier to assure for a smaller area of the KRY Site.

Page 22, Alternatives 8 and 9– Excavation and Off-site Disposal and Excavation, Ex-Situ Treatment and Backfill

- 1. The text refers to land ban restrictions on soil containing F032 listed hazardous waste. If this soil is land banned from land disposal, how would MDEQ excavate the soil and place it in a LTU and then backfill the excavation with treated soil consistent with 40 CFR Part 268 and ARM Title 17, Chapter 53, Subchapter 11? A soil barrier could be put in place and not generate land ban concerns.*

Response: The ROD identifies ERCLs which apply to the cleanup of the KRY Site and include RCRA regulations that address the F032 listed hazardous waste. One of the identified ERCLs is 40 CFR 264.552, which allows the designation of a corrective action management unit (CAMU) located within the contiguous property where the wastes to be managed in the CAMU originated and provides requirements for siting, managing, and closing the CAMU. The CAMU-eligible waste at the KRY Site includes the F032-contaminated soil that must be managed to implement the remedy selected in the Record of Decision. Placement of this CAMU-eligible waste does not constitute land disposal of hazardous waste (see 40 CFR 264.552(a)(1)).

As EPA explained in its amendments to the CAMU rule, strict application of the RCRA regulations “discourage[ed] cleanup or the amount of wastes cleaned up” and led to “capping waste in place, or in some cases not engaging in cleanup at all. In general, these types of approaches are less desirable than remedies that involve excavation of some, or all, cleanup waste for more aggressive treatment and/or off-site disposal.” Use of a

CAMU at the KRY Site allows excavation and ex situ treatment of the F032 waste without violating RCRA.

Page 27, Soil

1(a). Excavation of Contaminated Soils and Sawdust. Excavation and treatment of approximately 42,000 cubic yards of subsurface PCP soil (soil volume data obtained from MDEQ) is based upon a screening level soil leaching model based upon unsubstantiated site data (leaching of soil to groundwater one meter above the water table). More appropriate means of establishing soil leaching levels include site risk data, soil lysimeter sampling and evaluation of other wood treating records of decisions. In addition, excavation of soil containing dioxins/furans is recommended to remove an exposure pathway that could be addressed with a soil barrier. An in-place soil barrier (i.e., an engineering control) would break the exposure pathway while at the same time acknowledging that treatment in the LTU is expected to be unsuccessful.

Dioxin/furan impacted soil has been identified on the site in both the surface and in the subsurface in areas that are co-located with PCP impacted soil and in areas separate from PCP impacted soil. The majority (by far) of surface impacted soil is dioxin/furan soil that is not co-located. Dioxin/furan impacted soil by itself (i.e., in areas where it is not co-located with PCP) is thought to have a very low potential for leaching to the groundwater and is primarily a health concern by direct contact with the soil. This coupled with the fact that treatment of dioxin/furan soil in a LTU has been ineffectual in the past suggests that the most appropriate approach to surface and subsurface dioxin/furan impacted soil that is not co-located with PCP is isolation using a barrier. A safe, protective and long term barrier can be integrated into future site development as previously stated.

Given that bioremediation of dioxin soil is generally considered ineffective (EPA/625/R-97/009), and that the final disposition of dioxin soil that goes into the LTU may in fact be that the soil is placed below a protective soil barrier on the site, the proposed plan should allow a soil barrier in place of dioxin/furan impacted soil. This remedy also lessens the volume of soil that is affected by land disposal restrictions.

Page 28 of the Proposed Plan, 2nd paragraph contains a statement “However, dioxins/furans may not be effectively treated to cleanup levels through bioremediation. If after treatment, soils contain dioxins/furans above cleanup levels, the treated soil will be placed in a repository and capped.” If these soils are destined to be capped anyway, why not use the soil barrier for dioxin/furan-impacted soils in place? Why disrupt site conditions and incur unnecessary costs for excavation? The PCP-impacted soils could also use the soil barrier to both break the surface soil exposure pathway and limit the amount of water infiltrating from the ground surface to the water table.

If MDEQ prefers treatment of PCP-impacted soil, hot spot removal of PCP soil could be excavated and treated in the LTU. The dioxin/furan-impacted soil could be left in place and capped or alternatively, these soils could be consolidated on the site and capped instead of adding thousands of cubic yards of soil to a landfarm where treatment goals could not be reached.

Response: Please see previous responses to comments regarding the modeling issue, lysimeter sampling, and cleanup levels reached at other wood treating sites. A soil barrier would not adequately address the exposure pathway for dioxin/furan contaminated soils that are co-located with PCP, as PCP contamination would remain in place that could continue to leach to groundwater (depending on the barrier material), and would continue to be mobilized due to the natural fluctuations in the water table. For dioxin/furan contaminated soils that are not co-located with PCP-impacted soils, a soil barrier may address the exposure pathway, which is why DEQ proposed a soil barrier if these soils were unable to be treated in the LTU to the cleanup levels. However, capping all these soils in place would require an extensive surface area barrier that would withstand the current and future industrial use at the KRY Site and would require maintenance in perpetuity to ensure the integrity of the remedy. A large capped area at the KRY Site would limit future development potential because institutional controls would preclude utility corridors and excavation in the capped area to ensure long-term protectiveness. There is information available suggesting that the dioxin/furan contaminated soils are unlikely to be treated to below cleanup levels via bioremediation in an LTU and this would increase the amount of soil that must be handled in the LTU. Therefore, based on this comment, DEQ reevaluated its preferred alternative for dioxin/furan contaminated soils and determined that although dioxin/furan contaminated soils were co-located with PCP contamination will be excavated and treated in the LTU, soils contaminated with dioxins/furans alone, which are not classified as F032 listed hazardous waste, will be excavated and placed into an on-site repository, rather than being treated in the LTU. As a result, the volume of PCP and dioxin/furan contaminated soil to be treated in the LTU is substantially reduced, which will also decrease both the cleanup timeframe and the overall cost. Excavation, consolidation and covering the repository with a soil cap meets the CECRA cleanup criteria for dioxin/furan contaminated soils because these compounds do not readily leach to groundwater; the compounds are not prohibited from land disposal; and operation, maintenance, and institutional controls that preclude disturbance of the soil barrier will be easier to assure for a smaller area of the KRY Site. The ROD reflects this revision to the remedy and includes revised costs.

- b. Sawdust excavation is proposed, however, no mention of investigation of sawdust or possible impacts were included in the RI. USEPA RI/FS guidance states that nature and extent of contamination are determined during the RI phase and remedies are evaluated during the FS phase (USEPA 1988). The RI did not present any data on sawdust impacts and the FS did not address any alternatives addressing sawdust in soil or groundwater. The statements in the Proposed Plan are not substantiated with site data or any other supporting technical information as to why sawdust should be*

remediated. The public has not had a chance to comment on the sawdust presence and possible need for remediation during the RI comment period because no information was provided at that time. BNSF requested further information on the sawdust concern in an email from RETEC/ENSR to MDEQ dated 1/3/08 and no information has been received at this time.

The proposed plan requires that all visible sawdust be excavated and treated on the KRY site. The plan further states: "These increased concentrations may be related to the presence of buried sawdust in this area, which is decomposing" when speculating about elevated high iron and manganese groundwater concentrations in the vicinity of KRY-103A. The presence of sawdust or its contribution to the soil and groundwater impacts at the KRY site were not included in the RI report and the extent and need for remediation of this material is unclear. The public has not had a chance to comment on the sawdust presence and possible need for remediation during the RI comment period because no information was provided at that time. Without a full understanding of the data, it is speculated that the sawdust in contact with groundwater provides a reducing local environment that promotes naturally occurring metals in the soil to go into solution. It is further speculated (again without specific data on the sawdust) that COC concentrations in the sawdust itself will be below site cleanup levels and that metals concentrations in the local soil will be no higher than background. If the sawdust does not contain COC concentrations above site cleanup levels, it is our opinion that other alternatives be explored for the metals issue attributed to the sawdust rather than assuming that the sawdust be treated in the LTU. What would be the treatment goals for the sawdust?

Response: The sawdust is referenced in the RI (see Appendix D) and DEQ revised the FS to include a discussion regarding the sawdust. Preliminary groundwater plume maps were generated in the RI for the contaminants that were most prevalent at the KRY Site. As DEQ prepared its Proposed Plan, groundwater plume maps for individual metals were generated based on the RI data which identified the source location for the metals in the northwest portion of the KRY Site. DEQ summarized the existing information regarding the buried sawdust in its Proposed Plan, thus providing the public with the opportunity to comment. DEQ received an email from ENSR on 1/3/08 regarding a request for more information on the EPA degradation rate for PCP that was used in the Proposed Plan, although there was no mention of sawdust in that email (ENSR 2008a). DEQ did not receive an email from ENSR regarding the sawdust issue until 1/28/08, and responded to that request on 2/5/08 (ENSR 2008b, DEQ 2008i).

KRY-103A is the monitoring well that was installed within the buried sawdust. A groundwater sample collected from this well indicated manganese at 2,930 ppb and iron at 8,240 ppb, both of which exceed the secondary MCLs of 50 ppb and 300 ppb, respectively. The detected manganese concentration also exceeds the human health level of 880 ppb (EPA 2004). Based on the sampling data and the low dissolved oxygen (~2 mg/L) measured in the monitoring well, DEQ assumes the sawdust may be creating reducing conditions that result from the breakdown of large volumes of

wood wastes or other organic materials (OME 2004; Welsch 1995). The reducing conditions may be mobilizing some metals from the soil, resulting in the high level of manganese seen in KRY-103A. In addition, buried sawdust can result in methane generation at explosive levels, which may create a safety issue for on-site workers. One threshold requirement for remedy selection under CECRA is protection of public health, safety, and welfare and the environment. Based on this comment, DEQ has determined that additional information on the reduction/oxidation potential is necessary before requiring excavation of the buried sawdust. Therefore, the ROD does not require excavation of the sawdust, but requires sampling of the soil gas in the sawdust area for methane and further characterization of a reducing environment. Selected remedy costs have been adjusted accordingly. Based upon the results of the sampling, DEQ will determine what actions are necessary, if any, through a memorandum to the file, an ESD, or a ROD amendment.

- b. *It is understood that there is a benefit of providing organic material to promote more vigorous biologic treatment, so some use of sawdust in the LTU may be desirable. However, the plan should not automatically assume that the best use, or reuse of the sawdust is in the LTU. In addition, the feasibility study indicates that landfarming is not an appropriate treatment for soils containing metals. The Proposed Plan should not call for complete removal and treatment of the sawdust without an understanding of its impact on the environment.*

Response: Based on this comment, the ROD does not require removal of the sawdust, but instead requires sampling of soil gas in the sawdust area for methane and further characterization of a reducing environment in order to understand the sawdust's impact to public health, safety, or welfare or the environment.

2. *Stabilization of Lead Contaminated Soil. BNSF agrees with the approach to stabilize lead-impacted soil and either backfill or transport off-site for disposal. It appears that a local landfill is considered for ultimate disposal. Has MDEQ contacted the landfill to determine if these soils would be accepted?*

Response: Lead contaminated soils will be disposed of offsite, after stabilization, if necessary and, for purposes of estimating costs, a local landfill was considered for disposal after stabilization. DEQ contacted the local landfill and was informed that after proper sampling, the local landfill will accept the soils (DEQ 2008j).

3. *Recycling of Petroleum Sludge. How was the sludge volume of 3,126 yards estimated? Figure 8 shows locations of sludge and discreet depths, but no depth intervals. Based on this map, it would appear that most of the sludge on site is mixed with material that would preclude recycling. In addition, sludge areas in the southern portion of Reliance and possibly other areas are also impacted by lead contamination. The petroleum sludge map (Figure 8) was not included in the RI or the FS. Why is this material introduced and a remedy presented at the Proposed Plan stage? The public has not had an opportunity to comment on the presence of the sludge in the RI.*

Response: The sludge volume was estimated based on assumptions of aerial extent (as depicted in Figure 8 of the Proposed Plan, which is also included in the ROD), discrete depths, and applying some assumptions regarding thickness based on those discrete depths. The ROD contains a table identifying the various assumptions used to calculate the sludge volume estimate (See Table 9). The sludge was discussed in the RI (see pages 1-8, 1-10, 2-13, etc.), the FS (see pages 5 and 14), and Proposed Plan (see pages 3, 8, and 9) all of which have been subject to public comment.

Page 28, Ex-situ Bioremediation of Soils using LTUs

1. *Land treatment units have been shown to be effective at treating wood preserving site wastes. However, there are several concerns with the way this technology is applied at this site.*
 - a. *The LTU planned for the KPT site for treatment of PCP soil will be in operation for an estimated 50 years. Removal and backfill of the soil will occur incrementally until treatment is completed, leaving an open excavation in different parts of the site for the duration of the treatment. This approach will impair the ability of the property owner to use the property for beneficial use (new tenant and beneficial use of the rail spur). How does MDEQ's Proposed Plan consider the interested parties who want to use the property and the rail spur?*

Response: Excavation and off-site disposal of contaminated soils in combination with backfill using clean fill would allow for redevelopment/reuse more rapidly than any other option. However, this is also the most expensive remedial alternative at approximately \$121 million. Therefore, DEQ evaluated remedial options through balancing of the CECRA criteria, and determined that excavation and ex-situ treatment was the best remedial alternative for the contaminated soils at the KRY Site. The 50 year timeframe used for cost estimating purposes is based on various assumptions, and will be refined based on the results of site-specific treatability studies conducted as part of the remedial design phase. Additionally, based on public comment, DEQ determined that it will not require treatment of soils contaminated with dioxins/furans only in the LTU, which will reduce the volume of soil that will be treated in the LTU. This will also reduce the operational timeframe for the LTU. DEQ anticipates that the most efficient approach is to excavate all of the contaminated soil at once, and place it in the LTU, with active treatment occurring in lifts (the top 18 to 24 inches (a lift)). Once the top lift is treated to the cleanup levels, the lift will be removed and utilized as backfill material. The ROD also allows for clean fill to backfill the excavations so that some or all of those areas may be available for reuse more rapidly or allows for treated soil to be used as backfill. Use of clean fill would likely increase the cleanup cost to some degree as treated soil would no longer be used as backfill, but may allow for more rapid reuse/redevelopment of the property. If clean fill is used to backfill the excavations, alternatives for the treated soil include regrading site topography to handle the additional volume of

soil, finding an appropriate nearby location to use the treated soil as fill, or disposing of the treated soil offsite.

- b. *The KPT LTU is slated to contain PCP impacted soil from the site, and the stated treatment goal is to reduce the PCP concentration to 0.43 mg/kg. With an assumed initial average concentration of 93.53 mg/kg, the required destruction percentage is 99.5 percent. We have not seen this level of PCP treatment in a LTU, nor have we seen this level of treatment in the literature for other sites. Documented sites that we are aware of generally have target treatment goals of somewhere around 35 to 43 mg/kg (Libby Groundwater, Idaho Pole site, Montana Pole site, Dubose Oil Products), or somewhere around 7 to 8 mg/kg (Broderick, Ross Complex). LTU treatment at the Ross Complex site was not successful in attempting to treat to 8 mg/kg PCP, so a protective surface soil barrier was employed over the backfilled PCP soil. We suggest that the treatment level of 0.43 mg/kg may be difficult to achieve even with more time allotted for treatment since some amount of the PCP may not be available for degradation. It is difficult to predict without adequate treatability testing. We suggest that the proposed plan be modified to include treatment goals as well as contingency measures such as a protective soil barrier in the event that the stated treatment goals cannot be achieved.*

Response: The treatment timeframe for remediating site soils using an LTU is dependent on several factors, including degree of residual soil impacts, soil structure (i.e., clay vs. sand vs. silt), soil moisture content, aeration, pH and nutrients. These conditions can be altered to increase the rate of contaminant degradation. The type of additions/amendments will be determined during treatability studies. Once the maximum degradation rate is achieved based on amendments such as moisture, aeration, pH adjustments, and nutrient additions, a site-specific treatment timeframe can be estimated.

The treatment time estimate in the Proposed Plan was based on an estimated degradation rate of 0.03 mg/kg/day (EPA 1996a and 1996d), and assumed a linear biodegradation rate. These assumptions were used for cost estimating purposes. DEQ will use site-specific treatability studies to verify both the degradation rate and the kinetics of reaction within the treated soil. Typically, the degradation rate is high initially, and decreases over time as the amount of bio-available carbon is reduced. Additional degradation beyond that which has been seen in the referenced site data may be achievable through application of amendments, depending on the rate limiting element. As indicated in a previous response, at the EPA Beaverwood Products site in Columbia Falls, Montana, soil concentrations were remediated from a range of 13-190 ppm down to all samples having detections of less than 1 ppm in a matter of one month (ACE 2005). The ROD clarifies that treatability studies are required prior to constructing the LTU. No contingency is incorporated in the ROD because it is premature to assume the cleanup levels cannot be met.

However, DEQ has determined that it will provide the option, once LTU soils have reached the direct contact cleanup level for commercial/industrial exposure of 98 mg/kg for surface soil or 650 mg/kg for subsurface soil, depending on where the treated soil will be placed after removal, from the LTU and universal treatment standards are met, of collecting an appropriate number of samples to have analyzed for SPLP in order to determine a leachate concentration. If DEQ determines that the SPLP samples demonstrate that leachate concentrations do not pose a leaching to groundwater risk, then DEQ will allow the soil to be removed from the LTU even if the leaching to groundwater cleanup level of 0.43 mg/kg has not been reached. DEQ will also provide the option of applying this strategy to the excavation of contaminated soils, where soils are excavated until cleanup levels for direct contact are met and SPLP confirmation sampling shows that the remaining soils do not pose a leaching to groundwater risk. This approach recognizes that real world results may differ from modeled results. DEQ finds this strategy is appropriate and the ROD incorporates this approach.

- c. *The location of the LTU on the Montana Mokko property is in an area that is saturated in the springtime and therefore would make it difficult to have the 1 meter separation from the bottom of the treatment zone to the seasonal high water table without additional clean fill and/or federal permits related to wetlands and surface waters (USEPA 1983).*

Response: The conceptual LTU location on the Montana Mokko property is shown in an area that is removed from the 100-year or 500-year floodplain (Figure 1-1 of the FS and Figure 1 of the ROD). In response to a separate comment, DEQ contacted Traci Sears-Tull of DNRC's Floodplain Program and accessed the FEMA floodplain maps to determine if floodplain maps were updated since the RI. DEQ determined that the maps were updated in September 2007 and also verified that the conceptual LTU location is still outside of the designated floodplain (FEMA 2007). A new floodplain map was generated using the new FEMA maps and has been incorporated into the Final FS and the ROD. However, DEQ recognizes that current drainage may be poor for portions of the KRY Site and this will be considered during the design phase. In addition, there do not appear to be any areas on the KRY Site that are designated as wetlands based on information obtained from the U.S. Fish & Wildlife Service Wetlands Information page (available online at <http://wetlandfws.er.usgs.gov/>). The comment regarding water levels and one meter separation and potential groundwater fluctuation is noted. Monthly static water level readings were collected at the KRY Site from June 2006 through July 2007. This data can be used to evaluate appropriate locations for the LTUs. The ROD provides that the design and location of the LTUs are conceptual and the ultimate siting of the LTUs will comply with ERCLs and will be determined during remedial design.

- d. *Soil removal for treatment in the LTU on the Reliance property includes deep removal up to 20 feet deep on the south end of the property. Would sheet piling be*

required for these excavation depths and was this considered in the cost estimate? The LTU planned for the Reliance property is shown to be constructed in the same area as the deep removal. Given that the deep excavation will not be backfilled until completion of soil treatment in the LTU, the LTU cannot be constructed over the same area that contains the deep excavation.

Response: DEQ does not anticipate the use of sheet piling for the soil excavation phase. Based on Figure 3-4 of the RI report, the lithology on the eastern portion of the KRY Site consists of silt, clay, sandy gravel and gravelly sand. If the slopes are engineered and constructed correctly, the possibility of requiring shoring is minimal.

The cost estimate assumes excavation side slopes of 3(H):1(V) with an access ramp for the heavy equipment. Additionally, there is a 25% contingency accounted for if sheet piling is required during the excavation phase on the eastern portion of the KRY Site. Based on CostWorks 2007, the unit cost for sheet piling is approximately \$24 per square foot (20 foot deep excavation, left in place) (RS Means 2008).

DEQ anticipates that the petroleum LTU will be constructed within the excavation, thereby minimizing the need to backfill prior to construction of the LTU. As each lift is treated to cleanup levels, the lift would be removed and treated soil would be temporarily stockpiled until the last lift met cleanup levels. The LTU would be shut down and the treated soil would be used to backfill the excavated LTU area. The ROD provides the option of using clean backfill instead of treated soil to allow for more rapid reuse of portions of the KRY Site.

e. Excavation and landfarming of soil in LTUs may unnecessarily increase potential for exposure to dioxins and furans.

Response: Engineering controls and construction practices are frequently employed during superfund cleanups to limit the short-term exposure to contaminants. The selected remedy requires dust control measures are implemented during excavation and land treatment activities. Air monitoring will also be conducted during implementation of the remedial action. While safety regulations are not ERCLs, they are independently applicable and health and safety plans are required. Implementation of the selected remedy must comply with all federal and state safety laws. DEQ finds that the selected remedy is protective of public health, safety, and welfare and the environment in the short and long term.

f. The Proposed Plan precludes re-use of the property for at least a decade. Engineering controls such as soil barriers would effectively prevent the exposure pathway and allow immediate reuse of portions of the site relatively quickly when combined with oxidation of subsurface soil, free product recovery, and institutional controls.

Response: The selected remedy does not preclude reuse of the KRY Site. DEQ estimated cleanup timeframes of 50 years for soil treatment and 10 for groundwater treatment. The ROD provides an option of using clean fill or treated soil to backfill excavations in order to provide more rapid reuse of the property. DEQ also reconsidered the cleanup option for dioxin/furan contaminated soils and determined that those soils will be consolidated and capped in an on-site repository. Because there are areas where only dioxin/furan contaminated soils exists, DEQ anticipates that reuse of these areas can occur as soon as the soil is excavated and the excavation is backfilled. DEQ understands that there is significant interest in reuse of the property and selected a remedy that meets the CECRA cleanup criteria in Section 75-10-721, MCA, and provides less restriction of future operations by excavating contaminated soils, consolidating them into controlled areas, and treating the PCP and petroleum contaminated soils or capping the dioxin contaminated soils in an on-site repository. Please refer to previous comments regarding soil barriers.

