PROPOSED PLAN

Burlington Northern Mission Wye
State Superfund Facility

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ACRONYMS

ACM – Asbestos Containing Material
ALS – Asphalt-like Substance
ARM – Administrative Rule of Montana
bgs – Below Ground Surface
BNSF –BNSF Railway Company
CCR – Construction Completion Report
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
CECRA – Comprehensive Environmental Cleanup and Responsibility Act
COC – Contaminant of Concern
COPC – Contaminant of Potential Concern
DEQ – Montana Department of Environmental Quality
EPA – U.S. Environmental Protection Agency
EPA RSLs - U.S. Environmental Protection Agency Regional Screening Levels
ERCLs – Environmental Requirements, Criteria or Limitations
FS – Feasibility Study
GIS – Geographic Information System
IAM- Interim Action Memorandum
IAMA- Interim Action Memorandum Amendment
ICs – Institutional Control
IRA – Interim Remedial Action
MCA – Montana Code Annotated
MNA – Monitored Natural Attenuation
MRL- Montana Rail Link, Inc.
NOAA - National Oceanic and Atmospheric Administration
NPL – National Priorities List
PAH – Polycyclic Aromatic Hydrocarbon
PCB – Polychlorinated Biphenyl
PCE - Tetrachloroethene
PRAO – Preliminary Remedial Action Objective
RCRA – Resource Conservation and Recovery Act
RI – Remedial Investigation
ROD – Record of Decision
SC – Specific conductance/Specific conductivity
SOW- Statement of Work
SSCL – Site-Specific Cleanup Level
SVE – Soil Vapor Extraction
TCLP - Toxicity Characteristic Leaching Procedure
TCE – Trichloroethene
TPH – Total Petroleum Hydrocarbon
USGS – United States Geologic Survey
VMP – Vapor Monitoring Point
VOC – Volatile Organic Compound
VI – Vapor Intrusion

1.0 INTRODUCTION

The Montana Department of Environmental Quality (DEQ) prepared this Proposed Plan to identify its preferred final remedy for completing cleanup activities at the Mission Wye Facility (Facility), which is being addressed under the Comprehensive Environmental Cleanup and Responsibility Act (CECRA) (also known as State Superfund). Under CECRA, the Facility includes any site or area where a hazardous or deleterious substance has been deposited, stored, disposed of, placed, or otherwise come to be located. DEQ will identify the Facility boundary when it issues the Record of Decision (ROD).

The Facility is located in the Southeast ¼, Northwest ¼, of Section 35, Township 1 South, Range 10 East in Park County Montana. The Facility is approximately seven acres and is located in the "wye" of the BNSF Railway Company (BNSF) railroad tracks at the intersection of Interstate 90 (to the south of the Facility) and Highway 89 (to the east of the Facility) (Figure 1). Livingston is the closest town, approximately five miles west of the Facility. The northern portion of the Facility is owned by the Montana Rail Link, Inc. (MRL) and the southern portion is owned by BNSF (Figure 2).

The Facility is ranked a high priority on the CECRA Priority List, and DEQ has determined that a release or substantial threat of a release of a hazardous or deleterious substance at this Facility into the environment presents or may present an imminent and substantial endangerment to the public health, safety, or welfare or the environment.

The Proposed Plan identifies and explains DEQ's preferred remedy for addressing the release or threatened release. This document also summarizes the cleanup alternatives evaluated for the Facility outlined within the Feasibility Study (FS) Report (AECOM, 2019). DEQ has identified its preferred final remedy for the Facility in this Proposed Plan and will select the final remedy in the ROD after reviewing and considering relevant information, including but not limited to any comments submitted during the public comment period on the FS and Proposed Plan. DEQ may modify the preferred remedy or select another remedy if DEQ determines a different remedy is more appropriate. The public is encouraged to participate in the decision process for the preferred remedy by providing comments during the public comment period.

DEQ's issuance of this Proposed Plan complies with its public participation responsibilities under Section 75-10-713, Montana Code Annotated (MCA). This Proposed Plan summarizes information found in the Remedial Investigation (RI), Risk Assessment, FS Report, and other documents contained in DEQ's files for the Facility. The Facility's complete record file is available at DEQ's office in Helena:

Montana Department of Environmental Quality
1225 Cedar Street
Helena, MT 59601
(406) 444-6444
Business Hours: Monday - Friday: 8:00 a.m. – 5:00 p.m.

DEQ has also placed a copy of this Proposed Plan and the FS Report in a local information repository:

Livingston - Park County Library
228 W Callendar St.
Livingston, MT 59047
406-222-0862
Business hours:

Monday – Tuesday: 12:00 p.m -8:00 p.m.
Wednesday – Thursday: 10:00 a.m. – 8:00 p.m.
Friday: 10:00 a.m. – 6:00 p.m.
Saturday: 10:00 a.m. – 5:00 p.m.

These documents are also available electronically at the following website: http://deq.mt.gov/Public/publiccomment. The table on the website provides the electronic version or location(s) of the document as well as the email to the Project Officer to submit comments, which is also provided in Section 2.0 below.

2.0 PUBLIC INVOLVEMENT

Public involvement is an important part of CECRA and DEQ encourages public comment on the FS and Proposed Plan. The public will have the opportunity to comment on these documents for a 30-day period, occurring from June 6, 2019 through July 6, 2019. Comments received through the postal service must be postmarked no later than July 6, 2019, and comments submitted electronically must be received no later than 11:59 p.m. on July 6, 2019. During this time, the public can comment in writing to:

Heather Foslund
DEQ-Remediation Division
P.O. Box 200901
Helena, MT 59620-0901
or
hfoslund@mt.gov

DEQ will hold a public meeting and hearing on June 19, 2019. This meeting will consist of two segments; in the first segment, DEQ will summarize the preferred remedy in the Proposed Plan and answer questions from the public. During the second portion of the meeting, DEQ will hold a hearing during which time it will accept and record verbal comments on the FS and Proposed Plan. DEQ will consider submitted comments (mailed letters, electronic mail, and verbal comments provided during the public hearing) in its selection of the final remedial action for the Facility.

The public may call Heather Foslund at 406-444-6745 for additional information about the Facility. However, DEQ does not accept public comments over the phone.

3.0 FACILITY BACKGROUND AND REGULATORY HISTORY

3.1 OPERATIONAL HISTORY

BNSF operated the Facility as a seven-acre industrial landfill from approximately 1955 to 1979. BNSF used the landfill for disposal of clay source material that was separated from lube oil in a reclamation plant. The landfill also received debris that BNSF generated at the Burlington Northern Livingston Shop Complex, which is also a CECRA facility. BNSF opened the reclamation plant in the mid-1950's and disposed approximately one truck load of clay waste per week to the landfill until it stopped using the landfill for disposal around 1977 (RETEC, 1991). The following year, BNSF ceased operations at the reclamation plant.

The oil in the reclamation plant consisted primarily of crank case oil from the train engines and oil waste generated from shop complex maintenance. The pH of the clay source material was low due to the use of sulfuric acid in the reclamation process. This process separated the oil into two components: a light end phase referred to as "skunk oil" and a clay-like acid residue referred to as "clay source material." The skunk oil was put in tank cars to sell, and the clay source material was brought to the Facility for disposal (RETEC, 1991).

BNSF did not complete disposal records while it was operating the landfill. However, personal communication with BNSF staff occurred while gathering information for the RI (RETEC, 1991). These communications describe that one cell at a time was dug out and when each cell was filled to about two to three feet from the top with clay source material, it was covered with soil excavated to the form the next cell.

3.2 REGULATORY HISTORY

In 1981, BNSF filed a 'Notification of Hazardous Waste Facility' form with the U. S. Environmental Protection Agency (EPA). Between 1984 and 1986, EPA evaluated the Facility to determine if placement on the National Priorities List (NPL) was appropriate by performing a preliminary assessment and site inspection. In 1987, the EPA determined that the Facility did not meet the criteria for NPL listing and declared no further action was warranted under the Comprehensive Response, Compensation, and Liability Act (CERCLA). DEQ placed the Facility on the CECRA Priority List in January 1989.

