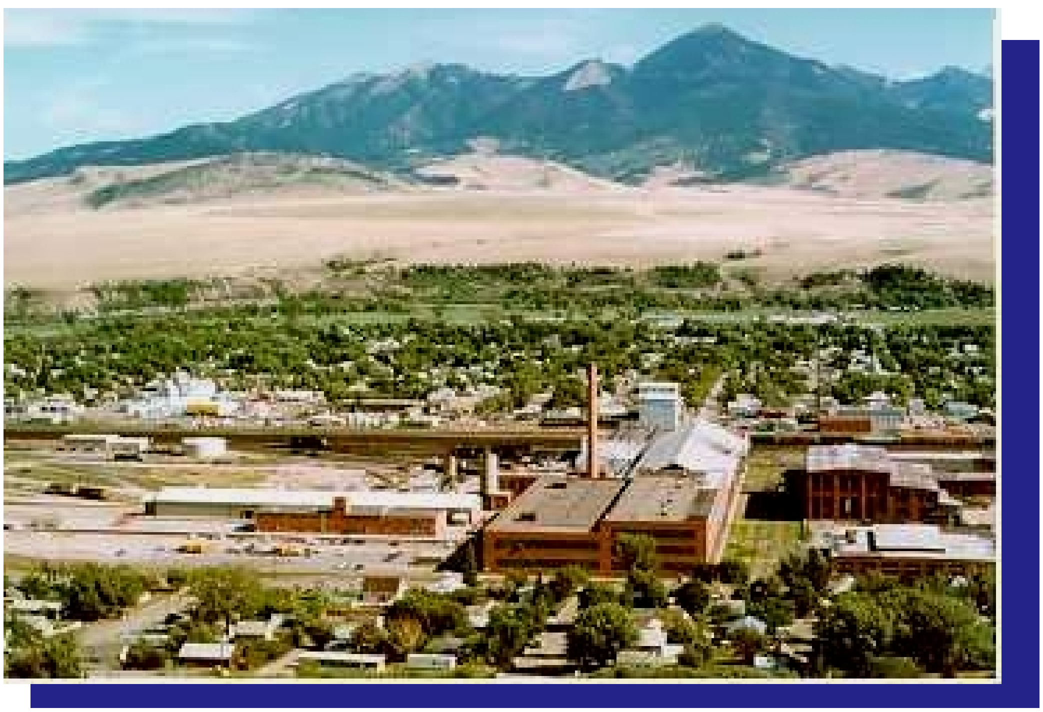
Record of Decision

Burlington Northern
Livingston Shop Complex

Livingston, Montana



September 2001

Montana Department of Environmental Quality

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INTRODUCTION

The Montana Department of Environmental Quality (DEQ) presents the Record of Decision (ROD) for the Burlington Northern (BN) Livingston Shop Complex. The BN Livingston Shop Complex is a maximum priority Comprehensive Environmental Cleanup and Responsibility Act (CECRA, also known as state Superfund) site. DEQ considered the remedial investigation and feasibility studies in selecting the remedy. The ROD is based on the Administrative Record, including: the remedial investigation (RI); two feasibility studies (FSs); the baseline risk assessment (BRA); the Proposed Plan; public comments received, including those from the potentially liable persons; and other related information. All of these documents are available for public review at the information repositories listed in Section III of the ROD. The ROD presents a brief review of the RI and FSs; actual and potential risks to human health and the environment; Environmental Requirements, Criteria and Limitations (ERCLs); and the selected remedy. This remedy is selected pursuant to CECRA, as amended in 1991. In addition, DEQ drew upon the Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA), National Contingency Plan (NCP), and Environmental Protection Agency (EPA) guidance for direction in preparing the ROD and as otherwise appropriate. The ROD has three purposes:

- To certify that the remedy selection process is carried out in accordance with the requirements of CECRA, as amended in 1991, and to document that the remedy selection is consistent with the requirements of CERCLA and the NCP to the extent practicable, and to certify compliance with paragraph 7.A. of the Modified Partial Consent Decree, Order and Judgment entered in the United States District Court for the District of Montana in State of Montana ex rel. Department of Health and Environmental Sciences v. Burlington Northern, 88-141-H-CCL (April 27, 1990).

- To outline the remedial components and requirements of the selected remedy; and

- To provide the public with a consolidated source of information about the history, characteristics and risks posed by conditions at the BN Livingston Shop Complex, as well as a summary and evaluation of the cleanup alternatives considered, the rationale behind the selected remedy, and DEQ's responses to comments received on the Proposed Plan.

The ROD consists of three components:

1. The **Declaration** is a summary of key information contained in the ROD and is the section of the ROD signed by the Director of DEQ.

2. The **Decision Summary** provides an overview of the site characteristics, the alternatives considered and evaluated and the analysis of those options. The Decision Summary also identifies the selected remedy and explains how the remedy fulfills statutory requirements.

3. The **Response Summary** reiterates public comments received on the Proposed Plan, the FSs and other information in the Administrative Record and provides DEQ's response to those comments.

DECLARATION

Declaration of Record of Decision

SITE NAME AND LOCATION

The BN Livingston Shop Complex is a maximum priority site on the Montana CECRA Priorities List.

STATEMENT OF PURPOSE

This decision document presents DEQ's selected remedial action for the BN Livingston Shop Complex in Livingston, Montana. This document is developed in accordance with CECRA, as amended in 1991, and is consistent with the requirements of CERCLA and the NCP to the extent practicable.

STATEMENT OF BASIS

The selected remedial action set forth in the ROD is based on the Administrative Record. The Administrative Record was developed in accordance with section 75-10-713 of CECRA and sections 113(k) and 117 of CERCLA and complies with the Modified Partial Consent Decree. The complete Administrative Record is available for public review at the information repository located at DEQ, Remediation Division, 2209 Phoenix Avenue, Helena, Montana. A partial Administrative Record is available at the Livingston-Park County Public Library located at 228 West Callender Street in Livingston, Montana.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous or deleterious substances from this site, if not addressed by implementing the remedial action selected in this ROD, may pose an imminent and substantial endangerment to public health, safety, and welfare, or the environment.

DESCRIPTION OF THE REMEDY

The remedy for the BN Livingston Shop Complex consists of remediation of all contaminated media to cleanup levels specified in Table 1 of the ROD, with reliance on institutional controls in certain instances.

Numerous interim actions were performed at the site since site investigation began. These actions are considered part of the selected remedy. Previously completed confirmation sampling will be reviewed and additional sampling will be performed if necessary at all interim action locations to assure these actions meet the cleanup levels.

Major components of the remedy are set forth below.

Waste

Volatile organic compound (VOC)-contaminated sludge: The selected remedy is source removal of all sludge followed by off-site disposal at a licensed Resource Conservation and Recovery Act (RCRA) subtitle C facility. All known sludge within Livingston Rail Yard (LRY) has been properly disposed off-site. Any new sources of sludge will be removed in accordance with previous DEQ-approved work plans and in compliance with all environmental laws.

Asbestos-contaminated soils and debris: The selected remedy relies on capping of the cinder pile coupled with fencing and restrictive covenants.

Soils

VOC-contaminated soils: The selected remedy is treatment of all contaminated soils to below cleanup levels. The treatment consists of either in-situ soil vapor extraction (SVE), or ex-situ SVE treatment. Ex-situ soils treated to cleanup levels will be disposed on-site. With the exception of the transfer pit manways and locomotive shop manways, all known VOC-contaminated soils have now been excavated.

Petroleum-contaminated subsurface soils: The selected remedy is installation and operation of bioventing wells until cleanup levels are achieved and maintained. This will be accomplished in two phases, with information learned in Phase I being applied to the second phase.

Petroleum-contaminated surface soils: The selected remedy will be an evaluation of site conditions compared to screening levels. If data indicate that petroleum in surface soils is a contaminant of concern, then site-specific cleanup levels will be developed and approved by DEQ. Alternatives will be evaluated followed by implementation of an approved remedial action that will achieve site-specific cleanup levels, should contamination be confirmed on-site.

PAH-contaminated soils: The selected remedy will be an evaluation of cleanup alternatives followed by implementation of an approved remedial action that will achieve cleanup levels.

Lead-contaminated soils: The selected remedy will be an evaluation of cleanup alternatives followed by implementation of an approved remedial action that will achieve cleanup levels, should lead in soils be confirmed as a contaminant of concern.

Groundwater

VOC-contaminated groundwater: The selected remedy is source removal of VOC-contaminated sludge and soils (as set forth above) followed by monitored natural attenuation (MNA) to meet cleanup levels within a reasonable time (twenty years). A contingency remedy requires active groundwater treatment in source areas using localized pump-and-treat systems if, after three years of MNA, it is determined that cleanup levels will not be met within twenty years under the natural attenuation remedy.

Free product on groundwater: The selected remedy is source removal throughout the diesel plumes of the free product to the cleanup level. This will be accomplished in two phases, with information learned in Phase I being applied to the second phase.

Dissolved phase petroleum in groundwater: The selected remedy is source removal of the free product followed by MNA for the dissolved phase to meet cleanup levels within a reasonable time (twenty years). A contingency remedy will be implemented if, after three years of MNA, it is determined that cleanup levels will not be met within twenty years under the natural attenuation remedy.

Lead in groundwater: The selected remedy will be an evaluation of cleanup alternatives followed by implementation of an approved remedial action that will achieve cleanup levels.

Private domestic use wells: The selected remedy is to identify all domestic use wells within the VOC-contaminated groundwater plume by updating the well inventory and monitoring those wells at least annually until cleanup levels are achieved throughout the plume. Any domestic use wells that are approaching or exceed EPA's maximum contaminant level for drinking water will be connected with alternate water, which typically means connection to city water, at no expense to the well owner.

Air

Indoor air/basement gas: The selected remedy will be an evaluation of site conditions compared to screening levels. If data indicates screening levels are exceeded, then sampling will be expanded as appropriate and site-specific cleanup levels will be calculated for indoor air. If cleanup levels are exceeded, installation and operation of removal systems to meet cleanup levels will be required.

In addition, the remedy calls for expanded sampling and confirmation sampling, reliance on institutional controls, and monitoring and maintenance until all cleanup levels are reached. Institutional controls required include a controlled groundwater area for the plumes, and restrictive covenants for the diesel plumes and certain industrial properties. Waste left on-site after remedy completion includes asbestos-contaminated debris in the cinder pile, capped with a RCRA subtitle D cap, and contaminated soils at certain industrial properties restricted to industrial use.

COMMUNITY ACCEPTANCE

The majority of the community supported the Proposed Plan remedy, but expressed concerns for worker safety during implementation of remedial actions. The site includes active railyard operations. Health and safety issues were considered in the formulation of the phased diesel fuel recovery plan and will be further developed during remedial design and remedial action.

Remediation construction activities within an active railyard must be performed with the highest concern for worker safety and protection. Using planning, coordination, train-spotters, radio communication and daily safety meetings will ensure the installation, maintenance and operation of the diesel fuel recovery system can occur safely.

STATUTORY DETERMINATIONS

The selected remedy will attain a degree of cleanup that assures present and future protection of public health, safety, welfare and of the environment, and complies with federal and state environmental criteria, limitations, or requirements that are applicable or well-suited to the remedial action and site conditions. The selected remedy protects public health, safety, and welfare, and the environment, and uses permanent solutions, alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and is cost-effective.

Because this remedy will result in hazardous or deleterious substances remaining on-site, DEQ will continue to periodically review the remedial action to ensure the remedy protects public health, safety and welfare, and the environment until the remedy no longer relies on institutional or engineered controls.

__Original Copy Signed________ ___9/7/2001_
Jan P. Sensibaugh Date
Director
Montana Department of Environmental Quality

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ACRONYMS

API	American Petroleum Institute
ATSDR	Agency for Toxic Substances and Disease Registry
beta-BHC	beta-benzene hexachloride
BN	Burlington Northern
BNRR	Burlington Northern Railroad
BNSF	The Burlington Northern and Santa Fe Railway Company
BRA	Baseline Risk Assessment
BTEX	Benzene, Toluene, Ethyl benzene and Xylene
CECRA	Comprehensive Environmental Cleanup and Responsibility Act
CERCLA	Comprehensive Environmental Responsibility, Compensation and Liability Act of 1980
CFR	Code of Federal Regulations
CGWA	Controlled Groundwater Area
cis-DCE	cis-1,2-Dichloroethene
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
DEQ	Department of Environmental Quality
DHES	Department of Health and Environmental Sciences
DNRC	Department of Natural Resources
DO	Dissolved Oxygen
DOT	Department of Transportation
EPA	Environmental Protection Agency
ERCLs	Environmental Requirements, Criteria and Limitations
FS	Feasibility Study
IRMWP	Interim Remedial Measures Work Plan
LIFE	Livingston Informed Friends of the Environment
LRC	Livingston Rebuild Center
LRY	Livingston Rail Yard
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MPDES	Montana Pollution Discharge Elimination System permit
MRL	Montana Rail Link
NCP	National Contingency Plan
NPRR	Northern Pacific Railroad
O&M	Operation and Maintenance
ORP	Oxidation-reduction Potential
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PCEC	Park County Environmental Council
PM-10	Particulate Matter less than or equal to 10 microns
RBCA	Risk-Based Corrective Action
RCRA	Resource Conversation and Recovery Act

RETEC	Remediation Technologies (recently changed name to ThermoRETEC)
RI	Remedial Investigation
ROD	Record of Decision
SVE	Soil Vapor Extraction
SVOCs	Semi-volatile Organic Compounds
TAG	Technical Assistance Grant
TCE	Trichloroethene
TPH	Total Petroleum Hydrocarbons
trans-DCE	trans-1,2-Dichloroethene
TSP	Total Suspended Particulate
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter of air
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds
WWTP	Wastewater Treatment Plant
WQB-7	Montana water quality standards

DECISION SUMMARY

I. SITE NAME, LOCATION AND DESCRIPTION

The BN Livingston Shop Complex facility (the site) includes the Livingston Railyard (LRY) and the surrounding area where hazardous or deleterious substances have been deposited, stored, disposed of, placed or otherwise come to be located. The site is located in Park County, Montana with the majority of it within the city of Livingston. Livingston is approximately 26 miles east of Bozeman, Montana and 100 miles west of Billings, Montana (see Figure 1). Figure 2 shows the location of the LRY general facilities. The site is approximately 1.5 miles long and 0.25 miles wide and is generally bounded by Park Street on the south, Gallatin Street on the north, Fifth Street on the west and beyond the Yellowstone River on the east. Some easterly portions of the site are located outside the city limits but within Park County.

The site specifically does not include the Mission Wye facility. In addition, the site specifically excludes dioxins, furans, and polychlorinated biphenyls (PCBs) as known hazardous or deleterious substances located at the site and therefore does not include cleanup levels for these contaminants. Should previously unknown or undetected conditions be discovered regarding these contaminants, the ROD will be modified, or listing as a second site will commence.

Most of LRY is surrounded by residential land except for a strip of land zoned industrial between the main railroad line and Park Street. The passenger depot is zoned highway commercial. Much of the land east of the Yellowstone River is zoned agricultural, except for a strip of land along U.S. Highway 89 between the Yellowstone River and the proposed Rustad subdivision on the north side of the highway and the Boulder Road Industrial Park on the south side of the highway. This strip of land along U.S. Highway 89 and both the proposed Rustad subdivision and the Boulder Road Industrial Park are zoned industrial. Detailed maps describing zoning in Park County are in the Park County Zoning Plan (March 1997) and shown on Figure 3. The 1999 city of Livingston zoning map identified by section 30.13 of the Livingston Municipal Code (1999) shows zoning within Livingston.

By ordinance, the city of Livingston prohibits installation of domestic groundwater supply wells within city limits. Residential, commercial and industrial land surrounding LRY is serviced by city water. Residences located southeast of Park Street and other possible areas own private groundwater wells. Land east of the Yellowstone River is not currently serviced by city water and landowners rely on private groundwater wells for all purposes.

Both the Department of Environmental Quality (DEQ) and Burlington Northern and Santa Fe Railway Company (BNSF) have changed over the last few years as the result of reorganization and mergers. DEQ was created on July 1, 1995 by consolidating environmental programs from the Departments of Health and Environmental Sciences (DHES), Natural Resources and Conservation, and State Lands. Documents in the Administrative Record dated before July 1, 1995 refer to DHES; documents in the Administrative Record dated after July 1, 1995 refer to DEQ. The Burlington Northern

Railroad (BNRR) merged with Atchison, Topeka & Santa Fe Railway Company in 1996 and changed its name to BNSF. Documents in the Administrative Record dated before December 31, 1996 refer to BNRR; documents created after December 31, 1996 refer to BNSF.

For purposes of clarity in the ROD, the acronym DEQ will be used to refer to the current Department of Environmental Quality and the former DHES. The acronym BNSF will be used to refer to the current Burlington Northern and Santa Fe Railway Company and the former BNRR.