- g. *Excavation criteria for impacted soil are proposed by MDEQ to be LTU treatment goals. If the LTUs are proposed to be ultimately capped as a repository, there would be no need to use a leaching number based cleanup goal in a lined and soil barrier unit. In addition, if the soils are used to backfill the open excavation, average percent removals of constituents of concern is accepted practice at Superfund and RCRA sites in Montana and are shown to be protective of receptors following land treatment.*

Response: The ROD establishes the risk-based site-specific cleanup levels for the KRY Site. These cleanup levels will determine which impacted soils must be excavated and removed, but they also apply to soils that will be treated. The ROD provides that soils contaminated with dioxins/furans only may be placed in an on-site repository and capped (please refer to previous responses). DEQ anticipates that the most efficient approach is to excavate all of the PCP contaminated soil at once, and place it in the LTU, with active treatment occurring in lifts. Once the top lift is treated to at or below the cleanup levels, the lift would be removed and utilized as backfill material. However, a phased approach may also be considered during design. If dioxin/furan cleanup levels are not achieved in a lift, the soil will be moved to the dioxin/furan repository. The ROD clarifies that to determine whether a lift of soil from the LTU has been treated to the appropriate cleanup level for direct contact, an appropriate number of samples will be collected from the lift, and a 95% upper confidence level (UCL) will be applied on the mean concentration of those samples. If the 95% UCL is at or below the cleanup level, the soil in that lift will be determined to be clean and can be removed from the LTU. However, this does not apply to COCs with cleanup levels based on leaching to groundwater, which would be required to meet the established cleanup level without the use of a 95% UCL. Alternatively, DEQ has determined that it will allow the option, once LTU soils have reached the direct contact cleanup levels for commercial/industrial exposure for surface soil or subsurface soil, depending on where the treated soil will be placed after

removal from the LTU and universal treatment standards are met, of collecting an appropriate number of samples to have analyzed for SPLP in order to determine a leachate concentration. If DEQ determines that the SPLP samples demonstrate that leachate concentrations do not pose a leaching to groundwater risk, then DEQ will allow the soil to be removed from the LTU even if the soil cleanup levels based on leaching to groundwater have not been reached. DEQ will also provide the option of applying this strategy to the excavation of contaminated soils, where soils are excavated until direct contact cleanup levels are met and SPLP confirmation sampling shows that the remaining soils do not pose a leaching to groundwater risk. This approach recognizes that real world results may differ from modeled results. DEQ finds this strategy is appropriate and the ROD incorporates this approach.

- h. The proposed plan indicates that treatment in a LTU will be used to treat petroleum impacted soil on the Reliance property. It is presumed that soil will need to be treated to meet the subsurface soil cleanup levels published in the plan. An understood limitation of land farming TPH soil is that treatment is less effective on higher-end hydrocarbons, and less effective on soil that is finer grained. Since both of these conditions exist on Reliance to some degree, it becomes more difficult to predict treatment times without bench scale tests, and therefore it is much more difficult to adequately bound upper end costs. The plan should consider the possibility that a LTU may not be effective for treatment on Reliance. Given that the goal of the LTU treatment is to “reduce contaminant concentrations to levels that no longer pose a risk for leaching to groundwater”, and that there is currently not a risk of this leaching, we suggest that a soil barrier be reconsidered for the Reliance petroleum impacts.*

Response: For the purpose of responding to this comment, DEQ assumed that the commenter’s use of the term “higher-end hydrocarbons” means higher molecular weight petroleum hydrocarbons. Based on evaluations in the RI and FS reports, DEQ finds that soil excavation and LTU treatment will remediate the petroleum contaminated soils to below risk based cleanup levels. As outlined in the FS, soil barriers, as a stand-alone technology, would require a projected timeframe of over 100 years to achieve groundwater cleanup levels. Additionally, soil barriers as a stand-alone technology would not prevent the vertical migration of contaminants as seasonal groundwater fluctuations occur, and may not prevent infiltration of precipitation through the soil column where some lighter end petroleum constituents may be a continuing source of contamination leaching to groundwater. They would also preclude the removal of free product and sludge from the northeastern portion of the KRY Site. The selected remedy incorporates excavation and land treatment to meet cleanup levels in a reasonable timeframe and comply with ERCLs.

Page 28, Groundwater

- 1. The text refers to the FS in regards to the time it will take groundwater to meet cleanup levels (i.e., 40 years). As shown in Figure 1, there is a well in the*

downgradient area (KPT-5) that met DEQ-7 standards after 11 years of monitoring. Wells GWRR-12, GWRR-2 and GWY-14 met DEQ-7 standards after 13, 15, and 16 years respectively. These data are lower than the MDEQ model prediction for degradation of 100 years. Part of the difference in time to reach the DEQ-7 standard is likely related to the fact that the model looked at all site data including the source area (LNAPL). However, it should be noted that with removal/treatment of smear zone soil, the time to reach DEQ-7 standards is greatly reduced. Site data are believed more reliable than computer predictions and should be considered when estimating cleanup time and costs in the Proposed Plan.

Response: The modeling indicated that approximately 40 years would be required for the PCP plume to achieve compliance with the Montana water quality standard following the removal of the contaminant source(s) in groundwater. DEQ based this modeling analysis on site-measured attributes which affect the fate and transport of PCP. Measured PCP concentrations over time and into the future may be incorporated into an assessment to better calibrate the modeling of remediation time frames and evaluate the effectiveness of cleanup. The importance of this modeling analysis is that it reasonably predicts the compliance time for the entire groundwater PCP plume. Please note that DEQ assumed the commenter was referring to monitoring well GWY-12 when GWRR-12 was stated, since GWRR-12 does not exist. Please refer to previous responses regarding decreases in contaminant concentrations in monitoring wells at the KRY Site.

Page 29, Free-Product Removal

- 1. MDEQ stated during the December 20, 2007, meeting that belt skimmers were under consideration for the KPT site and BNSF is in agreement with this alternative. Our experience at this site is that the product is not mobile (as indicated by the 1995 product bail down tests that showed 0.37 gallon of LNAPL removed with no LNAPL migration to the well after 25 hours of monitoring indicating a very slow LNAPL recovery rate [Remediation Technologies, Inc. 1995]). Attempts at more aggressive product removal will likely not be successful as indicated by the current product recovery rates from 6 wells (totaling less than 5 gallons per year).*

Response: A review of the bail-down test shows the evacuation of approximately 75% water and 25% LNAPL. This volume of water evacuation makes it difficult to evaluate LNAPL recovery; therefore, the 1995 product bail-down test results are unreliable in selecting an appropriate LNAPL recovery technology. DEQ agrees that the data appears to show that the water table may have dropped during the last portion of the test. Aside from this observation, the data is difficult to interpret because LNAPL was not withdrawn while leaving water in the well. The assumption that because the LNAPL level had not rebounded in 25 hours "indicated that recovery rate is very slow" may or may not be accurate. The ROD requires pilot tests prior to design of the free product recovery system and a new baildown test will be included.

DEQ has determined that extrapolating product recovery rates from six wells where absorbent socks were utilized to other recovery technologies is not appropriate.

Assessing product recovery efforts based on the use of absorbent socks is difficult. The comment is misleading by stating the product recovery rates total less than five gallons per year. Based on information presented in the BNSF monitoring reports, approximately 14.6 gallons of LNAPL were recovered from January 1, 2006 to January 31, 2007, and approximately 9.5 gallons of LNAPL were recovered from February 1, 2007 to November 13, 2007 from the 6 wells (KPT-2, KPT-3, OSW-1, OSW-2, OMW-3, and OMW-5). It is unclear whether the socks were replaced at a frequency that maximizes LNAPL recovery. Recovery rates may be slower in wells where product thickness is less than 0.10 feet. Product recovery rates for wells OMW-4, KRY-114, and KRY-111A, which show the greatest average thickness of LNAPL, are not currently part of BNSF's LNAPL removal using the socks. These wells will also be evaluated during pilot tests prior to design.

Belt skimmers are only one technology that will be evaluated for use at the KRY Site. The ROD includes utilizing free-product recovery methods such as trenches or recovery wells to remove free product. The ROD also requires that pilot testing be conducted to optimize the system design. Based upon the results, DEQ will determine the most effective method of removing free product. Additional soil borings to address concerns with the potential continuity of LNAPL between wells and detailed LNAPL recovery rate information may be installed prior to system design. Slow recovery rates may be based on the natural aquifer gradient present at the particular LNAPL location. Recovery rates may be increased when groundwater gradients are increased toward pumping locations.

- 2. The plan recommends the use of wells and/or trenches to recover mobile free product to less than 1/8 inch thickness. Our experience at the KPT site indicates that slow recovery rates into wells and the limited thickness of free product will make significant mass removal from free product recovery difficult at best.*

Even if the goal of 1/8 thickness is achieved; a significant mass of diesel fuel and solubilized PCP will remain sorbed to the soils and will act as an ongoing source as it dissolves into the groundwater over time. BNSF feels that a remedial approach that results in removal or destruction of the chemicals of concern in the smear zone should be added to the remedial approach in order to meet the cleanup levels for the site.

Response: DEQ will evaluate enhanced recovery techniques during the pilot testing for LNAPL removal if traditional methods do not appear to be effective. DEQ agrees that a remedial approach is necessary to address residual contamination in the smear zone. The chemical oxidation system described in the ROD is expected to destroy petroleum contaminants that cannot be removed through product removal techniques or excavation. If product thicknesses in the aquifer are considerably thinner than the observed thickness of product in the monitoring wells, (as indicated earlier by the commenter) the resultant smear zone will be relatively thin and effectively cleaned up through use of the chemical oxidation system.

Page 29, Chemical Oxidation of Contaminated Groundwater Plume

1. *MDEQ may want to consider the following ideas related to the ozone system:*
 - a. *The plan proposes to expand the in situ ozonation system (ISOS) at the KPT facility as the full scale approach for the site groundwater remediation. The operational results of the ISOS clearly demonstrate that the mass of PCP, dioxin and diesel fuel in groundwater within the zone of influence of the ISOS has been significantly reduced. While we understand that the design of the preferred remedy is conceptual in nature and that additional design and pilot testing will be conducted, we are not confident that in situ ozonation as currently designed and shown on Figure 11 is capable of achieving the cleanup levels in a ten year timeframe.*

On page 29 of the plan, MDEQ states that “It may be possible to use another oxidant, persulfate, in place of ozone,” but qualifies the approach because it is more expensive. Up until recently BNSF would have agreed. The shallow sand and gravel units were thought to be a limit to the use of direct push drilling approaches. Therefore, only hollow stem drilling techniques were used at the site and implementation of persulfate or other liquid oxidants was not considered because of the high cost of closely spaced drilled injection wells required to accomplish effective oxidant/contaminant contact. In October 2007, BNSF conducted a pilot test using a new direct push drill rig with vibratory capabilities to determine if this approach could be successfully implemented at the site. A total of nine borings, with push rod diameters from 1.5 to 3 inches, were advanced to depths below the smear zone (approximately 24 feet bgs). The borings were located throughout the KPT facility and each boring was advanced without refusal in a very short period of time (20 to 30 minutes). The details of the direct push testing are presented in Report for Field Pilot Testing and Laboratory Bench Testing, BNSF KPT Facility, Kalispell, Montana, (Report) in attached Appendix B.

Soil samples were collected at two depths within the smear zone and were sent along with a groundwater sample to Dr. Richard Watts at Washington State University for bench scale oxidant testing. Three oxidants, modified Fenton’s, persulfate and Cool Ox™ were tested on the site samples to determine whether in situ chemical oxidation using liquid oxidants would be effective at mass reduction of contaminants in the smear zone. The bench testing indicated that both the Fenton’s method and persulfate were effective at reducing the PCP concentrations. However, because of the presence of excess persulfate at the end of the 12 week test period, it is felt that persulfate would more effectively reduce the TPH concentrations indicative of the diesel fuel over extended reaction periods. The details of the bench testing are presented in the Report, Appendix B.

Based on the results of the direct push pilot testing and the oxidant bench testing, BNSF is prepared to implement pilot testing in the summer of 2008 in several areas at the KPT facility to determine the effectiveness of persulfate injections

under field conditions. The pilot test will determine the radius of influence, persulfate concentrations, injection pressures and flow rates. The pilot testing will be conducted in several areas, specifically in the vicinity of wells OSW-1 and 2 (south barrier), KPT-5 (north barrier) and KPT-3 (upgradient area) where the extent of LNAPL and the smear zone are well defined.

Response: The ten year timeframe in the Proposed Plan was primarily used for cost estimating purposes to help understand overall remedial costs compared to other alternatives. The ROD does not prescribe that the cleanup be completed in 10 years or less. The existing operational chemical oxidation system has been shown to be effective for some portions of the KRY Site. The ROD requires treatability studies and pilot tests for chemical oxidation prior to expanding the system. Information gained from recent bench scale testing of oxidants and the drilling pilot test will be taken into consideration as well. Based upon the results of past and future treatability studies and pilot tests, DEQ will determine the most effective oxidant(s) to use and how the system needs to be expanded.

b. In situ chemical oxidation, including ozonation, persulfate injection and similar oxidant treatment of groundwater are generally more effective in areas where dissolved phase concentrations are greater than 500 mg/L (ppb). Treatment of PCP at concentrations of less than 100 to 200 ppb is generally not cost effective and therefore is not recommended in any of the downgradient areas. Please see the discussion on Monitored Natural Attenuation for our recommendation of the best alternative to address these downgradient areas where PCP concentrations range from the DEQ-7 standard to about 100 ppb. As described in General Comment No. 1e, PCP concentrations have decreased to levels below DEQ-7 standards. Aggressive treatment of the source area with ozone or another oxidant will reduce the mass in the source area and eliminate further dissolution impacts to groundwater. This effort in combination with free-product removal will reduce the PCP leaving the KPT site. Off-site PCP will be degraded anaerobically by the bacteria present in groundwater and can be easily monitored to show PCP degradation.

Response: The ROD requires active treatment of the PCP and dioxin/furan groundwater plume, including deeper portions of the aquifer. Based upon existing data, contaminated groundwater extends beyond the historical operational property boundaries and the current data does not indicate that the plume is stable or shrinking. In addition, a previous EPA hydrogeological study at the KRY Site indicates potential preferential flow for groundwater through a buried paleochannel (EPA 1992a). The RI indicates contamination east of Highway 2. The groundwater is Class I and is used to provide drinking water to some residents. The commenter previously noted that injection of persulfate via direct push methods is cost effective for treating the contaminants at the KRY Site. The ROD also specifies that the sources of groundwater contamination will be addressed through the following: 1) free product will be removed to 1/8 inch or less, if practicable; 2) PCP-contaminated soils will be excavated and treated in an

LTU; 3) soils contaminated with dioxins/furans only will be excavated, consolidated, and capped; and 4) contaminated smear zone soils will be treated with chemical oxidation.

Monitored natural attenuation for PCP and dioxin/furan contaminated groundwater will not reduce contaminant concentration to levels that meet Montana water quality standards/cleanup levels within a reasonable timeframe. Natural attenuation modeling was performed during the FS to aid in evaluation of remedial alternatives. This modeling demonstrated that with complete PCP and dioxin/furan source removal (both free-product and contamination in soil overlying the groundwater), it will take approximately 40 years for the PCP plume to meet the groundwater cleanup level, and more than 100 years for the dioxin/furan plume to meet the groundwater cleanup level. This timeframe is not reasonable given that alternatives exist to actively treat the groundwater plume to speed up the cleanup process. Removing contamination from soil, in combination with active treatment of the contaminated groundwater plume and free-product recovery, is expected to help achieve established groundwater cleanup levels.

- c. *During the December 20, 2007 meeting between BNSF and MDEQ, MDEQ expressed concern over the possibility of the ozone system pushing free product to downgradient wells. RETEC/ENSR prepared graphs of product thickness measurements for several of the wells near and downgradient of the ozone injection system. The attached figures (2 through 7) show that the free product thickness has generally decreased in these wells over time, however increases in product thickness can be seen when the water table drops (which follows a historical pattern at this site). There is no indication from the graphs that LNAPL has moved from the ozone system injection area in the downgradient direction based on historical product thickness measurements.*

Response: DEQ's voiced concern in the December 20, 2007 meeting was that the ozone system may be mobilizing free product to flow away from the treatment area, rather than "pushing free product to downgradient wells." DEQ is concerned that the ozone system may be spreading LNAPL over a larger aerial extent, thus causing "a thinner plume over a larger area." DEQ was questioning BNSF's claim that the observed reductions in LNAPL thicknesses measured in monitoring wells affected by the ozonation system are due to product destruction. DEQ does not believe that evidence exists to confirm this claim.

Also, the statement that free product thickness has generally decreased in the wells (presented in ENSR's attached Figures 2 through 7) over time is not substantiated by the data. Product thickness has increased at KRY-111A; decreased at KRY-114A from Aug-06 to Sept-06 but then has demonstrated an increasing trend since Sept-06; OMW-3 and KPT-19 have remained stable; and, OMW-5 is on a decreasing trend. The graphs indicate product thickness measurements over a period of only one annual cycle of water table elevation changes. LNAPL thicknesses must be evaluated over several years to identify

trends in a hydrologic system where water table fluctuations so significantly affect LNAPL thicknesses in monitoring wells. Any alternative that relies on the injection of materials to an aquifer, or changes natural hydraulic gradients has the possibility of affecting the movement of an overlying LNAPL plume. These potential affects will be considered during remedial design.

Page 30, Monitored Natural Attenuation for Petroleum and Metals

- 1. This section should address the use of MNA to treat PCP in groundwater. It is unclear why PCP is not mentioned in this section. PCP has clearly been shown to degrade anaerobically at the KRY site as shown in the accompanying graphs and as indicated by WRI's study results presented in the FS.*

Response: PCP is not mentioned in this sub-section because DEQ did not select MNA as the remedy for PCP in groundwater. This is explained earlier in the primary "Groundwater" section in the FS, which states "[Natural attenuation] modeling demonstrated that with complete PCP and dioxin/furan source removal..., it will take approximately 40 years for the PCP plume to meet the groundwater cleanup level. This timeframe is not reasonable given that alternatives exist to actively treat the groundwater plume to speed up the process." The ROD clarifies the remedy for the PCP-impacted groundwater is active treatment via a chemical oxidation system and free-product removal, along with excavation of PCP-contaminated soils.

Tables

The cost tables in Appendices A and B were reviewed and we have the following concerns:

- 1. For the soil volume assumptions in Appendix B, Tables 2 and 3, could MDEQ provide the assumptions that went into estimating these soil volumes? In other words, it is not clear how the surface soil areas provided on Figure 6 were used in the impacted surface soil volumes. The use of Figure 7 subsurface soil volumes is also not clear. Were these values somehow converted to soil quantity by chemical?*

Response: For Table 2, the assumptions for calculating soil volumes are provided in the "Assumptions" area at the bottom of the table. The soil volume for Table 3 was based on the aerial extent of contamination (based on individual contaminants) depicted in Figures 6 and 7 of the Proposed Plan, combined with vertical extent using the assumptions discussed in the FS, which were also described in the RI. The subsurface soil impacts were divided by chemical, and the chemical-specific volumes were inadvertently left out of the Final Draft FS and were not included in the Proposed Plan. A table providing chemical-specific volumes is included in the ROD as Table 13. Additionally, Figure 7 in the Proposed Plan, which depicts subsurface soil contamination, has been revised in response to comments and is included in the ROD as Figures 9 A-B, 10 A-B, 11 A-B, and 12 A-B. This figure was divided into multiple figures that are contaminant specific and the vertical extent of contamination will be more easily discernable. The figures were developed using a combination of a

three-dimensional modeling software (C Tech 2008), which also calculated volumes, and Autodesk Map 3D (Autodesk 2008). Both the revised figures and volume estimates are included in the Final FS and the ROD. Also, DEQ has applied a multiplier of 1.8 to the volume estimates based on the experience of and approach used by Montana's Petroleum Tank Release Compensation Board to account for the likely increase in the volume of excavated soil from that originally estimated. Estimated costs were also revised in the FS and ROD.

- 2. PCP impacted subsurface soil on the site appears to be in one of two categories: 1) soil that is impacted somewhat continuously from the ground surface down to the water table; and 2) impacted soil that is essentially at the water table where LNAPL free product is present, and without vadose impacts. In general, the first category relates locally to former operations areas, the latter to peripheral and hydraulically downgradient of the KPT operations. This fact is important when calculating soil volumes at the site.*

Response: DEQ considered the difference in impacted subsurface soil when calculating volumes of soil, as evidenced by the assumptions used and described in Section 3.3 of the FS. However, as a result of these comments, the figures depicting soil contamination in the FS and Proposed Plan were modified for the ROD using a combination of a three-dimensional modeling software (C Tech 2008), which also calculated volumes, and Autodesk Map 3D (Autodesk 2008). Also, DEQ has applied a multiplier of 1.8 to the volume estimates based on the experience of and approach used by Montana's Petroleum Tank Release Compensation Board to account for the likely increase in the volume of excavated soil from that originally estimated. Both the revised figures and volume estimates are included in the FS and ROD. Estimated costs were also revised in the FS and ROD.

- 3. MDEQ should provide backup for in-place soil volumes at proposed PCP screening levels for surface and subsurface soil. Additionally, MDEQ should consider in their volume estimates whether PCP is present above screening levels at only the water table (where groundwater remediation would be effective instead of excavation) versus surface and vadose PCP exceedances (where excavation, and soil remediation are practical). There is concern that PCP volumes in the proposed plan may be skewed by data exclusive to the LNAPL/smear zone areas that extend away from former KPT operations area. Excavation in areas without vadose zone impacts could lead to unnecessary work that could be addressed through groundwater remediation.*

Response: See responses to previous comments related to this issue. DEQ's assumptions used for calculating soil volumes (discussed in both the RI and the FS) considered the issues described in the comment. As previously mentioned, the table showing volumes in surface and subsurface soil on a contaminant specific basis is included in the ROD. Together, this text and table document the soil volume estimates. However, in response to comments on the Proposed Plan and FS, DEQ revised the above-referenced figures using a combination of a three-dimensional modeling software (C Tech 2008), which also calculated volumes, and Autodesk Map 3D

(Autodesk 2008). Also, DEQ has applied a multiplier of 1.8 to the volume estimates based on the experience of and approach used by the Petroleum Tank Release Compensation Board to account for the likely increase in the volume of excavated soil from that originally estimated. Both the revised figures and volume estimates are included in the FS and ROD. Estimated costs were also revised in the FS and ROD.

4. *Appendix A, Table F-5,*

a. *Kalispell Pole Treatment Site*

1. *Injection Wells: 2" diameter, 22 feet deep – Basis for unit cost and quantity of 650 units is unclear.*

Response: The basis for initial unit cost was a verbal vendor quote, as noted in the “Source of Cost data” column of Table F-5. The total of 650 units was assigned using the approximate area of the contaminant plumes on the western portion of the KRY Site, and covering the footprint of the plume with ozone wells, spaced with each well having an approximate effective radius of 15 feet. The conceptual design of 650 injection points assumes complete coverage of the plume area is required.

Please note that Table F-5 and all the tables in Appendix A were carried forward from the FS and included in the Proposed Plan to support the “Summary and Evaluation of Alternatives” section of the Proposed Plan. Following selection as a component of the preferred alternative in the Proposed Plan, more detailed estimates were generated to address the updated conceptual design and are included in Appendix B of the Proposed Plan. The quantity of injection points was reviewed in more detail for the Proposed Plan and an updated conceptual design, depicted in Figure 11 of the Proposed Plan and detailed in Appendix B, Table 7 of the Proposed Plan was developed and contains substantially fewer injection points.

The design presented in Figure 11 of the Proposed Plan is conceptual; the ROD requires bench scale and pilot testing. DEQ will evaluate the results and determine the most-effective approach for augmenting the ozone treatment system throughout the KRY Site. Only the detailed estimates generated to address the updated conceptual design (found in Appendix B of the Proposed Plan) were carried forward to the ROD.

2. *Piping – What is the basis for the engineers estimate lump sum of \$200,000?*

Response: The sum of \$200,000 is a lump sum engineer’s estimate as indicated on the form. The lump sum estimate is provided for preliminary cost estimates when detailed costing is not performed. The estimates provided draw from technical engineering experience and are designed to provide an estimate of costs that provide interested parties with rough-order-of-magnitude estimates to implement a specific task. In addition, because this “preliminary cost

estimate” includes qualitative assumptions for design and estimates, the tables include a 25% contingency to allow for changes in cost, changes in volume estimates, etc. Ultimately, the preliminary cost estimate tables are only tools to estimate potential costs. The bench scale and pilot testing will allow DEQ to determine how to optimize system efficiency. The final design will determine actual costs.

b. Reliance Refinery Site

- 1. Injection Wells: 2” diameter, 22 feet deep – Basis for unit cost and quantity of 300 units is unclear.*

Response: See response to Comment #1 “Injection Wells”, above.