On December 27, 1988, DEQ filed an action against BNSF's predecessors in federal court for response costs, remedial action, declarative and injunctive relief, penalties, and natural resource damage claims for the Burlington Northern Livingston Shop Complex and the Mission Wye Facility. On April 27, 1990, DEQ and BNSF's predecessors entered into a Modified Partial Consent Decree, Order, and Judgement (Modified Consent Decree) (DEQ, 1990) and BNSF was deemed liable for all remedial costs of investigation, removal, or remedial action pursuant to the Modified Consent Decree. The Modified Consent Decree also addressed the approach to implement remedial actions at both facilities, but did not resolve the issues of natural resource damages or the final remedies.

In 1995, the Montana legislature revised the remedy selection criteria in CECRA and included language specifying that the amendments did not apply to civil actions commenced prior to May 1, 1995, or to claims based on those actions, a legislative provision known as the 'savings clause.' Civil actions were filed by the State for the Facility prior to that date. The way in which the savings clause has been considered at this Facility is found in Sections 7.0 and 9.0.

In 1995, using information that BNSF provided in the RI and previous EPA investigations, DEQ prepared an Interim Action Memorandum (IAM) to allow interim actions to occur at the Facility.

The focus of the document was to remediate the clay source material and contaminated soil (DEQ, 1995). After soliciting and considering public comment, DEQ selected thermal desorption and a vented pile system as the interim remedial action (IRA) (DEQ, 1995). Pursuant to Paragraph 6.H of the Modified Consent Decree, BNSF prepared work plans to proceed with implementing the IRA (See Section 4.0).

On May 4, 1998, DEQ issued BNSF a Notice of Violation under the Resource Conservation and Recovery Act (RCRA) for failure to send and/or submit proper notice and certification of de-characterized wastes shipped to the Subtitle D landfill in Great Falls, Montana (DEQ, 1998). The violation led to DEQ issuing an Order that required BNSF to provide High Plains Landfill a one-time notification and certification for disposing of hazardous wastes, provide documentation to DEQ that the notification and certification was provided, and pay a $1,200 penalty.

In 2000, DEQ prepared an IAM Addendum (IAMA) to re-evaluate the interim remedial alternatives because thermal desorption was proving to be an impractical alternative. The IAMA focused on remediating the rest of the contamination, including clay source material, asphalt-like substance (ALS), spent carbon, contaminated soil, seep area, filter cakes, and debris (DEQ, 2000). DEQ solicited public comment on the IAMA and selected a number of interim remedies to address the remaining contamination, including excavation, soil vapor extraction (SVE), and disposal to a landfill or incineration.

In the following years, BNSF and DEQ negotiated potential revisions to the Modified Consent Decree but were unable to reach an agreement. On November 1, 2005, DEQ sent BNSF a letter that outlined the approach for final cleanup of the Facility. This letter required BNSF to prepare a Construction Completion Report (CCR) to summarize the interim actions completed and evaluate the results from the work to determine whether screening levels were met (DEQ, 2005b). The screening levels used were the EPA regional screening levels (EPA RSLs), DEQ Tier 1 risk-based corrective action screening levels for petroleum releases, and DEQ-7 standards. The letter outlined that if exceedances occurred and BNSF proposed to develop site-specific cleanup levels (SSCLs), then the 1993 Risk Assessment would be amended and an FS Report completed. When the Modified Consent Decree was later revised, this letter became Exhibit IV to the amendment (DEQ, 2007).

4.0 PREVIOUS INVESTIGATIONS AND INTERIM REMEDIAL ACTIONS

There have been numerous investigations and IRAs that have taken place at the Facility. This section briefly describes the focus of each investigation and IRA.

In 1984, the EPA performed a CERCLA preliminary assessment to evaluate the nature of contamination, potential pathways and receptors, and whether to include the Facility on the NPL. EPA also conducted a site inspection to collect samples and determine if the Facility should be proposed to the NPL (CH2M Hill and Ecology & Environment, 1984).

In 1986, the EPA performed a second investigation focused on determining the thickness of the aquifer and sampling groundwater for contamination. The presence of polychlorinated biphenyls (PCBs) and dioxin were also investigated (CH2MHill and Ecology & Environment, 1986).

Based upon the results of the investigations, EPA determined that the Facility did not meet the criteria to be placed on the NPL. Subsequently, the Facility was placed on the CECRA Priority List in 1989 and DEQ became the lead agency.

From 1991 through 1992, BNSF performed a two-phased RI to determine the extent and magnitude of the contamination at the Facility. The work performed included installing wells and sampling the source areas, soil, and groundwater at the Facility, in addition to sampling sediment and surface water from the Yellowstone River. The samples were tested for volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), total metals, and toxicity characteristic leaching procedure (TCLP); TCLP is a method used by laboratories to determine whether the material is a RCRA waste. If the material is a RCRA waste, then it must be handled, treated, and disposed of in a specific manner. In addition, BNSF began monitoring groundwater routinely on a semi-annual basis while RI work was taking place.

The findings of the RI led to BNSF conducting a series of IRAs that started in 1995, as outlined in the IAM and IAMA. The work associated with the IAM and IAMA was focused on removing the clay source material and contaminated soil to reduce impacts to groundwater. Remediation goals, which are IRA cleanup levels, were established and the IRA was considered complete when the remediation goals were met.

The remedy selected in the IAM was thermal desorption, which is a technology that utilizes heat to remove contamination by volatilization. BNSF constructed a thermal desorption unit on the western side of the Facility to treat the contaminated soil. Water was perched on top of the North and South Cells and needed to be removed before the soil could be treated by thermal desorption. Perched water in the North and South Cells was removed, pumped through a filter, treated by an air stripper to remove contaminants and sprayed on a one-acre plot on BNSF's property. BNSF discontinued using thermal desorption in June 1997 because of difficulties in maintaining the unit's operation, overall low production rates, compliance issues, and safety and equipment problems (AECOM, 2012).

Upon termination of thermal desorption, BNSF proposed installing a vented pile system to treat the remaining contaminated soil. The vented pile system was constructed on the north-eastern side of the property (Figure 3). Contaminated soil was placed in four piles and covered with a non-porous liner (RETEC, 1997). Perforated pipes were placed within the piles and connected to a manifold and vacuum blower. The vacuum blower circulated air and was connected to two carbon canisters to remove contaminants that volatilized out of the soil. BNSF collected samples from the vented soil and screened for TCLP levels for VOCs and metals. When soils passed TCLP levels, BNSF shipped them to a Subtitle D Landfill for disposal. This treatment stopped in February 1998 when DEQ discovered a violation under the Montana Hazardous Waste Act and issued BNSF a Notice of Violation in May 1998 (DEQ, 1998).

The IAMA focused on the additional waste streams, which included rocks, debris, spent carbon, and ALS wastes were also treated as they were encountered. The interim action included a combination of excavation, sampling, and treatment of waste before off-site disposal. In brief, the following four paragraphs described how each waste stream was treated.

Rocks were pressure washed, visually inspected for stains, and visually clean rocks were stock piled in 200-ton piles. A sample was collected from each pile to determine if the interim remediation goals were met. If the goals were met, the rocks were used as back fill.

Debris found in the North, Center, South, and East Cells was sampled and analyzed for TCLP VOCs, and TCLP metals. The results from the analyses indicated that all the debris samples passed TCLP VOC levels, but one sample failed for TCLP metals (AECOM, 2012). Lime was added to treat the debris until it passed TCLP for metals. The debris was then disposed of at a Subtitle D Landfill in Great Falls.

Spent carbon was generated from operating the thermal desorption unit, running the vented pile system, and treating water. The carbon was tested for TCLP (metals and VOCs), total VOCs, and pH for disposal options. The thermal desorption and vented pile samples did not pass TCLP for VOCs, and elevated levels of VOCs were detected. Therefore, the spent carbon used for the vented pile was incinerated in Aragonite, Utah. The spent carbon used for water treatment did pass TCLP and it was shipped to the landfill in Great Falls.