The CECRA facility, including the LRY site, is referred to as the Burlington Northern Livingston Shop Complex (referred to in this ROD as BN Livingston Shop Complex or the site).

II. SITE HISTORY

The BN Livingston Shop Complex includes an active railyard (LRY), which began as a major industrial railroad and maintenance shop complex that the Northern Pacific Railroad (NPRR) constructed in 1883. Original facilities included a locomotive shop, car shop, wheel shop, and boiler house. During the 1880s the passenger depot, located at Park and Second Streets, was constructed and by 1900 the overall facility had expanded to include car shops, a 54-foot turntable, and a 15-stall roundhouse. An industrial wastewater treatment plant (WWTP) was constructed in 1968. Today, two railroad mainlines extend through the site for active rail traffic. Train traffic through Livingston may range from 18 to 24 trains daily. Ten active rail sidings are maintained, along with additional tracks to adjacent facilities such as the turntable and maintenance shops.

The LRY was owned and operated by NPRR until 1970 when NPRR merged with the Great Northern Railroad, the Chicago, Burlington and Quincy Railroad and the Spokane, Portland and Seattle Railroad to form the BNRR. In 1987, Washington Corporation's Montana Rail Link (MRL) purchased the buildings within the Livingston complex from BNSF and began operation of MRL at the site. A group of shareholders owned and operated the Livingston Rebuild Center (LRC) until its sale in 2000 to Talgo-LRC, LLC and the USA Northwest, Inc. The Talgo-LRC company rebuilds locomotives and railroad cars and MRL performs locomotive repairs and maintenance. On December 31, 1996, BNRR merged with Atchison, Topeka & Santa Fe Railway Company in 1996 and changed its name to BNSF. Both MRL and Talgo-LRC continue to operate at the site.

A. Regulatory History

In 1977 BNSF submitted self-monitoring data to DEQ indicating violations of BNSF's 1974 Montana Pollution Discharge and Elimination System (MPDES) permit. These violations occurred between September 29, 1976 and January 12, 1977. On May 5, 1977, DEQ issued an administrative compliance order directing BNSF to correct all violations within 30 days. DEQ filed a complaint against BNSF in Park County District Court on December 22, 1977 seeking an injunction prohibiting further violations and requesting civil penalties of $340,000. In January 1979 the district court approved a stipulation between DEQ and BNSF which resulted in the dismissal of this suit with prejudice and imposition of a $170,000 penalty; $100,000 was suspended contingent upon BNSF obtaining full operational compliance with its permit by January 1, 1980.

In 1985 DEQ required BNSF to investigate the potential that diesel fuel was leaking into soil and migrating to groundwater. Diesel fuel was found in several monitoring wells. Another investigation discovered VOCs in monitoring and municipal wells. In 1988, the city of Livingston shut down the Q and L Street municipal wells to eliminate VOC contamination in the city water supply and installed two new replacement wells outside of the plume.

On April 9, 1987, DEQ filed a complaint against BNSF alleging violations of Montana's Water Quality Act and seeking an injunction prohibiting further violations and requiring BNSF to prepare and submit a groundwater cleanup plan.

In the summer and fall of 1988, DEQ and BNSF entered into two administrative orders on consent which provided for the disclosure of documents related to the BN Livingston Shop Complex by BNSF and the removal of underground storage tanks (USTs).

On December 27, 1988, DEQ filed an action in U.S. District Court (Civ. No. 88-141-H-CCL) seeking to consolidate the issues raised in the two 1987 lawsuits and asserting other claims. These claims include liability under CECRA and under CERCLA for all remedial action costs incurred by the state and natural resource damages in connection with the Livingston site, as well as the Mission Wye facility, Park County landfill, and the Park County incinerator.

On July 31, 1989, DEQ and BNSF filed a draft partial consent decree with the U.S. District Court in Helena to resolve DEQ's claims against BNSF. The partial consent decree was the subject of four public meetings and a public hearing in Livingston during 1989. In light of public comments, DEQ and BNSF renegotiated many portions of the partial consent decree. A final Modified Partial Consent Decree was agreed upon and lodged with the court (U.S. District Court, Cause No. 88-141-H-CCL) on December 21, 1989. On April 6, 1990 the court preliminarily approved the Modified Partial Consent Decree and invited public comment to be filed with the court on or before April 24, 1990. At a hearing on April 27, 1990, after consideration of the comments submitted and responses given by DEQ and BNSF, the court approved the consent decree and accompanying stipulations and motions.

Both 1987 lawsuits and many of the issues in the 1988 suit were resolved in connection with the Modified Partial Consent Decree. Through a stipulation entered into in conjunction with the Modified Partial Consent Decree, both 1987 lawsuits were dismissed with prejudice and BNSF agreed to pay $1,000,000 in settlement of DEQ's past remedial action costs through June 30, 1989 and penalties; $100,000 was suspended contingent upon the quality of the work performed by BNSF. The issue of water quality is addressed through implementation of the Modified Partial Consent Decree, work plans and addenda.

Pursuant to the consent decree, BNSF committed to perform the remedial investigation and feasibility study (RI/FS) for the site, with required oversight by DEQ. DEQ committed to selection of the proper remedy for the site through a record of decision process, upon consideration of the RI/FS, and drawing upon CERCLA and NCP for guidance or as otherwise appropriate.

In April 1991 the U.S. Environmental Protection Agency (EPA) initiated field investigations to determine whether the site should be placed on the federal Superfund National Priorities List (NPL). Based solely on the groundwater exposure pathway, the site scored 50.0 using the EPA hazard ranking system and EPA proposed the site for the NPL in August 1994. Until recently, EPA's policy required the governor of the state to request placement of a site on the NPL. No Montana governor has made such a request and the site has not been placed on the NPL.

The RI and two FSs were conducted between 1989 and 1994. During the RI and FSs, numerous interim actions were conducted and are considered part of the selected remedy.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Public participation in the decision making process proceeded in accordance with the partial consent decree, and sections 113 and 117 of CERCLA and section 75–10–713, Montana Code Annotated (MCA), of CECRA.

DEQ provided notice and on September 22, 1998, the Proposed Plan and two FSs for the BN Livingston Shop Complex were released for public comment. DEQ held a public meeting on September 22, 1998 to present and discuss the Proposed Plan and FSs describing alternatives considered in selecting the preferred remedy. Copies of the FSs were distributed to the repositories. Copies of the Proposed Plan were provided to the September 22, 1998 meeting attendees and were made available to the public at the information repositories. In addition, the Proposed Plan was distributed to a mailing list of 300 persons and approximately 40 newspapers and radio stations in Livingston, Bozeman, Big Timber and Billings. Public notice requesting comment on the Proposed Plan was published in the Livingston Enterprise on September 23, 1998. In addition, a display ad advertising the September 22, 1998 public meeting in Livingston to discuss the Proposed Plan was published both in the Billings Gazette and Bozeman Chronicle on September 20, 1998 and in the Livingston Enterprise on September 17 and 21, 1998. A 60-day public comment period on the Proposed Plan and FSs was held from September 22, 1998 through November 23, 1998. A public hearing was held on October 22, 1998 to receive oral comments on the Proposed Plan and FSs.

Notice of the ROD will be published and copies of the ROD will be made available to the public for review at the repositories. The ROD will also be made available on the DEQ website (http://www.deq.state.mt.us). The ROD is accompanied by a discussion of any significant changes to the preferred remedy presented in the Proposed Plan along with reasons for the changes. Also accompanying the ROD is a Response Summary, which provides a response to each of the comments submitted in writing or orally at the hearing during the public comment period on the Proposed Plan and FSs.

The complete Administrative Record (that contains all documents related to the selection of the remedy for the BN Livingston Shop Complex) is located at:

Department of Environmental Quality
Remediation Division
Hazardous Waste Site Cleanup Bureau
2209 Phoenix Avenue
Helena, MT 59620-0901
Telephone: (406) 444-1420

A partial copy of the Administrative Record is located at:

Livingston-Park County Public Library
228 West Callender
Livingston, MT 59047
Telephone: (406) 222-0862

Additional repositories for major documents are located at:

Montana State Library, Capitol Complex, Helena, MT 59620
University of Montana Mansfield Library, Missoula, MT 59801
Montana State University, Renne Library, Bozeman, MT 59715

IV. SCOPE AND ROLE OF REMEDIAL ACTION

The purpose of the BN Livingston Shop Complex RI/FSs was to evaluate findings of previous investigations, collect additional data to characterize the nature and extent of contamination and assist in assessing current and future risks to the human health and the environment, and develop and evaluate remedial action alternatives.

The primary objectives of the RI/FSs were to:

- Investigate site physical features and define sources of contamination,
- Determine the nature and extent of contamination and evaluate contaminant fate and transport,
- Provide information on site characteristics and contaminants for use in the BRA and FSs,

- Identify applicable or well-suited Environmental, Requirements, Criteria and Limitations (ERCLs), and

- Identify and evaluate remedial alternatives to address human health and environmental risks and compliance with ERCLs.

Based on findings from previous investigations and results of the RI and treatability studies performed under the FSs, DEQ believes the data obtained is adequate for DEQ to evaluate and select an appropriate remedy for the site. The ROD contains screening levels or cleanup levels for all known contaminants of concern (COCs). Any new areas of contamination will require further data collection. Any new COCs or media will require an evaluation of clean-up alternatives and a DEQ-approved remedy.

The remedy outlined in this ROD represents the final remedial action at the BN Livingston Shop Complex; it will address principal threats to public health and the environment posed by contaminated media and compliance with ERCLs. Previously completed interim actions are considered part of the final selected remedy. Interim actions are discussed in Section VI.

V. SUMMARY OF SITE CHARACTERISTICS

Investigative activities began in October 1985. In January 1989 BNSF submitted the Environmental Site Audit Report, Livingston Rail Yard, Livingston, Montana (Envirocon, January 1989) to DEQ which summarized early investigative information. The Interim Remedial Measures Work Plan (IRMWP) was also prepared to initiate investigative and interim actions at the BN Livingston Shop Complex that would occur during negotiations of the Modified Partial Consent Decree. The IRMWP evolved into a RI work plan. The supplemental IRMWP was attached to the Modified Partial Consent Decree. In addition, over 30 supplementary work plans were written by BNSF’s consultant, Envirocon, Inc., and reviewed, modified when necessary, and approved by DEQ. The RI Report (Envirocon March 1994), including appendices (volumes II through VI), presents information collected while implementing the IRMWP and supplemental work plans. Section one of the RI report lists supplemental work plans and reports that were completed during the RI investigation through July 1992. This section of the ROD summarizes information and presents tables and figures from the RI report and other documents in the Administrative Record.

A. Hydrogeology

Hydrogeological investigations were conducted as part of the RI to characterize groundwater flow and contaminant transport through the aquifer. Based on geological information in the RI report the following conclusions are made:

1) The BN Livingston Shop Complex and the greater city of Livingston overlie an unconfined alluvial aquifer composed of highly permeable, relatively homogeneous, coarse, sandy gravel deposited by the Yellowstone River. A

confining unit composed of shales, siltstones and fine-grained volcanic sandstones of the Cokedale and Miner Creek formations underlies the alluvium.

2) The saturated thickness of the aquifer ranges from 10 to 25 feet beneath most of the site but can be as great as 60 feet. Depths to groundwater vary from approximately 25 feet on the southwest end of the site to 2 to 3 feet on the northeast portion of the site near the Yellowstone River. Seasonal groundwater fluctuations average about 2 to 3 feet per year near the shop complex, but are as great as 6 feet per year near the Yellowstone River. The highest seasonal water table typically occurs in July while the low water table typically occurs in February or March.

3) Based on water table maps and aquifer pump tests completed on and near the site, the following are estimates of hydrogeological parameters:

a) hydraulic conductivity - 170 to 380 feet/day
b) hydraulic gradient - 22 feet/mile (0.004)
c) effective porosity - 15 to 25 percent
d) groundwater velocity - 2 to 10 feet/day

4) Groundwater flows northeast and east beneath the western two-thirds of the site. Beneath the eastern third of the site, groundwater seasonal flow directions can vary almost 90 degrees due to the interaction between the aquifer and the Yellowstone River. During late summer and early fall when the water table is high and the river is low, flow is eastward and more directly toward the river. As the water table drops through the winter and early spring, groundwater flow becomes more northerly and parallel to the river. This seasonal shift in groundwater flow direction causes the VOC plume to shift north and south near the Yellowstone River.

B. General Discussion of Sources

Contaminant groups attributable to the BN Livingston Shop Complex include VOCs, semi-volatile organic compounds (SVOCs), metals, diesel fuel (both free product and dissolved phase), and asbestos. These are hazardous or deleterious substances under CECRA and include the following COCs: chlorobenzene, 2-chlorotoluene, 1,4 dichlorobenzene, methylene chloride, tetrachloroethene (PCE), trichloroethene (TCE), vinyl chloride, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, lead, cis-1,2 dichloroethene (cis-DCE), trans-1,2 dichloroethene (trans-DCE), and asbestos. Petroleum hydrocarbons are present as free product (diesel fuel) on top of groundwater, as diesel fuel adsorbed to surface and subsurface soil, and as dissolved phase petroleum hydrocarbons in the groundwater. Metals were found most often in soil, sludge, and the cinder pile; lead was also detected in groundwater. Asbestos contamination is limited to the cinder pile.

Known areas where COCs exceeding cleanup levels remain at the BN Livingston Shop Complex are in the groundwater for VOCs, lead, and diesel fuel; above the groundwater for diesel fuel; in subsurface soils for VOCs and diesel fuel; in surface soils for PAHs; and at the cinder pile for asbestos. Suspected areas where COCs exceeding cleanup levels remain at the site are in surface and subsurface soils for lead contamination and petroleum and other contaminants; and basement gas for VOCs. Known areas where COCs exceeding cleanup levels were removed since the issuance of the Proposed Plan are surface and subsurface soil at the electric shop for VOCs; confirmation soil samples were collected at the transfer pit and locomotive shop manways for VOCs, but the data has not been evaluated. All areas are subject to confirmation sampling review, and additional sampling, if appropriate, to ensure cleanup levels have been met.

C. Contaminant Fate and Transport

Figure 5 depicts a conceptual model and provides an overview of the primary contaminant transport pathways and mechanisms. The conceptual model shows the relationship between source areas and transport pathways. The most important contaminant transport mechanism is infiltration. VOCs, lead, and diesel fuel have infiltrated downward through subsurface soil to groundwater from several source areas such as unlined sludge pits, wastewater manways and drain lines, USTs, spills and leaks. Other contaminant transport mechanisms of importance include VOCs partitioning between subsurface soil and groundwater, diesel fuel dissolving slowly into groundwater, and VOCs volatilizing and diffusing from groundwater into the vapor phase within subsurface soil pores. VOC vapors then migrate through soil to ambient air and building basements through earth floors and cracked foundations. Friable asbestos may migrate to ambient air through wind scouring and dispersion. For a complete discussion of the contaminant transport mechanisms and pathways, see each appropriate section in the RI report (sludge, soil, diesel fuel, air and groundwater).

D. Specific Contaminated Media, Contaminants, Volume and Extent of Contamination

<u>Sludge</u>

Sludge was generated during wastewater treatment operations and was composed of materials from the shop complex. Sludge originating from the treatment of wastewater was composed primarily of solid materials, petroleum hydrocarbons and water. During the RI investigation, sludge was discovered in five unlined disposal pits including the American Petroleum Institute (API) separator pond, overflow pond, WWTP sump and two pits located at the cinder pile. Sludge was also present at the in-line grit chamber, various manways, surge tank, and the WWTP grit chambers. The total volume and areas of sludge identified (and then removed) from the BN Livingston Shop Complex are listed in Table 2.

Sludge was analyzed for VOCs, SVOCs, metals and RCRA characteristics. The sludge contained PCE ranging from 0.7 to 25 milligrams per kilogram (mg/kg); TCE ranging from 5.7 to 10 mg/kg; cis-DCE ranging from 1 to 450 mg/kg; cholorobenzene ranging from 1 to 450 mg/kg; and 1,4-dichlorobenzene ranging from 1.1 to 94 mg/kg. Table 3 lists the analytical results of sludge.

Based on these levels and downgradient groundwater sampling, DEQ determined the sludge was a source of contamination to groundwater, as well as a potential source of windborne contamination. Beginning in 1989 sludge was excavated from all known sources. This interim action is explained in Section VI.