- 2. Piping – What is the basis for the engineers estimate lump sum of \$100,000?*

Response: See response to Comment #2 “Piping”, above.

c. The basis for annual operation and maintenance (O&M) costs are unclear.

Response: The basis for initial unit cost for site maintenance was a verbal vendor quote, as noted in the “Source of Cost data” column of Table F-5. The sum of \$200,000 is a lump sum engineer estimate as indicated on the form. The lump sum estimate is provided for preliminary cost estimates when detailed costing is not performed. The estimates provided draw from technical engineering experience, and are designed to provide an estimate of costs that provide interested parties with rough-order-of-magnitude estimates to implement a specific task. In addition, because this “preliminary cost estimate” includes qualitative assumptions for design and estimates, the tables include a 25% contingency to allow for changes in cost, changes in volume estimates, etc. Ultimately, the preliminary cost estimate tables are only tools to estimate potential costs. The bench scale and pilot testing will allow DEQ to determine how to optimize system efficiency. The final design will determine actual costs. Lastly, it is important to note that this conceptual design was reviewed in more detail for the Proposed Plan and a different conceptual design (Figure 11 of the Proposed Plan and Appendix B, Table 7) and new cost estimate was developed. The ROD includes revised cost estimates based on changes to the remedy in response to public comments.

- 5. Appendix B, Table 4 Assumption of recycling of sludge at 50% is probably too high due to fill, debris and soil to be likely mixed with the sludge.*

Response: DEQ reviewed site boring logs, combined with site visual observations, to estimate the potential lateral extent of sludge, the vertical extent of sludge, and the potential consistency of the sludge, sludge/soil, or sludge/debris mixtures. A table summarizing this information is included in the Final FS and ROD. Based on this data review, DEQ estimated that the maximum extent of recoverable sludge (potential

recyclable material) could be 50%. This estimate of 50% was developed for cost estimating purposes and the actual recoverable percentage may be more or less than this estimate and cannot be quantified precisely until sludge recovery activities commence.

6. *Appendix B, Table 3, LTU area needed is estimated to be 6.5 acres (283,140 ft²), based on 5 lifts, 2 feet thick, our estimate is on the order of estimate 482,000 ft².*

Response: DEQ assumes that the commenter believes there is an error in DEQ's volume or size calculations for the LTUs in the Proposed Plan. Because DEQ reconsidered its cleanup alternative for dioxin/furan contaminated soils and sawdust based on public comments, DEQ recalculated the estimated volumes of contaminated soils that will be treated in the LTUs (approximately 280,970 cubic yards) and also revised the costs (total present worth value of \$7,921,242). These calculations are presented in the FS and ROD.

7. *Appendix B, Table 7*

- a. *Geologist – 200 hours to oversee installation of 193 wells seems unrealistically low.*

Response: This cost estimate was generated in a software package called RACER (RACER 2008). The software package assigns a list of labor, equipment, and materials based on certain input parameters. DEQ has reviewed the estimate and agrees that the estimate of 200 hours is low and should be revised. Additionally, DEQ has revised the conceptual design of the chemical oxidation system as a result of a larger dioxin/furan-contaminated groundwater plume than was used in the Proposed Plan. The size of the plume increased because DEQ considered additional data provided by BNSF. This resulted in an increased number of injection wells. Therefore, DEQ has increased the number of hours for geologist oversight. Depending upon drilling conditions, a more realistic estimate of 928 hours for one geologist is reasonable assuming one drill rig for the entire task. If multiple rigs were employed, the 928 hour oversight time could decrease. For cost estimating purposes, DEQ has updated the projected hours for a geologist in the FS and ROD to an estimated 928 hours.

Please note that the cost estimate also includes a construction contingency of 25% to address overruns or oversights in the project scope. As previously noted, the ROD requires additional bench scale and pilot testing to further define the ultimate system design and to generate more detailed costs.

- b. *4-inch PVC well casing and screen are not typical for in situ ozonation systems. One inch diameter stainless steel screens with 1-inch-diameter Sch. 80 CPVC risers or 0.5-inch stainless steel or Teflon connector tubing is more commonly used.*

Response: Based on this comment, DEQ reevaluated the cost estimate for the

chemical oxidation system. As referenced in the comment, the 4-inch PVC casing and screens were replaced with one inch stainless steel casing and screens. Additionally, the lateral piping, which was previously stainless steel, has been replaced with PVC. The result is a minimal reduction in cost of the overall remedy component. The Final FS and the ROD include this revised cost estimate.

- c. *1-inch stainless steel piping costs do not appear to include the cost of Swagelok or equivalent stainless steel compression fittings and connectors.*

Response: As noted in the response to previous comments, RACER software was used to generate the rough estimate and the software is limited in the allowable parameter modifications and output (RACER 2008). Details of the final design, such as well and piping construction variables, may vary from estimates presented for the conceptually designed system in the Proposed Plan and ROD. These details will be generated during remedial design to maximize effectiveness of the system. However, based on this comment, DEQ has added a line-item to the cost estimate for use of Swagelok compression fittings.

- d. *Based on references in Appendix A Table F-5, the total ozone system output is 60 lb./day. If this is true the unit cost of \$74,685.00 for a 4 lb/day ozone system seems high. A rule of thumb cost per lb. of ozone generated per day is \$4000 to \$5000 (\$20,000 unit rate). (Personal communication with Joe Mendez, Piper Environmental Group, Inc.)*

Response: Please note that the conceptual chemical oxidation system design substantially changed from the Final Draft FS Report to the preferred remedy described in the Proposed Plan.

The comment above references the costs as presented in the Final Draft FS and brought forward into Appendix A of the Proposed Plan to support the “Summary and Evaluation of Alternatives” section of the Proposed Plan. As outlined in Table F-5 in the Final Draft FS report, lump sum costs (not unit rate costs) were provided for two ozone systems, with estimated flow rates of 60 lbs/day and 10 lbs/day. An updated cost estimate was provided by CALCON Systems in San Ramon, California for incorporation in the Proposed Plan (Trihydro 2007). The updated cost estimate was based on the new ozone system conceptual layout. In turn, the updated cost estimate was broken down into a unit cost for DEQ evaluation of remedial technologies.

As stated previously, the chemical oxidation system layout in the source area is conceptual. More data will be gathered through bench scale and pilot testing in order for DEQ to determine how to optimize the chemical oxidation system design for the PCP/dioxin contaminated areas. DEQ revised the FS to include the costs presented in the Proposed Plan.

- e. *It is not clear whether the capital costs include costs for subcontract labor for installation.*

Response: As noted in the responses to previous comments, RACER software was used to generate the rough estimate and the software package includes labor, equipment, and materials based on certain input parameters. The RACER output includes all costs associated with the conceptually designed system, including subcontract labor (RACER 2008). However, DEQ determined that while the cost estimated included labor, surface completion measures (concrete pad, protective enclosure, etc) would be needed for protection and to facilitate technician access to the wells, and those were not previously included in the cost estimate. Therefore, a line item was added to the cost estimate as a result of this comment.

Figure Comments

1. **Figure 1.** *The scale of the map does not show the location of the proposed LTU relative to the 100-year floodplain. When on site, it seems that the LTU north of the KPT site is likely within the Stillwater River Floodplain. Also, since Hurricane Katrina, some floodplain boundaries have been re-defined. The water table depth in this area may also be too shallow to support an LTU.*

Response: The conceptual LTU location on the Montana Mokko property is shown in an area that is removed from the 100-year or 500-year floodplain (Figure 1-1 of the FS and Figure 1 of the ROD). In response to a separate comment, DEQ contacted Traci Sears-Tull of DNRC's Floodplain Program and accessed the FEMA floodplain maps to determine if floodplain maps were updated since the RI. DEQ determined that the maps were updated in September 2007 and also verified that the conceptual LTU location is still outside of the designated floodplain (FEMA 2007). A new floodplain map was generated using the new FEMA maps and has been incorporated into the Final FS and the ROD. The comment regarding water table depth is noted. Monthly static water level readings were collected at the KRY Site from July 2006 through July 2007. This data can be used to evaluate appropriate locations for the LTUs. The ROD states that the design and location of the LTUs are conceptual and the ultimate siting of the LTUs will comply with ERCLs and will be determined during remedial design.

2. **Figure 2.** *It would be helpful if this figure depicted property boundaries in addition to a generic property boundary. This would aid in the decision process of where to place remediation units (e.g., LTUs) and keep them within single property boundaries, if possible.*

Response: DEQ does not routinely depict property boundaries on its figures as CECRA defines a "facility" as any place contamination has come to be located. The "facility" is not defined with reference to property boundaries. During remedial design, DEQ will consider property ownership and current and future use when locating various remediation technologies. However, for conceptual design in the ROD, revision of the figure is not necessary.

3. **Figure 4.** *The apparent mounding of groundwater at Reliance and Yale is from perched aquifer conditions. Groundwater flow on the perched zones likely follows topography of shallow clay zones in these areas, and is not likely radial to the southeast flowing unconfined aquifer. Flow arrows are not depicted accurately. They should be perpendicular to the contours.*

Response: As noted in the response to Final Draft FS Report, General Comment #3 and Figure Comment #1, DEQ has determined that a perched aquifer does not exist separate and unconnected from the main unconfined aquifer beneath the KRY Site. As further stated in that response, DEQ agrees that the underlying layers of finer-grained silty clay exhibit lower permeability and slow, but do not stop the downward movement of groundwater through those layers. This characteristic produces the observable groundwater mounds above these layers and the outward radial flow of groundwater on the flanks of these mounds. This radial flow may be influenced to a minimal degree by the upper topography of the lower-permeability silty clay that underlies the mounds, but groundwater flow in unconfined aquifers is dominantly controlled by the water table topography.

DEQ acknowledges that flow arrows should be drawn perpendicular to contour lines and has updated Figure 4 (and related figures) in the RI, FS and ROD.

4. **Figure 7.** *This figure is misleading and should include depth intervals. For example, is the 5-foot shading for 0 to 5 feet below ground surface, or is it 15 to 20 feet below ground surface? As it stands, the figure does not depict volumes as maybe it should. It is also confusing in that it includes the same color scheme as Figure 6, which utilizes color to identify the chemicals of concern.*

Response: In response to this comment, DEQ revised the above-referenced figure using a three-dimensional modeling software to depict the distribution of contaminants in soil that exceed the site-specific cleanup levels in the ROD. The modeling software also calculated volumes (C Tech 2008). Both the revised figures and volume estimates are included in the Final FS and the ROD. Estimated cleanup costs were also revised based on the revised volumes.

5. **Figure 9.** *The LTU north of KPT is likely within a floodplain boundary and/or in an area with a shallow water table not suitable for landfarming. The second LTU over Reliance is constructed over an area presumably to be excavated?*

Response: Please see previous responses to comments regarding the floodplain location and groundwater table depths. As mentioned previously, DEQ anticipates that the petroleum LTU will be constructed within the excavation once contaminated soil is removed; however, the ultimate siting of the LTUs that complies with ERCLs will be determined during remedial design.

6. **Figure 10.** This figure would benefit from chemical characterization of NAPL types in addition to anecdotal sample descriptions. For example, the Reliance area is predominantly weathered crude oil whereas KPT is fuel oil with PCP. The LNAPL thickness is extrapolated over large distances between wells. As previously mentioned, the RI soil sampling and recent drilling experience would indicate that areas of hot spot smear zones are shown rather than a continuous LNAPL thickness.

Response: The figure includes “anecdotal” descriptions of product, rather than specific chemical descriptions of product because LNAPL samples have not been collected from the majority of the monitoring wells/sample locations. Additionally, the commingling of contamination between the western and eastern portions of the KRY Site makes it difficult to differentiate between product that contains PCP and product that does not without actual samples results. Therefore, the “anecdotal” descriptions of the LNAPL in the figure are unchanged, although other changes were made to the figure, as discussed in previous responses to comments.

As stated earlier, without further data specifically between locations of existing wells, DEQ has reasonably assumed that NAPL extends between wells with documented occurrence. The appropriateness of this approach is supported by the smooth and regular pattern of contour lines that are generated from the LNAPL thickness data in Figure 10. DEQ has added the following note to figures depicting LNAPL in the final FS and ROD: “Note: NAPL presence is inferred in the areas between wells with documented NAPL occurrences.”

7. **Figure 11.** The installation of deep injection points at the northeast end of KPT are not understood, Figure 5 does not depict deep level PCP impacts in this area.

Response: The Data Summary Report (DSR) identifies PCP concentrations ranging from <0.25 ug/L to 0.25 ug/L in monitoring well KPT-10 (a shallow well) (TtEMI 2005). PCP concentrations in monitoring well KPT-14 (a deeper well in the same location) range from 16 ug/L to 36 ug/L. The DSR identifies another set of wells in the general area with the following PCP concentrations: KPT-9 (the shallow well) ranged from 0.94 ug/L to 1000 ug/L, and KPT-13 (the deeper well at the same location) was <0.25 ug/L. The commenter sampled the shallow wells periodically between October 2005 and October 2007. Those results indicate PCP concentrations in KPT-9 ranged from <0.0845 ug/L to 0.9777 ug/L, and KPT-10 was less than detection limits. Unfortunately, the commenter did not sample the deep wells during this timeframe. DEQ’s RI results indicate PCP was present in monitoring wells KPT-9, KPT-13, and KPT-14 at levels below Montana’s water quality standard. Because of previous detections of PCP in nearby residential wells and historic data indicating exceedances of Montana’s water quality standards in these areas, the ROD clarifies that subsequent groundwater monitoring in the northern portion of the KRY Site will occur. If PCP concentrations exceed Montana’s water quality standard for PCP, then the chemical oxidation system will be expanded to treat contaminated groundwater in the northern portion of the KRY Site.

8. **Figure 12A.** Iron isopacs are a heavily weighted on one well (GWRR-7). There is insufficient data to support the map interpretation. A similar case could be made for Figures 12B and 12C.

Response: The isopacs are drawn based upon the concentrations of iron detected in 28 wells spread throughout the KRY Site. Weighting can occur during the contouring of the data, especially in areas where data is not present. GWRR-7 could be weighted based on the concentrations of iron in that well that are one to three orders of magnitude higher than the wells surrounding this location. DEQ presented the isopacs as interpreted and drawn by the contouring program with minimal physical interpretation. Additional physical modification of the isopac contours without additional analytical data cannot be justified. DEQ added a note to the equivalent figures in the FS and ROD that states: “The isoconcentration contours presented on this figure represent one interpretation based upon the data presented, other interpretations are possible.”

References

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USEPA. 1999. Multi-Phase Extraction: State-of-the-Practice. Solid Waste and Emergency Response. EPA 542-R-99-004. June.

Response: DEQ appreciates ENSR providing a reference list for the documents cited in its comments. Unless DEQ cited to one of these documents in a response to comments, the document will not be separately identified in part 2, Section 14.0.

TABLES

TABLE 1
CURRENT PROPERTY OWNERSHIP AND LAND USE
KRY SITE

KRY Site Location	Tract Number	Township, Range, and Section	Legal Description	Owner Name	Land Use
West	3B	T28N R21W S8	TR 3B IN NW4	Klingler Lumber Company, Inc.	Building
West	5A	T28N R21W S8	TR 5A IN NW4	Burlington Northern & Santa Fe	Commercial
West	11CA	T28N R21W S5	TR 11CA IN SE4SW4	Stillwater Forest Products	Industrial
West	11C	T28N R21W S5	TR 11C IN SE4SW4	Montana Mokko, Inc.	Industrial
West	19	T28N R21W S8	TR 19 IN NW4NE4	Klingler Lumber Company, Inc. ^a	Vacant
West	19A	T28N R21W S8	TR 19A IN NW4NE4	Klingler Lumber Company, Inc. ^a	Vacant
West	19B	T28N R21W S8	TR 19B IN NW4NE4	Klingler Lumber Company, Inc. ^a	Vacant
West	30I	T28N R21W S8	TR 30I IN NW4NE4	Klingler Lumber Company, Inc. ^a	Vacant
West	30V	T28N R21W S8	TR 30V IN NW4NE4 NEW ASSR# FOR 89	State of Montana	Exempt
West	3	T28N R21W S8	TR 3 IN NE4NW4	William & Anne Russell	Vacant
East	30V	T28N R21W S8	TR 30V IN NW4NE4 NEW ASSR# FOR 89	State of Montana	Exempt
East	30Z	T28N R21W S8	TR 30Z IN NW4NE4	Swank Enterprises	Vacant
East	1	T28N R21W S8	TR 1 IN SW4SE4 and TR 8A IN NW4NE4 082821	Howard Gipe	Residential
South	5	T28N R21W S8	TR 30S IN NW4NE4	JTL Group Inc.	Industrial
Southeast	6	T28N R21W S8	TR 6 TR6A TR7	Pacific Hide & Fur Depot	Commercial
Southeast	6A	T28N R21W S8	TR 6 TR6A TR7	Pacific Hide & Fur Depot	Commercial
Southeast	6B	T28N R21W S8	TR 6B IN NW4NE4	Pacific Hide & Fur Depot	Commercial
Southeast	7	T28N R21W S8	TR 6 TR6A TR7	Pacific Hide & Fur Depot	Commercial
Southeast	9	T28N R21W S8	TR 9 IN NW4NE4 and SE4NE4	Kalispell Holdings LLC	Commercial
Southeast	9B	T28N R21W S8	TR 9B IN NW4NE4	Wesley & Pamela Holmquist	Commercial
Southeast	11	T28N R21W S8	TR 11 IN NW4NE4	Kalispell Partners LLC	Commercial
Southeast	11A	T28N R21W S8	TR 11A (IN NW4NE4)	Flathead County	Exempt
Southeast	11D	T28N R21W S8	(Legal description not listed)	(Owner not listed) ^b	Other
Southeast	13K	T28N R21W S8	TR 13K IN NE4NE4	Kalispell Holdings LLC	Commercial
Southeast	16	T28N R21W S8	TR 16 IN SW4NE4	Randy Mock	Commercial
Northeast	4	T28N R21W S5	TR 4 IN L15	Bobby and Cassandra Stanearth	Residential
Northeast	6	T28N R21W S5	TR 6 IN L15	Calvin Huntley	Vacant
Northeast	6A	T28N R21W S5	TR 6A IN L15	M. Gene and Richard Dale Cordell	Residential
Northeast	6B	T28N R21W S5	TR 6B IN L15	Calvin Huntley	Residential
Northeast	6C	T28N R21W S5	TR 6 IN I15	Blaine McGranor	Residential

**TABLE 1
CURRENT PROPERTY OWNERSHIP AND LAND USE
KRY SITE**

KRY Site Location	Tract Number	Township, Range, and Section	Legal Description	Owner Name	Land Use
Northeast	6AA	T28N R21W S5	TR 6AA IN SW4SE4	Debra Hanson	Residential
Northeast	6AB	T28N R21W S5	TR 6AB IN L15	Jon and Deborah Wilson	Commercial
Northeast	11D	T28N R21W S5	TR 11D and TR 4A IN L15	Mark and Shannon Fraleigh	Commercial
Northeast	11HA	T28N R21W S5	Tract 11HA 11HC IN 115 TR 11HB in L15 TR 11H in L14 and L15	Gina Swartz	Residential

Notes:

a On March 2, 1992, Swank Enterprises sold Tracts 19, 19A, 19B, and 30I to Klingler Lumber Company, Inc. pursuant to an unrecorded deed.

b A NorthWestern Energy station exists on this property.

Exempt property includes state and local government lands, parks, and cemeteries.

Other property includes roads, rivers, and unclassified parcels.

Source: Modified from Flathead County cadastral geographic information system data (Flathead 2007).

**TABLE 2
HISTORY OF PROPERTY OWNERS, OPERATORS, GENERATORS, AND TRANSPORTERS
KRY SITE**

	KPT Facility Tract 3B	KPT Facility Tract 5A	KPT Facility Tract 11CA	KPT Facility Tract 11C	KPT Facility Tract 3	KPT Facility Tract 19	KPT Facility Tract 19A	KPT Facility Tract 19B	KPT Facility Tract 30I
Property Owner & Ownership Dates	Somers Lumber Company Unknown - April 30, 1941	David McGinniss Unknown - May 21, 1938	Kalispell Pole and Timber Company ³ Unknown March 10, 1986	Kalispell Pole and Timber Company ³ Unknown March 10, 1986	William and Anne Russell Unknown - (Current Property Owner)	Kalispell Industrial Company Unknown - January 26, 1925	Kalispell Industrial Company Unknown - April 12, 1912	Kalispell Industrial Company Unknown - January 26, 1925	Kalispell Townsite Company Unknown - November 21, 1930
Property Owner & Ownership Dates	Glacier Park Hotel Company April 30, 1941 - September 8, 1945	Somers Lumber Company May 21, 1938 - September 8, 1945	Kal-Mont Lumber Company ³ March 20, 1986 - December 30, 1986	Kal-Mont Lumber Company ³ March 20, 1986 - December 30, 1986	No additional owners.	Rozenia Wooldridge January 26, 1925 - February 18, 1964	C.E. Conrad Memorial Cemetery Association April 12, 1912 - September 9, 1988 Kalispell Pole and Timber Company may have leased this property prior to 1988. The 1969 aerial photograph shows poles being stored in Tract 19A.	Rozenia Wooldridge January 26, 1925 - February 18, 1964	Boris A. S. Aronow November 21, 1930 - March 31, 1933 Mr. Aronow purchased the Reliance Refining Company in February 1932. The Reliance refinery was located on Tract 30Z. In March 1933, the Unity Petroleum Corporation was incorporated.
Property Owner & Ownership Dates	Great Northern Railroad Company September 8, 1945 - March 2, 1970 (Merger date) Kalispell Pole and Timber Company owned and operated a wood treatment and storage facility on property leased from the railroad company from as early as October 1945 to May 1990. The facility used PCP in the wood treatment process. Raw materials and products were transported by rail (until 1980) and truck.	Great Northern Railroad Company September 8, 1945 - March 2, 1970 (Merger date)	Robert Parmenter December 30, 1986 (Current Property Owner) Montana Mokko, Inc., owns and operates a lumber processing and storage facility on this property. The facility is not currently in operation.	Montana Mokko, Inc. December 30, 1986 (Current Property Owner) Montana Mokko, Inc., owns and operated a lumber processing and storage facility on this property. The facility is not currently in operation.	No additional owners.	William F. Behenna February 18, 1964 - June 8, 1987 Mr. Behenna was a long-time president of the Kalispell Pole and Timber Company. The 1969 aerial photograph shows poles being stored in Tract 19. Kalispell Pole and Timber Company owned and operated its facility until May 1990.	Kalispell Pole and Timber Company September 9, 1988 - June 1, 1990 Kalispell Pole and Timber Company owned and operated its facility until May 1990.	William F. Behenna February 18, 1964 - March 18, 1971 Mr. Behenna was a long-time President of the Kalispell Pole and Timber Company. Although the 1969 aerial photograph shows poles being stored in Tracts 19 and 19A, pole storage is not visible in Tract 19B.	Unity Petroleum Corporation March 31, 1933 - July 19, 1960 It is unknown what operations, if any, were conducted on this property.