The ALS waste was treated and excavated separately. It was mixed and neutralized with kiln dust and water. The ALS was processed through a soil stabilizer because it consisted of larger, solid material. Samples were analyzed for total VOCs, TCLP (VOCs and metals), metals, oil, grease, and halogens. The results indicated the ALS waste did not meet the interim remediation goals and was deemed hazardous. Therefore, all ALS waste was hauled off-site to Aragonite, Utah to be incinerated at a RCRA-permitted facility. BNSF collected confirmation samples at the base of the excavations in the Seep area and North Parking lot area (Table 1). The samples met the remediation goals for VOCs but showed elevated levels of total petroleum hydrocarbon (TPH). Further excavation was done until the remediation goals for TPHs were met. Upon review of the results, DEQ approved the excavated areas to be backfilled with clean material (AECOM, 2012). BNSF completed all the IAM and IAMA activities by 2000.

Confirmation sampling followed in 2007 to test the effectiveness of the IRAs, particularly near the East Cells and South Cells as they were collected during the initial IRAs (DEQ, 2005a). Due to these areas being previously backfilled with clean material, BNSF collected samples biasedly to target soil that appeared visually contaminated (i.e. stained). The samples were selected for analysis based on visual inspections, where biased samples were collected to contain minimal clean fill material (ENSR, 2008). The samples were analyzed for VOCs, extractable petroleum hydrocarbons, and VPH. If clean material could not be differentiated from original contaminated soil, then samples were collected at depths between seven and 24 inches below ground surface (bgs). The results indicated exceedances of leaching to groundwater SSCLs, particularly, between the South and East Cells (Figure 5). Residential cleanup levels were exceeded in two samples collected and those samples were targeted as part of the 2015 soil tilling pilot study discussed below in this section.

In 2012, DEQ required BNSF to have the Facility inspected for asbestos because it was discovered that asbestos containing material (ACM) was used to fill areas under nearby railroad tracks, and asbestos was found in surrounding railroad yards (e.g. BNSF Livingston Shop Complex); therefore, ACM could have been used at the Facility (DEQ, 2012). DEQ conducted a visual inspection of the Facility, including the abandoned railroad beds, to determine if ACM was present at the Facility (DEQ, 2013). During the inspection, firebrick was uncovered on the abandoned railroad bed. Samples of the firebricks and underlying soils were collected and analyzed for asbestos. Results indicated the bricks and soils did not meet the DEQ Asbestos Program's definition of ACM because the results were either non-detect for asbestos fibers or contained less than 1 percent asbestos. Nonetheless, BNSF removed the firebrick from the Facility and disposed of it as a non-hazardous substance at a Subtitle D Landfill in Great Falls.

In August 2015, BNSF initiated a soil tilling pilot test to expedite the chemical break down of contaminants in surface soils. By tilling the soil, the contaminants are degraded by the climate (e.g. wind and sun) and biological activity. BNSF focused on two areas based on the 2007 confirmation sampling event. These locations were tilled at depths of two feet in approximately 10 feet wide by 10 feet long grids (Table 1). Samples were collected prior to tilling and two days after tilling; results indicated tetrachloroethene (PCE) and trichloroethene (TCE) concentrations were below SSCLs for leaching to groundwater and residential (pre- and post-tilling).

BNSF implemented a soil vapor extraction (SVE) pilot test in September 2015 to remediate contaminants identified in subsurface soils. Vapor monitoring points (VMPs) and SVE wells were constructed to understand the distribution of contamination in the subsurface; however, the VMPs and SVE wells were constructed around MW-3 as this is where most of the exceedances are occurring in groundwater. Samples were collected from the VMPs to establish baseline concentrations prior to activating the SVE system. Samples collected from VMP-1D contained the highest concentrations of PCE (12,000 $\mu g/m^3$) and TCE (3,800 $\mu g/m^3$); VMP-1D was located centrally in an area identified as having a leaching to groundwater potential. In September 2017, BNSF shut down the SVE system because it was running voluntarily and BNSF wanted to wait until the preferred remedy was identified to determine if it needed to be turned back on (BNSF, 2017).

While the IRAs were being conducted, BNSF continued groundwater monitoring on a semi-annual basis. The effectiveness of the IRAs could be observed as concentrations began to steadily decrease after they took place. In 2001, DEQ allowed BNSF to monitor groundwater on an annual basis. The annual event takes place in the months when groundwater elevation and contaminant concentrations are highest, which typically occurs in July, and it is currently an on-going event.

DEQ considered all of these IRAs when identifying its preferred final remedy.

5.0 FACILITY CHARACTERISTICS

5.1 CLIMATE

The climate in Livingston is representative of the climate observed at the Facility. A weather station was installed at the Livingston Airport by the National Oceanic and Atmospheric Administration (NOAA) in July 1948. In the 1990's, the weather station became automated with very little manned oversight. Due to this change, the precipitation measured during the winter months may be underestimated (NOAA, 2017).

The Livingston area receives rain and snow as precipitation. The average annual precipitation within a 30-year period is 14.8 inches, with May typically being the wettest month of the year. The area receives snow most often between December and April and the ground is most likely to freeze during January and February. Temperatures in Livingston stay relatively cool; average temperatures over a 30-year period ranged from 27 °F to 36 °F during the winter months (December through February) and 55°F to 70 °F during the summer months (July through September). The Facility is in an area with minimal tree cover. As a result, it is subjected to high winds and sun exposure. The average wind gusts are 16 mph, but winds have reached a maximum 76 mph. Prevailing winds are typically from the southwest (Wunderground.com, 2018).

5.2 HYDROLOGY

The Facility is relatively flat with an elevation of approximately 4,400 feet above mean sea level. The Yellowstone River generally flows from west to east and flows are typically highest in May and June, and lowest from November through February. The United States Geologic Survey (USGS) has a streamflow station located near Carter's Bridge in Livingston, MT (45.596951, -110.566138) that has been measuring discharge of the Yellowstone River for over 90 years (USGS, 2017). Within those years, the average daily discharge was 1,390 cubic feet per second. Administrative Rule of Montana (ARM) 17.30.611 classifies the mainstem of the Yellowstone River as B-1 and ARM 17.30.625 requires that B-1 surface water be maintained suitable for drinking, culinary, and food processing (after conventional treatment); bathing, swimming, and recreation; aquatic and animal life; and agricultural and industrial water supply.

There are also two gravel pits located near the Facility. ARM 17.30.615 classifies the waters of the gravel pit ponds as E-4, and ARM 17.30.655 requires that E-4 surface water be maintained suitable for aquatic life, agricultural purposes, secondary contact recreation, and wildlife.

The aquifer underlying the Facility has been identified as the Yellowstone aquifer (aquifer) (AECOM, 2019). The saturated thickness of the aquifer varies from approximately 20 feet during periods of low flow (April/May) to 30 feet during periods of high flow (July/August). The hydraulic conductivity is estimated to be 170 to 380 feet per day and the average hydraulic gradient of the aquifer is 0.003 feet/feet (AECOM, 2019). Groundwater flow underneath the Facility generally flows from east to north east (AECOM, 2019).

Groundwater classification is defined in ARM 17.30.1006. The lowest specific conductivity (SC) for the groundwater at the Facility corresponding to the highest quality is appropriate for classification of the groundwater. The background well, MW-1, was used to determine the groundwater classification because groundwater from the well is not impacted by contamination at the Facility. From 2015 through 2017, the average SC at MW-1 was 526 µs/cm. Thus, the groundwater is Class I, meaning its quality must be maintained as suitable for 1) public and private water supplies, 2) culinary and food processing, 3) irrigation, 4) drinking for livestock and wildlife, and 5) commercial and industrial purposes.

5.3 GEOLOGY

The quaternary system of the Yellowstone River Basin consists of fluvial, glacial, landslide, and volcanic deposits; valley-fill consists of unconsolidated gravel, sand, silt, and clay (Zelt et al., 1999). Deposits of valley-fill occur adjacent to larger streams. Soil borings at the Facility have verified that subsurface soil is comprised of about 40 feet of coarse-grained, fluvial deposits, unconsolidated cobbles and gravels with a silt/sand matrix, and some sand.

5.1 FACILITY CONTAMINATION

Soil, soil vapor, and groundwater became contaminated because of activities that took place at the Facility. DEQ evaluated the contaminants of potential concern (COPCs) during the RI and subsequent investigations. Much of the contamination has been reduced because of the IRAs that occurred from 1995 through 2000, and subsequent pilot tests. The sections below summarize the initial extent of contamination and more recent data that suggests the IRAs have reduced the extent of contamination.