Soil

Subsurface soil

As part of the RI, 223 test pits were excavated and 243 subsurface soil samples were collected and analyzed for VOCs, SVOCs, TPH, metals, pesticides and PCBs. The subsurface soil excavation focused on nine areas of suspected contamination: the shop complex, WWTP facility, Church Universal and Triumphant facility, livestock-car clean-out pile, oil-reclamation sludge disposal area, API separator and overflow ponds, cinder pile, freight-train and depot fueling facilities and the C & P Packing pits (see Figure 2). Between 1989 and 1991 additional work plan addenda were approved by DEQ to investigate other areas not originally included in the IRMWP. These areas included: oil-stained river gravel at the former WWTP drain line outfall in the Yellowstone River; contaminated soil at the track-pan installation area east of MRL shops; along drain lines and the electric shop (soil gas survey); around the lube-oil building and turntable pit; and along the mainline right-of-way east of the Yellowstone River. In January 1992 more investigations were completed at the WWTP septic tank drain field; C & P Packing pits; transfer pit; north drainage ditch; and the waste-oil reclamation plant (see Figure 2).

Table 4 and Table 5 show the concentration of contaminants found in subsurface soil samples. PCE was the predominant VOC found in samples at concentrations ranging from 5.4 to 420,000 micrograms per kilogram (μg/kg). The highest PCE concentrations were found near the vapor degreaser pit located in the electric shop. TCE was found in samples at concentrations ranging from 5.0 to 1,800,000 μg/kg. Concentrations of cis-DCE ranged from 5.7 to 710,000 μg/kg. Vinyl chloride was detected in one sample at 11,000 μg/kg. Chlorobenzene was identified in the samples in concentrations ranging from 6.4 to 34,000 μg/kg. Concentrations of 1,4-dichlorobenzene ranged from 6.6 to 162,000 μg/kg. Methylene chloride was detected in eight samples, but laboratory contamination of the samples was suspected.

Phenanthrene was the most commonly detected SVOC in subsurface soil. Phenanthrene ranged from 90 to 80,000 μg/kg. Most SVOCs were detected beneath portions of the shop complex, drain lines, manways and sludge disposal pits.

Average total metal concentrations were within the background ranges, with the exception of lead and chromium, which were primarily detected beneath sludge pits and drain lines. One sample contained PCBs and two samples contained the pesticide beta BHC. The largest TPH concentrations were detected around the fueling facilities, beneath sludge disposal pits, near manways and drain lines and in the diesel fuel smear zone. TPH was identified at concentrations ranging from <10 parts per million (ppm) to 6500 ppm. Table 6 lists the estimated volume of contaminated soil at the time when the RI was submitted.

Surficial Soil

Surficial soil samples were collected and analyzed in eight areas: 1) the cinder pile, 2) API separator and overflow pond, 3) freight-train refueling area, 4) WWTP and sump area, 5) in-line grit chamber, 6) passenger-train (depot) refueling area west of the shop complex, 7) areas not significantly impacted by past or present operations, and 8) areas currently being managed by MRL, including the post-1943 relic slough. Five surficial soil samples were collected in the city of Livingston. Details of the surficial soil investigation are described in the Surficial Soil Investigation Report, Livingston Rail Yard (Envirocon, July 1992) which is part of the RI.

Table 7 lists sample results for surficial soil. Sixty-seven samples were collected and analyzed for VOCs, PAHs, pesticides and metals. TPH was not analyzed for in surficial soils. PCE was detected in concentrations from 5.2 to 24.3 μg/kg. Methylene chloride was detected in some samples; however, laboratory contamination of those samples was suspected.

PAHs were detected in all areas and at several locations within the city of Livingston. PAHs are common products of incomplete combustion and constituents of diesel fuel. Fluoranthene and pyrene were the most commonly detected PAHs. Fluoranthene and pyrene were detected in the samples at concentrations ranging from 420 to 27,000 μg/kg and 440 μg/kg to 27,000 μg/kg, respectively. The largest PAH concentrations were detected in sludge disposal areas. Some surficial soil samples collected from the city of Livingston areas contained low levels of the pesticides 4,4'-DDE and 4,4'-DDT. Except for lead, barium, and chromium, average metal concentrations were within background ranges expected for this area of the country. The largest lead and chromium concentrations were near sludge disposal areas.

<u>Diesel Fuel</u>

Two separate free product diesel fuel plumes were originally discovered in 1985: the freight-train refueling area (freight train) and depot plumes (see Figure 6). The freight-train plume extends northeast from the former freight-train fueling area past the WWTP, and the depot plume emanates from the passenger-train (depot) refueling area. Both plumes extend beyond BNSF property. Although free product was located at the depot-refueling area initially, there does not appear to be diesel fuel on top of groundwater in the depot area. A manway and storm drain located in the B Street underpass may act as a sink, which drains groundwater and diesel fuel from this area. During precipitation events, diesel fuel was flushed from contaminated soils by storm water into the storm drain and eventually into Fleshman Creek. Diesel fuel was reported flowing in the B Street storm drain and sewer outfall, but is no longer detected there. Diesel fuel is no longer observed in the B Street underpass after heavy precipitation events. When the B Street storm drain was cleaned in May 1999, no diesel fuel was observed in the drain line. TPH was detected in monitoring wells (especially L-87-7 and L-87-8) near and within the depot plume and freight-train plume when TPH monitoring was conducted in 1989 through 1992; concentrations ranged from <0.1 mg/L to 9.9 mg/L and <0.1 mg/L to 34 mg/L, respectively. Table 8 summarizes TPH analytical data from May 1989 through May 1992. One groundwater sample in the freight-train plume contained 222 mg/L, but a bladder pump failure is suspected of contaminating the sample. TPH was detected south of Park Street in monitoring wells numbered 1 and 3.

The RI focused largely on the freight-train plume. The freight-train plume covers an area of approximately 30 acres. DEQ originally estimated the volume of diesel fuel in the ground at 1,600,000 gallons. Envirocon estimated the amount of diesel fuel at 300,000 to 600,000 gallons in the RI (March 1994). Envirocon subsequently estimated the volume of free product to be 150,000 gallons. Therefore, the estimated volume of diesel fuel on top of groundwater and adsorbed to soil ranges from 150,000 to 1,600,000 gallons. The estimated volume of free product in the freight train and depot plumes will be re-evaluated in Phase I of the selected remedy.

The smear zone is the area of diesel contamination above and below (approximately 6 feet) the groundwater table, which contains diesel, adsorbed to soil resulting from fluctuating groundwater. Table 5 summarizes TPH analytical results for subsurface soil. The estimated total volume of contaminated alluvial material within the smear zone of the freight-train plume is 275,000 cubic yards. The extent of the depot plume containing residual diesel fuel is approximately 10 acres. The estimated total volume of contaminated alluvial material within the smear zone of the depot plume is 70,000 cubic yards. The estimated volume of contaminated residual diesel fuel will be re-evaluated in Phase I.

Diesel fuel present as free product and adsorbed to soil is weathered and contains low concentrations of benzene, toluene, ethyl benzene and xylene (BTEX) compounds and other VOCs associated with diesel fuel. The flash point of free product in the freight-train plume ranges from greater than 140°F to 210°F. The specific gravity ranges from 0.881 to 0.898. Some free product contains low levels of cadmium, chromium and lead. Free product in the northeast portion of the freight-train plume contains low concentrations of VOCs.

Low levels of TPH, SVOCs, BTEX (benzene, toluene, ethyl benzene and xylene), associated with diesel fuel, and VOCs are dissolved in groundwater. The primary source of these contaminants is diesel fuel on top of groundwater and adsorbed to soil in the smear zone.

Since May 1989, free product thickness was monitored in certain wells located in the freight-train diesel plume. Monitoring wells were screened across the water table. Figure 7 shows the apparent free product thickness of diesel fuel in feet. Table 9 from the 2000 Annual Groundwater Sampling Report (Envirocon, April 2000) shows apparent free product thickness measurements from February 1995 through November 2000. Table 10 from the 1996 Annual Groundwater Sampling Report, Livingston Rail Yard (Envirocon, September 1996) shows apparent free product thickness measurements from August 1994 through May 1996. Free product thickness has remained fairly constant from 1991 through 2000. Presently, there are no monitoring wells located in the center of the plume; therefore, no free product thickness measurements are available for this area. The RI report speculates the greatest free product thickness is in the center of plumes.

Table 5 shows TPH concentrations in monitoring well drill cuttings outside and within the freight-train plume. TPH concentrations in the alluvial smear zone ranges from 1,050 to 6,500 parts per million (ppm).

Air

Ambient air (outdoor air) and indoor air (within a residence) were sampled during the RI. Ambient air samples were collected upwind and downwind of the site and analyzed for particulate matter less than or equal to 10 microns (PM-10), total suspended particulate (TSP), PAHs and metals. During removal and investigative activities, work-zone air was monitored within work areas for total particulate, VOCs, and PAHs. Eight indoor air sampling events were conducted in homes on the north side and south side of the LRY to determine if excessive concentrations of PCE, TCE, cis-DCE and trans-DCE were entering basements and homes.

Ambient Air

Meteorological data was collected during ambient air and indoor air sampling events. During the period from November 11, 1990 through March 31, 1992 the average wind speed was 12.5 mph. The wind direction was 231 degrees (from the southwest). The percentage of calm hours was 0.0%. The maximum temperature for the period was 93°F. The minimum temperature was –24°F. The average temperature was 43°F. The ambient air data was taken over a two year period, with PM-10 samples collected every 6 days. DEQ evaluated data from Montana's Department of Transportation Maintenance Division road weather informational system for Livingston between January 1999 and July 2001. The average monthly wind gust is approximately 92 miles per hour (mph); the maximum average monthly wind gust is 138 mph and the minimum average monthly wind gust is 66 mph.

As shown on Table 11, mean PM-10 concentrations were 18 $\mu g/m^3$ for the upwind site and 16 $\mu g/m^3$ for the downwind site. The peak reporting concentrations for the upwind and downwind sites were 56 $\mu g/m^3$ and 34 $\mu g/m^3$, respectively. These levels were below the PM-10 standards shown on Table 11. TSP samples were collected and compared to TSP standards. The levels measured were below these standards. PAH concentrations are listed on Table 12 and are at levels below the screening criteria levels generated in the BRA. Screening criteria levels were also generated for metals listed on Table 13. Metal levels in ambient air were obtained by analyzing PM-10 samples and were below the screening criteria. Lead concentrations were below the ambient air quality standard for lead.

Indoor Air

DEQ conducted three indoor air sampling events; BNSF conducted five additional indoor air sampling events as part of the RI. This section will summarize two of these sampling events. These and other indoor air sampling events are described in detail in the RI report and Phase I through Phase IV basement gas investigation reports (see Section XIII, References, for a complete citation of these documents).

February and March 1992 Sampling Event: Three ambient air, six soil-gas and 19 residential samples were collected and analyzed during the February and March 1992 sampling event. Table 14 summarizes PCE, TCE, cis-DCE and trans-DCE analytical results for the February 1992 sampling event. Table 15 summarizes PCE, TCE, cis-DCE and trans-DCE analytical results for the March 1992 sampling event. Table 16 is a statistical summary for chemicals detected in indoor air. Table 17 summarizes vinyl chloride analytical results for the March 1992 sampling event. Figure 8 shows the sample locations and analytical results for the February and March 1992 indoor air sampling event. These results are located on the February 1991 groundwater plume map.

All indoor air samples (and outdoor air samples) contained detectable concentrations of PCE ranging from 0.56 $\mu g/m^3$ to 82.1 $\mu g/m^3$. TCE was not found in outdoor samples, but was detected in small concentrations in several area residences located upgradient from the site, and in low concentrations from 0.21 $\mu g/m^3$ to 3.33 $\mu g/m^3$ in residences within the study area. The cis-DCE and trans-DCE compounds were detected in only a small number of samples. Vinyl chloride was found in the primary and duplicate sample from home SE-2 at 0.8 $\mu g/m^3$ and 0.64 $\mu g/m^3$, respectively.

Based on sample analyses from the February and March 1992 sampling event and evaluation by toxicologists, VOCs posed an unacceptable risk in indoor air at three homes (SE-5, NE-3, and NE-1). DEQ mitigated VOC vapors in home SE-5 by installing a vapor removal system in the crawl space. Subsequent sampling showed the vapor ventilation system was effective in removing VOC vapors. The homeowners of home NE-3 refused a ventilation system. Home NE-1, with the highest concentration of PCE (70.2 $\mu g/m^3$), was temporarily abandoned. DEQ will evaluate the status of these homes during the remedial design process.

January and February 1993 Sampling Event: Residences with basements, crawlspaces, and mobile homes were investigated during the January and February 1993 sampling event. Except for mobile homes without basements, both living areas and basements were sampled. Sixty-eight indoor air samples were collected from 36 residences located on the north and south side of the LRY. Fifteen residences contained crawlspaces, 15 contained cement basements, three contained earthen basements and three were mobile homes. Table 18 lists PCE sample results for the January and February 1993 sampling event. Nine residences contained detectable concentrations of PCE, which ranged from 4.5 $\mu g/m^3$ to 19.0 $\mu g/m^3$; five residences contained PCE concentrations below the ambient air concentration of 10.2 $\mu g/m^3$. Figure 9 shows the sample location and results of the January and February 1993 indoor air sampling event. The risk from indoor contamination air is discussed in Section VII.

Groundwater

The Livingston aquifer is a shallow, unconfined, coarse, alluvial aquifer. PCE, TCE, cis-DCE, chlorobenzene, trans-DCE and 1,4-dichlorobenzene are the predominant VOCs dissolved in the aquifer. PCE was detected in the groundwater samples ranging in concentrations from 0.5 μg/L to 850 μg/L. TCE was detected the samples ranging in concentration from 0.5 μg/L to 73 μg/L. Cis-DCE was found in the samples ranging in concentrations from 1.0 μg/L to 2550 μg/L. Chlorobenzene was detected the samples ranging in concentration from 1μg/L to 2,100 μg/L. Trans-DCE was detected in the samples ranging in concentration from 1 μg/L to 31 μg/L. The minimum concentration of 1,4-dichlorobenzene was detected in samples ranging in concentration from 0.5 μg/L to 150 μg/L. See Table 19 for more information on VOCs in groundwater.

Figure 10 shows the average PCE concentrations in groundwater from May 1989 through May 1992. VOC contamination in groundwater generally decreases downgradient from the electric and locomotive shops. This pattern is typified by the drop in concentrations of VOCs in the direction of groundwater flow from the electric shop toward the Yellowstone River to the east.

Other VOCs dissolved in groundwater are listed on Table 19 (includes groundwater monitoring data through May 1992). Some VOCs, such as naphthalene and isopropylbenzene, are constituents of diesel fuel; other VOCs, such as sec-butylbenzene, n-propylbenzene and 1,2,4-trimethylbenzene are chemical constituents of crude oil**.** Since diesel fuel is refined from crude oil, these constituents are also related to diesel fuel contamination. Additional groundwater monitoring data is available in annual groundwater monitoring reports from May 1993 through May 2000 (refer to Section XIII of the ROD for a complete citation of these groundwater monitoring reports). The VOC plume extends from the shop complex to the East Side of the Yellowstone River.

Groundwater contamination levels in the aquifer exceed the human health standards for VOCs set forth in the Environmental Requirements, Criteria and Limitations (ERCLs) attached as Appendix A. However, groundwater data collected from May 1989 through May 1992 confirms that VOC concentrations were higher than are seen in current data (through 2000) and are decreasing with time. This decrease is presumed to be the result of these solvents not being used and disposed of at the site and most VOC sources, including sludge and soil with high VOC concentrations, having been removed during interim actions. Dilution by groundwater through flow and dispersion in the aquifer has also reduced VOC concentrations. Figures 10 and 11 depict the estimated decrease in PCE concentrations in groundwater from 1992 and 2000, respectively. Other VOCs have also decreased in groundwater and DEQ expects all VOC concentrations in groundwater to continue to decline.

Figure 12 shows the municipal and private well locations west of the Yellowstone River that were either investigated or sampled during the RI. The new Billman Creek and Clinic replacement public water supply wells, installed as a result of contamination in Q and L Street wells from the LRY, are located south and west of the Park High School. Table 20 lists sampling results for municipal wells. PCE was detected five times in the Q Street well at less than 1.0 μg/L. PCE was detected in the L Street well twice at less than 1.0 μg/L. Contamination was not detected in any other municipal well. Table 21 lists sampling results from private wells. PCE contamination was detected in six private wells and ranged from 0.6 μg/L to 96 μg/L. Other VOCs and TPH were also detected in private wells, with four of the wells containing levels over the MCL. The Proposed Plan states that no one is known to currently be using groundwater above MCLs.

Figure 15 identifies the location and sampling results for three private wells BNSF sampled in October 1998 and seven private wells sampled in September 1999. All of these wells were located east of the Yellowstone River. PCE concentrations ranged from <0.5 μg/L and 1.5 μg/L.

Table 8 summarizes TPH analytical data from May 1989 through May 1992. TPH was detected in several on-site monitoring wells, especially L-87-7 and L-87-8. TPH was detected south of Park Street in off-site monitoring wells numbered 1 and 3. Dissolved metal results are listed in Table 22. Metals were detected in monitoring, municipal and private wells. WQB-7 levels for lead were exceeded in six monitoring wells.