**TABLE 2
HISTORY OF PROPERTY OWNERS, OPERATORS, GENERATORS, AND TRANSPORTERS
KRY SITE**

	KPT Facility Tract 3B	KPT Facility Tract 5A	KPT Facility Tract 11CA	KPT Facility Tract 11C	KPT Facility Tract 3	KPT Facility Tract 19	KPT Facility Tract 19A	KPT Facility Tract 19B	KPT Facility Tract 30I
Property Owner & Ownership Dates	Burlington Northern Railroad Company March 2, 1970 - September 22, 1995 (Merger Date) Kalispell Pole and Timber Company owned and operated a wood treatment and storage facility on property leased from the railroad company from as early as October 1945 to May 1990. The facility used PCP in the wood treatment process. Raw materials and products were transported by rail (until 1980) and truck.	Burlington Northern Railroad Company March 2, 1970 - September 22, 1995 (Merger Date)	No additional owners.	No additional owners.	No additional owners.	Kalispell Pole and Timber Company June 8, 1987 - June 1, 1990 Kalispell Pole and Timber Company owned and operated its facility until May 1990.	Swank Enterprises June 1, 1990 - March 2, 1992 Swank Enterprises stored construction materials and equipment on the property.	Marie L. Miller and Earl C. Ellis March 18, 1971 - July 1, 1980	Flathead County July 19, 1960 - August 19, 1965
Property Owner & Ownership Dates	Burlington Northern and Santa Fe Railway Company September 22, 1995 - (Current Property Owner)	Burlington Northern and Santa Fe Railway Company September 22, 1995 - (Current Property Owner)	No additional owners.	No additional owners.	No additional owners.	Swank Enterprises June 1, 1990 - March 2, 1992 Swank Enterprises stored construction materials and equipment on the property.	Klingler Lumber Company, Inc. March 2, 1992 - (Current Property Owner) Klingler Lumber Company stores lumber and poles on the property.	Kalispell Pole and Timber Company July 1, 1980 - June 1, 1990 Kalispell Pole and Timber Company may have stored poles on this property. Kalispell Pole and Timber owned and operated its facility until May 1990.	Cedor B. Aronow August 19, 1965 - August 5, 1969
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	Klingler Lumber Company, Inc. March 2, 1992 - (Current Property Owner) Klingler Lumber Company stores lumber and poles on the property.	No additional owners.	Swank Enterprises June 1, 1990 - March 2, 1992 Swank Enterprises stored construction materials and equipment on the property.	Kalispell Pole and Timber Company August 5, 1969 - June 1, 1990 The 1987 aerial photograph shows poles being stored in Tract 30I. Kalispell Pole and Timber Company owned and operated its facility until May 1990

**TABLE 2
HISTORY OF PROPERTY OWNERS, OPERATORS, GENERATORS, AND TRANSPORTERS
KRY SITE**

	KPT Facility Tract 3B	KPT Facility Tract 5A	KPT Facility Tract 11CA	KPT Facility Tract 11C	KPT Facility Tract 3	KPT Facility Tract 19	KPT Facility Tract 19A	KPT Facility Tract 19B	KPT Facility Tract 30I
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	Klingler Lumber Company, Inc. March 2, 1992 - (Current Property Owner) Klingler Lumber Company stores lumber and poles on the property.	Swank Enterprises June 1, 1990 - March 2, 1992 Swank Enterprises stored construction materials and equipment on the property.
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	Klingler Lumber Company, Inc. March 2, 1992 - (Current Property Owner) Klingler Lumber Company stores lumber and poles on the property.
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.
Additional Notes	Other lumber companies, including Montana Mokko, Inc. and Klingler Lumber Company, Inc., have or are currently leasing portions of Tract 3B.	Other lumber companies, including Klingler Lumber Company, Inc., have or are currently leasing portions of Tract 5A.	A portion of the Montana Mokko, Inc. facility is located in Tract 3B. ³ Information obtained from Flathead County Plat Room personnel (TTEMI 2005e)	A portion of the Montana Mokko, Inc. facility is located in Tract 3B. ³ Information obtained from Flathead County Plat Room personnel (TTEMI 2005e)	None.	On March 2, 1992, Swank Enterprises sold Tract 19 to Klingler Lumber Company, Inc. pursuant to an unrecorded deed (DEQ 2005b).	On March 2, 1992, Swank Enterprises sold Tract 19A to Klingler Lumber Company, Inc. pursuant to an unrecorded deed (DEQ 2005b).	Tract 19B was created through the property sale by William F. Behenna on July 1, 1980. Prior to this sale, the property was within Tract 19. On March 2, 1992, Swank Enterprises sold Tract 19B to Klingler Lumber Company, Inc. pursuant to an unrecorded deed (DEQ 2005b)	It is unknown if Schumacher's Evergreen Fuel Company leased Tract 30Z from Flathead County or Cedor B. Aronow during its period of operation (1962 to 1969). On March 2, 1992, Swank Enterprises sold tract 30I to Klingler Lumber Company, Inc. pursuant to an unrecorded deed (DEQ 2005b).

**TABLE 2
HISTORY OF PROPERTY OWNERS, OPERATORS, GENERATORS, AND TRANSPORTERS
KRY SITE**

	KPT Facility Tract 30V (West Portion)	Reliance Facility Tract 30V (East Portion)	Reliance Facility Tract 30Z	Reliance Facility Tract 30S	Yale Oil Facility Tract 6B	Yale Oil Facility Tract 9B	Yale Oil Facility Tract 11	Yale Oil Facility Tract 11D	Yale Oil Facility Tract 11A
Property Owner & Ownership Dates	Kalispell Townsite Company Unknown - January 23, 1926	Kalispell Townsite Company Unknown - November 21, 1930	JTL Group, Inc. (McElroy & Wilken) Unknown - (Current Owner)	William and Ida Hafferman Unknown - March 23, 1938	S.C. and Laura Rhone Unknown - April 11, 1940	Jessie Hamil Unknown - December 13, 1937	Jessie Hamil Unknown - December 13, 1937	Flathead County Unknown - (Current Property Owner)	
Property Owner & Ownership Dates	Reliance Refining Company January 23, 1926 - November 21, 1930 The Reliance Refining Company owned and operated a refinery on this property. Crude oil and refinery products were transported by rail and truck. The 1950 Sanborn Map shows the refinery, storage tanks, and loading platform on the eastern portion of the property. An office, oil truck building, and gasoline and oil storage building are shown on the western portion of the property.	Boris A. S. Aronow November 21, 1930 - March 31, 1933 Mr. Aronow purchased the Reliance Refining Company in February 1932. The Reliance refinery was located on Tract 30Z. In March 1933, the Unity Petroleum Corporation was incorporated.	No additional owners.	Yale Oil Corporation of South Dakota March 23, 1938 - April 29, 1944 Yale Oil Corporation built a loading platform and pump house on Tract 6B. Yale Oil also granted an easement to the Great Northern Railroad Company to construct and operate a spur track to serve the refinery.	Yale Oil Corporation of South Dakota April 11, 1940 - April 29, 1944 Tract 9B does not appear to be separate property from Tract 11 (refinery) on the 1950 Sanborn Fire Insurance Map. However, there are no buildings or storage tanks noted on the Sanborn Map.	Yale Oil Corporation of South Dakota December, 1937 - April 29, 1944 Yale Oil Corporation owned and operated a refinery and bulk storage plant on the property until 1944. Crude oil and refinery products were transported by rail and truck.	Yale Oil Corporation of South Dakota December, 1937 - April 29, 1944 Yale Oil Corporation owned and operated a refinery and bulk storage plant on the property until 1944. Crude oil and refinery products were transported by rail and truck.	No additional owners.	
Property Owner & Ownership Dates	State of Montana November 21, 1930 - (Current Property Owner) Boris A. S. Aronow and Unity Petroleum Corporation owned and operated the refinery on property leased from the state as early as 1933 through 1969. Mr. Aronow (doing business as Unity Petroleum Corporation) leased Tract 30V from December 5, 1930 to November 26, 1935. Unity Petroleum Corporation leased the property from 1935 to 1969. Crude oil and refinery products were transported by rail and truck. Schumacher's Evergreen Fuel Company conducted bulk storage operations from 1962 to 1969. Kalispell Pole and Timber leased tract 30V for pole storage from August 13, 1969 to May 1990; the lease was terminated on January 28, 1994. Pole storage was visible in the western portion of the property (west of Flathead Drive) on the 1969 and 1987 aerial photographs.	Unity Petroleum Corporation March 31, 1933 - July 19, 1960 The Unity Petroleum Corporation owned and operated bulk storage tanks on this property. Crude oil and refinery products were transported by rail and truck. It is unknown when the tanks were constructed, as they are not identified on the Sanborn Fire Insurance Maps for the refinery.	No additional owners.	Leader Oil Company April 29, 1944 (Purchased and sold on the same day)	Leader Oil Company April 29, 1944 (Purchased and sold on the same day)	Leader Oil Company April 29, 1944 (Purchased and sold on the same day)	Leader Oil Company April 29, 1944 (Purchased and sold on the same day)	No additional owners.	

**TABLE 2
HISTORY OF PROPERTY OWNERS, OPERATORS, GENERATORS, AND TRANSPORTERS
KRY SITE**

	KPT Facility Tract 30V (West Portion)	Reliance Facility Tract 30V (East Portion)	Reliance Facility Tract 30Z	Reliance Facility Tract 30S	Yale Oil Facility Tract 6B	Yale Oil Facility Tract 9B	Yale Oil Facility Tract 11	Yale Oil Facility Tract 11D	Yale Oil Facility Tract 11A
Property Owner & Ownership Dates	No additional owners.	No additional owners.	Flathead County July 19, 1960 - August 19, 1965	No additional owners.	Carter Oil Company April 29, 1944 - December 15, 1959 (Merger Date) The 1950 Sanborn Fire Insurance Map shows the loading platform located adjacent to (west of) the spur track. The pump house and two sumps are also identified on the Sanborn map. The sumps are located south of the loading platform and the pump house is located southeast of the platform and adjacent to (north of) Montclair Drive.	Carter Oil Company April 29, 1944 - November 10, 1948 (Sold before merger)	Carter Oil Company April 29, 1944 - December 15, 1959 (Merger Date) Carter Oil Company ceased refinery operations shortly after purchasing the refinery. As early as 1954, Carter Oil leased the property to T.J. Landry Oil Company that owned and operated an oil distributorship onsite until 1978. It is unknown how petroleum products were transported.	Carter Oil Company April 29, 1944 - December 15, 1959 (Merger Date) Carter Oil Company ceased refinery operations shortly after purchasing the refinery. As early as 1954, Carter Oil leased the property to T.J. Landry Oil Company that owned and operated an oil distributorship onsite until 1978. It is unknown how petroleum products were transported.	No additional owners.
Property Owner & Ownership Dates	No additional owners.	No additional owners.	Cedor B. Aronow August 19, 1965 - August 5, 1969	No additional owners.	Humble Oil & Refining Company December 15, 1959 - December 26, 1972 (Merger Date) It appears that the loading platform, sumps, and pump house were no longer in use by 1963. These features are identified on the 1963 Sanborn map, but have been crossed out. Normally, the note "not used" is annotated on these maps.	Sid Ludwig Agency of Kalispell November 10, 1948 - November 26, 1948	Humble Oil & Refining Company December 15, 1959 - December 26, 1972 (Merger Date) Humble Oil & Refining Company continued to lease the property to T.J. Landry Oil Company that owned and operated the oil distributorship until 1978. It is unknown how petroleum products were transported.	Humble Oil & Refining Company December 15, 1959 - Unknown The 1963 Sanborn Fire Insurance Map shows an unused pump house located in this portion of the property. The 1961 aerial photograph also shows this building. The 1969 aerial map shows a new building has been built.	No additional owners.
Property Owner & Ownership Dates	No additional owners.	No additional owners.	Kalispell Pole and Timber Company August 5, 1969 - June 1, 1990 Kalispell Pole and Timber Company may have stored poles on this property. Kalispell Pole and Timber owned and operated its facility until May 1990.	No additional owners.	Exxon Corporation December 26, 1972 - February 12, 1980	Westmont Tractor and Equipment Company of Missoula November 26, 1948 - August 1, 1984	Exxon Corporation December 26, 1972 - February 12, 1980 Exxon Corporation continued to lease the property to T.J. Landry Oil Company that owned and operated the oil distributorship until 1978. It is unknown how petroleum products were transported.	Montana Power Company Unknown - Unknown An April 15, 1994, report prepared by Applied Earth Sciences, Inc. for Exxon Company, U.S.A., contains a piping location map that identifies the Montana Power Company as the owner of the property (Tract 11D).	No additional owners.

**TABLE 2
HISTORY OF PROPERTY OWNERS, OPERATORS, GENERATORS, AND TRANSPORTERS
KRY SITE**

	KPT Facility Tract 30V (West Portion)	Reliance Facility Tract 30V (East Portion)	Reliance Facility Tract 30Z	Reliance Facility Tract 30S	Yale Oil Facility Tract 6B	Yale Oil Facility Tract 9B	Yale Oil Facility Tract 11	Yale Oil Facility Tract 11D	Yale Oil Facility Tract 11A
Property Owner & Ownership Dates	No additional owners.	No additional owners.	Swank Enterprises June 1, 1990 - (Current Property Owner) Swank Enterprises stored construction materials and equipment on the property. Swank Enterprises is not currently storing anything on the property.	No additional owners.	Exxon Education Foundation February 12, 1980 - December 3, 1981	Wesley and Pamela Homquist August 1, 1984 (Current Property Owners)	Exxon Education Foundation February 12, 1980 - December 3, 1981	NorthWestern Energy Unknown - (Current Property Owner)	No additional owners.
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	National Development Corporation of Colorado December 3, 1981 - October 19, 1983	No additional owners.	National Development Corporation of Colorado December 3, 1981 - October 19, 1983	No additional owners.	No additional owners.
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	Exxon Education Foundation ¹ October 19, 1983 - January 11, 1989	No additional owners.	Exxon Education Foundation ¹ October 19, 1983 - January 11, 1988	No additional owners.	No additional owners.
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	Exxon Corporation ¹ January 11, 1989 - August 23, 1996	No additional owners.	Exxon Corporation ^{1,2} January 11, 1989 - October 18, 1996	No additional owners.	No additional owners.
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	Pacific Hide & Fur Depot ¹ August 23, 1996 - (Current Property Owner)	No additional owners.	First X Realty, L.P. ² October 18, 1996 - September 4, 1997		
Property Owner & Ownership Dates	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	No additional owners.	Kalispell Partners, LLC ² September 4, 1997 - (Current Property Owner)	No additional owners.	No additional owners.
Additional Notes	None.	None.	It is unknown if Schumacher's Evergreen Fuel Company leased Tract 30Z from Flathead County or Cedor B. Aronow during its period of operation (1962 to 1969).	No refinery operations or storage occurred on Tract 30S. However, the northeast portion of this tract is considered part of the Reliance Facility because of contamination in subsurface soils.	¹ Information obtained from Flathead County Plat Room personnel (TTEMI 2005b).	None.	¹ Information obtained from Flathead County Plat Room personnel (TTEMI 2005b). ² Information obtained from DEQ-provided deeds (DEQ 2005b).	Flathead County records do not list an owner for Tract 11D. The property type is listed as other, which contains roads, rivers, and unclassified parcels.	It is assumed Tract 11A is a highway right-of-way easement granted to Flathead County. Tract 11A is located in the northwestern corner of Tract 11D at the intersection of Flathead Drive and Montclair Drive.

**TABLE 3
SUMMARY OF AQUIFER TEST RESULTS
KRY SITE**

Well Number	Well Diameter (inches)	Aquifer Zone ⁽¹⁾	Aquifer Thickness (feet)	Test Date	Test Type Conducted	Test Duration (minutes)	Pumping Rate (gpm)	Maximum Drawdown (feet)	Solution Method	Transmissivity (ft ² /day)	Hydraulic Conductivity (ft/day)
KRY108A	2	Upper Unconfined	91	8/21/06	Pumping Well Drawdown	94	6.1	0.03	NC ⁽²⁾	NC ⁽²⁾	NC ⁽²⁾
KRY113B	2	Lower Unconfined	91	8/21/06	Pumping Well Drawdown	112	6.1	1.1	Theis Unconfined	5,500	60
KRY121A	2	Upper Unconfined	106	8/18/06	Pumping Well Drawdown	56	6.1	0.1	NC ⁽²⁾	NC ⁽²⁾	NC ⁽²⁾
KRY121B	4	Lower Unconfined	106	8/16/06	Pumping Well Drawdown	42	30	1.1	Theis Unconfined	34,600	326
KRY139A	4	Upper Unconfined	164	8/22/06	Pumping Well Drawdown	105	5.8	2.97	Theis Unconfined	2,800	17
KRY139A	4	Upper Unconfined	14.6 ⁽³⁾	8/22/06	Pumping Well Recovery	15	5.8	2.97	Theis Confined	138	9
KRY139B	2	Lower Unconfined	164	8/22/06	Pumping Well Drawdown	84	6.1	1.3	Theis Unconfined	8,941	55

Notes:

- (1) Upper Unconfined refers to wells completed in upper portion of unconfined aquifer. Lower Unconfined refers to wells completed in lower portion of unconfined aquifer.
- (2) NC = not calculated. Aquifer tests at wells KRY108A and KRY121A yielded insufficient drawdown to complete the analysis.
- (3) Calculation of transmissivity and hydraulic conductivity used the length of the saturated portion of the well screen.

Solution Methods: Theis (1935)

Gpm Gallons per minute ft²/d Feet squared per day

Table 4
Groundwater Cleanup Levels
KRY Site

Contaminant of Concern	Cleanup Level (ug/L)	Rationale for Cleanup Level Selection			
		Background	DEQ-7 Standard	RBCA RBSL	Tap Water SL
1,2,4-Trimethylbenzene	15				X
Arsenic	10		X		
Benzene	5		X	X	
C11-C22 Aromatics	1000			X	
C5-C8 Aliphatics	800			X	
C9-C10 Aromatics	1000			X	
C9-C12 Aliphatics	500			X	
Dioxins/furans (TEQ - WHO 1998)	5.61 pg/L	X			
Ethylbenzene	700		X	X	
Iron	300		X		
Manganese	778	X			
Naphthalene	100		X	X	
Pentachlorophenol	1		X		
Toluene	1000		X	X	
Free-product	1/8 inch*				

ug/L - microgram per liter (parts per billion)

pg/L - picograms per liter (parts per quadrillion)

* - 40 CFR 280.64 and ARM 17.56.607 require removal of free-product to the maximum extent practicable; determined by DEQ to be 1/8 inch or less. See Section 12.0 of the ROD for more information.

**Table 5
Soil Cleanup Levels
KRY Site**

Contaminant of Concern	Surface Soil Commercial/Industrial Cleanup Level (mg/kg)	Surface Soil Residential Cleanup Level (ng/kg) ^f	Subsurface Soil Construction/Excavation Cleanup Level (mg/kg)
1,2,4-Trimethylbenzene	NA	NA	25
Acenaphthene	NA	NA	27,000
Arsenic	40 ^a	NA	40 ^a
Benz(a)anthracene	^b	NA	^g
Benzo(a)pyrene	^b	NA	^g
Benzo(b)fluoranthene	^b	NA	NA
C11-C22 Aromatics	33,445 [*]	NA	33,445
C19-C36 Aliphatics	NA	NA	260,154
C5-C8 Aliphatics	NA	NA	730
C9-C10 Aromatics	NA	NA	4,800
C9-C12 Aliphatics	NA	NA	1,550
C9-C18 Aliphatics	2,634 [*]	NA	2,634
Carbazole	NA	NA	99
Chromium	150	NA	20
Dibenzo(a,h)anthracene	^b	NA	NA
Dioxins/furans (TEQ - 2005)	103 ng/kg	62.5	850 ng/kg
Ethylbenzene	NA	NA	320
Fluorene	NA	NA	130,000
Indeno(1,2,3-cd)pyrene	^b	NA	NA
Iron	NA	NA	46,686
Lead	800 ^c	NA	800 ^c
Methylene Chloride	0.82	NA	NA
2-Methylnaphthalene	NA	NA	1,982
Naphthalene	NA	NA	220
Pentachlorophenol	12^d	NA	0.43
Selenium	NA	NA	1.7
Sludge	Visible ^e	NA	Visible ^e
Toluene	NA	NA	260
Xylenes	NA	NA	486

mg/kg - milligrams per kilogram (parts per million)

ng/kg - nanograms per kilogram (parts per trillion)

Cleanup levels in **bold** are based on leaching to groundwater (assumes contamination only in the surface soil with clean subsurface soils).

* - Cleanup levels are based on excavation because that pathway is more protective

^a - DEQ Action Level from DEQ's April 2005 Arsenic Position Paper

^b - Total cPAH cleanup level is 1.7 mg/kg (determined using the approach outlined in EPA, 1993). cPAHs include benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene for surface soils. See Risk Analysis for more information.

^c - EPA Region 9 Industrial Preliminary Remediation Goal

^d - Cleanup level unless subsurface soil is contaminated in same area, then it is 0.43 mg/kg (the excavation leaching to groundwater level - see * above), unless the SPLP option is chosen for use in place of the leaching to groundwater cleanup levels. If that option is chosen, the SPLP result would be compared to the groundwater cleanup level multiplied by the site-specific DAF of 30.

^e - 40 CFR 280.64 and ARM 17.56.607 require removal of free product to the maximum extent practicable. For soil, this is based on visual observation.

^f - Dioxins/furans were the only COC for residential soil

^g - Total cPAH cleanup level is 13 mg/kg (determined using the approach outlined in EPA, 1993). cPAHs include benzo(a)anthracene and benzo(a)pyrene for subsurface soils. See Risk Analysis for more information.

NA - Not applicable

TABLE 6
Worse Case Estimated Volume of LNAPL
KRY Site

Area Description	Surface Area (square feet)	LNAPL Volume (gallons)	Average Maximum Thickness (feet)
Less Viscous	186,901	81,921	0.279
More Viscous	139,487	82,176	0.375
Total	326,388	164,097	NA

LNAPL volume = Surface Area x Average Maximum LNAPL Thickness x 7.481 (gallons per cubic foot) x 0.21 (value of effective porosity)

Average Maximum LNAPL Thickness derived from monthly LNAPL thickness measurements collected from KRY Site monitoring wells from July 2006 through July 2007.

Note: LNAPL presence is inferred in the areas between wells with documented LNAPL occurrences.

NA - Not Applicable

TABLE 7
Estimated Volume of Contaminated Groundwater
KRY SITE

COCs	Surface Area (square feet)	Volume (gallons)	Cleanup Level (ug/L)
Dioxins/Furans	512,085	41,368,275	5.61 pg/L
PCP	98,916	7,990,830	1
Petroleum Hydrocarbons	279,811	22,604,252	^a
Metals	2,103,984	629,596,172	^b

^a - Cleanup Levels are different for different compounds. Volume calculation includes C11-C22 Aromatics, C5-C8 Aliphatics, C9-C10 Aromatics, and C9-C12 Aliphatics, as these are the COCs for the KRY Site. See Table 4 for cleanup levels for individual compounds.

^b - Cleanup Levels are different for different compounds. Volume calculation includes arsenic, iron, and manganese, as these are the COCs for the KRY Site. See Table 4 for cleanup levels for individual compounds.