5.1.1 SOIL

The RI revealed VOCs, including PCE and TCE, as well as toluene, ethylbenzene, and xylenes were found in the soil (RETEC, 1992). Metals and PAHs were detected in the samples of the clay source material. The North, Center, and South cells contained a layer of water perched on the clay material and it contained elevated levels of VOCs and metals (RETEC, 1992). During the IRAs that took place between 1995 and 2000, the perched water and soils from the cells were treated and/or shipped for off-site disposal.

Samples were collected from the bottoms of the North Cell, East Cell, South Cell, Center Cell, Seep Area, and North Parking lot area to confirm excavation was complete and could be backfilled with clean material. The cells were excavated until all the interim remediation goals were met. Although the results in these areas met the remediation goals for the IRAs, some of the locations do not meet the SSCLs for leaching to groundwater for VOCs as developed in the 2014 Risk Assessment Amendment. An estimated 36,925 tons of contaminated material (clay source, ALS, soil etc.) was neutralized, excavated, or processed during the IRAs (AECOM, 2012).

The confirmation sampling that took place in 2007 demonstrated the IRAs were effective in cleaning up most of the contamination. The focus of the confirmation sampling was to characterize the contamination between MW-4 and MW-3 because groundwater impacts are localized in that area. During this event, BNSF collected surface samples throughout the Facility and subsurface sampling occurred within the vicinity of MW-4 and MW-3. At the time of the confirmation sampling, the results were compared to the EPA RSLs, but results were later compared to the residential and leaching to groundwater SSCLs for PCE and TCE when the 2014 Risk Assessment Amendment was prepared. The residential SSCLs were exceeded in a single, discreet sample (SS-88d) and it was sampled because the soil was visibly stained. There was also a composite sample collected from the same location and it did not exceed the residential SSCLs. The leaching to groundwater SSCLs in surface and subsurface samples were exceeded in several sample locations, and they are generally located around the South and East Cells (Figure 4). No additional cleanup efforts occurred at these locations following the confirmation results with the exception to SS-88d and SBS-7D, which were selected as the locations for the soil tilling pilot test (Table 1).

BNSF conducted the soil tilling pilot test in 2015. The pilot test focused on two areas with higher contaminant concentrations in surface soil during the 2007 confirmation sampling. BNSF collected samples prior to tilling (pre-tilling) and two days after tilling (post-tilling) at two locations in 10 ft. by 10 ft. grids that were two ft. deep. None of the soil sample concentrations exceeded the residential or leaching to groundwater SSCLs for either PCE or TCE (Table 1). On March 3, 2016, DEQ notified BNSF that the objectives of the soil tilling pilot test were met and no additional soil tilling was required at that time (DEQ, 2016).

There are potentially a few localized areas where soil contamination still exceeds the leaching to groundwater SSCLs. However, contaminant concentrations in groundwater downgradient of those areas have decreased to below cleanup levels. This empirical data suggests that although some soil may still exceed the leaching to groundwater SSCLs, whatever contamination that remains in the soil has already leached and is no longer causing exceedances of groundwater SSCLs.

5.1.2 SOIL VAPOR

PCE and TCE in soil can volatilize off soil particles and occupy the pore spaces as vapor. The contaminated vapor can migrate through the soil column and accumulate in buildings or excavations at levels that present a risk to human health. Removing sources of soil contamination can reduce the magnitude of contaminated soil vapor. However, there are also other technologies available that are effective in removing soil vapor contamination, such as SVE.

Prior to starting the SVE system pilot test in September 2015, BNSF collected baseline samples to assess the level of contamination of PCE and TCE in soil vapor. The soil vapor concentrations detected in the samples ranged from 650 $\mu g/m^3$ to 12,000 $\mu g/m^3$ for PCE, and 64 $\mu g/m^3$ to 3,800 $\mu g/m^3$ for TCE (AECOM, 2019). The area with the highest concentrations were located to the east of the unlined cells. When BNSF turned on the SVE system, soil vapor concentrations were collected at the eight individual SVE wells. The last time samples were collected at the individual SVE wells was in June 2016 and the results are in Figure 6.

BNSF continued monitoring on a quarterly basis for six months at three locations within the SVE system: combined effluent (pre-treatment), mid-treatment, and post-treatment. The results of monitoring at those locations demonstrate an overall steady decline in soil vapor concentrations (Figure 7). BNSF shut down the SVE system in September 2017 (BNSF, 2017). The last time samples were collected was in June 2017, and the concentrations were 630 $\mu g/m^3$ for PCE and 94 $\mu g/m^3$ for TCE at the pre-treatment location. These concentrations are nearly 13 and 43 times above the residential indoor air SSCLs for PCE (47 $\mu g/m^3$) and TCE (2.15 $\mu g/m^3$), respectively. The June 2017 results are also nearly two and six times the construction worker SSCLs for PCE (353 $\mu g/m^3$) and TCE (17 $\mu g/m^3$).

5.1.3 GROUNDWATER

DEQ developed the Circular DEQ-7 (DEQ-7) water quality standards for Montana’s surface waters and groundwaters that require adoption to protect beneficial uses (DEQ, 2017). BNSF has collected groundwater samples from nine monitoring wells (MW-1, MW-3, MW-4, MW-5, MW-9, MW-12, MW-14, MW-18, MW-19) since 1992. During this span, certain periods of the year were targeted to capture the extent of contamination coinciding with low and high groundwater levels. In 2001, DEQ allowed BNSF to reduce the monitoring frequency to annually, when groundwater and contaminant concentration levels are high, typically in July.

The highest concentrations occurred before interim actions occurred in 1995 for both PCE and TCE (Table 2a and Table 3a). After interim actions took place and the source to groundwater contamination was treated or removed, groundwater quality began to improve. Table 2b and Table 3b provide the groundwater results after the 1995 and 2000 interim actions occurred and results appear to slowly decline.

The majority of exceedances of the DEQ-7 standards have occurred in samples collected from MW-3, MW-4, MW-5, MW-9, and MW-14 (Figures 8 and 9). Groundwater concentrations have decreased steadily over time since the IRAs and pilot tests but have only recently started to meet DEQ-7 standards during some events. Samples collected from MW-3 consistently contain concentrations of PCE and TCE above the DEQ-7 standard. The most recent exceedance of DEQ-7 in MW-3 was in July 2018 (PCE) and July 2013 (TCE).

6.0 SUMMARY OF RISKS ASSOCIATED WITH FACILTY CONTAMINATION

BNSF prepared a Human Health Risk Assessment (Risk Assessment) in 1993 to evaluate potential exposure pathways and receptors against the contaminant concentrations detected in sample results. The exposure pathways for several potential receptors were evaluated.

The Modified Consent Decree required BNSF to prepare a Risk Assessment Amendment if exceedances of generic screening levels occurred in samples collected during the IRAs. These results from the IRAs were reported in the CCR and exceedances were identified. The 2014 Risk Assessment Amendment included an evaluation of the data collected from the IRAs, and changes to the exposure assumptions and EPA's chemical and toxicity information (AECOM, 2014b). The Risk Assessment Amendment replaced the 1993 Risk Assessment and is the document discussed herein.

In 2017, DEQ identified the need to evaluate the inhalation pathway for vapors that could potentially accumulate in a trench or excavation as this potential pathway was not included in the 1993 Risk Assessment or 2014 Risk Assessment Amendment. DEQ's evaluation identified an unacceptable risk to construction workers who may be involved in excavation activities in the area where soil vapor results have been collected (DEQ, 2018a).

6.1 POTENTIAL RECEPTORS

Not all of the exposure pathways pose an unacceptable risk to a receptor; in some cases, a single pathway may be a risk to a receptor. All pathways that pose an unacceptable risk to a receptor must be addressed by the final cleanup. Figure 10 provides the Site Conceptual Model provided in the Risk Assessment Amendment and has been updated with the pathways identified by DEQ in 2018. A summary of each receptor and associated potential exposure pathways are summarized below:

Adult excavation/construction workers: Individuals representing this population may perform construction and excavation activities at the Facility. Due to the work performed, they may come in contact with contaminated surface and subsurface soils (0-10 feet bgs). Therefore, potential exposure pathways include ingestion, dermal contact, and inhalation of soil particulates/vapors. Inhalation of vapors may occur by breathing particles with the contaminants adsorbed onto the particles or by inhaling vapors that accumulate in a subsurface trench. Additionally, the average depth to groundwater is 12 feet bgs, which is considered shallow, and dermal contact with groundwater may occur during excavation activities.