Yellowstone River Surface Water and Sediment

Figure 13 shows the locations where four sediment samples were collected from the banks of the Yellowstone River in March 1990. These samples were collected at the Sacajawea slough outfall (SS-063), at locations downgradient from the abandoned BNSF WWTP discharge line (SS-061 and SS-060) and at one upstream location (SS-064). Table 23 lists and identifies results of the Yellowstone River gravel and sediment samples. Sediment samples are identified with the letters SS. Other samples listed on Table 23 with the letters RG- and TP- refer to samples collected during the river gravel investigation. All four sediment samples, including the upstream sample (used as background), contained detectable concentrations of toluene and TPH. Arsenic, barium, chromium and lead were also detected in sediment. No VOCs, SVOCs, PCBs or pesticides were detected in the samples.

Figure 14 shows the locations of surface water samples collected in the Yellowstone River. Three samples were collected both upgradient and downgradient from the BN Livingston Shop Complex. Table 24 lists sample results for VOCs, TPH, SVOCs, PCBs, pesticides, and metals. PCE and 2-chlorotoluene were detected at low levels downgradient from the site. These levels were below WQB-7 standards. TPH was detected in both an upgradient and downgradient sample. No SVOCs, PCBs or pesticides were detected. Arsenic was detected in most of the samples and it is suspected to be related to Yellowstone Park thermal discharges to the Yellowstone River.

Asbestos

Asbestos was reportedly disposed of and buried in the cinder pile. The cinder pile covers about 6.3 acres and is shown on Figure 2. It is approximately 633 feet long, 333 feet wide and 20 feet high and contains approximately 202,000 cubic yards of a combination of cinders and other solid waste; the cinders are a waste product resulting from burning coal in steam locomotives.

On November 1, 1990 DEQ collected samples of materials obtained from the surface of the cinder pile. The three samples contained chrysotile asbestos. Sample results for DEQ's asbestos detections are found in Appendix C. Two separate sampling events in June 1991 provided no evidence of asbestos.

VI. DESCRIPTION OF INTERIM ACTIONS

To reduce contaminant migration to groundwater, DEQ and BNSF conducted interim actions, including source removal, during the RI and FSs. Pursuant to a DEQ enforcement action, BNSF began removing leaking underground storage tanks, associated piping and soil in 1988. In November 1989, work began to temporarily contain WWTP sludge until it could be shipped off site for disposal. Many other early interim actions helped reduce the potential for exposure to contamination and limit contamination migrating to groundwater. Consequently, interim actions were evaluated in the two FSs and are considered to be part of the selected remedy. Interim actions and certain voluntary actions conducted by MRL and LRC to remove contamination from the site are shown in Figure 4 and include the following:

1) Abandonment and replacement of two contaminated city wells:

DEQ sampled the Q and L Street municipal wells on the East Side of Livingston in 1988 and found PCE contamination below MCLs. As a result of this contamination, the city of Livingston discontinued using the wells. In 1989 BNSF agreed to provide the city of Livingston with up to $1.7 million to install new municipal wells and modify the municipal water distribution system. The city permanently abandoned these wells in 1990 and replaced them with the Billman Creek well near Billman Creek and the Clinic well at Cambridge and South 14th Streets in the southwestern section of the city, away from groundwater contamination. A new city water line with 10 connections for potential new businesses along Gallatin Street near the city shops was also installed.

2) Replacement of leaking wastewater lines and manways:

In 1986, one of the first environmental projects for LRC was to replace leaking wastewater lines and manways. In 1988, LRC sleeved old sewer lines, replaced some manways, and had the system hydrostatically tested by Olympus Environmental in 1990 and 1994. The tests indicated some manways were leaking. Subsequently, LRC replaced four manways.

3) Removal of 14 underground storage tanks, associated piping and visibly contaminated soil:

In 1988, DEQ and BNSF signed the Storage Tank Monitoring, Testing, Reporting and Corrective Action Administrative Order on Consent. The purpose of the order was to investigate environmental conditions at the BN Livingston Shop Complex concerning underground storage tanks (USTs). The investigation was conducted in accordance with the Work Plan for the Removal of Storage Tanks, Piping and Contaminated Soils (RETEC, October 27, 1988). The Summary Report for the Removal of Storage Tanks, Piping and Contaminated Soils & Gravels, Livingston Fueling Facility, Livingston, Montana (RETEC, April 1989) describes the number of USTs removed, the piping associated with each tank and the volume of contaminated soil removed at each tank location. See Table 25 for volumes of soil removed during the storage tank removal. In the Summary Report Management of Containerized Materials, Tank Removal Program, Burlington Northern Fueling Site, Livingston, Montana (RETEC, September 1989) analytical results are discussed along with alternatives considered for disposing of the wastes. The contaminated soil was sent to another BNSF site in Nebraska for treatment.

4) Removal and disposal of approximately 12,500 tons of WWTP sludge from four unlined pits and other containment areas:

Under the Sludge Removal-Action Work Plan, Livingston Rail Yard, Livingston, Montana (Envirocon, May 29, 1992), sludge located in the WWTP sump and cinder pile lagoon was excavated and placed on temporary liners beginning in November 1989. The purpose of the source control action was to reduce VOCs migrating from sludge to groundwater. In 1992, DEQ prepared a Request for a Time Critical Removal Action Memorandum to remove and dispose of sludge from the LRY. The memorandum directed BNSF to prepare a Sludge Removal - Action Work Plan in 1992. After DEQ approved the work plan, approximately 7,000 tons of sludge was excavated, stabilized with kiln dust and sawdust, and transported to the U.S. Pollution Control, Inc. Grassy/Grayback Mountain Facility in western Utah for disposal.

During Phase II of sludge removal activities, approximately 5,500 cubic yards of sludge buried in the cinder pile was excavated, stabilized, transported in railcars and disposed of at East Carbon Development Corporation's industrial landfill near Price, Utah.

5) Removal of approximately 3,000 pounds of chlorinated solvents from soil using eight in-situ SVE systems from 1992 through 1994:

From approximately 1992 through 1994 BNSF tested and then operated eight SVE systems in areas with high VOC concentrations. Systems consisted of one or more vertical SVE wells connected to a vacuum pump. SVE systems were located at the electric shop, transfer pit manways, locomotive shop manways, main WWTP manways, WWTP sump area, cinder pile, waste oil recycling plant, and in-line grit chambers. Air samples were collected to calculate individual VOC removal rates and estimate the total VOCs removed from soil. An estimated 3,000 pounds of VOCs were removed from soil at the eight SVE systems.

6) Removal of approximately 50 cubic yards of contaminated gravel from the Yellowstone River:

On January 24, 1990 a reportedly small volume of oil leaked from the abandoned wastewater treatment plant discharge line into the Yellowstone River bed. To eliminate future discharges, BNSF removed oil from an in-line sump and permanently plugged the discharge line with concrete. The U.S. Army Corps of Engineers, Soil Conservation Service, and DEQ approved sediment removal operations in the Yellowstone River. An area approximately 100 feet by 30 feet of oil-stained river gravels was excavated. Approximately 30 tons of contaminated river gravels was hauled to the API separator pit, mixed with sludge and eventually shipped off-site for disposal.

7) Removal of 600 tons of contaminated soil in front of MRL shops and installation of track pans to contain dripping oil from locomotives:

In October 1990, MRL excavated approximately 14 inches of contaminated soil from under each set of tracks east of the MRL shop building. The soil was replaced with new ballast. Fourteen inches of soil was also removed from between the tracks. Visibly stained contaminated soil beneath the 14-inch depth was removed and stock piled until it was sampled. Track pans were installed on top of new ballast to contain waste oil spills and fuel that drips from locomotives being repaired at MRL. Piping connected to track pans and buried underneath railroad tracks diverts liquid wastes to the on-site WWTP. MRL removed approximately 500 tons of contaminated soil during this project. The soil was shipped to a land farm near East Helena for treatment. BNSF later removed an additional 100 tons of visibly contaminated soil, which was also shipped to the East Helena land farm for treatment.

8) Removal and disposal of visible asbestos from the surface of the cinder pile:

In November 1990 DEQ detected asbestos in waste material located on the cinder pile. Under the Cinder Pile Asbestos Work Plan, the cinder pile investigation was performed in June 1991. Visible asbestos was collected in approximately three plastic bags and properly disposed of at the Park County landfill. Two sample events were conducted at wind speeds greater than 15 miles per hour and less than 15 miles per hour. No asbestos was detected in the air during the sampling events.

9) Removal and disposal of PCE contaminated backfill from the vapor degreaser pit:

During the week of July 17, 1995 about 40 yards of concrete debris, soil and cobbles were removed from the vapor degreaser pit. Several unsuccessful attempts were made to treat the material to site cleanup levels. On April 8, 1998 BNSF shipped the soil to a hazardous waste incinerator for disposal in Utah. The concrete debris was steam-cleaned and remains on-site awaiting final disposition.

10) Removal of approximately 2,700 gallons of floating diesel fuel from groundwater while testing various diesel removal technologies, 1990-1994:

Seven treatability studies were performed from 1990 through 1994 to investigate the best way to remove diesel fuel from groundwater. Tests included installation and operation of a recovery trench, dual-pump recovery system in LPW-1, and five passive and active recovery systems conducted in the freight train plume. Active recovery tests pumped groundwater to increase the flow of diesel fuel into recovery wells; passive recovery tests removed diesel fuel from groundwater with a skimmer. Approximately 2,700 gallons of diesel fuel was removed while testing these technologies.

Of the five field-scale free product recovery tests designated Test Cells 1 through 5 , Test Cell 1 evaluated free product recovery using a product-only skimmer. Test Cell 2 evaluated two-pump product recovery on the periphery of the freight-train plume. Test Cell 3 also evaluated two-pump product recovery east of the WWTP. Test Cell 4 evaluated the efficiency of a two-pump product recovery system with water treatment and reinjection. Test Cell 5 was installed to evaluate various passive recovery techniques and equipment. This test was not performed because diesel fuel did not re-enter some recovery wells; it is suspected that air rotary drilling evacuated diesel fuel from around recovery wells. These tests are described in greater detail in the Final Draft Primary Hydrocarbon Feasibility Study Report (Envirocon, January 1998). Approximately 3,000 gallons of diesel fuel were removed from groundwater during operation of Test Cells 1 through 4.

11) Retrofit WWTP grit chambers:

In 1991 after sludge was removed from the WWTP grit chambers, LRC pressure washed the interior of the concrete chambers and applied a sealant to the interior wall. Since current wastewater flow from the shop complex is significantly less than the original design of the WWTP, a smaller steel container, approximately 10 feet by 6 feet by 60 feet, was installed to replace the original grit chambers which are no longer used for wastewater storage.

12) Removal and treatment of soils beneath the vapor degreaser pit – Electric Shop:

At the release of the Proposed Plan, contaminated soil remained beneath the vapor degreaser pit at the electric shop and transfer pit manways. This was the largest remaining known source of VOC contamination to groundwater. The soil beneath the electric shop has since been excavated pursuant to an approved interim action work plan and is presently being treated ex-situ. The transfer pit manways and locomotive shop manways await disposition. Once soils are treated to cleanup levels, they may be placed on-site in an appropriate location. This interim action is considered part of the selected remedy to be implemented because it had not been performed when the Proposed Plan was issued.

VII. SUMMARY OF SITE RISKS

A. Public Health Studies

Early in the RI, DEQ received many inquiries and complaints from local residents about a reportedly high number of cancer cases and other community health concerns in Livingston. Citizens wanted to know if health problems in the area could be attributed to contaminants from the BN Livingston Shop Complex. DEQ asked the federal Agency of Toxic Substances and Disease Registry (ATSDR) to investigate these reports.

After reviewing the state cancer registry, ATSDR and DEQ began a pancreatic cancer study in February 1989 called the Investigation of a Cluster of Pancreatic Cancer Deaths in Livingston and Park County, Montana (ATSDR, September 1992**)**. This report concluded there was an elevated number of pancreatic cancer cases in Livingston from 1980 to 1989 and recommended a more rigorous epidemiological study to investigate whether environmental factors and pancreatic cancer in Livingston were related. In the follow-up study, Pancreatic Cancer Mortality and Residential Proximity to Railroad Refueling Facilities in Montana: A Records-Based Case-Control Pilot Study (ATSDR, December 1994), ATSDR concluded that residential proximity to railroad refueling facilities, as determined at the time of death, was not associated with pancreatic cancer mortality in Montana.

In February 1997 DEQ and ATSDR held a public meeting in Livingston to discuss the results of the draft ATSDR public health assessment for the BN Livingston Shop Complex. The final public health assessment document entitled Petitioned Public Health Assessment, Burlington Northern Livingston Complex, Livingston, Park County, Montana (ATSDR, September 30, 1997), concludes that there is no current health risk from contaminants at the site. ATSDR assumed that no one is currently using contaminated groundwater, that indoor air concerns were mitigated, and that workers would unlikely have direct contact with on-site soil in quantities large enough to produce illness. Also, ATSDR's document did not evaluate potential future risks. The DEQ Baseline Risk Assessment (BRA), Livingston Rail Yard (Camp Dresser & McKee, Inc., May 1993) evaluated both potential current and future risks and identified, among other things, a potential increased cancer risk in the general population near the site based on exposure to contaminated groundwater and a potential increased cancer risk to on-site worker based on exposure to contaminated surficial soils.

B. Baseline Risk Assessment

The BRA for the BN Livingston Shop Complex was completed in 1993. It provides a basis for taking action and concludes which analyzed exposure pathways must be remediated. The BRA serves as the baseline for indicating what risks may exist if no remedial actions are conducted at the site. As part of the RI/FSs, the human health and ecological risk assessments, which comprise the BRA, were developed to help DEQ determine actions necessary to reduce potential current and future risks from hazardous and deleterious substances. EPA guidance requires a BRA to provide an analysis of baseline risk and the need for cleanup action, a basis for determining cleanup levels that are protective of public health and the environment, a basis to compare potential health and ecological impacts of various cleanup alternatives, and a consistent process to evaluate and document potential public health and ecological threats at the site.

The objective of the Human Health Risk Assessment was to develop reasonable but conservative estimates of potential current and future exposures in order to calculate potential current and future human health risks due to contaminants released from the site. The objective of the ecological risk assessment is to develop reasonable yet conservative estimates of potential exposures so that ecological risk estimates can be derived for COCs in all relevant media.

C. Human Health Risks

Contaminants of Concern

Screening of chemicals detected at the BN Livingston Shop Complex was based on toxicity, mobility, frequency of detection, association with site activities, comparison with background concentrations and human nutritional requirements. Screening ensures that only those chemicals attributable to contamination and likely to contribute to health risks are analyzed through the remainder of the BRA process. Chemicals that remain after this screening are called COCs. Based on this screening, COCs for groundwater are chlorobenzene, 2-chlorotoluene, 1,4-dichlorobenzene, cis-1, 2-dichloroethene, methylene chloride, tetrachloroethene, trichloroethene, vinyl chloride, and lead. For surface soil, COCs are benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and lead. For indoor air, COCs are cis- and trans-dichloroethene, tetrachloroethene, trichloroethene and vinyl chloride. A single COC, 2-chlorotoluene, is selected for sediment. COCs are listed on Table 26. No COCs are identified for surface water. No COCs are selected for subsurface soil based on direct contact because a screening analysis showed that exposure to subsurface soil is not likely to impact the health of workers who may come into contact with it. However, chemicals in subsurface soil are evaluated for their potential to contaminate other media, such as air and water, in the future. COCs are not selected for ambient air and soil gas because screening analyses showed that exposures to chemicals in these media are not expected to impact the health of workers or residents who are most likely to be impacted.

Exposure Assessment

The goal of the exposure assessment is to estimate reasonable maximum exposures (RMEs) in the absence of any future remedial actions for populations that may be exposed to contaminants related to the site. RME estimates are intended to be protective of at least 95% of an exposed population, but are still believed to be within the realm of possible exposures. Potential routes by which individuals may be exposed to site-related contaminants are shown on Table 27. Potential pathways for current populations evaluated in the BRA include incidental ingestion of on-site surface soils for workers and trespassers and inhalation of chemicals volatilizing into basements of homes for residential populations. Future potential pathways evaluated in the BRA include ingestion of contaminated groundwater, dermal exposure to contaminated groundwater, inhalation of contaminated water while showering for residential populations and ingestion of sediment and dermal contact with sediment during recreational activities on the Yellowstone River. Table 28 shows routes for further evaluation. In identifying potential exposure pathways, both current and reasonably anticipated future land use at the site and surrounding area were considered. The site's proximity to the Yellowstone River suggests that recreational users may be exposed to contaminated sediment in the river. Past and current industrial use of the site suggests that current and future on-site workers may be exposed to contaminated surface soil. The close proximity of residential property suggests residents may be exposed to contaminated groundwater and indoor air and site trespassers may be exposed to contaminated soil.