Table 8
Estimated Volume of Contaminated Soil
KRY Site

COCs	Surface Soil Volume (cy)	Surface Soil Volume with Multiplier* (cy)	Cleanup Level (mg/kg)	Subsurface Soil Volume (cy)	Subsurface Soil Volume with Multiplier* (cy)	Cleanup Level (mg/kg)
Dioxins/Furans	19,898	35,816	89 ng/kg	4,239	7,630	736 ng/kg
PCP	8,865	15,957	0.43	24,993	44,987	0.43
Petroleum Hydrocarbons	2,867	5,161	^a	12,928	23,270	^b
Lead	1,135	2,043	800	794	1,429	800

* - Multiplier of 1.8 applied to soil volumes to account for DEQ Petroleum Release Compensation Board experience with estimated volume increases for excavation-related remedial actions.

^a - Cleanup levels are different for different compounds (see Table 5). Volume calculation for surface soil includes C5-C8 Aliphatics and C9-C18 Aliphatics, as they were the only petroleum compounds with exceedances of cleanup levels.

^b - Cleanup levels are different for different compounds (see Table 5). Volume calculation for subsurface soil includes C5-C8 Aliphatics, C9-C10 Aromatics, C9-C12 Aliphatics, C9-C18 Aliphatics, as they were the compounds with exceedances of cleanup levels.

Table 9
Estimated Volume of Sludge
KRY Site

Feature	Description	Estimated Sludge Volume (cy)
Sludge Pit	Liquid layer (0 ft to 0.5 ft)	9
Sludge Pit	Sludge mixed with debris (0.5 ft to 4 ft)	31
Area Distribution of Sludge	Potential sludge area based on boring logs	2,871
Area Distribution of Sludge	Surface sludge at low depressions and surrounding GWRR-3	10
Area Distribution of Sludge	Surface sludge in the triangular area	122
Fenced-off Sludge Area (East of Railroad)	Sludge at the ground surface (0.5 ft estimated maximum thickness)	83
Grand Total -- Sludge Volume Estimate		3,126

Table 10
Cost Estimate Summary for Alternatives
KRY Site

Alternative	Capital Cost	Annual O&M Cost	Total Present Worth Cost
1	\$0	\$0	\$0
2	\$1,295,710	\$272,640	\$9,910,800
3	\$1,607,710	\$341,290	\$12,392,100
4	\$3,257,800	\$1,043,240	\$36,223,000
5	\$1,688,430	\$1,600,830	\$52,272,900
6	\$6,694,029	\$302,938	\$16,266,537
7	\$4,424,590	\$37,190	\$5,599,800
8	\$120,555,880	\$12,500	\$120,950,900
9	\$5,326,400	\$103,125	\$8,585,039
10*	\$0	\$144,169	\$4,555,585

Note: Total present worth cost calculated at 3% over 100 years

* - Specific costs developed for MNA include sampling costs associated with long-term monitoring for evaluation of remedy effectiveness, since they will likely be conducted at the same time.

**Table 11
Comparison of Alternatives
KRY Site**

Alternatives	Protectiveness	Compliance with ERCLs	Mitigation of Risk	Effectiveness and Reliability	Implementability and Practicability	Treatment or Resource Recovery Technologies	Present Cost at 3% Over 100 Years
1 - No Action	No	No	No	No	Yes	No	\$0
2 - Multi-Phase Extraction and Disposal	Yes (when combined)	Yes (when combined)	Yes (when combined)	Yes (for LNAPL)	Yes	Yes	\$ 9,910,800
3 - LNAPL Extraction and Disposal	Yes (when combined)	Yes (when combined)	Yes (when combined)	Yes (for LNAPL)	Yes	Yes	\$ 12,392,100
4 - Extraction, Ex-Situ Treatment, and Discharge of Groundwater	Yes (when combined)	Yes (when combined)	Yes (Groundwater contamination) No (LNAPL, sludge, soil contamination)	Yes (for petroleum and PCP) No (for dioxins/furans and metals)	Yes	Yes	\$ 36,223,000
5 - In-Situ Bioremediation of Groundwater and Soil	Yes (when combined)	Yes (when combined)	Yes (PCP and petroleum) No (LNAPL, sludge, dioxin/furan and metals)	Yes (PCP and petroleum) No (dioxin/furans and metals)	Yes	Yes	\$ 52,272,900
6 - In-Situ Chemical Treatment of Groundwater and Soil	Yes (when combined)	Yes (when combined)	Yes (PCP and petroleum) No (LNAPL, sludge, metals) Maybe (dioxins/furans)	Yes (PCP and petroleum) No (metals) Maybe (dioxins/furans)	Yes	Yes	\$ 16,266,537
7 - Soil Barriers	Yes (when combined)	Yes (when combined)	Yes (when combined)	Yes (when combined)	Yes	No	\$ 5,599,800
8 - Excavation, Off-Site Disposal	Yes (when combined)	Yes (when combined)	Yes (for soils) No (for LNAPL and groundwater)	Yes (for soils)	Yes	No	\$ 120,950,900
9 - Excavation, Ex-Situ Treatment, and Backfill	Yes (when combined)	Yes (when combined)	Yes (for soils) No (for LNAPL and groundwater) Maybe (dioxin)	Yes (when combined)	Yes	Yes	\$8,585,039.00
10 - Monitored Natural Attenuation	Yes (when combined)	Yes (when combined)	Yes (for groundwater) No (for soils, sludge, and LNAPL)	Yes (for groundwater, when combined)	Yes	Yes	\$4,555,585.00
SELECTED REMEDY	YES	YES	YES	YES	YES	YES	\$32,062,368*

* - Selected Remedy Total Present Worth Value is based on a 3% discount rate and the timeframe varies for each component. Please see Table 13 of the ROD for more information on timeframe for each component.

Table 12
Selected Remedy Cost Summary
KRY Site

Component	Capital Costs	Annual O&M Costs
Free-product recovery (GW)	\$1,036,892.00	\$329,267.00
Sawdust Sampling	\$44,622.00	\$0.00
Chemical Oxidation	\$6,124,632.00	\$310,948.00
Excavation, Ex Situ Treatment (LTU), and Backfill	\$5,267,857.00	\$103,125.00
Lead Soils Removal	\$885,316.00	\$0.00
Sludge Removal	\$747,335.00	\$0.00
Free Product Removal by Excavation	\$4,306,751.00	\$0.00
MNA and Site-Wide Elements	\$28,125.00	\$144,169*
Dioxin/Furan Soils Repository	\$1,136,600.00	\$0.00

* Assumes semi-annual groundwater sampling for first five years and annual thereafter; reported costs are for one sampling event per year.

Table 13
Selected Remedy Present Worth Value Summary
KRY Site

Remedy Component	Timeframe (years)	Present Value @ 3% Discount Rate
Free-product recovery (GW)	10	\$3,845,608
Sawdust Sampling	1	\$44,622
Excavation, Ex-Situ Treatment and Backfill	50*	\$7,921,242
Sludge Removal	1	\$747,335
Lead Soils Removal	1	\$885,316
Free-product removal by excavation	1	\$4,306,751
Chemical Oxidation	10	\$8,777,080
Dioxin/Furan Soils Repository	1	\$1,136,600
MNA and Site-Wide Elements	50	\$4,397,814
TOTAL		\$32,062,368

* - Section 11.4 of the ROD states that the timeframe is at least 30 years because DEQ anticipates that pilot testing will identify ways to reduce treatment timeframes and/or the use of SPLP will reduce treatment timeframes.

FIGURES

APPENDICES

Appendix A

**Determination of
Environmental Requirements, Criteria, and Limitations**

Remedial actions undertaken pursuant to the Comprehensive Environmental Cleanup and Responsibility Act (CECRA), §§ 75-10-701, et seq., MCA, must "attain a degree of cleanup of the hazardous or deleterious substance and control of a threatened release or further release of that substance that assures protection of public health, safety, and welfare and of the environment." Section 75-10-721(1), MCA. Additionally, the Montana Department of Environmental Quality (DEQ) "shall require cleanup consistent with applicable state or federal environmental requirements, criteria, or limitations" and "may consider substantive state or federal environmental requirements, criteria or limitations that are relevant to the site conditions." Section 75-10-721(2)(a) and (b), MCA.

A distinction exists between "applicable" requirements and those that are "relevant." "Applicable" requirements are those requirements that would legally apply at the KRY Site regardless of the CECRA action. "Relevant" requirements are those requirements that are not applicable, but address situations or problems sufficiently similar to those at the KRY Site and, therefore, are relevant for use at the site.

Environmental requirements, criteria, and limitations (ERCLs) are grouped into three categories: contaminant-specific, location-specific, and action-specific. Contaminant-specific requirements are those that establish an allowable level or concentration of a hazardous or deleterious substance in the environment or which describe a level or method of treatment for a hazardous or deleterious substance. Location-specific requirements are those that serve as restrictions on the concentration of a hazardous or deleterious substance or the conduct of activities because they are in specific locations. Action-specific requirements are those that are relevant or applicable to implementation of a particular remedy. Action-specific requirements do not in themselves determine the remedy but rather indicate the manner in which the remedy must be implemented.

CECRA defines cleanup requirements as only state and federal ERCLs. Remedial designs, implementation, operation, and maintenance must, nevertheless, comply with all other applicable laws, including local, state, and federal. Many such laws, while not strictly environmental, have environmental impacts. It remains the responsibility of the persons implementing the remedy to identify and comply with all other laws.

Many requirements listed here are promulgated as identical or nearly identical requirements in both federal and state law, usually pursuant to delegated environmental programs administered by the Environmental Protection Agency (EPA) and the states, such as the requirements of the federal Clean Water Act and the Montana Water Quality Act. ERCLs and other laws that are unique to state law are also identified.

Within this document, DEQ has identified applicable or relevant state and federal environmental requirements for the remedial actions at the KRY Site. The description of applicable and relevant federal and state requirements that follows includes summaries of the legal requirements which attempt to set out the requirement in a reasonably concise fashion that is useful in evaluating compliance with the requirement. These descriptions are provided to allow the user a basic indication of the requirement without having to refer back to the statute or regulation itself. However, in the event of any inconsistency between the law itself and the summaries provided in this document, the actual requirement is ultimately the requirement as set out in the law, rather than any paraphrase of the law provided here.

CONTAMINANT SPECIFIC REQUIREMENTS

GROUNDWATER

Safe Drinking Water Act 42 USC §§ 300f et seq. and the National Primary Drinking Water Regulations (40 CFR Part 141) (Relevant) establish maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) for contaminants in drinking water distributed in public water systems. These requirements were evaluated during this ERCLs analysis in conjunction with the groundwater classification standards promulgated by the State of Montana. The MCLs and MCLGs are identified because the groundwater in the area of the KRY Site is a source of drinking water and has been used in the past as a drinking water source. The Evergreen Water and Sewer District operates two wells located just northeast of the KRY Site. One well was installed in 1967, is reportedly 85 feet deep, and has a water right for 2,000 gallons per minute (gpm). The second well was installed in 1975, is reportedly 143 feet deep, and has a water right for 3,000 gpm. Both wells are currently in operation. In addition, there are numerous commercial, industrial, and residential wells on or near the KRY Site that use the groundwater.

Use of these standards for this action is fully supported by EPA regulations and guidance. The Preamble to the National Contingency Plan (NCP) clearly states that MCLs are relevant for groundwater that is a current or potential source of drinking water (55 Fed.Reg. 8750, March 8, 1990), and this determination is further supported by requirements in the regulations governing conduct of the RI/FS studies found at 40 CFR • 300.430(e)(2)(i)(B). EPA's guidance on Remedial Action for Contaminated Groundwater at Superfund Sites states that MCLs developed under the Safe Drinking Water Act generally are ARARs [the federal equivalent of ERCLs] for current or potential drinking water sources. MCLGs which are above zero are relevant under the same conditions (55 Fed.Reg. 8750-8752, March 8, 1990). See also, State of Ohio v. EPA, 997 F.2d 1520 (D.C. Cir. 1993), which upholds EPA's application of MCLs and non-zero MCLGs as ARAR standards for groundwater which is a potential drinking water source.

Chemical	MCLG	MCL
Arsenic	0 ¹	10 ug/L
Benzene	0 ¹	5 ug/L
Dioxins/furans	0 ¹	.00003 ug/L (30 ppq)
Ethylbenzene	700	700 ug/L
Pentachlorophenol	0 ¹	1 ug/L
Toluene	1,000 ug/L	1,000 ug/L

¹ An MCLG of zero is not an appropriate standard for Superfund site cleanups.

In addition, the Secondary Maximum Contaminant Levels (SMCLS) specified in 40 CFR Part 143.3 are relevant requirements which are ultimately to be attained by the remedy for the KRY Site. This regulation contains standards for iron, manganese, color, odor, and corrosivity that are relevant to the remedial actions.

The Montana Water Quality Act, § 75-5-605, MCA (Applicable) provides that it is unlawful to cause pollution of any state waters and § 75-6-112, MCA (Applicable) provides that it is unlawful to discharge drainage or other waste that will cause pollution of state waters used as a source for a public water supply or for domestic use as well as prohibits other unlawful actions.

Section 75-5-605, MCA (Applicable) also states that it is unlawful to place or cause to be placed any wastes where they will cause pollution of any state waters.

Section 75-5-303, MCA (Applicable) states that existing uses of state waters and the level of water quality necessary to protect the uses must be maintained and protected.

ARM 17.30.1006 (Applicable) classifies groundwater into Classes I through IV based upon its specific conductance and establishes the groundwater quality standards applicable with respect to each groundwater classification. Class I is the highest quality class; class IV the lowest. Based on its specific conductance, groundwater at the KRY Site has been classified as Class I groundwater. Concentrations of substances in groundwater within Class I may not exceed the human health standards for groundwater listed in Circular DEQ-7, Montana Numeric Water Quality Standards, February 2006 (Applicable). In addition, no increase of a parameter may cause a violation of § 75-5-303, MCA (Applicable). For concentrations of parameters for which human health standards are not listed in DEQ-7, ARM 17.30.1006 allows no increase of a parameter to a level that renders the waters harmful, detrimental or injurious to the beneficial uses listed for that class of water.

Human health standards for the primary contaminants of concern (COCs) are listed below and are based on the standards outlined in DEQ-7. (For a complete list of COCs, see Table 4-1 in the Remedial Investigation.) However, compliance with all DEQ-7 standards is required and remedial actions must meet the DEQ-7 standards for all contaminants at the KRY Site, including any breakdown products generated during remedial actions.

Contaminant	DEQ-7 Standard
Arsenic	10 µg/l
Benzene	5 µg/l
Dioxins/furans	.000002 µg/l ¹
Ethylbenzene	700 µg/l
Iron	300 µg/l
Manganese	50 µg/l ²
Naphthalene	100 µg/l
Pentachloropheno l	1 µg/l
Toluene	1,000 µg/l

1 The background level of 5.61 pg/L is the cleanup level

2 The background level of 778 µg/l is the cleanup level

ARM 17.30.1011 (Applicable) provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality in accordance with § 75-5-303, MCA, and ARM Title 17, chapter 30, subchapter 7.

An additional concern with respect to ERCLs for groundwater is the impact of groundwater upon surface water. If significant loadings of contaminants from groundwater sources to any surface water body contribute to the inability of the surface water to meet its applicable class standards, (i.e., the DEQ-7 levels described in the Surface Water section below), then alternatives to alleviate such groundwater loading must be evaluated and, if appropriate, implemented

SURFACE WATER

The KRY Site is located in adjacent to the Stillwater River. Surface water and groundwater in the unconfined aquifer are generally interconnected with the Stillwater River and the river likely discharges to the upper aquifer in the vicinity of the KRY Site.

The federal Clean Water Act, 33 U.S.C. § 1251, et seq., provides the authority for each state to adopt water quality standards (40 CFR Part 131) designed to protect beneficial uses of each water body and requires each state to designate uses for each water body. Under the state Water Quality Act, §§ 75-5-101, et seq., MCA, Montana has promulgated regulations, ARM 17.30.601 et seq., (Applicable), to protect, maintain, and improve the quality of surface waters in the state. The State has the authority to adopt water quality standards designed to protect beneficial uses of each water body and to designate uses for each water body.

Montana's regulations classify State waters according to quality, place restrictions on the discharge of pollutants to State waters, and prohibit degradation of State waters.

Pursuant to this authority and the criteria established by Montana surface water quality regulations, ARM 17.30.601, et seq., Montana has established the Water-Use Classification system. ARM 17.30.608 (Applicable) provides that the Stillwater River mainstem from Logan Creek to the Flathead River is classified as B-2. The Whitefish River from the outlet of Whitefish Lake to the Stillwater River is also classified as B-2, and the Flathead River above Flathead Lake is classified as B-1.

ARM 17.30.623 (Applicable) provides the classification standards and beneficial uses for the B-1 classification and provides that concentrations of carcinogenic, bioconcentrating, toxic, or harmful parameters that would remain in the water after conventional water treatment may not exceed DEQ-7 standards. The section also provides the specific water quality standards for water classified as B-1 that must be met.

In addition, the following criteria apply:

1. Dissolved oxygen concentration must not be reduced below the levels given in DEQ-7, as provided in the following table (in milligrams per liter)

	Early Life Stages ^{1,2}	Other Life Stages
30 Day Mean	n/a ³	6.5
7 Day Mean	9.5 (6.5)	n/a ³
7 Day Mean Minimum	n/a ³	5.0
1 Day Minimum ⁴	8.0 (5.0)	4.0

1 These are water column concentrations recommended to achieve the required inter-gravel dissolved oxygen concentrations shown in parentheses. For species that have early life stages exposed directly to the water column, the figures in parentheses apply.

2 Includes all embryonic and larval stages and all juvenile forms of fish to 30 days following hatching.

3 not applicable

4 All minima should be considered instantaneous concentrations to be achieved at all times

2. Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 must be maintained at less than 0.5 pH unit. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0;
3. The maximum allowable increase above naturally occurring turbidity is five nephelometric turbidity units, except as permitted by § 75-5-318, MCA;
4. Temperature increases must be kept within prescribed limits;
5. No increase is allowed above naturally occurring concentrations of sediment, settleable solids, oils, or floating solids which will or is likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife;
6. True color must be kept within specified limits; and
7. E-coli must be kept below specified limits.

ARM 17.30.624 (Applicable) provides the classification standards and beneficial uses for the B-2 classification and provides that concentrations of carcinogenic, bioconcentrating, toxic, or harmful parameters that would remain in the water after conventional water treatment may not exceed DEQ-7 standards. The section also provides the specific water quality standards for water classified as B-2 that must be met.

In addition, the following criteria apply:

1. Dissolved oxygen concentration must not be reduced below the levels given in DEQ-7, as provided in the following table (in milligrams per liter)

	Early Life Stages ^{1,2}	Other Life Stages
30 Day Mean	n/a ³	6.5
7 Day Mean	9.5 (6.5)	n/a ³
7 Day Mean Minimum	n/a ³	5.0
1 Day Minimum ⁴	8.0 (5.0)	4.0

1 These are water column concentrations recommended to achieve the required inter-gravel dissolved oxygen concentrations shown in parentheses. For species that have early life stages exposed directly to the water column, the figures in parentheses apply.

2 Includes all embryonic and larval stages and all juvenile forms of fish to 30 days following hatching.

3 not applicable

4 All minima should be considered instantaneous concentrations to be achieved at all times

2. Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 9.0 must be maintained at less than 0.5 pH unit. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0;
3. The maximum allowable increase above naturally occurring turbidity is 10 nephelometric turbidity units, except as permitted by § 75-5-318, MCA;
4. Temperature increases must be kept within prescribed limits;
5. No increase is allowed above naturally occurring concentrations of sediment, settleable solids, oils, or floating solids which will or is likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife;
6. True color must be kept within specified limits; and
7. E-coli must be kept below specified limits.

For the primary COC, the DEQ-7 surface water standard is listed below. However, compliance with all DEQ-7 standards is required. If both Aquatic Life Standards and Surface Water Human Health Standards exist for the same analyte, the more restrictive of these values will be used as the applicable numeric standard.

<u>Chemical</u>	<u>DEQ-7 Standard</u>
Dioxin/furans	.00000005 µg/l

Creeks, rivers, ditches, and certain other bodies of surface water must meet these requirements.¹

ARM 17.30.637 (Applicable) requires state surface waters to be free from substances attributable to municipal, industrial, agricultural practices, or other discharges that will:

1. settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines;
2. create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials;
3. produce odors, colors or other conditions as to which create a nuisance or render undesirable tastes to fish flesh or make fish inedible;
4. create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life; and
5. create conditions which produce undesirable aquatic life.

¹ As provided under ARM 17.30.602(33), "surface waters' means any waters on the earth's surface including, but not limited to, streams, lakes, ponds, and reservoirs; and irrigation and drainage systems discharging directly into a stream, lake, pond, reservoir, or other surface water. Water bodies used solely for treating, transporting, or impounding pollutants shall not be considered surface water."

ARM 17.30.637 (Applicable) also states that no waste may be discharged and no activities conducted which, either along or in combination with other waste activities, will cause violation of surface water quality standards.

ARM 17.30.705 (Applicable): This provides that for any surface water, existing and anticipated uses and the water quality necessary to protect these uses must be maintained and protected unless degradation is allowed under the nondegradation rules at ARM 17.30.708.

AIR QUALITY

The Clean Air Act (42 USC §§ 7401 et seq.) provides limitations on air emissions resulting from cleanup activities or emissions resulting from wind erosion of exposed hazardous substances. Sections 75-2-101, et seq, MCA (Applicable) provides that state emission standards are enforceable under the Montana Clean Air Act.

ARM 17.8.204 and 206 (Applicable) This provision establishes monitoring, data collection and analytical requirements to ensure compliance with ambient air quality standards and requires compliance with the Montana Quality Assurance Project Plan except when more stringent requirements are determined by DEQ to be necessary.

ARM 17.8.220 (Applicable). Settled particulate matter shall not exceed a thirty (30) day average of 10 grams per square meter.

ARM 17.8.222 (Applicable). Lead in ambient air shall not exceed a 90 day average of 1.5 micrograms per cubic meter of air.

ARM 17.8.223 (Applicable). PM-10 concentrations in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air.

Ambient air standards are also promulgated for carbon monoxide, hydrogen sulfide, nitrogen dioxide, sulfur dioxide, and ozone. If emissions of these compounds were to occur at the KRY Site in connection with any remedial action, these standards would also be applicable. See ARM 17.8.210, 17.8.211, 17.8.212, 17.8.213, and 17.8.214.

LOCATION SPECIFIC REQUIREMENTS

The Endangered Species Act (Relevant): This statute and implementing regulations (16 U.S.C. § 1531 et seq., 50 CFR Part 402, 40 CFR 6.302(h), and 40 CFR 257.3-2) require that any federal activity or federally authorized activity may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat. Compliance with this requirement involves consultation with the U.S. Fish and Wildlife Service (USFWS) and a determination of whether there are listed or proposed species or critical habitats present at the facility, and, if so, whether any proposed activities will impact such wildlife or habitat. No threatened or endangered species or critical habitat has been identified at the KRY Site and no

federal actions activities are anticipated. However, if any threatened or endangered species are subsequently encountered during remedial actions, consultation with the USFWS will occur.

Montana Nongame and Endangered Species Act, §§ 87-5-101 et seq (Applicable): Endangered species should be protected in order to maintain and to the extent possible enhance their numbers. These sections list endangered species, prohibited acts and penalties. See also, § 87-5-201, MCA, (Applicable) concerning protection of wild birds, nests and eggs; and ARM 12.5.201 (Applicable) prohibiting certain activities with respect to specified endangered species. No threatened or endangered species or critical habitat has been identified at the KRY Site. However, if any threatened or endangered species or critical habitat are subsequently encountered during remedial actions, compliance with these ERCLs is required.