Adult utility workers: Similar to the excavation/construction worker, utility workers perform work that requires being in a trench for maintenance or repair. The utility worker typically has a shorter exposure frequency than the construction worker since the basis of the work is usually not as extensive. The utility worker may inhale particles with contaminants adsorbed, inhale vapors, or have contact with groundwater.

Adult commercial/industrial workers: If future industrial and/or commercial development occurs at the Facility, these individuals may be exposed to contaminated soil and soil vapor. Exposure would include direct contact (incidental ingestion and dermal contact) with surface soil and groundwater and inhalation of particulates or soil vapor that has moved inside buildings constructed for work-related use.

Adolescent trespassers: Adolescents may trespass on the Facility for a variety of reasons. Although the Facility is currently fenced, a trespasser could gain access with ease through the cattle gate that is currently utilized by BNSF and other authorized personnel to enter the Facility by vehicle. Exposure would be limited to incidental ingestion, dermal contact with surface soil, and inhalation of particulates/vapors from surface soil (0 to 2 feet bgs).

Future adult and child residents: If future residential development were to occur at the Facility, resident exposures are limited to direct contact (incidental ingestion and dermal contact) with surface soil (0 to 2 feet bgs) and groundwater, and inhalation of particulates/vapors from surface soil. Assuming a hypothetical future home is constructed on the property, future residents could potentially be exposed to subsurface vapors migrating inside the home (referred to as vapor intrusion (VI)). This scenario/pathway is described in the Soil Vapor Monitoring and Vapor Intrusion Evaluation Report (VI Report; AECOM, 2014a).

Leaching to groundwater: Leaching to groundwater is a transport mechanism that causes groundwater contamination from contaminated surface and subsurface soils. Soil contamination may leach and cause groundwater concentrations to exceed DEQ-7 standards. At the Facility, leaching to groundwater is evident as groundwater concentrations collected in samples have exceeded DEQ-7 standards.

6.2 HUMAN HEALTH RISKS

Studies have identified various health effects associated with exposure to PCE and TCE. The symptoms of breathing in high levels of PCE and TCE are similar; dizziness, drowsiness, headache, incoordination, and at higher levels, an individual may fall unconscious or even die (ATSDR, 2014; ATSDR, 2016). Exposure to PCE may result in a higher risk of being diagnosed with bladder cancer, multiple myeloma, or non-Hodgkin’s lymphoma, but the evidence available is not very strong. TCE has been identified as a known human carcinogen and exposure can cause kidney cancer, liver cancer, and malignant lymphoma (ATSDR, 2016). Exposure during pregnancy has also been linked to cardiac birth defects (EPA, 2011). Due to these identified health impacts, SSCLs were developed as part of the risk assessment process to protect human health and the environment.

Risk characterization integrates both exposure and toxicity assessments to provide the basis for characterizing human health risks. Risk calculations and SSCLs are evaluated together to determine where cleanup efforts are needed. Acceptable risk levels are developed for compounds that are carcinogenic and not carcinogenic. The carcinogenic risk level is defined as the probability of developing cancer due to an exposure to a COPC. Currently, DEQ uses an acceptable cumulative carcinogenic risk level of 1 in 100,000 increased cancer risks. For non-carcinogenic risk, the cumulative, acceptable level is a hazard index less than or equal to 1.0 to be considered protective of human health. If the risk scenarios for any of the receptors demonstrated a potential for unacceptable risk, the COPCs were retained as contaminants of concern (COCs). Completion of the Risk Assessment Amendment identified PCE and TCE as COCs at the Facility.

Where potential unacceptable risk exists to a receptor, SSCLs are developed to protect that exposure pathway at the Facility. Table 4 summarizes the remaining risks at the Facility, and they are also discussed in the bulleted list below:

- Groundwater remains a risk to potential users because results remain above DEQ-7 standards. Samples collected from MW-3 consistently contain concentrations of PCE and TCE above the DEQ-7 standard. The last time the DEQ-7 standard for TCE was met at this well was in 2013. Due to exceedances of the DEQ-7 standard, the final remedy must address groundwater.
- Indoor air is a risk to potential future occupants in a hypothetical residential building and to workers in an industrial or commercial building. This has been determined based on the findings in the VI Report and soil vapor monitoring results collected during the SVE pilot test. Pre-treatment soil vapor samples are above residential (child and adult) and commercial/industrial indoor air SSCLs. Although this pathway is currently incomplete because there are no permanent residential or commercial structures, the final remedy must address soil vapor risks.
- Soil vapors in the subsurface are a potential risk to a construction worker involved in excavation activities (DEQ, 2018a). This risk pathway was identified in the DEQ-issued risk memorandum dated August 10, 2018. The SSCLs determined in this memorandum have not been met for either PCE or TCE in samples collected from the pre-treatment location. Therefore, the final remedy must address soil vapor risks.
- Leaching to groundwater is a potential pathway in subsurface soil, particularly for PCE. This is based on groundwater results not meeting the DEQ-7 standard for PCE. Therefore, the final remedy must address subsurface soils.
- The potential for surface soil contaminating groundwater was initially considered a risk. However, it is no longer considered a leaching pathway because the majority of surface soil samples meet the leaching SSCLs, and in those areas where there are still exceedances, empirical groundwater data demonstrates that contamination has already leached in those areas to a point where contamination is no longer causing exceedances of groundwater standards. Therefore, a remedy to address surface soils is not necessary.

- Inhalation of soil particles and/or incidental ingestion was initially considered a risk to residents, if residential development occurred. However, this scenario is unlikely based on the anticipated future land use as described in Section 7.0 and because of the results collected during the soil tilling pilot test meet residential SSCLs. Therefore, a remedy is not necessary to address this pathway.

The preferred remedy is selected based on whether it can cleanup a pathway and/or prevent exposure to the remaining contamination. The SSCLs are discussed in Section 6.4 and identified in Table 5.

6.3 ECOLOGICAL RISKS

The Facility contamination poses a "low risk" to potential ecological receptors. This conclusion was based on an evaluation using the EPA Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (AECOM, 2013). The evaluation included a habitat assessment, ecological survey for state or federal rare, threatened, or endangered species, and a contaminant exposure assessment.

The habitat assessment indicated surface water in the surrounding area was predominantly ephemeral and could not support ecological populations; the evaluation was based on a half mile radius, which excludes the Yellowstone River. Wetlands were identified in the area; however, all of them were upgradient or cross gradient from contamination and, therefore, not impacted. The two rare, threatened, or endangered species identified as potentially inhabiting portions of the Facility were the bald eagle (*Haliaeetus leucocephalus*) and western toad (*anaxyrus boreas*). These two species could potentially inhabit portions of the land within the Facility due to its proximity to the Yellowstone River, but the two species are more likely to forage and nest closer to the Yellowstone River (AECOM, 2014b). Since then, the Sage Grouse Conservation Program implemented Executive Orders 12-2015 and 21-2015 to ensure habitat conservation for and sustainable populations of the Greater Sage Grouse (*Centrocerus urophasianus*). Any project located in the boundaries of sage grouse habitat (habitats designated as: core area, general area, connectivity area) must work with the Sage Grouse Conservation Program to ensure impacts to the habitat are minimized. The Facility is not located in any designated sage grouse habitat area (DNRC, 2017).

6.4 COCS AND SSCLS

SSCLs were developed for the COCs (PCE and TCE) and they are summarized in Table 5. The SSCLs established in the Risk Assessment Amendment and 2018 DEQ memorandum are based on combined exposure pathways (e.g. dermal, inhalation etc.) for each receptor. In instances where potential carcinogenic and non-carcinogenic risks were evident, SSCLs were based on the lower, more conservative value. Table 5 lists the SSCLs for each media and potential exposure pathway.