Toxicity Assessment

The purpose of the toxicity assessment is to examine the potential for each COC to cause adverse effects in exposed individuals and to describe the relationship between the extent of exposure to a particular contaminant and adverse effects. Adverse effects include both carcinogenic and noncarcinogenic health effects in humans.

Toxicity criteria for carcinogens are slope factors in units of risk per milligram of chemical exposure per kilogram body weight per day ((mg/kg-day)). These cancer slope factors are based on the assumption that no threshold for carcinogenic effects exists and any dose, no matter how small, is associated with a finite cancer risk. Toxicity values for noncarcinogens, or for carcinogens that may also cause significant noncarcinogenic effects, are reference doses (RfDs) in units of milligrams of chemical exposure per mg/kg-day. RfDs are estimates of thresholds. Exposures less than the RfD are not expected to cause adverse effects even in the most sensitive populations with continuous exposure over a life time.

Table 29 shows carcinogenic and noncarcinogenic effects. A COC may be both a carcinogen and a noncarcinogen based on its adverse effects.

Risk Characterization

Chemical exposure estimates are combined with toxicity values to develop quantitative health risk estimates for exposure to BN Livingston Shop Complex COCs. Both cancer and noncancer health risks are estimated, as appropriate, for each significant exposure route identified. Risks from different exposure routes are combined to provide a total estimate of carcinogenic and noncarcinogenic health risks. Cancer and noncancer risks are summarized for each pathway in Table 29.

Carcinogens

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. An excess lifetime cancer risk of 1×10^{-5} indicates that, as a reasonable maximum estimate, an individual has a 1 in 100,000 chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at the site.

The excess individual cancer risk is the additional chance that a person could develop cancer in his lifetime from being exposed to contaminated material. This risk is in addition to the risk for the general population of 1 in 3 chance or higher of developing cancer. Based on legislative directive, DEQ considers a 1×10^{-5} or lower excess cancer risk for known or suspected carcinogens as acceptable.[1] Cancer risks ranging from 1×10^{-4} to 1×10^{-6} are considered acceptable under CERCLA and the NCP, with 1×10^{-6} considered the point of departure.

The highest cancer risks estimated for the site are for potential future residents using groundwater for drinking, bathing and cooking. Cancer risks from drinking contaminated groundwater are estimated at 1×10^{-4} or a little greater than 1 in 10,000. Ingestion of contaminated groundwater containing tetrachloroethene contributes half of the aggregate cancer risk for this receptor population. Similar risks are estimated for dermal contact and inhalation while using contaminated groundwater while showering, bringing the total cancer risk for exposure to contaminated groundwater to 2×10^{-4}. Table 30 provides a summary of total cancer risks.

According to the BRA, current and potential future on-site workers have an increased incremental risk of cancer of 2×10^{-5} through ingestion of PAH contaminated surface

1 Section 75-5-301(2)(b)(i), MCA.

soils. Risk estimates for ingestion of PAHs are based on the toxicity of benzo(a)pyrene. This approach considers the varying carcinogenic potency of PAHs. This risk calculation did not include the dermal exposure pathway. Dermal exposure would now be considered a standard pathway in this type of risk determination. Table 31 summarizes the cancer risks.

The BRA calculated the cancer risk in six individual homes where there was basement gas data that exceeded initial screening levels. Total cancer risks from exposure to VOC contaminated air in homes ranged from 2×10^{-6} to 2×10^{-5} for the low use scenario and from 3×10^{-6} to 2×10^{-5} for the high use scenario. Two homes exceeded the acceptable risk levels for both scenarios. Table 32 summarizes the cancer risks.

The total cancer risk with inhalation of basement air (high use scenario) for current residents is 2×10^{-5} and for future residents (also including exposure to contaminated groundwater) it is 3×10^{-4}. Inhalation of basement air accounts for the majority of the total potential risk for current residents and only a small percentage of the total potential risk for future residents. The total cancer risk without inhalation of basement air for current residents is 7×10^{-7} and for future residents it is 2×10^{-4}. DEQ believes that additional data are required to adequately evaluate the risks from inhalation of indoor air. The total cancer risk for current and future on-site workers is 2×10^{-5}.

Noncarcinogens

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., a 70-year lifetime) with a reference dose derived for a similar exposure period for each noncarinogenic COC. Then cumulative toxic effects for combined exposures of multiple COCs are calculated. The ratio of exposure to reference dose is called a hazard quotient (HQ). The Hazard Index (HI) is calculated by adding the HQs for all COCs that affect the same target organ (e.g., liver) within a medium or across all media to which a given population that may reasonably be exposed.

Where the HI exceeds one, risks of noncancer effects may be elevated. Both EPA and DEQ consider a hazard index equal to or less than one for the human population, including sensitive subgroups, as protective. The highest noncancer risks are also associated with domestic use of contaminated groundwater. For small children (ages 1-6), the HI for ingestion of contaminants in groundwater approaches three. Table 33 summarizes these risks. Two homes were found to have HIs greater than one associated with inhalation of basement air (high use scenario). Table 34 summarizes these risks. The total HI for small children including ingestion of, dermal contact with, and vapor inhalation from contaminated groundwater is greater than thirteen. Table 29 summarizes these risks. For older children and adults, the HIs are six and four, respectively.

Additional Contaminants of Concern

Petroleum: Because petroleum products are a complex and highly variable mixture of hundreds of individual hydrocarbon compounds, characterizing the risks posed by petroleum contaminated soil and water has proven to be difficult and inexact. The BRA did not identify petroleum as a COC because at the time the BRA was conducted there was no established procedure by which to quantitatively evaluate risk from petroleum. There has been considerable development in recent years regarding the risk posed by petroleum contamination in soils and groundwater. Some constituents of petroleum products, including benzene and certain PAHs, have adequate toxicity information and are currently evaluated as individual COCs as they were in the BRA. However, focusing risk evaluation only on these indicator compounds cannot adequately characterize the risks posed by all the hydrocarbons present. The non-carcinogenic risks posed by non-target petroleum hydrocarbons to human health and the environment must also be evaluated. The Massachusetts Department of Environmental Protection (MADEP) and the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) have each developed fraction/surrogate methods for evaluating the risks from these non-target petroleum mixtures (MADEP, October 1997 and TPHCWG, March 1998).

DEQ evaluated the MADEP and TPHCWG methods and, using the MADEP method, developed the Montana Risk-Based Corrective Action (RBCA) Tier I guidance that identifies screening levels for petroleum fractions and compounds in soil and groundwater. The screening levels consider risk to human health and leaching from soil to groundwater. RBCA uses environmental risk analysis, which incorporates elements of toxicology, hydrogeology, chemistry and engineering to assess the existing and potential risks from petroleum hydrocarbon contamination. Because RBCA Tier I screening levels are based upon conservative assumptions, DEQ considers them protective of human health and the environment. DEQ uses RBCA Tier I guidelines as screening levels to determine if additional evaluation is warranted at sites. If petroleum contamination exceeds the RBCA Tier I screening levels, then cleanup may be conducted to Tier I screening levels or further evaluation including site-specific risk assessment may be conducted.

Lead: According to the BRA, lead is known to cause toxic effects, including alterations in the hematopoietic and nervous systems. High doses of lead can produce damage to the kidneys, gastrointestinal tract, liver, and endocrine glands. In addition, exposure to lead that results in high blood lead levels can cause severe, irreversible brain damage, and possibly death.

The BRA identified lead as a COC in surface soil; however, exposure point concentrations for lead in soil for both commercial and trespasser scenarios were essentially the same as the 200 mg/kg default value used in the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children (EPA, February 1994). This default concentration is meant to represent a plausible urban background and the model indicates that 200 mg/kg lead in soil does not result in unacceptable blood lead concentrations in children. The BRA concluded that trespassers and workers were not expected to receive significant lead exposure; therefore, it was not quantitatively evaluated in the BRA.

However, the potential exists that exposure point concentrations for lead in soil at C&P Packing will be significantly higher thereby posing an unacceptable risk to trespassers and workers. EPA's Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil (EPA, December 1996) and the associated Frequently Asked Questions on the Adult Lead Model Guidance Document (EPA, April 1999) provides a screening level of 750 mg/kg lead in commercial/industrial (i.e., non-residential) soils. EPA Region IX has also accepted this level as its Preliminary Remediation Goal (PRG) for lead in industrial soils (EPA, November 2000). DEQ believes this level is protective of human health.

Asbestos: Asbestos is a name commonly applied to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite, and anthophyllite). It is a mineral made up of long, thin fibers that appear somewhat similar to fiberglass. Asbestos fibers are very strong and resistant to heat and chemicals. Since the fibers are so resistant, they are also very stable in the environment. They do not evaporate into air or dissolve in water; however, pieces of fibers can enter the air and water from the weathering of natural deposits and the wearing down of man-made asbestos products. Asbestos is a known human carcinogen that causes lung cancer and mesothelioma. (Toxicological Profile for Asbestos, ATSDR December 1995).

D. Ecological Risk Assessment

The ecological risk assessment (ERA) evaluated potential adverse ecological effects of contaminated groundwater, surface water, sediment, and surface soil from the site. An important concern to community residents and groups such as Trout Unlimited was whether contamination from the BN Livingston Shop Complex affected fish and stream invertebrate populations in the Yellowstone River. Although samples obtained from river water and sediment both upstream and downstream from the site did not detect contamination directly related to the site, an investigation near the on-site WWTP outfall pipe did show contaminated river gravels. Test pits in river gravel near the outfall showed waste oil and VOC contamination. As discussed in the Section VI, approximately 50 yards of contaminated river gravel and sediment was removed from the Yellowstone River in 1990.

Receptors include major plant and animal species, both terrestrial and aquatic, that might be exposed to site contaminants. No rare, threatened, or endangered terrestrial or aquatic plant or animal species are reported near or make significant use of the site. However, the Yellowstone trout is considered a species of special concern by the state.

Although several inorganic and organic chemicals are detected in various media at the site, not all are found at concentrations that are cause for concern. The primary COCs identified in the ERA, based on frequency of detection, concentration, potential toxicity and bioaccumulation, include 4,4-DDE, aldrin, mercury and PAHs.

Overall risks posed to local ecological receptors are not unacceptable. The cumulative risks for surface water and surface soil COCs are low. The primary medium of concern from an ecological risk standpoint is Yellowstone River sediment. Contaminant concentrations in sediment can pose both a direct risk to benthic biota and an indirect risk to aquatic biota (because sediment serves as a potential source of surface water contamination) and to terrestrial biota (because of potential biomagnification of 4,4-DDE and possibly mercury).

VIII. DESCRIPTION OF ALTERNATIVES

A brief description of the site cleanup alternatives DEQ evaluated in the 1993 and 1994 FSs is set forth below. The soil and groundwater FS analyzed six soil and groundwater alternatives. The primary hydrocarbon FS analyzed seven diesel fuel alternatives. Each set of alternatives is examined separately. To distinguish between the soil and groundwater and diesel fuel alternatives DEQ has attached letters A through F to the diesel fuel remedies and 1 through 6 to the soil and groundwater remedies.

A. Soil and Groundwater Alternatives

Alternative 1 - No Action

The No Action alternative provides a baseline against which other options are compared. No further cleanup is considered under this action. For purposes of the FS and ROD, no action is defined as no further action as of September 19, 1998, the date of the proposed plan. Contamination would remain on-site and continue to affect soil and groundwater. Groundwater monitoring would continue. Groundwater monitoring costs for alternatives 1 through 6 include costs for diesel fuel monitoring. Typically, groundwater monitoring is considered an action and is not part of the no action alternative under CECRA.

Alternative 2 - Institutional Controls, Alternative Water Supplies, Asbestos Abatement, Possible In-Situ SVE

Institutional controls, which include controlled groundwater areas and covenants or deed restrictions on railyard property, would prohibit drilling water wells for domestic use on the BN Livingston Shop Complex and adjacent property where groundwater contains dissolved VOCs above cleanup levels. BNSF has already extended municipal water distribution lines for groundwater users within a portion of the VOC plume. Existing in-situ SVE systems would be operated to achieve additional source removal, if necessary.

Visible asbestos would be removed from the cinder pile, soil would be sampled for asbestos and portions of the cinder pile that contain more than one percent asbestos would be covered with 24 inches of clean soil.

<u>Alternative 3 – In-Situ SVE, Air Sparging, Institutional Controls and Asbestos Abatement</u>

In-situ SVE and air sparging would be used to remediate source areas of VOCs to the groundwater. SVE and air sparging would remove VOCs from soil that contains VOCs above cleanup levels underneath the electric shop and transfer pit manway.

Alternative 3 also includes institutional controls and asbestos abatement actions described in alternative 2.

<u>Alternative 4 - SVE, Air Sparging, Excavation and Ex-situ Soil Treatment, Institutional Controls and Asbestos Abatement</u>

Under alternative 4, soil containing VOCs above soil cleanup levels would be excavated from around and beneath the electric shop, transfer pit manways and, if necessary, a portion of the cinder pile. Soil would be excavated and treated above ground on the BN Livingston Shop Complex or shipped off-site for disposal. Above ground treatment would include SVE within a contained cell to remove VOCs or later biological land treatment (land farming) to degrade any remaining petroleum hydrocarbons. In-situ SVE and air sparging would be used to remediate soil and groundwater at the electric shop.

Alternative 4 also includes the institutional controls and asbestos abatement actions described in alternative 2.

<u>Alternative 5 - Groundwater Pumping and Ex-situ Treatment, In-Situ SVE, Institutional Controls and Asbestos Abatement</u>

Under alternative 5 groundwater pump-and-treat systems would be installed at the electric shop and transfer pit manways. Groundwater would be pumped to the surface at these areas and treated to remove dissolved VOCs. After treatment, the water would be reinjected into upgradient injection wells. In-situ SVE systems would also be operated at the electric shop and transfer pit manways.

The free product diesel that contains chlorinated solvents and residual diesel fuel area is not suitable for pump-and-treat remediation at this time because the source of VOCs is in the petroleum smear zone near the water table. Groundwater pump-and-treat methods would not be used in this area because it could only recover dissolved VOCs that are transferred from the smear zone to the groundwater and not remove the source of these VOCs.

Alternative 5 also includes the institutional controls and asbestos abatement actions described in alternative 2.

Alternative 6 (Modified Alternative 4) - Excavation and Ex-situ Soil Treatment, Institutional Controls and Asbestos Abatement, Possible In-Situ SVE

Alternative 6 is the DEQ preferred remedy for soil and groundwater from the proposed plan; it includes all technologies described in alternative 4 except air sparging. Soil beneath the vapor degreaser pit in the electric shop and around the transfer pit manway will be excavated and treated on-site to attain cleanup levels. If soil cleanup levels are exceeded at the locomotive shop manways, this soil will also be excavated and treated on site. Soil exceeding VOC cleanup levels in the cinder pile will also be excavated and treated to cleanup levels. Treated soil from excavations that does not meet on-site cleanup levels or regulatory requirements will be shipped off site for disposal. The existing SVE wells will be restarted and sampled after confirmation sampling to determine if additional soil contamination can be removed using existing in-situ SVE systems.

No active groundwater treatment is proposed under alternative 6. Studies conducted at the site indicate that air sparging groundwater in areas contaminated with chlorinated solvents produces vinyl chloride, a known human carcinogen, in groundwater. Therefore, alternative 6 may not clean up groundwater as quickly as alternative 4, but it will be more protective of human health. Institutional controls will prohibit the installation of groundwater wells and eliminate potential exposure to contaminated groundwater on land overlying the dissolved solvent plume. A groundwater monitoring program will be installed to continue to measure and confirm declining VOC concentrations.

The entire cinder pile will be recontoured, capped and revegetated whether or not it contains > 1% asbestos as described in alternative 2.

Additional basement gas samples, private groundwater wells and other necessary sampling will be performed.

B. Diesel Fuel Alternatives

The Diesel Fuel alternatives address free phase petroleum hydrocarbons (free product) on the water table. Residual hydrocarbons adsorbed to the soil are primarily discussed in the soil and groundwater alternatives.

Alternative A - No Action

The No Action alternative for diesel fuel provides a baseline against which other alternatives are compared. This alternative would allow diesel fuel to remain in place and degrade naturally. BNSF has estimated the time required for natural degradation is about 20 to 40 years or more for the thickest areas of diesel fuel. DEQ has estimated the time required for natural degradation to be greater than 100 years. For alternatives requiring more than 100 years, DEQ did not quantify recovery times. Diesel fuel would be monitored using the existing monitoring system to determine if floating diesel fuel is migrating and to measure the rate of degradation. No monitoring costs are shown for this alternative because they are included in monitoring costs for alternative 1 for soil and groundwater.