Migratory Bird Treaty Act (Relevant): This requirement (16 U.S.C. § 703 et seq.) establishes a federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that the cleanup of the KRY Site does not unnecessarily impact migratory birds. Specific mitigative measures may be identified for compliance with this requirement. If any migratory birds are encountered during remedial actions, consultation with the USFWS will occur.

Bald Eagle Protection Act (Relevant): This requirement (16 U.S.C. § 668 et seq.) establishes a federal responsibility for protection of bald and golden eagles, and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that any cleanup of the KRY Site does not unnecessarily adversely affect the bald and golden eagle. To date, bald and golden eagles have not been identified at the KRY Site. However, if any bald or golden eagles are subsequently encountered during remedial actions, consultation with the USFWS will occur.

Historic Sites, Buildings, Objects and Antiquities Act (Relevant): These requirements, found at 16 U.S.C. 461 et seq., provide that, in conducting an environmental review of a proposed action, the responsible official shall consider the existence and location of natural landmarks using information provided by the National Park Service pursuant to 36 CFR 62.6(d) to avoid undesirable impacts upon such landmarks. To date, no such landmarks are identified in the area. Therefore, no further actions are required to comply with this requirement.

Resource Conservation and Recovery Act (Relevant): 40 CFR 264.18 provides location standards for owners and operators of hazardous waste management units. Portions of new management units must not be located within 200 feet of a fault which has had displacement in Holocene time and management units in or near a 100 year floodplain must be designed, constructed, operated, and maintained to avoid washout.

Wetlands, Floodplains, and Streambed Preservation

The majority of the KRY Site is situated outside of the 100-year floodplain, except for a small area on the west side of the KRY Site, and a small area near the railroad tracks on the northeastern edge of the KRY Site. To the extent that there are floodplains potentially impacted by the KRY Site, applicable or relevant ERCLs are identified. In addition, there are surface water bodies adjacent to the KRY Site which necessitates the identification of streambed

requirements. However, it is not anticipated that the remedy will require work in the streambed. No wetlands have been identified on the KRY Site so no wetland ERCLs have been included.

Fish and Wildlife Coordination Act (Relevant): These standards are found at 16 U.S.C. § 661 *et seq.* and 40 CFR 6 and require that federally funded or authorized projects ensure that any modification of any stream or other water body affected by a funded or authorized action provide for adequate protection of fish and wildlife resources. The regulations are relevant because there are surface water bodies adjacent to the KRY Site; however, no federal action is anticipated at the site and it is not anticipated that further actions are required to comply with this requirement.

Floodplain Management Order (Relevant): Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Implementing regulations for this executive order are found at 40 CFR 6. The executive order and regulations are relevant because a portion of the KRY Site is in a floodplain; however, no federal action is anticipated at the site and it is not anticipated that further actions are required to comply with this requirement. In addition, application of the Montana floodplain requirements (see below) addresses protection of the floodplain.

Montana Floodplain and Floodway Management Act and Regulations, §§ 76-5-401, et seq., MCA, ARM 36.15.601, et seq. (Applicable): The Floodway Management Act and regulations specify types of uses and structures that are allowed or prohibited in the designated 100-year floodway and floodplain.

Section 76-5-401, MCA and ARM 36.15.601 (Applicable) allow certain open-space uses in a floodway.

ARM 36.15.701 (Applicable) allow certain activities in the flood fringe.

ARM 36.15.605(2) and 36.15.703 (Applicable) prohibit certain uses anywhere in either the floodway or the flood fringe.

Section 76-5-402, MCA, (Applicable) allows uses in the floodplain outside the flood way.

Section 76-5-404, MCA (Applicable), establishes that it is unlawful to alter an artificial obstruction or designated floodway without a permit. This section applies to any remedial action in the designated floodplain or designated floodway where such action requires more than maintenance. The substantive requirements of a Floodplain Development Permit are applicable to activities planned in the floodway.

The substantive requirements specify factors that must be considered in allowing diversions of the stream, changes in place of diversion of the stream, flood control works, new construction or alteration of artificial obstructions, or any other nonconforming use within the floodplain or floodway. Many of these requirements are set forth as factors that must be considered in determining whether a permit can be issued for certain obstructions or uses. Factors which must

be considered in addressing any obstruction or use within the floodway or floodplain include:

1. the danger to life and property from backwater or diverted flow caused by the obstruction or use;
2. the danger that the obstruction or use will be swept downstream to the injury of others;
3. the availability of alternate locations;
4. the construction or alteration of the obstruction or use in such a manner as to lessen the danger;
5. the permanence of the obstruction or use; and
6. the anticipated development in the foreseeable future of the area which may be affected by the obstruction or use.

See § 76-5-406, MCA; ARM 36.15.216 (Applicable). Conditions or restrictions that generally apply to specific activities within the floodway or floodplain are:

1. the proposed activity, construction, or use cannot increase the upstream elevation of the 100-year flood a significant amount (0.5 foot or as otherwise determined by the permit-issuing authority) or significantly increase flood velocities, ARM 36.15.604 (Applicable); and
2. the proposed activity, construction, or use must be designed and constructed to minimize potential erosion.

For the substantive conditions and restrictions applicable to specific obstructions or uses, see the following applicable regulations:

Excavation of material from pits or pools - ARM 36.15.602(1).

Storage of materials must be readily removable – ARM 36.15.602(5)(b).

Water diversions or changes in place of diversion - ARM 36.15.603.

Flood control works (levees, floodwalls, and riprap must comply with specified safety standards) - ARM 36.15.606.

Roads, streets, highways and rail lines (must be designed to minimize increases in flood heights) - ARM 36.15.701(3)(c).

Structures and facilities for liquid or solid waste treatment and disposal (must be floodproofed to ensure that no pollutants enter flood waters and may be allowed and approved only in accordance with DEQ regulations, which include certain additional prohibitions on such disposal) - ARM 36.15.701(3)(d).

Structures -ARM 36.15.702(1)(2).

Montana Natural Streambed and Land Preservation Act and Regulations, §§ 75-7-101, et seq., MCA, and ARM 36.2.401 et seq. (Applicable) - Applies if a remedial action alters or affects a streambed (including a river) or its banks. The adverse effects of any such action must be minimized. It is not anticipated that the remedial action will alter or affect a streambed or streambanks.

ARM 36.2.410 (Applicable) establishes minimum standards which would be applicable if a remedial action alters or affects a streambed, including any channel change, new diversion, riprap or other streambank protection project, jetty, new dam or reservoir or other commercial, industrial or residential development. Projects must be designed and constructed using methods that minimize adverse impacts to the stream (both upstream and downstream) and future disturbances to the stream. All disturbed areas must be managed during construction and reclaimed after construction to minimize erosion. Temporary structures used during construction must be designed to handle high flows reasonably anticipated during the construction period. Temporary structures must be completely removed from the stream channel at the conclusion of construction, and the area must be restored to a natural or stable condition. Channel alterations must be designed to retain original stream length or otherwise provide hydrologic stability. Streambank vegetation must be protected except where removal of such vegetation is necessary for the completion of the project. When removal of vegetation is necessary, it must be kept to a minimum. Riprap, rock, and other material used in a project must be of adequate size, shape, and density and must be properly placed to protect the streambank from erosion. The placement of road fill material in a stream, the placement of debris or other materials in a stream where it can erode or float into the stream, projects that permanently prevent fish migration, operation of construction equipment in a stream, and excavation of streambed gravels are prohibited unless specifically authorized by the district. Such projects must also protect the use of water for any useful or beneficial purpose. See § 75-7-102, MCA.

Section 75-7-111, MCA, (Applicable) provides that a person planning to engage in any activity that will physically alter or modify the bed or banks of a stream or river must give written notice to the Board of Supervisors of a Conservation District, the Directors of a Grass Conservation District, or the Board of County Commissioners if the proposed project is not within a district.

Montana Solid Waste Management Act and regulations, §§ 75-10-201, et seq., MCA, ARM 17.50.501 et seq. (Applicable) - Regulations promulgated under the Solid Waste Management Act, § 75-10-201, et seq., MCA, and pursuant to the federal Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, 42 U.S.C. ● 6901 et seq (RCRA Subtitle D). They specify requirements that apply to the location of any solid waste management facility. At the KRY Site, these requirements specifically apply to the petroleum land treatment unit and the dioxin/furan repository described in the Record of Decision.

ARM 17.50.505 (Applicable) provides that a facility for the treatment, storage or disposal of solid wastes:

1. must be located where a sufficient acreage of suitable land is available for solid waste management;

2. may not be located in a 100-year floodplain;
3. may be located only in areas which will prevent the pollution of ground and surface waters and public and private water supply systems;
4. must be located to allow for reclamation and reuse of the land;
5. drainage structures must be installed where necessary to prevent surface runoff from entering waste management areas; and
6. where underlying geological formations contain rock fractures or fissures which may lead to pollution of the ground water or areas in which springs exist that are hydraulically connected to a proposed disposal facility, only Class III disposal facilities may be approved.

ARM 17.50.505(2) (Applicable) specifies standards for solid waste management facilities, including the requirements that:

1. Class II² landfills must confine solid waste and leachate to the disposal facility. (Leachate is defined as a liquid which has contacted, passed through, or emerged from solid waste and contains soluble, suspended, or miscible materials removed from the waste. (ARM 17.50.502(29)) If there is the potential for leachate migration, it must be demonstrated that leachate will only migrate to underlying formations which have no hydraulic continuity with any state waters;

2. adequate separation of group II wastes from underlying or adjacent water must be provided³; and

3. no new disposal units or lateral expansions may be located in wetlands.

ARM 17.50.506 (Applicable) specifies design requirements for landfills, which is defined in ARM 17.50.502(27) as an area of land or an excavation where wastes are placed for permanent disposal, and that is not a land application unit, surface impoundment, injection well, or waste pile. Landfills must either be designed to ensure that MCLs are not exceeded or the landfill must contain a composite liner and leachate collection system which comply with specified criteria.

ARM 17.50.511 (Applicable) sets forth general operational and maintenance and design requirements for solid waste management systems. Specific operational and maintenance requirements include requirements for run-on and runoff control systems, requirements that sites be fenced to prevent unauthorized access, and prohibitions of point source and nonpoint source discharges which would violate Clean Water Act requirements.

2 Generally Class II landfills are licensed to receive Group II and Group III waste, but not regulated hazardous waste. Class III landfills may only receive Group III waste. Class IV landfills may receive Group III or IV waste.

3 The extent of separation shall be established on a case-by-case basis, considering terrain and the type of underlying soil formations, and facility design. The Waste Management Section of DEQ has generally construed this to require a 10 to 20 foot separation from groundwater.

ARM 17.50.523 (Applicable) requires that waste be transported in such a manner as to prevent its discharge, dumping, spilling or leaking from the transport vehicle. This applies to the off-site disposal of the lead contaminated soils.

ARM 17.50.525 (Applicable) states that DEQ may inspect at reasonable hours.

ARM 17.50.530 (Applicable) sets forth the closure requirements for landfills, including the repository described in the Record of Decision. This includes the requirement that the repository cap be a minimum of 24 inches thick and other criteria, as follows:

1. install a cover that is designed to minimize infiltration and erosion;
2. design and construct the final cover system to minimize infiltration through the closed unit by the use of an infiltration layer that contains a minimum 18 inches of earthen material and has a permeability less than or equal to the permeability of any bottom liner, barrier layer, or natural subsoils or a permeability no greater than 1×10^{-5} cm/sec, whichever is less;
3. minimize erosion of the final cover by the use of a seed bed layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth and protecting the infiltration layer from frost effects and rooting damage; and
4. revegetate the final cover with native plant growth within one year of placement of the final cover.

ARM 17.50.530(1)(b) (Applicable) allows an alternative final cover design if the infiltration layer achieves reduction in infiltration at least equivalent to the stated criteria and the erosion layer provides protection equivalent to the stated criteria.

ARM 17.50.531 (Applicable) sets forth post closure care requirements for Class II landfills and is applicable to the dioxin/furan contaminated soil repository. Post closure care must be conducted for a period sufficient to protect human health and the environment. Post closure care requires maintenance of the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the cover and comply with the groundwater monitoring requirements found at ARM Title 17, chapter 50, subchapter 7. The ground water monitoring requirements of ARM 17.50.701 *et seq.* will be coordinated with the other monitoring requirements required by the Record of Decision.

In addition, § 75-10-212, MCA, (Applicable) prohibits dumping or leaving any debris or refuse upon or within 200 yards of any highway, road, street, or alley of the State or other public property, or on privately owned property where hunting, fishing, or other recreation is permitted. However, the restriction relating to privately owned property does not apply to the owner, his agents, or those disposing of debris or refuse with the owner's consent.

ACTION SPECIFIC REQUIREMENTS

Point Source Controls: If point sources of water contamination are retained or created by any remediation activity, applicable Clean Water Act standards would apply to those discharges. The State of Montana established state standards and permit requirements in conformity with the Clean Water Act, and these standards and requirements apply to point source discharges. See ARM 17.30.1201 et seq., (standards) and ARM 17.30.1301 et seq. (permits).

Dredge and Fill Requirements (Applicable): The selected remedy does not involve depositing dredge and fill material into water of the United States. Therefore, remediation activities associated with waste removal and creek restoration which requires a Section 404 Permit are not anticipated.

Air Quality Regulations (Applicable): Dust suppression and control of certain substances likely to be released into the air as a result of earth moving, transportation and similar actions may be necessary to meet air quality requirements. Additional air quality regulations under the state Clean Air Act, §§ 75-2-101 et seq., MCA, promulgated pursuant to the Clean Air Act, 42 U.S.C. §§ 7401, et seq., are discussed below. These standards are applicable to cleanup activities.

ARM 17.8.220 (Applicable). Settled particulate matter shall not exceed a thirty (30) day average of 10 grams per square meter.

ARM 17.8.222 (Applicable). Lead in ambient air shall not exceed a 90 day average of 1.5 micrograms per cubic meter of air.

ARM 17.8.223 (Applicable). PM-10 concentrations in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air.

Ambient air standards under section 109 of the Clean Air Act are also promulgated for carbon monoxide, hydrogen sulfide, nitrogen dioxide, sulfur dioxide, and ozone. If emissions of these compounds were to occur at the KRY Site in connection with any cleanup action, these standards would also be applicable. See ARM 17.8.210, 17.8.211, 17.8.212, 17.8.213, and 17.8.214.

ARM 17.8.304 and 17.8.308 (Applicable) provide that no person shall cause or authorize the production, handling, transportation or storage of any material; or cause or authorize the use of any street, road, or parking lot; or operate a construction site or demolition project, unless reasonable precautions to control emissions of airborne particulate matter are taken. Emissions of airborne particulate matter must be controlled so that they do not "exhibit an opacity of twenty percent (20%) or greater averaged over six consecutive minutes."

ARM 17.24.761 (Relevant) specifies a range of measures for controlling fugitive dust emissions during mining and reclamation activities and requires that a fugitive dust control program be implemented. Some of these measures could be considered relevant to control fugitive dust emissions in connection with excavation, earth moving and transportation activities conducted as part of the remedy at the site. Such measures include, for example, paving, watering, chemically

stabilizing, or frequently compacting and scraping roads, promptly removing rock, soil or other dust-forming debris from roads, restricting vehicles speeds, revegetating, mulching, or otherwise stabilizing the surface of areas adjoining roads, restricting unauthorized vehicle travel, minimizing the area of disturbed land, and promptly revegetating regraded lands.

Groundwater Act (Applicable): § 85-2-505, MCA, precludes the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.

Section 85-2-516, MCA (Applicable) states that within 60 days after any well is completed a well log report must be filed by the driller with the Montana Bureau of Mines and Geology.

ARM 17.30.641 (Applicable) provides standards for sampling and analysis of water.

ARM 17.30.646 (Applicable) requires that bioassay tolerance concentrations be determined in a specified manner.

ARM 36.21.670-678 and 810 (Applicable) specifies certain requirements that must be fulfilled when abandoning monitoring wells.

Substantive MPDES Permit Requirements, ARM 17.30.1342-1344 (Applicable): Because the State of Montana has been delegated the authority to implement the Clean Water Act, these requirements are enforced in Montana through the Montana Pollutant Discharge Elimination System (MPDES). These regulations set forth the substantive requirements applicable to all MPDES and National Pollutant Discharge Elimination System permits. The substantive requirements, including the requirement to properly operate and maintain all facilities and systems of treatment and control, are applicable requirements.

Technology-Based Treatment, ARM 17.30.1203 (Applicable): Provisions of 40 CFR Part 125 for criteria and standards for the imposition of technology-based treatment requirements are adopted and incorporated in DEQ permits. For toxic and nonconventional pollutants treatment must apply the best available technology economically achievable (BAT); for conventional pollutants, application of the best conventional pollutant control technology (BCT) is required. Where effluent limitations are not specified for the particular industry or industrial category at issue, BCT/BAT technology-based treatment requirements are determined on a case by case basis using best professional judgment (BPJ).

Storm Water Runoff - ARM 17.30.1341 to 1344 (Applicable) requires a Storm Water Discharge General Permit for stormwater point sources. Generally, the permit requires the permittee to implement Best Management Practices (BMP) and to take all reasonable steps to minimize or prevent any discharge which has a reasonable likelihood of adversely affecting human health or the environment. However, if there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with the activity, additional protections may be required.

ARM 17.24.633 (Relevant): All surface drainage from a disturbed area must be treated by the best technology currently available.

RCRA Subtitle C Requirements and corresponding State requirements

RCRA, 42 U.S.C. §§ 6901 et seq., (Applicable, as incorporated by the Montana Hazardous Waste Act), the Montana Hazardous Waste Act, §§ 75-10-401 et seq., MCA, (Applicable) and the regulations under these acts establish a regulatory structure for the generation, transportation, treatment, storage and disposal of hazardous wastes. These requirements are applicable to substances and actions at the KRY Site that involve the active management of hazardous wastes, including excavation of listed hazardous waste and the pentachlorophenol land treatment unit described in the Record of Decision. Some of the requirements may also apply to the lead-contaminated soil if subsequent sampling reveals it is a characteristic hazardous waste.

Wastes may be designated as hazardous by either of two methods: listing or demonstration of a hazardous characteristic. Listed wastes are the specific types of wastes determined by EPA to be hazardous as identified in 40 CFR Part 261, Subpart D (40 CFR 261.30 - 261.33) (Applicable, as incorporated by the Montana Hazardous Waste Act). Listed wastes are designated hazardous by virtue of their origin or source, and must be managed as hazardous wastes. Characteristic wastes are those that by virtue of concentrations of hazardous constituents demonstrate the characteristic of ignitability, corrosivity, reactivity or toxicity, as described at 40 CFR Part 261, Subpart C (Applicable, as incorporated by the Montana Hazardous Waste Act).

40 CFR 261.31 defines F032 waste as:

Wastewaters (except those that have not come into contact with process contaminants), process residuals, preservative drippage, and spent formulations from wood preserving processes generated at plants that currently use or have previously used chlorophenolic formulations (except potentially cross-contaminated wastes that have had the F032 waste code deleted in accordance with §261.35 of this chapter or potentially cross-contaminated wastes that are otherwise currently regulated as hazardous wastes (i.e., F034 or F035), and where the generator does not resume or initiate use of chlorophenolic formulations). This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.

Media at the KRY site is contaminated with PCP from process residuals, preservative drippage, and spent formulations from a wood treating process that used chlorophenolic formulations. Therefore, the KRY Site contains F032 listed hazardous wastes and the various media and wastes contaminated by the F032 wastes are hazardous wastes pursuant to 40 CFR Part 261.

The RCRA requirements specified below are applicable requirements for the treatment, storage and disposal of these F032 wastes. In addition, the lead-contaminated soil at the KRY Site will be further characterized to determine if it is a hazardous waste.

The RCRA regulations at 40 CFR Part 262 (Applicable, as incorporated by the Montana Hazardous Waste Act) establish standards that apply to generators of hazardous waste. These standards include requirements for obtaining an EPA identification number and maintaining certain records and filing certain reports. These standards are applicable for any waste which will be transported offsite.

The RCRA regulations at 40 CFR Part 263 (Applicable, as incorporated by the Montana Hazardous Waste Act) establish standards that apply to transporters of hazardous waste. These standards include requirements for immediate action for hazardous waste discharges. These standards are applicable for any onsite transportation. These standards are independently applicable for any offsite transportation.

The regulations at 40 CFR 264, Subpart B (Applicable, as incorporated by the Montana Hazardous Waste Act) establish general facility requirements. These standards include requirements for general waste analysis, security and location standards.

The regulations at 40 CFR 264, Subpart F (Applicable, as incorporated by the Montana Hazardous Waste Act) establish requirements, including monitoring requirements, for groundwater protection for RCRA-regulated solid waste management units (including land treatment units). Subpart F provides for three general types of groundwater monitoring: detection monitoring (40 CFR 264.98); compliance monitoring (40 CFR 264.99); and corrective action monitoring (40 CFR 264.100). Monitoring wells must be cased according to 40 CFR 264.97(c). Monitoring is required during the active life of a hazardous waste management unit. If hazardous waste remains, monitoring is required for a period necessary to protect human health and the environment.

40 CFR Part 264, Subpart G (Applicable, as incorporated by the Montana Hazardous Waste Act) establishes that hazardous waste management facilities must be closed in such a manner as to (a) minimize the need for further maintenance and (b) control, minimize or eliminate, to the extent necessary to protect public health and the environment, post-closure escape of hazardous wastes, hazardous constituents, leachate, contaminated runoff or hazardous waste decomposition products to the ground or surface waters or to the atmosphere. Requirements for facilities requiring post-closure care include the following: the facilities must undertake appropriate monitoring and maintenance actions, control public access, and control post-closure use of the property to ensure that the integrity of the final cover, liner, or containment system is not disturbed. In addition, all contaminated equipment, structures and soil must be properly disposed of or decontaminated unless exempt and free liquids must be removed or solidified, the wastes stabilized, and the waste management unit covered.

40 CFR Part 264, Subpart I (Applicable, as incorporated by the Montana Hazardous Waste Act) apply to owners and operators of facilities that store hazardous waste in containers. These regulations are applicable to any storage of purge water or other media containing F032 hazardous waste. The related provisions of 40 CFR 261.7 regarding residues of hazardous waste in empty containers are also applicable, as incorporated by the Montana Hazardous Waste Act.

40 CFR Part 264, Subpart L (Applicable, as incorporated by the Montana Hazardous Waste Act)

applies to owners and operators of facilities that store or treat hazardous waste in piles. The regulations include requirements for the use of run-on and run-off control systems and collection and holding systems to prevent the release of contaminants from waste piles. These regulations apply to any storage in waste piles at the KRY Site.

40 CFR Part 264, Subpart M (Applicable, as incorporated by the Montana Hazardous Waste Act) apply to owners and operators of facilities that treat hazardous waste in land treatment units. These regulations are applicable to the design and operation of the pentachlorophenol land treatment unit discussed in the Record of Decision.

40 CFR Part 264, Subpart S (Applicable, as incorporated by the Montana Hazardous Waste Act) provides special provisions for cleanup; 40 CFR 264.552 allows the designation of a corrective action management unit (CAMU) located within the contiguous property under the control of the owner or operator where the wastes to be managed in the CAMU originated and provides requirements for siting, managing, and closing the CAMU. The CAMU-eligible waste at the KRY Site includes the F032-contaminated soil that must be managed to implement the cleanup. Placement of this CAMU-eligible waste does not constitute land disposal of hazardous waste. If staging piles are needed during remediation, compliance with 40 CFR 264.554 will be required.