7.0 FUTURE ANTICIPATED LAND USE

Reasonably anticipated land use was evaluated to ensure that the remedy selected is appropriate for the long-term intended use of the Facility and development trends in the surrounding area. Section 75-10-721, MCA, as it existed in 1995, did not include a consideration of reasonably anticipated future uses of a facility in remedy selection and consideration of future facility use in remedy selection is not required due to the savings clause (see Section 3.2). However, consideration of the current and future uses of a facility has typically been used in the risk assessment process to identify unacceptable risk and SSCLs. Consistent with that practice, current and anticipated future land use of the Facility was considered in the Risk Assessment Amendment when risk was evaluated for each receptor. In order to apply those Risk Assessment Amendment considerations at the Facility, DEQ evaluated Section 75-10-701(18), MCA, as guidance in evaluating the reasonably anticipated future use of this Facility. These factors include:(a) local land and resource use regulations, ordinances, restrictions, or covenants; (b) historical and anticipated uses of the facility; (c) patterns of development in the immediate area; and (d) relevant indications of anticipated land use from the owner of the facility and local planning officials. DEQ performed this evaluation more recently to ensure that the exposure pathways and assumptions provided in the Risk Assessment Amendment were accurate and adequately addressed, provided currently future and anticipated land use. The sections below provide DEQ's evaluation of each factor.

a) The population of Livingston is 7,401 and the Facility is located five miles east of the town center. DEQ independently reviewed the zoning regulations for the Mission Wye property. On June 7, 2017, DEQ contacted Park County via phone to discuss zoning requirements and was informed that the area is unzoned and no restrictions, regulations, ordinances or covenants are currently in place. DEQ then contacted the Director of Planning twice via email to confirm the Facility is in an unzoned area and no changes to the zoning regulations or ordinances have occurred (DEQ, 2017b, DEQ, 2018b). The Director of Planning confirmed that no changes have occurred during the review process.
b) Historically, the Facility was used as a BNSF landfill for waste disposed of as part of train or railroad repairs. It also served as a "wye" to connect north-south and east-west lines. However, those rail lines are no longer active and the line that makes up the eastern side of the wye has been removed. Currently, an active rail line and power line run east-west, making up the southern boundary of the Facility. The owners of the property making up the Facility (BNSF and MRL) have indicated there is no planned change in use at the Facility (AECOM, 2019; MRL, 2017).
c) The Facility has been a listed CECRA facility since 1989. Land use in the area has not changed much over the years since the Facility was listed. Two gravel pits are located to the east and north of the Facility. The gravel pit to the north began operation in early 2017 and continues to operate. The gravel pit to the east is inactive and the owner has verbally indicated that the land may be reclaimed to establish a recreational vehicle park. Highway 89 is to the east of the Facility and I-90 borders to the south. The area to the west is primarily used for grazing and is owned by Heart K Ranch and Cattle (Montana State Library, 2018).
d) There are two owners of property within the Facility: BNSF and MRL (Figure 2). DEQ contacted MRL regarding its anticipated land use on September 21, 2017. MRL indicated that, aside from overhead utility work that may occur in the future, it had no plans to develop its land within the Facility and that if, in the future it decided to develop the property, MRL would develop its plans around any restrictions DEQ set on the property (MRL, 2017). BNSF has indicated it expects to keep its property vacant

(AECOM, 2019). As referenced above, the Park County Director of Planning indicated there are no plans to change the zoning in this area.

8.0 PRELIMINARY REMEDIAL ACTION OBJECTIVES

DEQ established preliminary remedial action objectives (PRAOs) to allow the identification and screening of remedial alternatives that will achieve protection of public health, safety, and welfare and the environment. The PRAOs are established as follows:

<u>PRAOs for soil</u>

- Prevent migration of COCs that would potentially leach from soil to groundwater, causing exceedances of the DEQ-7 standards;
- Prevent exposure of humans to COCs in soil at concentrations above SSCLs; and
- Meet soil SSCLs for COCs.

<u>PRAOs for indoor air and soil vapor</u>:

- Where there is potential for vapors in groundwater or soil to accumulate beneath the surface, limit exposure to contaminants that may volatize to indoor air or in excavations.
- Prevent inhalation of COCs in indoor air above SSCLs if occupied structures are present in the future.

<u>PRAOs for groundwater</u>:

- Meet DEQ-7 groundwater standards for COCs in groundwater;
- Reduce potential future migration of the impacted groundwater plume;
- Prevent exposure of humans to COCs in groundwater at concentrations above DEQ-7 standards; and
- Comply with ERCLs for COCs in groundwater.

9.0 SUMMARY AND EVALUATION OF ALTERNATIVES

The FS Report describes the alternatives evaluated to cleanup groundwater, surface and subsurface soil, and soil vapor at the Facility. These alternatives are summarized and evaluated in the following sections using the remedy selection criteria provided in Section 75-10-721, MCA, as it existed in 1993. That version is used because the 1995 legislation that revised the statute included a savings clause making the amendments inapplicable to civil actions initiated prior to the date of the legislation, which is the case for the Facility. However, section 5.1.9 of the Scope of Work (SOW) associated with the Modified Consent Decree outlines the criteria for screening the alternatives. Several of the guidance documents referenced in the SOW are consistent with statutory language found under CERCLA, which requires seven criteria to be screened against the alternatives. DEQ followed this same approach of including 'implementability' and 'short-term effectiveness' in the evaluation of alternatives in the BNSF Livingston ROD, which is covered under the same Consent Decree as this Facility.

<u>Threshold Criteria</u>

1. Protectiveness- Alternatives must attain a degree of cleanup of the hazardous or deleterious substance and control of a threatened release or further release of that substance to assure present and future protection of public health, safety, and welfare, and the environment.

2. Compliance with environmental requirements, criteria, or limitations (ERCLs)- This criterion evaluates whether each alternative will meet applicable or relevant state and federal ERCLs.

Balancing Criteria

3. Permanent solutions- Evaluates whether the remedy provides long-term effectiveness and permanently and significantly reduces the threat posed by the hazardous and deleterious substances.

4. Treatment or resource recovery technologies reduce toxicity, mobility, and volume- Alternatives must be evaluated for the use of treatment technologies or resource recovery technologies that reduce toxicity, mobility, and volume. These are preferred over simple disposal options.

5. Short-term effectiveness- This criterion addresses the period of time needed to complete the alternative and any adverse impact on the community, workers, or the environment during the construction and implementation period.

6. Cost effectiveness- This criterion considers 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 and the SSCLs have been met. Cost effectiveness evaluates the direct capital, indirect capital, and operations and maintenance costs.

7. Implementability- Alternatives are evaluated on technical and administrative feasibility, including the availability of materials and services needed to carry out a particular option.

The first two criteria, protectiveness and compliance with ERCLs, are threshold criteria that must be met for an alternative to be considered a potential remedy and be screened through for comparison using the balancing criteria. The preliminary ERCLs are provided in Appendix A of the FS Report and DEQ will finalize the ERCLs when it issues the ROD. If a remedy is expected to meet the first two criteria, DEQ then evaluates the next five criteria, balancing each against the alternatives to evaluate which alternative, or combination of alternatives, provides the most appropriate remedy.

In addition to these criteria, DEQ will consider the acceptability of the preferred alternative to the affected community, as indicated by community members and local government, during the public comment period on this Proposed Plan. After the public comment period ends, DEQ will consider relevant information, including but not limited to any comments submitted during the public comment period, and determine whether any necessary revisions to the preferred remedy are appropriate. DEQ's final cleanup decision will be issued in the ROD.

10.0 EVALUATION OF ALTERNATIVES

Remedial alternatives were evaluated by media in the FS Report which included soil, soil vapor, and groundwater. Each impacted area was evaluated using the seven criteria described in Section 9.0. The costs are estimates only and may be more or less due to varying factors. However, to make estimates as accurate as possible, it is recommended that cost estimates include the design, construction, operation and maintenance, and any close out activities (EPA, 2000). The following alternatives were retained for further evaluation and comparative analysis:

- Alternative 1 – No further action
- Alternative 2 – Soil tilling
- Alternative 3 – SVE system
- Alternative 4 – Institutional controls (ICs)
- Alternative 5 – Monitored natural attenuation (MNA)

The alternatives above are limited in effectiveness at addressing contamination in certain media; therefore, the following alternatives were considered for addressing contamination in the following media:

- Soil – No further action, soil tilling, SVE system
- Groundwater – No further action, ICs, MNA
- Soil vapor – No further action, ICs, SVE system

These alternatives are discussed in detail in Section 6.4 of the FS Report and are summarized below. Cost estimates for the alternatives are provided in Appendix A. The net present value is the amount of money that needs to be available at the beginning of the alternative's implementation and it is a direct function of the discount rate of 3% and the estimated cleanup timeframe. Some of the alternatives do not have an applicable net present value because they could be implemented immediately and will not need a discount rate applied.