Alternative B - Intrinsic Bioremediation and Institutional Controls

Alternative B includes allowing the free product diesel fuel plume to biodegrade naturally without further product recovery. Institutional controls would be established to prevent human contact with the product during the degradation period. Institutional controls may include deed restrictions, restrictive covenants, a groundwater control area, and/or zoning restrictions prohibiting the installation of wells within the influence of the free product. BNSF has estimated the time required for natural degradation is about 20 to 40 years or more for the thickest areas of diesel fuel. DEQ has estimated the time required for natural degradation to be greater that 100 years.

Alternative C - Passive Recovery

Passive recovery would be used where diesel fuel can be recovered at rates greater than 0.10 gallon per day per well. Based on results from Test Cell 1, this would include the area where apparent diesel fuel thicknesses are greater than 0.25 foot, which includes an area of approximately 300,000 square feet. Up to 165 4-inch diameter recovery wells located on 40-foot centers would be installed in the area that contains apparent product thickness above 0.25 foot. Diesel fuel recovery from each well would be accomplished using a skimmer. Approximately 80 skimmers would be installed and operated in the area of thickest apparent diesel fuel. As recovery from wells decreases, the skimmers would be moved to other recovery wells within the diesel plume to maintain the total recovery rate. This alternative is estimated to recover 21,000 gallons of diesel fuel after 3 years. For comparison purposes, based upon the estimated volume of diesel fuel remaining (approximately 150,000 to 1,600,000 gallons) and the assumption that 30% of the release is recoverable, it would take 6.5 to 68.5 years to remove the diesel fuel.

Alternative D - Enhanced Two-Pump Recovery

Alternative D would involve recovery of diesel fuel with enhanced two-pump recovery systems. The enhanced recovery systems would recover diesel where recovery is the most efficient. Two groundwater extraction systems are required because a portion of diesel fuel overlies the dissolved VOC plume in groundwater and requires water treatment before reinjection. Alternative D requires the existing multiple well recovery system to be modified and expanded by adding one recovery well to the east and three recovery wells to the west of the existing system. A trench would be used to reinject pumped groundwater into the aquifer.

Alternative D includes the installation of a recovery system and a groundwater injection trench (to the west) for diesel fuel recovery outside of VOC plume. This alternative involves installing one well in the existing recovery trench to replace the existing sump and a second well similar to the pilot-scale recovery wells.

The western recovery system, modified from the existent multiple well system, would not treat groundwater before reinjection. The eastern recovery system, modified from the existent multiple well system, would utilize the pilot-scale treatment system for treating groundwater before reinjection. This alternative is estimated to recover 17,000 gallons of diesel fuel after 3 years. For comparison purposes, based upon the estimated volume of diesel fuel remaining (approximately 150,000 to 1,600,000 gallons) and the assumption that 30% of the release is recoverable, it would take 8 to 85 years to remove the diesel fuel.

Alternative E - Passive Recovery of Diesel Fuel Containing VOCs

Under this alternative, passive diesel fuel recovery would be conducted throughout the northeastern area where diesel fuel containing VOCs is located. The objective of alternative E would be to remove VOCs from diesel fuel.

Up to 22 passive recovery wells would be located within the area of diesel fuel that contains VOCs. The new recovery wells would be installed on 100-foot centers. Well placement and construction would be similar to that of alternative C. Existing observation and recovery wells within the area of diesel fuel containing VOCs would be used in this alternative. Diesel fuel thickness in this area is generally less than 0.10 foot.

Alternative E focuses on cleaning up the northeast portion of diesel fuel, which contains VOCs; no attempt to recover diesel fuel elsewhere would be made. This alternative is estimated to recover 1,600 gallons of diesel fuel after 3 years. Since this alternative only addresses a small area of the diesel fuel plume, approximately 43,000 to 478,000 gallons of diesel fuel estimated to be available for recovery would remain.

Alternative F - Bioventing and Passive Recovery

Alternative F combines bioventing with passive skimming of diesel fuel. This alternative is designed to remove diesel fuel from the center of the plume by skimming diesel fuel off the surface of the groundwater. This alternative also increases the oxygen concentration in the smear zone, through bioventing, while recovering diesel fuel through passive recovery from the south side of the plume along Park Street.

Wells would be installed along track 4 and south of the transfer table. Two new passive recovery wells would be installed between the mainline and Park Street and south of the MRL locomotive shop. Monitoring wells would be installed to monitor diesel fuel along Park Street and the leading edge of the plume.

In the FS, alternative F focuses on bioventing to remove diesel fuel in the thickest part of the plume. While bioventing is acceptable for remediating residual diesel fuel in soil, bioventing is not an acceptable technology to recover free product (diesel fuel). The conceptual use of bioventing to remove diesel fuel inappropriately assumes biodegradation occurs within diesel fuel when present as floating product. This alternative was retained because bioventing is effective in remediating residual diesel fuel. This alternative is estimated to recover 2,000 gallons of diesel fuel in 5 years.

<u>Modified Alternative F - Expanded Passive Recovery, Monitoring and Bioventing</u>

This is DEQ's preferred remedy for diesel fuel from the proposed plan. This alternative is similar to alternative F, but increases the number of passive recovery and bioventing wells to cover a larger area. It is also proposed in phases, which will allow for evaluation of various techniques in order to maximize diesel fuel recovery. The length of time over which recovery will occur is at least 6 years. This alternative will place more passive recovery wells in areas where diesel fuel is the thickest and in areas where the risk of worker injury would be lessened. These areas are along abandoned track 4 and Park Street, the MRL tunnel, in front of MRL shops and in existent recovery wells. During Phase I, diesel fuel recovery will take place for 2 to 3 years until sufficient information is obtained to design Phase II. DEQ will determine if residual diesel fuel will require additional evaluation and remediation. Phase II will probably require the installation of additional wells.

This alternative will also place more bioventing wells around the perimeter of the diesel plume in order to enhance biodegradation of residual diesel fuel adsorbed to soil. The perimeter of the diesel plume is an appropriate area for biodegradation because only residual diesel fuel with little or no free product remains in this area.

This alternative will also increase the number of monitoring wells south and east of the diesel plume to ensure the plume is not moving and to document that concentrations of diesel fuel constituents are decreasing in groundwater.

Under this alternative, Phase I and Phase II free product recovery will occur for at least 6 years and bioventing will occur for approximately 10 years. This alternative is estimated to recover 10,000 gallons of diesel fuel after 6 years only operating Phase I wells. However, recovery is anticipated to be greater since more wells are located in the thickest diesel fuel area and Phase II should add additional recovery wells.

IX. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The soil and groundwater and diesel fuel alternatives were evaluated and compared against the eight criteria listed below. The first two criteria are threshold criteria that must be met for any remedy. The five primary balancing criteria are those criteria which must be weighed and evaluated to select the best overall remedy for the site. The community acceptance criteria is a modifying criteria based on whether or not the community as a whole supports, has reservations about, or opposes a remedy. The reader should refer to Table 35 Comparison of Alternatives Using Eight Criteria for a comparative analysis summary.

A. Threshold Criteria

1) Overall protection of human health and the environment addresses whether an alternative provides adequate protection in both the short-term and the long-term from unacceptable risks posed by hazardous substances, pollutants or contaminants present at the site by eliminating, reducing, or controlling exposure to protective levels.

2) Compliance with environmental requirements, criteria and limitations (ERCLs) addresses whether an alternative will comply with applicable and well-suited requirements under federal and state environmental laws and regulations.

B. Primary Balancing Criteria

3) Long-term effectiveness and permanence refers to the ability of an alternative to maintain reliable protection of human health and the environment over time.

4) Reduction of toxicity, mobility and volume through treatment refers to the degree that the alternative reduces toxicity, mobility and volume of contamination.

5) Short-term effectiveness 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) Implementability refers to the technical and administrative feasibility of an alternative including the availability of materials and services needed to carry out a particular option.

7) Cost evaluates the estimated capital costs and operation and maintenance costs based on the present worth of each remedy for a specific time period.

C. Modifying Criteria

8) Community Acceptance is based on whether or not the community was a whole supports, has reservations about, or opposes a remedy.

The BN Livingston Shop Complex is being cleaned up pursuant to CECRA. The Montana legislature has modified certain areas of CECRA cleanup requirements in the 1995 and 1999 legislative sessions. However, due to a legislative savings clause, the changes do not apply to the BN Livingston Shop Complex cleanup. DEQ must therefore select and implement the remedy pursuant to CECRA as amended in 1991.

CECRA is modeled after the federal Superfund law (CERCLA). In 1991 CECRA was very similar to the federal CERCLA. Because of this similarity in the laws, DEQ relied on the criteria developed under the federal CERCLA in its implementation of the original CECRA. Also, in the 1990 consent decree with BNSF, DEQ committed to draw on CERCLA and its implementing regulations in the selection of a remedy for the BN Livingston Shop Complex. Therefore, the cleanup alternatives are evaluated based on the federal Superfund criteria. These criteria are similar to the FS criteria identified in the 1990 consent decree.

D. Soil and Groundwater Alternatives Evaluation

1) Overall Protection of Human Health and the Environment

Alternative 1 would not provide adequate protection to human health and the environment in the short-term and long-term, because the source of groundwater contamination still remains and continues to leach to groundwater and exposure to asbestos in the cinder pile is not addressed. Alternative 2 would protect public health in the short-term by reducing exposure to dissolved VOCs in groundwater through the implementation of ICs, but would not be protective in the long-term because the source of groundwater contamination still remains and continues to leach to groundwater. If all the cinder pile is capped, then exposure to asbestos is addressed. Alternatives 3, 4, 5 and 6 would all be protective of human health and the environment. Alternative 3 would protect public health in the short-term by reducing exposure to dissolved VOCs in groundwater through the implementation of ICs. Alternative 3 is also protective in the long-term because the source of groundwater contamination is removed, thus shortening the time for groundwater to reach cleanup levels. If all the cinder pile is capped, then exposure to asbestos is addressed. Alternative 4 would protect public health in the short-term by reducing exposure to dissolved VOCs in groundwater through implementation of ICs. Alternative 4 is also protective in the long-term because the source of groundwater contamination is removed. It is more protective than

Alternative 3 because it provides for groundwater to reach cleanup levels in a shorter time frame than Alternative 3. However, there is a concern that air sparging may increase the toxicity of contamination by creating vinyl chloride in the groundwater, which may make this alternative less protective. If all the cinder pile is capped, then exposure to asbestos is addressed. Alternative 5 would protect public health in the short-term by reducing exposure to dissolved VOCs in groundwater through implementation of ICs. Alternative 5 is also protective in the long-term because it removes contamination from the groundwater, but does not remove the source of groundwater contamination. If all the cinder pile is capped, then exposure to asbestos is addressed. Alternative 6 is the same as Alternative 4 with the exception of air sparging, and therefore is equally as protective.

2) Compliance with Environmental Requirements Criteria Limitations (ERCLs)

In the FS, Alternative 1 is expected to reach groundwater cleanup levels in 70 years. However, when compared to other alternatives FS, this is not a reasonable time frame for the chlorinated solvents; therefore, the no action alternative does not meet ERCLs. It also does not meet ERCLs for asbestos in the cinder pile. In the FS, Alternative 2 is expected to reach groundwater cleanup levels in 70 years. However, this is not a reasonable timeframe for chlorinated solvents when compared to other alternatives in the FS; therefore, alternative 2 does not meet ERCLs. If the entire cinder pile is capped, then it would meet asbestos ERCLs. Alternatives 3 and 4 would meet ERCLs for groundwater if air sparging was not implemented in areas of vinyl chloride concern. If the entire cinder pile is capped, then it would meet asbestos ERCLs. Alternative 5 does not remove the source of VOCs and ERCLs will not be met in the source area within a reasonable timeframe compared to other alternatives in the FS. Alternative 6 is equal in its compliance with ERCLs as Alternative 4 without the vinyl chloride concerns, which may lead to non-compliance with groundwater ERCLs. Alternative 1 would not comply with ERCLs because no cleanup would occur; neither air quality standards nor water quality standards would be attained. Alternative 2 would not treat groundwater to required water quality standards. Alternative 3 and 4 would meet ERCLs for groundwater. Alternative 5 would not comply with ERCLs for groundwater within a reasonable time when compared to other alternatives in the FS because all sources of contamination would not be removed, thus leaching contamination to groundwater for many years. ERCLs would not be achieved for the cinder pile under alternative 1. Alternatives 2, 3, 4 and 5 may comply with ERCLs associated with asbestos and solid waste only if the entire pile is capped. However, if portions remain uncapped, ERCLs will not be met. Alternative 6 will comply with ERCLs for contamination in all media including groundwater, soil and air.

3) Long-Term Effectiveness and Permanence

Alternative 1 would not provide long-term effectiveness and is not permanent because no cleanup would occur. Alternative 2 provides poor permanence and long-term solutions for cleaning up groundwater because of the poor reliability of institutional controls as the sole remedy. However, it would provide some degree of long-term protectiveness for the cinder pile if the entire cinder pile is covered with clean soil. Alternative 3 provides long-term effectiveness and permanence by cleaning up groundwater through source removal. With respect to asbestos, it has the same degree of effectiveness and permanence as alternative 2. In the FS alternative 4 provide the most long-term effectiveness and permanence; however, vinyl chloride may be generated through air sparging, thereby reducing long-term effectiveness. Alternative 5 offers fair long-term effectiveness and permanence, but at some point the effectiveness of treatment of contaminants diminishes. Alternative 6 provides the same level of permanence and long-term effectiveness as alternative 4, with the exception of vinyl chloride.

4) Reduction in Toxicity, Mobility and Volume

As the no action alternative, Alternative 1 would not reduce the toxicity, mobility or volume of contamination. Institutional controls under Alternative 2 would not reduce the toxicity, mobility and volume of VOCs in groundwater, but SVE would reduce the volume of VOCs in soil and capping of the entire cinder pile would reduce mobility of asbestos. SVE and air sparging under Alternative 3 would reduce the volume of VOCs in soil and groundwater in source areas. Excavation of VOC source areas under Alternative 4 offers an immediate reduction in mobility of VOCs; however, air sparging could increase toxicity if vinyl chloride is generated. Capping the entire cinder pile would reduce mobility of asbestos. The groundwater pump and treat system in alternative 5 would reduce the volume of VOCs in groundwater. SVE would reduce the volume of VOCs in soil and capping the entire cinder pile would reduce mobility of asbestos. Alternative 6 provide the same reductions as Alternative 4 without the potential generation of vinyl chloride.

5) Short-Term Effectivenes

Alternative 1 would not present a risk to the community during implementation because no construction would occur. Alternative 2 would present a limited risk to workers due to installation of an SVE system and operation of heavy equipment to cap the entire cinder pile. These risks could be minimized by following the proper safety procedures to protect the community and remediation workers by wetting the cinder pile. Alternative 3 would present a limited risk to workers due to installation of SVE and air sparging systems and operation of heavy equipment to cap the entire cinder pile. These risks could be minimized by following the proper safety procedures to protect the community and remediation workers, and by wetting the cinder pile. Alternative 4 would present a greater risk to workers than alternatives 2 and 3 due to installation of SVE and air sparging systems, excavation of contaminated soils, and operation of heavy equipment to cap the entire cinder pile. These risks could be minimized by following the proper safety procedures to protect the community and remediation workers, and by wetting the cinder pile. Alternative 5 would present the same risks posed by alternatives 2 and 3. Alternative 6 would present the same risks as alternative 4. The risk to the community is minimal for alternatives 2 through 6 and can be properly mitigated. Although an active railyard increases short-term risks to workers, this can be mitigated with proper safety precautions as demonstrated through the earlier interim actions at the site.

6) Implementability

Alternative 1 is easily implemented. Alternative 2 would require administrative time to properly record and file institutional controls. Equipment is locally available and the services of environmental contractors are available to cap the entire cinder pile with soil. Alternatives 2, 3, 4, 5 and 6 are all implementable and the materials and services needed to carry out these options are readily available.

7) Costs

As shown on Table 36, costs to implement soil and groundwater alternatives range from $501,000 for alternative 1 (groundwater monitoring would be performed under the no action alternative and monitoring for diesel fuel is also included in this cost) to $1,495,734 for alternative 6. Costs for alternatives 1, 2 and 3 are similar and range between $501,000 and $776,000. The costs for alternatives 4 and 5 are similar, ranging from $1,170,000 to $1,065,000. The cost of alternative 6 is the most costly alternative because it includes operation and maintenance costs for capping the entire cinder pile. Costs for capping the entire cinder pile are not included in cost estimates for alternatives 1 through 5. Based on public comment, DEQ re-evaluated the cost for alternative 6. That information is provided in Section X of the ROD.