40 CFR 264.554 sets forth the requirements for a staging pile. A staging pile must be located within the contiguous property under the control of the owner/operator where the wastes to be managed in the staging pile originated. The staging pile must be designed so as to prevent or minimize releases of hazardous wastes and hazardous constituents into the environment, and minimize or adequately control cross-media transfer, as necessary to protect human health and the environment (for example, through the use of liners, covers, run-off/run-on controls, as appropriate). The staging pile must not operate for more than two years and cannot be used for treatment.

Since F032 listed waste is present at the KRY Site, the RCRA Land Disposal Restrictions (LDRs) treatment levels set forth in 40 CFR Part 268 are applicable requirements (as incorporated by the Montana Hazardous Waste Act) including the treatment levels for F032 listed wastes for the disposal of hazardous wastes generated at the facility. With the exception of treated soils, hazardous wastes are prohibited from disposal onsite.

The Hazardous Waste Identification Rule (HWIR) for Contaminated Media promulgated at 63 Fed. Reg. 65874 (November 30, 1998) allows listed waste treated to levels protective of human health and the environment to be disposed onsite without triggering land ban or minimum technology requirements for these disposal requirements. Treated soils containing hazardous waste will need to meet site-specific cleanup levels as well as the land disposal restriction (LDR) treatment standards (Applicable, as incorporated by the Montana Hazardous Waste Act) (40 CFR 268.49(c) (1)(C)), which requires that contaminated soil to be land disposed be treated to reduce concentrations of the hazardous constituents by 90 percent or meet hazardous constituent concentrations that are ten times the universal treatment standards (UTS) (found at 40 CFR 268.48), whichever is greater, to avoid triggering land ban.

40 CFR Part 270 (Applicable, as incorporated by the Montana Hazardous Waste Act) sets forth the hazardous waste permit program. The requirements set forth in 40 CFR Part 270, Subpart C (permit conditions), including the requirement to properly operate and maintain all facilities and systems of treatment and control are applicable requirements.

For any management (i.e., treatment, storage, or disposal) or removal or retention, the RCRA regulations found at 40 CFR 264.116 and .119 (governing notice and deed restrictions), 264.228(a)(2)(i) (addressing de-watering of wastes prior to disposal), and 264.228(a)(2)(iii)(B)(C)(D) and .251 (c)(d)(f) (regarding run-on and run-off controls), are relevant requirements for any waste management units created or retained at the KRY Site that contain non-exempt waste. A construction de-watering permit covers similar requirements and is applicable to the KRY Site.

The Montana Hazardous Waste Act, §§ 75-10-401 et seq., MCA (Applicable) and regulations under this act establishes a regulatory structure for the generation, transportation, treatment, storage and disposal of hazardous wastes. These requirements are applicable to substances and actions at the KRY Site that involve listed and characteristic hazardous wastes.

ARM 17.53.501-502 (Applicable) adopts the equivalent of RCRA regulations at 40 CFR Part 261, establishing standards for the identification and listing of hazardous wastes, including standards for recyclable materials and standards for empty containers, with certain State exceptions and additions.

ARM 17.53.601-604 (Applicable) adopts the equivalent to RCRA regulations at 40 CFR Part 262, establishing standards that apply to generators of hazardous waste, including standards pertaining to the accumulation of hazardous wastes, with certain State exceptions and additions.

ARM 17.53.701-708 (Applicable) adopts the equivalent to RCRA regulations at 40 CFR Part 263, establishing standards that apply to transporters of hazardous waste, with certain State exceptions and additions.

ARM 17.53.801-803 (Applicable) adopts the equivalent to RCRA regulations at 40 CFR Part 264, establishing standards that apply to hazardous waste treatment, storage and disposal facilities, with certain State exceptions and additions.

ARM 17.53.1101-1102 (Applicable) adopts the equivalent to RCRA regulations at 40 CFR Part 268, establishing land disposal restrictions, with certain State exceptions and additions.

Section 75-10-422 MCA (Applicable) prohibits the unlawful disposal of hazardous wastes.

ARM 17.53.1201-1202 (Applicable) adopts the equivalent to RCRA regulations at 40 CFR Part 270 and 124, which establish standards for permitted facilities, with certain State exceptions and additions.

Underground Injection Control Program

All injection wells are regulated under the Underground Injection Control Program in accordance with 40 CFR 144 and 146 (Applicable) which set forth the standards and criteria for the injection of substances into aquifers. Wells are classified as Class I through V, depending on the location and the type of substance injected. For all classes, no owner may construct, operate or maintain an injection well in a manner that results in the contamination of an underground source of drinking water at levels that violate MCLs or otherwise adversely affect the health of persons. Each classification may also contain further specific standards, depending on the classification. Compliance with these regulations requires application to the EPA's Underground Injection Control Program for a permit to conduct in-situ chemical oxidation groundwater remediation described in the Record of Decision.

Free Product Removal

Information generated during the Remedial Investigation indicates that all known tanks have been removed from the KRY Site but that underground piping associated with the tanks may remain. In addition, there is free product at the site. Therefore, certain storage tank regulations are applicable or relevant.

40 CFR Part 280, Subpart F (Relevant) sets forth requirements for Release Response and Corrective Action for underground storage tank (UST) systems containing petroleum or hazardous substances. These include initial response, initial abatement measures, facility characterization, free product removal, and investigations for soil and groundwater cleanup.

40 CFR 280.43 (Relevant) specifies groundwater monitoring requirements for underground storage tanks and requires that the monitoring methods used be able to detect the presence of at least 1/8 of an inch of free product on top of the groundwater in the monitoring wells.

40 CFR 280.64 (Relevant) provides that where investigations in connection with leaking underground storage tanks reveal the presence of free product, owners and operators must remove free product to the maximum extent practicable as determined by the implementing agency. This regulation also requires that the free product removal be conducted in a manner that minimizes the spread of contamination into previously uncontaminated zones by using recovery and disposal techniques appropriate to the hydrogeologic conditions at the site, and that properly treats, discharges or disposes of recovery byproducts in compliance with applicable local, state and federal regulations. This regulation also provides that abatement of free product migration is a minimum objective for the design of the free product removal system and provides that any flammable products must be handled in a safe and competent manner to prevent fires or explosions.

ARM 17.56.407(1)(f)(vi)(Relevant) specifies groundwater monitoring requirements for underground storage tanks and requires that the monitoring methods used be able to detect the presence of at least 1/8 of an inch of free product on top of the groundwater in the monitoring wells.

ARM 17.56.602(1)(c) (Relevant) requires that after a release from an underground storage tank system is identified in any manner, owners and operators must investigate to determine the possible presence of free product, begin free product removal as soon as practicable, conduct free product removal in a manner that minimizes the spread of contamination into previously uncontaminated zones by using recovery and disposal techniques appropriate to the hydrogeologic conditions at the site, and that properly treats, discharges or disposes of recovery byproducts in compliance with applicable local, state and federal regulations. This regulation also provides that abatement of free product migration is a minimum objective for the design of the free product removal system and provides that any flammable products must be handled in a safe and competent manner to prevent fires or explosions.

ARM 17.56.607 (Relevant) specifies that all free product must be removed to the maximum extent practicable before a release may be considered resolved.

ARM 17.56.702 (Applicable) requires that all tanks and connecting piping which are taken out of service permanently must be removed from the ground. This applies if any remaining underground piping is encountered during remedial activities.

Reclamation Requirements (Relevant): Certain portions of the Montana Strip and Underground Mining Reclamation Act and Montana Metal Mining Act as outlined below are relevant requirements for activities at the KRY Site. While no mining activities are occurring at the KRY Site, these requirements are relevant for the management and reclamation of areas disturbed by excavation, grading, or similar actions.

Section 82-4-231, MCA: Requires operators to reclaim and revegetate affected lands using the most modern technology available. Operators must grade, backfill, topsoil, reduce high walls, stabilize subsidence, control water, minimize erosion, subsidence, land slides, and water pollution.

Section 82-4-233, MCA: Operators must plant vegetation that will yield a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area and capable of self-regeneration.

Section 82-4-336, MCA: Disturbed areas must be reclaimed to the utility and stability comparable to areas adjacent.

ARM 17.24.519: Pertinent areas where excavation occurs will be regraded to minimize settlement.

ARM 17.24.631(1), (2), (3)(a) and (b): Disturbances to the prevailing hydrologic balance will be minimized. Changes in water quality and quantity, in the depth to groundwater and in the location of surface water drainage channels will be minimized, to the extent consistent with the selected remedial action. Other pollution minimization devices must be used if appropriate, including stabilizing disturbed areas through land shaping, diverting runoff, planting quickly germinating and growing stands of temporary vegetation, regulating channel velocity of water,

lining drainage channels with rock or vegetation, mulching, and control of acid-forming, and toxic-forming waste materials.

ARM 17.24.633: Surface drainage from a disturbed area must be treated by the best technology currently available (BTCA). Treatment must continue until the area is stabilized.

ARM 17.24.635 through 17.24.637: Set forth requirements for temporary and permanent diversions.

ARM 17.24.638: Sediment control measures must be implemented during operations.

ARM 17.24.640: Discharges from diversions must be controlled to reduce erosion and enlargement of stream channels, and to minimize disturbance of the hydrologic balance.

ARM 17.24.641: Practices to prevent drainage from acid or toxic forming spoil material into ground and surface water will be employed.

ARM 17.24.643 through 17.24.646: Provisions for groundwater protection, groundwater recharge protection, and groundwater and surface water monitoring.

ARM 17.24.701 and 702: Requirements for redistributing and stockpiling of soil for reclamation. Also outlines practices to prevent compaction, slippage, erosion, and deterioration of biological properties of soil.

ARM 17.24.703: When using materials other than, or along with, soil for final surfacing in reclamation, the operator must demonstrate that the material (1) is at least as capable as the soil of supporting the approved vegetation and subsequent land use; and (2) the medium must be the best available in the area to support vegetation. Such substitutes must be used in a manner consistent with the requirements for redistribution of soil in ARM 17.24.701 and 702.

ARM 17.24.711: Requires that a diverse, effective and permanent vegetative cover of the same seasonal variety and utility as the vegetation native to the area of land to be affected must be established. This provision would not be relevant and appropriate in certain instances, for example, where there is dedicated development.

ARM 17.24.713: Seeding and planting of disturbed areas must be conducted during the first appropriate period for favorable planting after final seedbed.

ARM 17.24.714: Mulch or cover crop or both must be used until adequate permanent cover can be established.

ARM 17.24.716: Establishes method of revegetation.

ARM 17.24.717: Relates to the planting of trees and other woody species if necessary, as

provided in § 82-4-233, MCA, to establish a diverse, effective, and permanent vegetative cover.

ARM 17.24.718: Requires soil amendments if necessary to establish a permanent vegetative cover.

ARM 17.24.721: Specifies that rills or gullies must be stabilized and the area reseeded and replanted if the rills and gullies are disrupting the reestablishment of the vegetative cover or causing or contributing to a violation of water quality standards for a receiving stream.

ARM 17.24.723: Requires periodic monitoring of vegetation, soils, water, and wildlife.

ARM 17.24.724: Specifies how revegetation success is measured.

ARM 17.24.726: Sets the required methods for measuring vegetative success.

ARM 17.24.731: If toxicity to plants or animals is suspected, comparative chemical analyses may be required.

ARM 17.24.751: Measures to prevent degradation of fish and wildlife habitat will be employed.

ARM 17.24.761: This specifies fugitive dust control measures that will be employed during excavation and construction activities to minimize the emission of fugitive dust.

Noxious Weeds (Applicable): Section 7-22-2101(8)(a), MCA defines "noxious weeds" as any exotic plant species established or that may be introduced in the state which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities and that is designated: (i) as a statewide noxious weed by rule of the department of agriculture; or (ii) as a district noxious weed by a district weed board, following public notice of intent and a public hearing. Designated noxious weeds are listed in ARM 4.5.201 through 4.5.204 and must be managed consistent with weed management criteria developed under § 7-22-2109(2)(b), MCA. Section 7-22-2152, MCA, requires that any person proposing certain actions including but not limited to a solid waste facility, a highway or road, a commercial, industrial, or government development, or any other development that needs state or local approval and that results in the potential for noxious weed infestation within a district shall notify the district weed board at least 15 days prior to the activity. The board will require that the areas be seeded, planted, or otherwise managed to reestablish a cover of beneficial plants. The person committing the action shall submit to the board a written plan specifying the methods to be used to accomplish revegetation at least 15 days prior to the activity. The plan must describe the time and method of seeding, fertilization practices, recommended plant species, use of weed-free seed, and the weed management procedures to be used. The plan is subject to approval by the board, which may require revisions to bring the revegetation plan into compliance with the district weed management plan. The activity for which notice is given may not occur until the plan is approved by the board and signed by the presiding officer of the board and by the person or a representative of the agency responsible for the action. The signed plan constitutes a binding agreement between the board and the person or agency. The plan must be

approved, with revisions if necessary, within 10 days of receipt by the board.

OTHER LAWS (NON-EXCLUSIVE LIST)

CECRA defines as ERCLs only applicable or relevant state and federal environmental laws. Remedial design, implementation, and operation and maintenance must nevertheless comply with all other applicable laws.

The following "other laws" are included here to provide a reminder of other legally applicable requirements for actions being conducted at the KRY Site. They do not purport to be an exhaustive list of such legal requirements, but are included because they set out related concerns that must be addressed and, in some cases, may require some advance planning. They are not included as ERCLs because they are not "environmental laws."

Other Federal Laws

Occupational Safety and Health Regulations

The federal Occupational Safety and Health Act regulations found at 29 CFR 1910 are applicable to worker protection during conduct of all remedial activities.

Other Montana Laws

1. Public Water Supply Regulations

If remedial action at the KRY Site requires any reconstruction or modification of any public water supply line or sewer line, the construction standards specified in ARM 17.38.101 (Applicable) must be observed.

2. Water Rights

Section 85-2-101, MCA, declares that all waters within the state are the state's property, and may be appropriated for beneficial uses. The wise use of water resources is encouraged for the maximum benefit to the people and with minimum degradation of natural aquatic ecosystems.

Parts 3 and 4 of Title 85, Chapter 2, MCA, set out requirements for obtaining water rights and appropriating and utilizing water. All requirements of these parts are laws which must be complied with in any action using or affecting waters of the state. Some of the specific requirements are set forth below.

Section 85-2-301, MCA, of Montana law provides that a person may only appropriate water for a beneficial use.

Section 85-2-302, MCA, specifies that a person may not appropriate water or commence

construction of diversion, impoundment, withdrawal or distribution works therefore except by applying for and receiving a permit from the Montana Department of Natural Resources and Conservation. While the permit itself may not be required under federal law, appropriate notification and submission of an application should be performed and a permit should be applied for in order to establish a priority date in the prior appropriation system.

Section 85-2-306, MCA, specifies the conditions on which groundwater may be appropriated, and, at a minimum, requires notice of completion and appropriation within 60 days of well completion.

Section 85-2-311, MCA, specifies the criteria which must be met in order to appropriate water and includes requirements that:

1. there are unappropriated waters in the source of supply;
2. the proposed use of water is a beneficial use; and
3. the proposed use will not interfere unreasonably with other planned uses or developments.

Section 85-2-402, MCA, specifies that an appropriator may not change an appropriated right except as provided in this section with the approval of the DNRC.

Section 85-2-412, MCA, provides that, where a person has diverted all of the water of a stream by virtue of prior appropriation and there is a surplus of water, over and above what is actually and necessarily used, such surplus must be returned to the stream.

3. Controlled Ground Water Areas

Pursuant to § 85-2-507, MCA, the Montana Department of Natural Resources and Conservation may grant either a permanent or a temporary controlled ground water area. The maximum allowable time for a temporary area is two years, with a possible two-year extension.

Pursuant to § 85-2-506, MCA, designation of a controlled ground water area may be proposed if: (i) excessive ground water withdrawals would cause contaminant migration; (ii) ground water withdrawals adversely affecting ground water quality within the ground water area are occurring or are likely to occur; or (iii) ground water quality within the ground water area is not suited for a specific beneficial use.

4. Occupational Health Act, §§ 50-70-101 et seq., MCA.

ARM 17.74.101 addresses occupational noise. In accordance with this section, no worker shall be exposed to noise levels in excess of the levels specified in this regulation. This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR 1910.95 applies.

ARM 17.74.102 addresses occupational air contaminants. The purpose of this rule is to establish maximum threshold limit values for air contaminants under which it is believed that nearly all

workers may be repeatedly exposed day after day without adverse health effects. In accordance with this rule, no worker shall be exposed to air contaminant levels in excess of the threshold limit values listed in the regulation.

This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR 1910.1000 applies.

5. Montana Safety Act

Sections 50-71-201, 202 and 203, MCA, state that every employer must provide and maintain a safe place of employment, provide and require use of safety devices and safeguards, and ensure that operations and processes are reasonably adequate to render the place of employment safe. The employer must also do every other thing reasonably necessary to protect the life and safety of its employees. Employees are prohibited from refusing to use or interfering with the use of safety devices.

6. Employee and Community Hazardous Chemical Information

Sections 50-78-201, 202, and 204, MCA, state that each employer must post notice of employee rights, maintain at the work place a list of chemical names of each chemical in the work place, and indicate the work area where the chemical is stored or used. Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals.

Appendix B

Selected Remedy Cost Estimates

**Selected Remedy Cost Summary Table
KRY Site**

Technology	Capital Costs	Annual O&M	Total Net Present Value
Free-product recovery (GW)	\$1,036,892.00	\$329,267.00	\$3,845,608.00
Sawdust Sampling	\$44,622.00	\$0.00	\$44,622.00
Chemical Oxidation	\$6,124,632.00	\$310,948.00	\$8,777,080.00
Excavation, Ex Situ Treatment (LTU), and Backfill	\$5,267,857.00	\$103,125.00	\$7,921,242.00
Lead Soils Removal	\$885,316.00	\$0.00	\$885,316.00
Sludge Removal	\$747,335.00	\$0.00	\$747,335.00
Free Product Removal by Excavation	\$4,306,751.00	\$0.00	\$4,306,751.00
MNA and Site-Wide Elements	\$28,125.00	\$144,169.00	\$4,397,814.00
Dioxin/Furan Soils Repository	\$1,136,600.00	\$0.00	\$1,136,600.00
TOTAL	\$19,578,130.00	\$887,509.00	\$32,062,368.00

Table 1
Selected Remedy Cost Estimate
Free-Product Recovery
Groundwater
KRY Site

CAPITAL COSTS

Item	Unit	Unit Costs	Quantity	Cost	Source
Groundwater Extraction System	well	\$11,900.69	26	\$309,417.94	RACER
Free Product Recovery System	ls	102,698.00	1	\$102,698.00	RACER
Carbon Adsorption System	gpm	\$504.51	130	\$65,586.30	RACER
Treated Water Combined Discharge Pipeline	ls	\$43,788.00	1	\$43,788.00	RACER
Residual Waste Management	ls	\$6,742.00	1	\$6,742.00	RACER
Overhead Electrical Distribution System	ls	\$34,874.00	1	\$34,874.00	RACER
Subtotal				\$563,106.24	
Construction Contingencies		25%		\$140,776.56	10% Scope, 15% Bid
Subtotal				\$703,882.80	
Project Management		6%		\$42,232.97	EPA Cost Guidance
Remedial Design including Pilot Testing		12% plus \$150,000		\$234,465.94	EPA Cost Guidance
Construction Management		8%		\$56,310.62	EPA Cost Guidance
Subtotal				\$333,009.53	
TOTAL CAPITAL COSTS				\$1,036,892.33	

ANNUAL OPERATIONS AND MAINTENANCE COSTS

Item	Unit	Unit Cost	Quantity	Cost	Source
Site Maintenance	ls	\$46,276.50	1	\$46,276.50	Engineer Estimate
Site Operation	ls	\$189,977.00	1	\$189,977.00	RACER
Power	kwh	\$0.08	121263	\$9,701.04	RACER
Carbon Replacement	lb/yr	\$1.81	594	\$1,075.14	RACER
LNAPL Disposal (listed waste)	gal	\$2.00	8,192	\$16,384.00	Invoice (with 5% inflation/year) 81,921 gallons recovered over 10 years
Subtotal				\$263,413.68	
O&M Contingencies		25%		\$65,853.42	10% Scope, 15% Bid
TOTAL YEARLY O&M COSTS				\$329,267.10	

Net present value calculations include capital costs and O&M costs for 10 years

Present Value	3%
10 years	\$3,845,608

**Table 2
Selected Remedy
Sawdust Sampling
KRY Site**

CAPITAL COSTS

Item	Unit	Unit Costs	Quantity	Cost	Source
Contractor mobilization/gas surcharge	LS	\$0.10	---	\$1,720	10% of capital costs
Geoprobe	LF	\$40.80	252	\$10,282	RACER
Drilling team (2-man crew)	HR	\$120.00	32	\$3,840	Engineer's estimate
Geologist (logging and oversight)	HR	\$90.00	32	\$2,880	Engineer's estimate
Lantec GEM-2000 gas monitor (1)	DAY	\$100.00	2	\$200	Argus-Hazco quote
Subtotal				\$18,922	
Construction Contingencies		25%		\$4,730.44	10% Scope, 15% bid
Subtotal				\$23,652.20	
Project Management		6%		\$1,419	Engineer's estimate
Remedial Design		12%		\$2,838	Engineer's estimate
Construction Management		8%		\$1,892	Engineer's estimate
Subtotal				\$6,150	

OPERATION AND MAINTENANCE COSTS (MONTHLY FOR 6 MONTHS)

Staff-Level Technician	HR	\$65	72	\$4,680	Engineer's estimate
Lantec GEM-2000 gas monitor (1)	DAY	\$100.00	10	\$1,000	Argus-Hazco quote
Materials/disposable items/other	LS	\$100	5	\$500	Engineer's estimate
Air sample analysis (methane)	EA	\$90	96	\$8,640	Air Toxic Ltd. Quote
Subtotal				\$14,820	

TOTAL CAPITAL COSTS: \$44,622

Notes and Assumptions:

1 = Provides automatic sampling and analysis of gas composition % by volume CH₄, CO₂, O₂ and % balance gas, % CH₄LEL, temperature (with optional probe), barometric pressure and relative pressure

Sampling and monitoring the buried sawdust on the NW portion of the KRY site

Cost estimate intended for investigation purposes only

Subject area is 400 feet x 400 feet (160,000 FT² or 3.67 ACRES)

Install up to 16 soil gas sampling wells located 100-feet on center (ft O.C.)