A summary of the criteria screened against the alternatives is provided in Table 6. In previous drafts of the FS Report, several alternatives were considered for the Facility. However, over time, decreasing trends in contaminant concentrations made it unnecessary to consider certain highly technical alternatives, when more simplified alternatives could achieve similar results. The original alternative considered from previous drafts and the rationale for elimination can be reviewed in Table B-1 of Appendix B in the FS Report. The alternatives discussed below reflect the more simplified options being considered.

10.1 ALTERNATIVE 1 – NO FURTHER ACTION

DEQ requires that all other options be compared against the baseline alternative, no further action. No further action is considered under this alternative and contamination would remain at the Facility. No ICs or engineering controls would be put in place and no monitoring would occur. Alternative 1 is not protective of human health and the environment in the short-term or long-term. Receptors would continue to have the potential for exposure to unacceptable levels of PCE and TCE contamination in soil vapor, indoor air, and groundwater; contamination in soil could continue to leach to groundwater. Alternative 1 does not meet ERCLs because there are still exceedances of DEQ-7 standards. Unacceptable risks would remain and would not be mitigated. This alternative would not be effective and reliable in the short-term and long-term because unacceptable levels of contamination would remain and potential exposure to contamination would continue. Alternative 1 is easily implemented and does not use treatment or resource recovery technologies. The net present cost for implementing no further action at the Facility is $0.

10.2 ALTERNATIVE 2 – SOIL TILLING

Under this alternative soil would be turned over to degrade and volatilize PCE and TCE. This alternative would be protective of human health and the environment in the short- and long-term. Soil tilling would be effective and reliable in addressing remaining sources of contamination in surface soil that could leach to groundwater and/or contribute to VI. However, this alternative would not be effective and reliable for treating subsurface soils due to the limited depth at which the equipment can till soil. This alternative would not be compliant with ERCLs on its own but would be compliant if combined with another alternative. This alternative is immediately implemented and could be completed within a field season due to the size of the Facility; therefore, it is not necessary to add a net present value for cost estimate purposes because it would be implemented immediately. This alternative would cost $27,570.

10.3 ALTERNATIVE 3 – SVE SYSTEM

Under this alternative, an SVE system would remove soil vapors from the subsurface. An inactive, but operable, SVE system is at the Facility due to the previous SVE pilot test. During the pilot test, the SVE was effective in removing soil vapor from subsurface soil that could cause contamination of indoor air or air within an excavation. In addition, the SVE system would also be effective in reducing contaminants in soil that are causing exceedances of groundwater standards. This alternative is protective of human health and the environment in the short- and long-term, but will not meet all the ERCLs on its own; however, it would be in compliance if combined with another alternative. This alternative would be a permanent solution because it is removing contamination from the subsurface soils. The SVE system would utilize resource recovery technologies as it reduces the mobility and volume of contamination, and it is implementable because the system is already installed at the Facility. This alternative could be completed in two years and the net present value is $167,100.

10.4 ALTERNATIVE 4 – INSTITUTIONAL CONTROLS

Specific reference to ICs was not included in the 1993 version of CECRA. However, consideration of land use and the way in which restrictions can be applied to real property to limit exposure has long been a part of the Superfund process and it is appropriate to consider their use here. ICs are restrictions on the use of real property that mitigates the risk posed to public health, safety, and welfare and the environment and includes restrictive covenants, deed restrictions, controlled groundwater areas, and other legal mechanisms. Although ICs do not remediate the contamination, they manage human exposure to contaminants. The effectiveness of ICs depends on the mechanisms used, the durability of the IC, and the inspection and enforcement of the IC. This alternative is protective of human health in the short- and long-term provided monitoring and enforcement mechanisms are in place. It does not meet ERCLs on its own but would be compliance if combined with another alternative. This alternative does not offer a permanent solution on its own but can be effective when combined with other alternatives and implemented adequately to ensure compliance. Alternative 4 is effective in the short-term and is implementable because the process to put ICs in place is relatively easy. It may also be effective in the long-term with adequate monitoring; however, the most difficult aspect of ICs is ensuring compliance by the property owner and enforcement in the case of violations. This alternative does not utilize resource recovery technologies.

Currently, Park County only requires construction permits if buildings are being constructed and minimal regulatory oversight is conducted by the County on such projects. Therefore, ensuring that restrictions are enforced for activities that do not require a permit is also difficult without proper communication and collaboration between BNSF, MRL, and future property users. The appropriate IC or combination of ICs for the Facility would mitigate exposure to contaminated vapors during construction activities and in hypothetical buildings and mitigate exposure to contaminated groundwater by restricting use. The total net present value for implementing ICs is $67,500, which assumes placement of restrictive covenants on BNSF and MRL property and includes 30 years of annual site inspections and deed reviews every five years. It does not include the cost of enforcement if violations of the ICs are found.

For purposes of evaluating this alternative, it is assumed that the type of IC applicable to the Facility is a restrictive covenant which would:

1) Prohibit any kind of development and/or construction without advance DEQ approval, in order to address the soil gas and indoor air risk;

2) Limit the type of construction or development to prevent exposure to soil vapors in the subsurface or contact with groundwater;

3) Require a ventilation system for any excavation activities to limit soil vapor, and

4) Prohibit the use of groundwater in order to prevent exposure to contaminated groundwater. This IC would restrict use in the area where groundwater does not meet DEQ-7 standards.

BNSF has its own internal process to document and track restrictive covenants. After the restrictions are recorded in the county property record, BNSF tracks restrictions on real property by maintaining a geographic information system (GIS) mapping program (BNSF, 2018). The system has an environmental layer that identifies property use restrictions. Internal BNSF departments including Engineering, Real Estate, and Environmental, consult the GIS program as part of BNSF's planning process for construction projects or land use decisions (e.g. acquisitions). The restriction footprint is mapped on the GIS program and available for download and review. This process helps ensure the durability of ICs on BNSF property.

10.5 ALTERNATIVE 5- MONITORED NATURAL ATTENUATION

MNA refers to the natural breakdown of chemicals and this natural process can result in impacted media to meet SSCLs for COCs in groundwater. For MNA to be effective, the COCs must be conducive to this type of remediation and the source of contamination must either removed to the maximum extent practicable or contained through other alternatives. MNA is also an appropriate remedy when there is evidence that the extent of contamination has reduced in size (EPA, 1991). Although biodegradation is not occurring in a significant way at the Facility, volatilization and dilution are playing a role in attenuation processes. All of these factors, coupled with previous IRAs, which removed much of the source material, have been playing a role in decreasing contamination since groundwater monitoring started in 1992 (see Section 5.1.3). This alternative is not protective to human health and the environment on its own in the short-term, but will be protective in the long-term when DEQ-7 standards are met. MNA will reduce the toxicity, mobility, and volume of contamination even though it is not an active technology. ERCLs would eventually be met and would offer a permanent solution when standards are met. This alternative is easily implementable and expected to be completed in four years. For cost estimate purposes, it was assumed that DEQ-7 standards will be met within two years and monitoring will continue until the DEQ-7 standards are met during two consecutive events. The net present cost of MNA is $143,300. DEQ will determine the final monitoring requirements after it issues the ROD.

11.0 COMPARATIVE ANALYSIS

The alternatives were evaluated and compared against the cleanup criteria identified in Section 75-10-721, MCA, as it existed prior to the 1995 legislative amendments. Each criterion is listed individually below. A discussion about whether each alternative can meet the criteria is also provided, and this evaluation includes considerations of present and reasonably anticipated future uses of the Facility.