8) Community Acceptance

Thirteen commenters provided input during the public comment period. One set of comments was submitted after public comment period closed; however, DEQ considered and responded to the comments. Seven commentors supported removing and treating contaminated soils near the electric shop and transfer pit manways. Two commenters supported recapping the cinder pile and three other commenters supported removal and off-site disposal of the cinder pile. Two commenters did not believe the cinder pile poses a risk, but proposed recontouring and some capping of the pile. Seven commenters supported private well sampling and indoor air sampling in homes. One commenter expressed concern about being able to distinguish site contamination from other potential sources. One commenter supported ICs. The following issues were also raised: concern about industrial solvents being used at residential homes; availability of funds for technical assistance to the community; safety of on-site workers; air and noise impacts from current railyard activities; and timeliness of cleanup. The community's response to the proposed remedy is generally favorable. Discussion of removing the cinder pile is incorporated in DEQ's Response Summary.

E. Diesel Fuel Alternatives Evaluation

1) Overall Protection of Human Health and the Environment

Alternatives C, D and modified alternative F provide overall protection of human health and the environment because diesel fuel would be removed from the aquifer over a larger area. Modified alternative F provides for better protection by also addressing diesel fuel in soils. By removing free-product diesel, the source of dissolved diesel in the groundwater is removed, thus enhancing natural degradation of the dissolved diesel in the groundwater and residual diesel in the soil. Alternatives A, B, E and F are not expected to provide adequate protection of public health and the environment because Alternatives A and B do not actively remove the source of contamination and Alternatives E and F cover a substantially smaller area.

2) Compliance with Environmental Requirements, Criteria and Limitations (ERCLs)

Alternatives C, D and modified alternative F will meet ERCLs because free product would be removed from groundwater to the maximum extent practicable. Alternative E would remove VOCs and a small volume of diesel fuel in the northeast portion of the diesel plume but would not comply with ERCLs because diesel fuel would not be removed in the thickest part of the plume. Alternatives A and B would not comply with ERCLs because no attempt would be made to recover diesel fuel. Alternative F does not meet ERCLs due to the limited area of recovery.

3) Long-term Effectiveness and Permanence

Alternatives C, D and modified alternative F will provide long-term effective and permanent solutions for diesel fuel. Alternatives C and modified alternative F, with more wells and better coverage over the diesel contaminated area, will be more effective than Alternative D. Alternatives A, B and E would not be as effective over the long-term compared to alternatives C, D and modified alternative F because the source of contamination is not removed. Alternative F would provide some long-term effectiveness and permanence for passive recovery in a limited area. Modified alternative F will remove both free product using skimming technologies and residual diesel fuel using bioventing to address contamination in soil over a larger area. Alternatives C and D would not remove residual diesel fuel adsorbed to soil.

4) Reduction in Toxicity, Mobility and Volume

Alternatives C, D and modified alternative F recover the greatest volume of diesel fuel from groundwater and therefore provide the greatest reduction in toxicity, mobility and volume compared to Alternatives A, B and E. Modified alternative F will also remove residual diesel fuel from the subsurface through bioventing. Alternative E and F would reduce a lesser volume of diesel fuel on the water table. Alternatives A and B would not actively remove any diesel fuel from the aquifer.

5) Short-term Effectiveness

Alternatives C, D, F and Modified Alternative F present a potential for injury to workers during construction of the diesel recovery system in the active railyard, but utilizing safe work practices and employing a railyard spotter to control locomotive and train traffic during construction would greatly reduce the chance of accidents. Alternative E would present less potential injury to workers because this area is mostly outside active train tracks. Since Alternatives A and B do not include construction of diesel recovery systems there would be no short-term impacts on worker safety.

6) Implementability

Alternative A is easily implemented because it is the no action alternative. Alternative B would require additional administrative efforts to implement institutional controls. Alternatives C, D, E, F and modified alternative F are implementable as demonstrated at other sites. Materials and services needed to carry out these options are available locally, except for specialized drilling equipment, as discussed in the selected remedy section. However, many wells are already in place to carry out modified alternative F, as well as alternatives E and F.

7) Cost

As shown on Table 37, alternative A requires no action and no cost. Alternative B would cost about $124,387 to implement institutional controls and perform routine monitoring. Alternative E would cost about $245,014 to install the recovery well network and perform operation and maintenance on the system for three years. Alternative C, (passive recovery), is one of the most costly systems to install and operate ($869,673) if 165 recovery wells are installed. Alternative D would cost about $650,791 and alternative F about $493,545. Modified alternative F is the most costly alternative to implement at $1,010,694. However, costs for modified alternative F were calculated by DEQ with more assumptions than the costs for all other alternatives provided by BNSF in the FS, so these costs may not be strictly comparable. Based on public comment, DEQ re-evaluated the cost for alternative F. That information is provided in Section X of the ROD.

8) Community Acceptance

Four commenters supported free-product recovery, but some expressed concerns that it would not be 100% effective and that there were safety concerns associated with the free-product recovery and bioventing. One commenter suggested surfactants be used at the site instead of bioventing. One commenter only expressed safety concerns. Two other commenters disagreed with free-product recovery. One commenter wanted the site cleaned up to pristine conditions. The community’s response to the proposed remedy is generally favorable if safety concerns are addressed. Discussion of utilizing surfactants is incorporated in DEQ’s Response Summary.

X. SELECTED REMEDY

A. Summary of the Rationale for the Selected Remedy

This section presents the selected remedy for the BN Livingston Shop Complex. In compliance with CECRA's requirements, and consistent with CERCLA and the NCP to the extent practicable, and with consideration of public comments received, DEQ has determined that the Preferred Alternatives set forth in the Proposed Plan, with limited modifications as outlined below, comprise the appropriate remedy for site.

As presented here, the selected remedy will 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. The selected remedy will meet applicable state or federal environmental requirements, criteria, or limitations and substantive state or federal environmental requirements, criteria, or limitations that are well suited to site conditions.

In addition, the selected remedy protects public health, safety and welfare and the environment, uses permanent solutions, uses alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and 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. While certain other alternatives may better satisfy certain individual selection criteria, the selected remedy best meets the entire range of statutory criteria and in addition complies with all the requirements of CECRA.

In addition, although not required by statute to do so (due to the savings clause), the selected remedy also complies with CECRA remedy requirements as enacted by the legislature through 2001. The selected remedy will 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. The selected remedy will meet applicable state or federal environmental requirements, criteria, or limitations and substantive state or federal environmental requirements, criteria, or limitations that are relevant to site conditions.

The selected remedy, considering present and reasonably anticipated future uses, and giving due considerations to institutional controls, demonstrates acceptable mitigation of exposure to risks to the public health, safety, and welfare and the environment, is effective and reliable in the short term and the long term is technically practicable and implementable, uses treatment technologies or resource recovery technologies if practicable, giving due consideration to engineering controls, and is cost-effective.[2] As discussed in the ROD, the selected remedy is acceptable to the majority of the affected community, as indicated by community members and the local government.

B. Summary of the Selected Remedy

The remedy requires each media that contains COCs to meet the cleanup levels prescribed in the ROD. Cleanup levels are set forth in Table 1.

The selected remedy is comprised primarily of sixteen components as set forth below. Interim actions have been evaluated in the FSs and Proposed Plan and are considered part of the selected remedy.

- VOC-contaminated sludge: The selected remedy is source removal of sludge and off-site disposal at a licensed subtitle C facility. All known sludge has been properly disposed off-site.

- VOC-contaminated soils: The selected remedy is treatment of soils to below cleanup levels, either in-situ or ex-situ. Ex-situ treated soils with contaminant concentrations below cleanup levels may be disposed of within the site at an approved location, in compliance with ERCLs. All soils that are technically impracticable to treat to below cleanup levels must be properly disposed off-site in compliance with all laws. With the exception of the transfer pit manways and locomotive shop manways, all known VOC-contaminated soils have now been excavated and are currently being treated.

- PAH-contaminated soils: The selected remedy will be evaluation of cleanup alternatives followed by implementation of an approved remedial action that will achieve cleanup levels.

- Petroleum-contaminated subsurface soils, including PAHs: The selected remedy is installation and operation of bioventing wells until cleanup levels are achieved and maintained.

- Petroleum-contaminated surface soils: The selected remedy will be evaluation of cleanup alternatives followed by implementation of an approved remedial action that will achieve cleanup levels.

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2 Under 75-10-721, MCA (1999), 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.

- Lead-contaminated soils: The selected remedy will be evaluation of alternatives followed by implementation of an approved remedial action that will achieve cleanup levels, should lead contamination be confirmed on-site.

- Asbestos-contaminated soils and debris: The selected remedy relies on containment, fencing, and restrictive covenants.

- Contaminated residue: Contaminated residue remaining from any interim action will be properly disposed of in compliance with all environmental laws.

- VOC-contaminated groundwater: The selected remedy is source removal of VOC-contaminated sludge and soils (as set forth above) followed by monitored natural attenuation to meet cleanup levels within a reasonable time (twenty years). A contingency remedy requires active groundwater treatment in source areas using localized pump-and-treat systems if cleanup levels will not be met within twenty years under the natural attenuation remedy.

- Lead-contaminated groundwater: The selected remedy will be evaluation of cleanup alternatives followed by implementation of an approved remedial action that will achieve cleanup levels.

- Free product on groundwater: The selected remedy is source removal throughout the diesel plumes of the free product to the cleanup level.

- Dissolved phase petroleum in groundwater, including PAHs: The selected remedy is source removal of the free product and bioventing of petroleum-contaminated subsurface soils to the cleanup levels followed by MNA for the dissolved phase to meet cleanup levels within a reasonable time (twenty years). A contingency remedy will be required if cleanup levels will not be met within twenty years under the natural attenuation remedy.

- Indoor air / basement gas: The selected remedy is installation and operation of removal systems to meet cleanup levels.

- Expanded sampling and confirmation sampling.

- Monitoring and maintenance until all cleanup levels are reached.

- Reliance on Institutional Controls.

C. Components of the Selected Remedy

Sludge

RCRA generally defines sludge as any solid, semi-solid, or liquid waste generated from an industrial wastewater treatment plant, exclusive of the treated effluent. The interim actions that led to sludge removal are consistent with the final remedy. Removal of sludge is leading to a substantial decrease in groundwater contaminant concentrations. If any additional sludge is discovered on-site in the future, it will be removed and disposed of off-site consistent with the interim action and in compliance with all laws.

Contaminated Soil

VOC Contaminated Soil

The selected remedy is to treat all VOC contaminated soils to below cleanup levels. VOC contaminated soils at this site are treatable through conventional technologies. Both in-situ and ex-situ SVE has shown to be effective at reducing contaminant concentrations in soil to cleanup levels. Treatment of soils to cleanup levels is leading to a substantial decrease in groundwater contaminant concentrations.

At the release of the Proposed Plan, contaminated soil remained beneath the vapor degreaser pit at the electric shop and transfer pit manway and locomotive shop manway. This was the largest known remaining source of VOC contamination to groundwater. The soil from the electric shop has since been excavated pursuant to an approved interim action work plan and is presently being treated ex-situ. Transfer pit manway and locomotive shop manway soil await final disposition. Once soils are treated to cleanup levels, they may be placed on-site in an appropriate location. Since backfilling has already been completed, the soils can no longer be returned to the electric shop area and an evaluation of disposal locations must be performed and a site selected that complies with all ERCLs and is protective of human health and the environment. Any VOC contaminated soils subsequently discovered to be above cleanup levels will also need to be treated.

PAH Contaminated Surface Soil

PAH contaminated surface soil in the railyard poses an unacceptable risk to on-site workers. However, this contaminant was not addressed in the FS or Proposed Plan. As part of remedial design, an analysis of alternatives to remediate soil exceeding PAH cleanup levels will be conducted. Public input will be solicited and the DEQ selected alternative will be implemented as part of this remedial action.

Petroleum Contaminated Subsurface Soils

The selected remedy is installation and operation of bioventing wells until cleanup levels are achieved and maintained. During Phase I of the free product removal described below, petroleum contaminated subsurface soils in the railyard will be addressed through the installation of twelve bioventing wells. The effectiveness of bioventing will be evaluated in Phase I by collecting soil samples for EPH, including PAHs, and conducting respiration tests or other appropriate methods. If bioventing is found to be ineffective, other remedial options will be evaluated for Phase II. The locations of the Phase I bioventing wells are set forth in Figure 7. Phase II may require subsequent wells in order to meet cleanup levels site-wide. If any petroleum contaminated soils are found outside of the railyard, other alternatives including land farming can be evaluated, in addition to bioventing wells.

Petroleum contaminated soils will be treated to meet RBCA Tier 1 guidelines for subsurface soils or an alternate DEQ-approved cleanup level. Treatment of soils to cleanup levels is expected to provide a decrease in groundwater contaminant concentrations.

Petroleum Contaminated Surface Soils

Petroleum contamination in surface soil was not identified as a contaminant of concern for the site in the RI. Surface soil samples were not analyzed for petroleum compounds during the RI. At the time, there was no method to quantitatively evaluate risks from petroleum contaminated soils. However, methods are now available and DEQ has determined that petroleum contamination in soils at certain levels poses an unacceptable risk to human health and the environment as presented in RBCA Tier 1 guidelines for surface soils. As part of the remedial design, the nature and extent of this potential source will be determined and any surface soil exceeding RBCA Tier 1 levels or an alternate DEQ-approved cleanup level will be remediated. Cleanup alternatives will be evaluated as part of the remedial design. Public input will be solicited and the DEQ selected alternative will be implemented as part of the remedial action.

Lead Contaminated Soil

The BRA did not quantitatively evaluate the risk from lead in surface or subsurface soils. Since the proposed plan, new information indicates the potential for elevated lead levels on-site (C&P Packing property) that exceed the EPA's recommended screening level of 750 ppm for industrial soils. As part of remedial design, the nature and extent of this potential source will be determined and any on-site soil exceeding the 750 ppm level or an alternate DEQ-approved site-specific cleanup level will be remediated. Cleanup alternatives will be evaluated as part of the remedial design. Public input will be solicited and the DEQ selected alternative will be implemented as part of the remedial action.

Asbestos Contaminated Soil and Debris

Solid wastes and asbestos have been identified in the cinder pile. The selected remedy for the cinder pile is a cap consisting of 18 inches of clean fill and 6 inches of top soil, over the entire cinder pile which will be successfully revegetated. Some regrading may be necessary. In addition, the cinder pile will be fenced to restrict access and restrictive covenants will be applied in order to maintain the integrity of the cap.

For asbestos found outside of the cinder pile at levels greater than one percent, remediation alternatives must be considered and the asbestos remediated. All other solid waste (including hazardous waste other than media) must be removed, treated if practicable, and properly disposed off-site.

Contaminated Residue

Contaminated residue remaining from any interim action will be properly disposed of in compliance with all environmental laws. DEQ notes concrete debris from the vapor degreaser pit PCE-contaminated backfill interim action still remains onsite. It is unclear whether the concrete was treated pursuant to hazardous waste regulations.

<u>Contaminated Groundwater</u>

VOC Contaminated Groundwater

Since all the known sources of VOC contamination to groundwater will be remediated as part of the remedial action, the selected remedy for VOC contaminated groundwater includes monitored natural attenuation. The cleanup levels for VOCs in groundwater are shown on Table 1 and are the state's WQB-7 levels.

Monitored natural attenuation of chlorinated VOCs is suspected to be occurring. Collecting natural attenuation parameters would confirm whether it is occurring. A quarterly groundwater monitoring program will measure and confirm declining VOC concentrations. After 3 years, groundwater monitoring data will be evaluated to determine if localized active groundwater treatment is necessary. If monitoring data after 3 years indicates cleanup levels will not be met in 20 years, active groundwater treatment in source areas using localized pump-and-treat systems will be implemented as part of the remedial action.

Lead Contaminated Groundwater

The BRA did not identify lead as a contaminant of concern in groundwater for the site. During the RI, the maximum contaminant level (MCL) for lead in drinking water was 50 ug/L. Since that time, the MCL was revised to 15 ug/L and a WQB-7 standard of 15 ug/L was established. Based upon these revisions, lead exceeds standards in the groundwater in some portions of the plumes. As part of remedial design the nature and extent of lead contamination in groundwater will be determined and groundwater exceeding standards will be remediated. Cleanup alternatives will be evaluated as part of the remedial design. Public input will be solicited and the DEQ selected alternative will be implemented as part of the remedial action.