Geoprobe will collect soil samples, install soil gas sampling ports to a depth of 14 feet bgs, and collect ORP readings from groundwater table

Subcontractor will install soil gas wells in two days

Soil gas sampling activities will be performed monthly for 6 months

Soil gas samples will be collected in tedlar bags and shipped to Air Toxics Ltd in Folsom, California

Laboratory air sample analysis will be completed by ASTM D1946 (\$75 for analysis; \$15 per bag)

This estimate does not account for any hotel or per diem costs (if required)

Geoprobe rig will not encounter any adverse conditions at the site, and can drill without hitting refusal

Drilling would occur during the spring or summer with ideal conditions

The biggest concern is the lateral migration of the methane; The well network may require additional wells if a potential methane plume migrates laterally

The top of casing will be at least two feet abovegrade to account for flooding of the Stillwater River

Present Value	3%
1 year	\$44,622

Table 3
Selected Remedy Cost Estimate
Chemical Oxidation
Groundwater
KRY Site

Item	Unit	Unit Costs	Quantity	Cost	Source
Geologist	hr	\$75.00	928	\$69,600.00	RACER
1-inch stainless steel well casing (vertical)	lf	\$24.00	8,579	\$205,884.00	Estimate from Casper distributor
1-inch stainless steel well screen (vertical)	lf	\$36.00	3,677	\$132,354.00	Estimate from Casper distributor
Swagelok Compression Fittings (3 per well)	ea	\$57.00	1,044	\$59,508.00	Vendor Quote
Rotary Drilling, 6-inch borehole (<= 100 ft)	lf	\$32.00	12,255	\$392,160.00	RACER
4-inch bentonite seal	ea	\$20.16	348	\$7,015.68	RACER
Ozone wellhead assembly	ea	\$1,744.00	348	\$606,912.00	Engineer's estimate from similar project
1-inch PVC piping (lateral connection)	lf	\$1.00	14,925	\$14,925.00	Harrington Plastics
Trenching	cy	\$8.55	4,975	\$42,536.25	RACER
Ozone System	ls	\$74,685.00	25	\$1,867,125.00	Vendor Quote (Calcon Systems)
SCADA System and radio telemetry	ls	\$14,285.72	25	\$357,143.00	Vendor Quote (Calcon Systems)
Subtotal				\$3,755,162.93	
Construction Contingencies		25%		\$938,790.73	10% Scope, 15% bid
Subtotal				\$4,693,953.66	
Additional Tasks					
Electricity power pole drop to each system	ea	\$2,500.00	25	\$62,500.00	Engineer's estimate from similar project
Startup and troubleshooting	ea	\$1,000.00	25	\$25,000.00	Engineer's estimate from similar project
				\$87,500.00	
Project Management		6%		\$286,887.22	EPA Cost Guidance
Remedial Design including Pilot Testing		5% plus \$100,000		\$673,774.44	EPA Cost Guidance
Construction Management		8%		\$382,516.29	EPA Cost Guidance
Subtotal				\$1,430,677.95	
TOTAL CAPITAL COSTS				\$6,124,631.61	
ANNUAL OPERATIONS AND MAINTENANCE COSTS					
Item	Unit	Unit Cost	Quantity	Cost	Source
Site Operation and Maintenance	hr	\$65.00	2000	\$130,000.00	Engineer's estimate
Power	kwh	\$0.08	1456350	\$116,508.00	Bridger Valley Electric
Water	gal	\$2.25	1000	\$2,250.00	Laramie City
Subtotal				\$248,758.00	
O&M Contingencies		25%		\$62,189.50	10% Scope, 15% Bid
TOTAL YEARLY O&M COSTS				\$310,947.50	

Present value includes capital costs and O&M costs for 10 years

Present Value	3%
10 years	\$8,777,080.00

Table 4
Selected Remedy Cost Estimate
Excavation, Ex Situ Treatment, and Backfill
KRY Site

CAPITAL COSTS

Item	Unit	Unit Costs	Quantity	Cost	Source
Mobilization	%	8%	1	\$100,975.26	Engineer's Estimate
Clear and Grub	acre	\$186.00	6.5	\$1,209.00	CostWorks 2006
Contaminated soil excavation and hauling	cy	\$5.63	132822	\$747,787.86	CostWorks 2006
LTU Bottom slope dozer grading	cy	\$1.90	3500	\$6,650.00	CostWorks 2006
LTU Berm fill	cy	\$0.77	9100	\$7,007.00	CostWorks 2006
LTU Berm compaction	cy	\$0.38	9100	\$3,458.00	CostWorks 2006
4-inch PVC leachate piping	lf	\$3.28	600	\$1,968.00	CostWorks 2006
2-inch PVC irrigation piping	lf	\$2.50	1000	\$2,500.00	CostWorks 2006
Leachate Sump manhole	ea	\$2,490.00	2	\$4,980.00	CostWorks 2006
1 HP Submersible pump	ea	\$1,000.00	2	\$2,000.00	Engineer's Estimate
10,000-gallon double-walled fiberglass aboveground tank	ea	\$46,000.00	2	\$92,000.00	CostWorks 2006
8-inch structural slab on grade	sf	\$7.20	500	\$3,600.00	RACER
Haul road construction (base course on grade, includes material)	sy	\$24.86	8300	\$206,338.00	Engineer's Estimate - Hudson, WY
45 MIL RPP liner	sf	\$0.61	215,250	\$131,302.50	Engineer's Estimate - Hudson, WY
6 OZ Geocomposite drainage layer	sf	\$0.40	215,520	\$86,208.00	CostWorks 2006
Tilling contaminated soils in LTU (8 times per phase)	sy	\$0.59	697,000	\$411,230.00	Engineer's Estimate
Treated soil backfill (assumed to be same \$ as clean soil backfill)	cy	\$10.84	132,822	\$1,439,790.48	RACER
Berm removal after treatment is completed	cy	\$1.69	9100	\$15,379.00	CostWorks 2006
Demolition of piping	lf	\$7.50	600	\$4,500.00	CostWorks 2006
Demolition of manhole	ea	\$172.00	2	\$344.00	CostWorks 2006
Haul road demolition	cy	\$1.44	8300	\$11,952.00	CostWorks 2006
Subtotal				\$3,281,179.10	
Construction Contingencies		25%		\$820,294.78	10% Scope, 15% bid
Subtotal				\$4,101,473.88	
Project Management		6%		\$246,088.43	EPA Cost Guidance
Remedial Design including Pilot Testing		12% plus \$100,000		\$592,176.87	EPA Cost Guidance
Construction Management		8%		\$328,117.91	EPA Cost Guidance
Subtotal				\$1,166,383.21	
TOTAL CAPITAL COSTS				\$5,267,857.08	

ANNUAL OPERATIONS AND MAINTENANCE COSTS

Item	Unit	Unit Cost	Quantity	Cost	Source
Site Operation and Maintenance (technician)	wk	\$450.00	50	\$22,500.00	
Water	ls	\$2.00	25,000	\$50,000.00	
Miscellaneous (repairs, fertilizer, materials, etc.)	ls	\$10,000.00	1	\$10,000.00	
Subtotal				\$82,500.00	
O&M Contingencies		25%		\$20,625.00	10% Scope, 15% Bid
TOTAL YEARLY O&M COSTS				\$103,125.00	

Present value includes capital costs and O&M costs for 50 years

Present Value	3%
50 years	\$7,921,242

Table 5
Selected Remedy Cost Estimate
Lead Soils Removal
KRY Site

CAPITAL COSTS

Item	Quantity	Unit	Unit Cost	Cost	Source
SOIL EXCAVATION					
Mobilize equipment	1	EA	\$10,000	\$10,000	See Assumptions
Excavate and load, bank measure, medium material	3,472	BCY	\$1.18	\$4,097	RACER
Unclassified fill, 6" lifts, offsite, spreading and compaction	4,514	CY	\$10	\$44,278	RACER
Lab testing, metals	10	EA	\$150	\$1,500	RACER
Spray washing truck station	1	EA	\$318	\$318	RACER
EX SITU SOLIDIFICATION/STABILIZATION					
Mobilize equipment	1	EA	\$20,000	\$20,000	
910 Wheel Loader	25	HR	\$67	\$1,672	RACER
12 CY dump truck	25	HR	\$76	\$1,909	RACER
Aboveground water holding tanks	1	MO	\$336	\$336	RACER
Chemical fixation & stabilization agents (CKD)	2,818	TON	\$27	\$76,734	RACER
Chemical fixation & stabilization agents (other agents)	424	TON	\$92	\$38,932	RACER
Urrichem proprietary additive	29	TON	\$1,299	\$37,671	RACER
Operational labor	78	HR	\$33	\$2,559	RACER
15CY waste mixer	1	MO	\$6,185	\$6,185	RACER
Stabilization ancillary equipment	1	EA	\$9,411	\$9,411	RACER
TRANSPORTATION (KALISPELL, MT)					
Bulk solid haz waste loading into truck	4,514	CY	\$2.26	\$10,201	RACER
Waste disposal fees	4,861	TON	\$45	\$218,736	RACER
Waste Hauling*	221	EA	\$160	\$35,360	includes fuel, liners, and trips
Truck washout **	221	EA	\$177	\$39,033	RACER
Subtotal				\$558,931	
Construction Contingencies		25%		\$139,733	10% Scope, 15% Bid
Subtotal				\$698,664	
Project Management		6%		\$41,920	EPA Cost Guidance
Remedial Design including treatability testing		12% + \$5,000		\$88,840	EPA Cost Guidance
Construction Management		8%		\$55,893	EPA Cost Guidance
Subtotal				\$186,653	
TOTAL CAPITAL COSTS				\$885,316	

Assumptions:

- Mobilization cost is a blind estimate. Specific contractors and their locations were not determined for this estimate.
 - Assumes that 3,472 cubic yards of in-place soil need to be excavated. For this cost estimate, a volume of 4,514 cubic yards of soil (which includes a fluff-factor) is assigned for loading and transportation. These soils will be transported locally and 50% will require stabilization.
 - Assumes that cement kiln dust will be used as the stabilizing agent.
 - Assumes that 50% of the total estimated soil volume will require stabilization prior to disposal
 - Local landfill in Kalispell, MT will generate the profile and grant acceptance of subject soil
- * Waste disposal trucks will make an estimated 221 round trips from KRY site to local landfill; Due to the proximity of the landfill (assumed to be 10 miles from the site) RACER estimates a unit cost per truck

RT = Round Trip
MO = Month
MI = Mile
LS = Lump sum

Present Value	3%
1 year	\$885,316

Table 6
Selected Remedy Cost Estimate
Sludge Removal
KRY Site

CAPITAL COSTS

Item	Unit	Unit Costs	Quantity	Cost	Source
Mobilize equipment	EA	\$10,000.00	1	\$10,000	See Assumptions
Excavate and load, bank measure, medium material	BCY	\$1.18	3,126	\$3,689	RACER
Recycling at Asphalt Batch Plant (including transportation)	TON	\$70.00	6,583	\$460,810	Vendor quote
Subtotal				\$474,499	
Construction Contingencies		25%		\$118,625	
Subtotal				\$593,123	
Project Management		6%		\$35,587	EPA Cost Guidance
Remedial Design		12%		\$71,175	EPA Cost Guidance
Construction Management		8%		\$47,450	EPA Cost Guidance
Subtotal				\$154,212	
TOTAL CAPITAL COSTS				\$747,335	

Assumptions:

- Mobilization cost is a blind estimate. Specific contractors and their locations were not determined for this estimate.
- Assumes that 3126 cubic yards of in-place soil need to be excavated.
- Assumes that recycling costs include transportation (per vendor quote)
- Assumes that one cubic yard of soil weighs 1.62 tons and a fluff factor of 1.3 for medium soils
- Assumes no backfill due to minimal amount of soil and LTU sited in this location

Notes:

Cost estimate based on 2007 economics; Assume 2-3% increase per year for inflation

EA = Each

BCY = Bank cubic yard

Present Value	3%
1 year	\$747,335.00

**Table 7
Selected Remedy Cost Estimate
Free-Product Removal by Excavation
KRY Site**

CAPITAL COSTS

Item	Unit	Unit Costs	Quantity	Cost	Source
Mobilization	LS	\$100,975.26	1	\$100,975.26	Engineer Estimate
Contaminated soil excavation and hauling	cy	\$5.63	148,148	\$834,073.24	CostWorks 2006
Dewatering/extraction	LS	\$40,000.00	1	\$40,000.00	Engineer Estimate
LNAPL Disposal	GAL	\$1.00	82,176	\$82,176.00	Vendor Quote
Residual Waste Management	LS	\$7,804.00	1	\$7,804.00	
Treated Soil backfill	cy	\$10.84	148,148	\$1,605,924.32	
Subtotal				\$2,670,952.82	
Construction Contingencies		25%		\$667,738.21	10% Scope, 15% bid
Subtotal				\$3,338,691.03	
Project Management		6%		\$200,321.46	TTEMI - EPA Cost Guidance
Remedial Design		12%		\$500,642.92	TTEMI - EPA Cost Guidance
Construction Management		8%		\$267,095.28	TTEMI - EPA Cost Guidance
Subtotal				\$968,059.67	
TOTAL CAPITAL COSTS				\$4,306,750.69	

Assumptions:

- Assumes that the free-product plume covers a 400 ft by 400 ft area on the eastern portion of the KRY Site and is 20 feet below ground surface .
- Assumes the smear zone is 5 feet thick.
- Assumes that sloping will be used to prevent cave-in of the excavation, rather than shoring
- Assumes that residual waste management will cover booms, etc., to remove free-product once the excavation is complete.

Present Value	3%
1 year	\$4,306,750.69

**Table 8
Selected Remedy
MNA and Site-Wide Elements**

CAPITAL COSTS

KRY Site

Item	Unit	Unit Costs	Quantity	Cost	Source
Administrative Costs					
Controlled Groundwater Area	LS	\$20,000	1	\$20,000	DEQ estimate
Zoning/Restrictive Covenants	LS	\$2,500	1	\$2,500	DEQ estimate
Subtotal				\$22,500	
Contingencies		25%		\$5,625	

TOTAL CAPITAL COSTS \$28,125

OPERATIONS AND MAINTENANCE COSTS

Long-Term Monitoring (one event)

Equipment rental	LS	\$1,500.00	1	\$1,500	
Deep well sampling labor	HR	\$80.00	45	\$3,600	DEQ estimate
Shallow well sampling labor	HR	\$80.00	42	\$3,360	DEQ estimate
MNA Sample Analysis	well	\$530.00	57	\$30,210	Laboratory Price Schedule
Long-Term Monitoring Sample Analysis	well	\$1,345.00	57	\$76,665	Laboratory Price Schedule
Subtotal				\$115,335.00	
Contingencies		25%		\$28,833.75	

TOTAL O&M COSTS (PER YEAR) \$144,168.75

Net Present Value	3%
50 years	\$4,397,814

Assumptions:

- Long-term monitoring assumed to include 57 monitoring wells (15 deep and 42 shallow); sampling using a bladder pump
- Assumes that sampling will take 3 hours per deep well and 1 hour per shallow well
- Analytical suite for long-term monitoring includes PCP (low-level), SVOCs, PAHs (low level, in combination with SVOCs), and dioxin/furans. Cost reported as a lump sum per well, which includes costs for all these analyses.

- Analytical suite for MNA includes MNA parameters (dissolved oxygen, temperature, pH, oxidation/reduction potential, nitrate, sulfate, ferrous iron, and dissolved manganese), petroleum hydrocarbons (EPH/VPH), and metals. Cost reported as a lump sum per well, which includes costs for all these analyses.
- Semi-annual sampling first five years, then annually for 45 years

Note: MNA sampling will likely occur in conjunction with long-term monitoring conducted to evaluate the effectiveness of the remedial action, which will reduce costs for equipment rental and labor. If the two are not conducted together, the costs will increase.

**Table 9
Selected Remedy Cost Estimate
Soils Repository
KRY Site**

CAPITAL COSTS

Item	Unit	Unit Costs	Quantity	Cost	Source
Contractor mobilization	LS	---	10%	\$62,423	10% of capital costs
Security fenceline	LF	\$45.00	1,400	\$63,000	CostWorks2008
Topsoil stripping (12 inches)	CY	\$0.70	3,346	\$2,342	CostWorks2008
Subbase construction (18 inches)			5,019		
Scraper	CY	\$2.74	10,038	\$27,504	CostWorks2008
Compaction	CY	\$1.33	5,019	\$6,675	CostWorks2008
Water Truck	DAY	\$780.00	14	\$10,920	Engineer's estimate
Berm construction (6 feet high)			7,372		
Scraper	CY	\$2.74	14,744	\$40,399	CostWorks2008
Compaction	CY	\$1.33	7,372	\$9,805	CostWorks2008
Water Truck	HR	\$780.00	14	\$10,920	Engineer's estimate
Liner system	SY	\$2.00	7,674	\$15,348	CostWorks2008
Leachate piping (4-inch SCH40 PVC) (1)	LF	\$6.75	600	\$4,050	CostWorks2008
1/2 HP sump pump	EA	\$300.00	1	\$300	Engineer's estimate
Contaminated soil excavation and hauling	CY	\$7.32	23,831	\$174,421	CostWorks2008
Placement and compaction of contaminated soil (2)	CY	\$3.60	23,831	\$85,725	CostWorks2008
Engineered cap (18 inches clean fill)	CY	\$30.00	3,640	\$109,200	CostWorks2008
Trenching for passive gas vent system	CY	\$6.70	35	\$235	CostWorks2008
Passive gas vent system (2 inch PVC pipe)	LF	\$2.50	940	\$2,350	Harrington Plastics
Topsoil (6 inches)	SY	\$5.95	9,905	\$58,935	CostWorks2008
Seeding	ACRE	\$1,000.00	2.1	\$2,100	Engineer's estimate
Geotechnical Engineer		\$30,000	1	\$30,000	Engineer's estimate
Laboratory Analysis (geotechnical)		\$5,000	1	\$5,000	Engineer's estimate
Subtotal				\$721,651	
Construction Contingencies		25%		\$180,413	10% Scope, 15% bid
Subtotal				\$902,063	
Project Management		6%		\$54,124	Engineer's estimate
Remedial Design		12%		\$108,248	Engineer's estimate
Construction Management		8%		\$72,165	Engineer's estimate
Subtotal				\$234,536	
TOTAL CAPITAL COSTS				\$1,136,600	

Notes and Assumptions:

- 1 = Assumes no backfilling or excavation for leachate collection pipe
- 2 = Assumes that placing the material in the soil repository is relatively manageable, will required a moderate level of PPE, and decontamination procedures
- Unit costs based on 2008 economics
- Subbase preparation will consist of stripping, placing, and compacting a minimum of 18 inches of native material
- Berms will be constructed abovegrade
- Minimum area required to construct soil repository is 90,346 FT2 or 2.07 ACRES (227' x 398')
- Interior and exterior berm slopes are 3 to 1; height of berm is 6 feet; top of berm has a 10 foot width; berms will be keyed into the subbase material; the actual size and dimensions of the berms should be designed by the geotechnical engineer
- Geotechnical engineer (GE) will perform slope stability and subgrade preparation analysis (Kalispell located in seismic risk zone 3)
- GE will design the liner system and the determine the equipment weight limits to operate within the soil repository
- Topsoil from clearing and grubbing will be stockpiled on KRY Site
- Berms will be constructed with designated borrow material on KRY Site
- Borrow fill be analyzed for geotechnical properties at a designated laboratory
- Volume of dioxin/furan contaminated soil provided by DEQ is 19,859 CY; Add a swelling factor of 20% for excavation
- Hauling distance for the contaminated soil is limited to the KRY Site
- The contaminated soil has the high potential of clogging up the earthwork equipment; Estimate does not account for delays
- This estimate does not account for backfilling the borrow fill area (if necessary)
- Engineered cap is compacted fill to a depth of 18 inches; Includes geotextile fabric and HDPE liner
- Contaminated soil excavation will be monitored with a PID
- Fenceline is 8 foot high, 6-gauge wire, 2.5 line post, galvanized steel in concrete with signage
- Costs for managing leachate accumulating inside the repository are not included

Present Value	3%
1 year	\$1,136,600

Appendix C

Model Restrictive Covenants

DECLARATION OF RESTRICTIVE COVENANTS ON REAL PROPERTY

THIS DECLARATION OF RESTRICTIVE COVENANTS ON REAL PROPERTY is made by (insert name of property owner) as of _____, 2008.

RECITALS

WHEREAS, (insert name of property owner) is the owner of certain real property (the Subject Property) located in Flathead County, Montana, more particularly described as:

[insert property description here]

WHEREAS the Montana Department of Environmental Quality (DEQ) has determined that releases or threatened releases of hazardous or deleterious substances that may pose an imminent or substantial endangerment to public health, safety or welfare or the environment exist and that these hazardous or deleterious substances have come to be located upon the Subject Property [or, may be impacted by the KRY Site, as applicable];

WHEREAS DEQ, under the authority of the Montana Comprehensive Environmental Cleanup and Responsibility Act, §§ 75-10-701 et seq., MCA, has selected a remedy to abate the imminent and substantial endangerment posed by the hazardous or deleterious substances.

WHEREAS, the selected remedy requires that (insert name of property owner) restrict use of the Subject Property in order to mitigate the risk to the public health, safety or welfare or the environment and DEQ requires that such restrictions be recorded as provided for in § 75-10-727, MCA:

NOW, THEREFORE, (insert name of property owner) hereby agrees and declares:

1. No wells may be drilled within the boundaries of the Subject Property without the express prior written approval of DEQ. Groundwater within the Subject Property may not be used for any purpose other than sampling without the express prior written approval of DEQ. The integrity of any monitoring wells must be maintained and no seals may be removed on any closed wells.
2. No residential development or habitation shall occur upon the Subject Property.
3. No recreational use of the Subject Property shall be allowed without the express prior written approval of DEQ.
4. [For property being used as a repository, the footprint of the repository shall be surveyed after construction to narrow the property description. This provision applies to property being used as a repository.] No soil or soil caps shall be disturbed in any manner without the express prior written approval of DEQ. This restriction includes, but is not limited to, irrigation, drilling, excavation, or

construction of any structures, containments, footings for any purpose, or similar below ground appurtenances.

5. No action shall be taken, allowed, suffered, or omitted on the Subject Property if such action or omission is reasonably likely to create a risk of migration of hazardous or deleterious substances or a potential hazard to public health, safety, or welfare or the environment.
6. (Insert name of property owner) agrees to provide DEQ and its representatives and contractors and all representatives and contractors of any person conducting remedial actions approved by DEQ on the Subject Property access at all reasonable times to the Subject Property.
7. At all times after (insert name of property owner) conveys its interest in the Subject Property and no matter what person or entity holds title to or is in possession of the Subject Property, (insert name of property owner) and its agents shall retain the right to enter the Subject Property at reasonable intervals and at reasonable times of the day in order to inspect for violations of the Restrictive Covenants contained herein.
8. DEQ shall be entitled to enforce these covenants as an intended beneficiary thereof. (Insert name of property owner) specifically agrees that the remedy of “specific performance” shall be available to DEQ in such proceedings.
9. The provisions of this Declaration governing the use restrictions of the Subject Property shall run with the land and bind all holders, owners, lessees, occupiers, and purchasers of the Subject Property. These restrictive covenants apply in perpetuity and every subsequent instrument conveying an interest in all or any portion of the Subject Property shall include these Restrictive Covenants.
10. (Insert name of property owner) shall cause the requirements of these Restrictive Covenants to be placed in all instruments that convey an interest in the Subject Property and shall file this document with the county clerk and recorder in Flathead County, Montana.
11. The rights provided to DEQ in this declaration include any successor agencies of DEQ.

IN WITNESS WHEREOF, (insert name of property owner) has executed this Declaration of Restrictive Covenants on Real Property as of the first date written above.

(insert name of property owner)

By:

State of Montana)
 :SS.
County of Flathead)

On this __ day of _____, 2008, personally appeared _____, before me, a Notary Public for the State of Montana, known to me to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same, as _____ of the (insert name of property owner).

IN WITNESS WHEREOF I have hereunto set my hand and affixed my official seal the day and year hereinabove first written.

(SEAL)

NOTARY PUBLIC FOR THE STATE OF MONTANA
Residing at _____
My Commission Expires: _____