11.1 PROTECTIVENESS

Alternative 1 is not protective of human health or the environment because it would not address unacceptable risks present at the Facility, particularly potential exposure to soil vapor or indoor air and exceedances of groundwater standards. Alternative 2 is not protective in the short- and long-term by itself because it only addresses surface soil contamination, but it could be combined with other alternatives that would address subsurface vapor and groundwater to provide adequate protection. Alternative 3 would be protective in the long-term, but would need to be combined with another alternative to be protective in the short-term. Alternative 4 protects human health in the short-term and long-term so long as the ICs are monitored and enforced to ensure compliance; however, this alternative is not protective of the environment because contamination would continue to leach to groundwater. Alternative 5 is protective in the long-term once groundwater standards are met, but would not be protective in the short-term and does not address unacceptable risks from soil vapor.

11.2 COMPLIANCE WITH ERCLS

DEQ identified preliminary ERCLs for the Facility to guide the development of the FS Report. Those preliminary ERCLs are provided in Appendix A of the FS Report. The ERCLs will be finalized in the ROD.

Alternative 1 would not comply with the ERCLs. Alternatives 2 and 4 would not comply with ERCLs on their own. Alternatives 3 and 5 would be expected to comply with ERCLs in approximately two years.

11.3 PERMANENT SOLUTIONS

Alternative 1 would not be a permanent solution because contaminated soil vapor and groundwater would remain at levels that would continue to pose a potential risk. Alternatives 2 and 3 would be permanent because contaminant mass would be removed, but would need to be combined with alternative 4 until SSCLs are met. Alternative 4 would provide a permanent solution provided the ICs were adequately monitored and enforced to ensure compliance. Alternative 5 would ultimately be permanent once DEQ-7 standards are met, but it is estimated to take approximately two years followed by necessary monitoring.

11.4 TREATMENT OR RESOURCE RECOVERY TECHNOLOGIES TO REDUCE TOXICITY, MOBILITY, AND VOLUME

Alternatives 1 and 4 do not reduce toxicity, mobility, or volume of the contamination. Alternatives 2 and 3 do reduce toxicity, mobility, or volume of the COCs present at the Facility by treating contaminated soils or vapors to SSCLs. Although Alternative 5 is not a treatment or resource recovery technology, it does reduce the toxicity, volume, and mobility of COCs as they naturally attenuate.

11.5 SHORT-TERM EFFECTIVENESS

Alternatives 1 and 5 do not provide short-term effectiveness because the potential risk from soil vapor and contaminated groundwater would not be addressed. Alternative 2 presents limited risk to workers during operation of heavy equipment used for tilling. Alternative 3 presents limited risk to workers because the system is already installed. Risks associated with Alternatives 2 and 3 could be minimized by following proper safety procedures. Alternative 4 is effective in the short-term as implementation of ICs take little time and would limit potential exposure to contamination. Alternative 5 would need to be combined with another alternative to be effective in the short-term. All alternatives are expected to achieve remedial action objectives in approximately two years.

11.6 COST-EFFECTIVENESS

All costs are estimates and may vary as a result of unforeseen expenses and inflation. Cost effectiveness evaluates the overall monetary cost. Alternative 1 has the lowest costs but does not address the risk from contaminated soil vapor and groundwater. Alternative 2 is less costly than alternative 3 but does not reduce the soil vapor risk. Alternative 3 is the costliest alternative but would address remaining risks from soil vapor within a shorter timeframe. Alternative 4 is costlier than alternatives 1 and 2, but less costly than alternatives 3 and 5. Alternative 5 is less costly than alternative 3. The preferred remedy will cost more if alternatives need to be combined to meet other cleanup criteria.

11.7 IMPLEMENTABILITY

Alternatives 1 and 4 are easily implemented. Alternative 2 is implementable and contractors are locally available. Alternative 3 is easily implementable because the SVE system is already installed; however, some minimal maintenance may be needed to restart the system. Alternative 5 is implementable because it would use the same type of groundwater monitoring that has been occurring at the Facility for many years.

12.0 SCOPE OF THE PREFERRED REMEDY

DEQ's preferred remedy for the Facility is a combination of Alternatives 4 (MNA) and 5 (ICs). These alternatives are preferred because current and potential future risks from soil vapor, whether it is exposure during excavation activities or in constructed buildings, will be addressed by implementing ICs. MNA will continue to demonstrate contamination is decreasing and that DEQ-7 standards re met through natural processes. The net present value is $206,800.

As part of the preferred remedy, groundwater wells that are not needed for monitoring would be removed as would the existing SVE system.

DEQ's preferred remedy was evaluated as provided for in Section 75-10-721, MCA, as it existed in 1995; however, DEQ may revise or select a different remedy based on public comment or new information. Information regarding public comment participation is in Section 2.0 DEQ's final remedy decision will be documented in the ROD.

13.0 THE PREFERRED REMEDY

DEQ considered the previous IRAs when identifying its preferred final remedy. The previous IRAs that occurred at the Facility reduced the volume of impacted media as it was disposed of off-site or extensively treated. The surface soil results from previous work and the steady decline in groundwater results have demonstrated any residual contamination in surface soil meets PRAOs. The remaining volume of contamination in subsurface soils is not expected to leach to groundwater at levels that would result in exceedances of the DEQ-7 standards outside of the area where MW-3 is located. Based on the SVE system pre-treatment results, it is evident that some residual contamination is present in subsurface soils. The contamination poses a potential future risk to specific receptors (construction worker in a trench, occupants in a hypothetical building, and leaching to groundwater). However, the implementation of ICs will mitigate those risks by limiting future use. MNA will continue to reduce COCs to levels that meet SSCLs, which will be verified through monitoring.

13.1 MONITORED NATURAL ATTENUATION

The preferred remedy for groundwater is MNA. Concentrations of PCE and TCE have been declining, most notably since sources of contaminants were removed or controlled. Based on the monitoring results, the plume initially extended beyond Highway 89; however, in recent years the plume has receded and reduced in size. Thus, the plume has been adequately characterized and attenuation is already being observed. Existing wells are assumed to be sufficient to perform the necessary monitoring for MNA.

DEQ typically requires two consecutive groundwater monitoring events that demonstrate concentrations are below DEQ-7 standards before allowing monitoring to be discontinued. The estimated net present value for this alternative is $143,300 based on the assumption that two additional years of monitoring will occur after the first time DEQ-7 standards are met. However, DEQ will determine the required monitoring schedule after it issues the ROD. Once DEQ determines the remedy is complete, DEQ will require that the existing monitoring wells be properly abandoned.

13.2 INSTITUTIONAL CONTROLS

The preferred remedy requires ICs in the form of restrictive covenants prohibiting groundwater use and any development, construction, or excavation for the portion of the Facility where contamination remains above SSCLs (Figure 4, Figure 6). The preferred remedy also requires that the restrictive covenants prohibit residential use of the properties within the Facility. The areas requiring ICs encompass portions of the property owned by BNSF and MRL. Draft restrictive covenants are found in Appendix B. Restrictions would be recorded with Park County on both BNSF's and MRL's property. If this preferred remedy is selected in the ROD, DEQ will also require that the SVE system be removed. To ensure the effectiveness of the ICs, site inspections to confirm compliance with the restrictions will be required and BNSF will be required to enforce any violations. The net present value of the ICs is $67,500.

14.0 EVALUATION OF THE PREFERRED REMEDY

Monitoring will confirm that natural processes have reduced contamination in groundwater to DEQ-7 standards, and the ICs will mitigate risk of exposure to contaminated groundwater and the inhalation of vapors in the subsurface by limiting future use of the property and prohibiting groundwater use, construction, excavation, and development in areas where VI and groundwater poses an unacceptable risk to future receptors. The preferred remedy is expected to achieve SSCLs in a reasonable timeframe.

The preferred remedy of ICs for soil was selected over other alternatives because it is expected to achieve the same level of long-term risk reduction as the other soil alternatives by restricting property use for a portion of the Facility but does so at a lesser cost. The preferred combined remedy of MNA and ICs for groundwater was selected because it is expected that the cost-effective natural process will meet standards in a reasonable timeframe and the ICs will prevent exposure until those standards have been met.

Based on the information available now, the preferred remedy is protective of public health, safety, and welfare and the environment, will comply with ERCLs, provides a permanent solution, is effective in the short-term, is cost-effective, and is implementable. This preferred remedy does not use a treatment or resource recovery technology but will reduce the mobility of contaminants as they are attenuated through natural processes. The preferred remedy may be revised in response to public comment or new information; DEQ will identify the selected remedy in the ROD.

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