Petroleum Contaminated Groundwater

Free-Product: The selected remedy for free product is removal of free product to the maximum extent practicable. This means removing free product until a threshold thickness of 1/8 inch or less of free product is present over a 2 year, quarterly monitoring period. Free product recovery will be implemented in two phases. Figure 7 identifies the location of new and existing free product recovery wells. As part of Phase I, new monitoring wells will be installed to confirm the presence and thickness of free product within the presumed free product plume. Upon confirming the presence of free product, 40 new recovery wells will be installed. Previous treatability studies were not performed in a manner that would lead to recovery of free product to the maximum extent practicable. Advances in technology (including vacuum-enhanced recovery) associated with the highly transmissive nature of this aquifer should provide optimum free product recovery. The remedial design will provide a required framework for installation, operation, and maintenance of the recovery wells. DEQ expects reprocessing of removed diesel. In consideration of the ongoing operations in an active railyard (including remediation and railyard worker safety), the recovery wells associated with Phase I will be located with as little impact on ongoing operations as necessary. As part of remedial design, the structural stability of the MRL tunnel will be evaluated. Safety measures will be employed, which will further reduce the impacts to on-site workers.

Phase I will operate for 2-3 years. During that time, sufficient information will be obtained to design a permanent and cost-effective Phase II recovery system. Phase II will require recovery of free product throughout the entire plume to the cleanup level, relying on information gained in Phase I and new technology advances.

Dissolved Phase Petroleum: The selected remedy for dissolved phase petroleum is monitored natural attenuation coupled with free product and subsurface soil remediation described above. A groundwater monitoring program will measure and evaluate natural attenuation. Confirmation sampling will be performed at the depot plume to confirm no free product remains. Three years of monitoring data will be collected from the depot plume and the freight train refueling plume once free product has met cleanup levels and natural attenuation will be re-evaluated. If natural attenuation does not appear to degrade contaminants within a reasonable time frame (20 years) to WQB-7 levels or beneficial uses, alternate remedies will be evaluated and a DEQ-approved remedy will be implemented after free product cleanup levels have been met.

Basement Gas

Basement gas (indoor air) sampling at representative homes within the VOC plume will be implemented to determine if residences or businesses have levels of VOCs above EPA Region IX PRGs screening levels for ambient air. If results exceed screening levels, then sampling will be expanded as appropriate and site-specific cleanup levels will be calculated for indoor air based on the BRA with one modification for exposure time. All residences and businesses with basement gas levels above site-specific cleanup levels for indoor air will have a removal system installed at no cost to the owner. In order to remain protective, these systems will be maintained until cleanup levels are continually met without operation of the system. In addition, confirmation basement gas sampling will be performed at locations NE-1, NE-2, NE-3, NE-4, NE-5, SE-1, SE-2, SE-5.

D. Expanded Sampling and Confirmation Sampling

The nature and extent of petroleum contamination in soils and groundwater and lead contamination in soils and groundwater will be determined based on a DEQ-approved sampling and analysis plan. In addition, previously completed confirmation sampling will be reviewed and additional sampling will be performed if necessary, at all interim action locations and the locations of other remedial actions. Upon completion of each remedial action, samples will be taken to confirm cleanup levels have been achieved. If confirmation samples indicate exceedances of cleanup levels, then additional measures will be taken consistent with the remedy in order to meet cleanup levels. For VOC contaminated media this may include restarting the existing SVE wells located in the interim action area and sampling to determine if additional soil contamination can be removed using existing in-situ SVE systems.

E. Monitoring and Maintenance

Monitoring and maintenance will be on-going for all actions where COCs exceed cleanup levels.

Worker Safety

Worker safety issues were considered in the formulation of the phased diesel fuel recovery plan and will be further developed during remedial design and remedial action. Numerous federal and state Superfund cleanups occur at operating industrial facilities. Construction activities occur on a regular basis within active railyards. Similarly, remediation construction activities within an active railyard must be performed with the highest concern for worker safety and protection. Using planning, coordination, train-spotters, radio communication and daily safety meetings will ensure the installation, maintenance and operation of the diesel fuel recovery system can occur safely.

To reduce worker risk during construction and operation and maintenance activities, Phase I recovery wells will be installed in areas of the LRY with reduced or no train traffic. Envirocon, Inc. demonstrated that a multiple-well pilot-test diesel recovery system (Test Cell 4) could be successfully constructed within active train tracks without worker injury.

DEQ understands most railroads request wells installed in active railyards to be flush mounted to prevent tripping hazards. BNSF and its contractor, Envirocon, Inc., will coordinate with MRL about safety protocols MRL uses to protect MRL workers while working amongst active rail tracks. Construction personnel installing and operating the diesel recovery system will follow the same strict safety rules within the railyard that MRL workers follow. Similar coordination will occur with Talgo-LRC, LLC.

Groundwater Monitoring

Groundwater will be monitored to: 1) help ensure no additional migration of contaminants in the groundwater; 2) evaluate the effectiveness of monitored natural attenuation of VOCs and dissolved phase petroleum in the groundwater; 3) evaluate the effectiveness of source removal at the electric shop, transfer pit manways, and locomotive shop manways and other interim actions; and 4) ensure there are no receptors using groundwater above acceptable levels. The selected remedy includes the installation of eight new monitoring wells. Select wells will be monitored semi-annually during high and low groundwater elevations for 3 years for VOCs, EPH, VPH, PAHs (via method 8270), lead, and petroleum MNA parameters (redox potential, nitrate plus nitrite, ammonia, dissolved oxygen, ferrous or soluble iron, and sulfate) at which time the monitoring frequency will be re-evaluated. Water levels in monitoring wells will also be measured semi-annually during high and low groundwater elevations.

A well inventory will be completed for the area within and adjacent to the VOC and petroleum groundwater plumes. The last well inventory for the entire site was completed in 1989 as part of the RI. A more recent limited well inventory was conducted east of the Yellowstone River in 1998. Any domestic or commercial use wells within this area will be monitored for VOCs, and if located within or near the dissolved phase petroleum plume, will be monitored for EPH and PAHs at least annually. Monitoring frequency may be revised based upon results from previous monitoring (e.g. more frequent monitoring may be necessary if data indicates an increasing trend in contaminant concentrations approaching maximum contaminant levels for drinking water in a domestic or commercial use well). Any residence or business with a well confirmed to be approaching, meeting, or exceeding maximum contaminant levels will be connected with alternate water, which typically means connected to city water, at no cost to the resident or business as part of the remedial design.

Free Product Monitoring

Free product will be monitored to evaluate the effectiveness of Phases I and II as specified in the remedial design.

Cap Maintenance

The cap, vegetation, and fencing at the cinder pile will be inspected and maintained to ensure the integrity of the remedy.

F. Institutional Controls

Section 75-10-701(11), MCA of CECRA defines institutional controls (ICs) as a restriction on the use of real property that mitigates the risk posed to public health, safety, and welfare and the environment. Since ICs rely primarily on administrative means to restrict use, effective ICs are layered with other ICs or engineering controls.

ICs are a necessary component of the remedy where cleanup standards are not yet met. At the BN Livingston Shop Complex, ICs fall into two primary categories. These categories and their purposes are set forth below.

Controlled Groundwater Area

A controlled groundwater area (CGWA) will be implemented to restrict groundwater use for domestic purposes (drinking, showering, bathing, cooking, etc. at homes or businesses) at the site. The CGWA will be protective of human health by restricting domestic use of the groundwater. High yield industrial or irrigation wells that may cause expansion of the plume should also be prevented. It will be protective of the environment to prevent well usage that would cause an expansion of the plumes. The CGWA will remain in place until groundwater cleanup levels for COCs in groundwater are met. The ROD requires groundwater cleanup levels to be met within a reasonable time (20 years).

DEQ has already begun the CGWA process, which is being implemented pursuant to sections 85-2-501, et seq., MCA. The decision regarding the CGWA rests with the Montana Department of Natural Resources and Conservation (DNRC), with input from the public.

Use of groundwater within the City of Livingston is already prohibited through ordinance. For those otherwise affected by the CGWA, the ROD requires alternate water be supplied, which typically means connection to city water.

Restrictive covenants

Both the current and reasonably anticipated future use of certain parcels is commercial. These parcels include the LRY and the C&P Packing property. For these two parcels, the ROD requires restrictive covenants to be implemented restricting the properties to certain uses.

For the LRY property, cleanup levels for PAH contaminated soils are based on a worker scenario; therefore, the property must remain in industrial use for the cleanup to be protective. For the C&P Packing property, the cleanup level for any lead contaminated soils is based on an industrial scenario; the property must remain in industrial use for the cleanup to be protective. The commercial/industrial zoning of these two properties offers another level of ICs.

For the cinder pile, the remedy calls for capping of the pile. Restrictions must be placed on this part of the property to restrict access, development, excavation, or use of the pile to help ensure the integrity of the cover. For the free product and dissolved petroleum plume beneath the LRY, restrictive covenants must limit use of the groundwater (i.e., monitoring or recovery wells are allowable) to prevent its use and the possible expansion of the plume caused by extracting groundwater near the plume boundaries.

Section 75-10-727, MCA provides a procedure for implementing restrictive covenants.

G. Cleanup Levels

Table 1 lists the soil and groundwater cleanup levels for the site. For soil, the primary COCs are: PCE, TCE, cis-DCE, vinyl chloride, chlorobenzene, 1,4-dichlorobenzene, lead, PAHs, extractable petroleum hydrocarbons, and asbestos. For groundwater, the primary COCs are: PCE, TCE, cis-DCE, vinyl chloride, chlorobenzene, 1,4-dichlorobenzene, lead, PAHs, extractable petroleum hydrocarbons (dissolved phase petroleum), and free product diesel. For indoor air, the primary COCs are: PCE, TCE, cis-DCE, trans-DCE, and vinyl chloride.

Clean up levels are based both on ERCLs and protection of public health, safety, and welfare and of the environment. The primary bases for each cleanup level is set forth below.

- VOC-contaminated sludge: If any additional sludge is discovered on-site in the future, it will be removed and disposed of off-site consistent with the interim action and in compliance with all laws.

- VOCs in soils: These cleanup levels are calculated from the Montana Department of Environmental Quality, Circular WQB-7, Montana Numeric Water Quality Standards

(September, 1999). Soil cleanup levels were calculated using a fate and transport model developed by a BNSF contractor, RETEC (Mathematical Model for Calculation of Soil Cleanup Criteria Based on Leaching to Groundwater, RETEC undated).

- PAHs in surficial soils: These cleanup levels are calculated from the BRA exposure parameters but include dermal exposure as an additional pathway.[3] Please refer to Appendix D.

- Petroleum and PAHs in soil: The cleanup levels for petroleum hydrocarbons in soil are screening levels and are from DEQ's *Tier 1 Risk-Based Corrective Action Guidance Document*, Final Draft, March 2000. Should concentrations in samples collected following the approved sampling and analysis plan exceed these screening levels, a cleanup level will be calculated using the methods provided in the *Tier 1 Risk-Based Corrective Action Guidance Document*.

- Lead in soils: These levels are screening levels rather than cleanup levels. These levels are found in Environmental Protection Agency, Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil (EPA, December 1996) and the associated Frequently Asked Questions on the Adult Lead Model Guidance Document (EPA, April 1999) and the EPA Region IX PRGs (EPA, November 2000). Should concentrations in samples collected following the approved sampling and analysis plan exceed these screening levels, these levels will either be used as the cleanup levels or an approved site-specific level based on the methodology set forth in Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead may be developed.

- Asbestos-contaminated soil and debris: For asbestos found outside of the cinder pile at levels greater than one percent, remediation alternatives must be considered and the asbestos remediated. All other solid waste (including hazardous waste other than media) must be removed, treated if practicable, and properly disposed off-site.

- VOCs in groundwater: These cleanup levels are found in the Montana Department of Environmental Quality, Circular WQB-7, Montana Numeric Water Quality Standards (September, 1999) which are the State's water quality standards. These

[3] In calculating the ROD PAH clean up level from the BRA, it was noted that dermal exposure was not included as a pathway in the BRA assumptions. Dermal exposure would now be considered a standard pathway in this type of risk determination. Therefore, the ROD contains the cleanup levels derived from the BRA exposure parameters, but including dermal exposure as a pathway. The cleanup level developed represents a total carcinogenic PAH concentration. This concentration is based on the toxicity of benzo(a)pyrene. The relative toxicity of each carcinogenic PAH to benzo(a)pyrene is used to adjust its concentration. Following this adjustment the resulting concentrations are summed. The summed exposure point concentration must not exceed the total carcinogenic PAH cleanup level.

standards were developed to comply with the Montana Water Quality Act requirement that standards be adopted to protect the present and future beneficial uses of State waters (§ 75-5-301, MCA).

- Lead in groundwater: This cleanup level is found in the Montana Department of Environmental Quality, Circular WQB-7, Montana Numeric Water Quality Standards (September, 1999).

- Free product on groundwater: This cleanup level is found in State and federal Underground Storage Tanks regulations requiring free product removal to the maximum extent practicable.

- Petroleum and PAHs in groundwater: PAH cleanup levels are found in the Montana Department of Environmental Quality, Circular WQB-7, Montana Numeric Water Quality Standards (September, 1999). The cleanup levels for petroleum hydrocarbons in groundwater are screening levels and are from DEQ's *Tier 1 Risk-Based Corrective Action Guidance Document*, Final Draft, March 2000. Should concentrations in samples collected following the approved sampling and analysis plan exceed these screening levels, a cleanup level will be calculated using the methods provided in the *Tier 1 Risk-Based Corrective Action Guidance Document*.

- Basement Gas: These levels are screening levels rather than cleanup levels. These screening levels are found in Region IX PRGs (EPA, November 2000). Should concentrations in samples collected following the approved sampling and analysis plan exceed these screening levels, cleanup levels will be calculated based on the carcinogenic and noncarcinogenic exposure parameters included in the BRA, with the exception of the exposure time. The exposure time must be 24 hours/day in order to protect residents who remain in the home throughout the majority of the day (e.g., children, the elderly, and those who work at home).

H. Estimated Remedy Costs

DEQ estimated the total present worth cost of the remedy to be $2,229,028 (using a 7% present worth discount factor). This is $277,400 less than the Proposed Plan costs for the preferred remedy. This was based on generally conservative assumptions. Capital costs were calculated for direct implementation of the remedy (e.g. excavation, clean fill, design costs, well construction materials, MRL spotter). Operation and maintenance costs were calculated based on the appropriate number of years of operation for the specific remedy component. Operation and maintenance costs included activities such as inspections of the free product recovery system, free product disposal, labor for maintaining the free product recovery system, and mowing the cinder pile. The ICs cost includes provision of alternate water.

DEQ relied upon costs presented in the FS and Proposed Plan when appropriate. However, based upon the cinder pile capping requirements, the assumption that some private wells will require long-term monitoring, and other site-specific information set forth in the ROD, DEQ revised the cost assumptions for the selected remedy. DEQ did calculate costs for Phase II of the free product recovery component of the remedy. The costs assume an additional 20 wells will be added as part of Phase II. These revised costs for the selected remedy are presented in Table 38.

Cost Uncertainties

DEQ could not calculate costs for some components of the selected remedy due to the limited information regarding the nature and extent of some of the contaminated areas (potential lead and petroleum contamination in soil and groundwater; PAHs in surficial soil). Remedial design will play a critical role in determining final costs and will be more reflective of actual costs. Subsequent investigation during remedial design will provide the information needed to determine costs for certain components of the remedy. These costs will be presented in an alternatives evaluation performed as part of remedial design. In approving subsequent alternatives in the remedial design, DEQ will ensure those remedial alternatives are cost-effective.

Other uncertainties that may affect the costs of the selected remedy include:

- Costs for the contingency of localized pump and treat for VOC contaminated groundwater were not included in the overall cost of the selected remedy.

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

- Engineer/Contractor contingencies (typically 20%) were not included on capital costs, but were also not included in the FS costs.

- Costs for excavation and off-site disposal of sludge were not included in the overall cost of the selected remedy, since the volume of sludge that may require disposal is unknown. There is a potential that sludge may be present at C&P Packing.

- Costs for cleanup of petroleum contaminated surface soils is not included, since the volume of soil that may require cleanup and the cleanup alternative is unknown. There is a potential that petroleum contaminated surface soil poses an unacceptable risk at LRY and C&P Packing.

- Costs for cleanup of lead contaminated soils and groundwater is not included in the overall cost of the selected remedy, since the volume of soil and groundwater that may require cleanup is unknown. There is a potential that lead contaminated soils may be present at C&P Packing, and lead contaminated groundwater may be present at LRY and C&P Packing.

- Costs for cleanup of PAH contaminated surface soils is not included in the overall cost of the selected remedy, since the volume of soil that may require cleanup and the cleanup alternative is unknown.

- The number of private wells that may require long-term monitoring is an estimate and may increase or decrease the costs of monitoring. The updated well inventory will identify the number of wells that will require monitoring.

- The number of homes with unacceptable risk from contaminated indoor air is an estimate and may increase or decrease the cost of the selected remedy.

- The cost for provision of alternate water is an estimate and may increase or decrease the overall cost of the remedy.

- The cost for confirmation sampling is not included in the overall cost of the selected remedy, since the number of samplings that may be required is unknown.

XI. STATUTORY DETERMINATIONS

A. Introduction

CECRA, as amended, 1991

Under Section 75-10-721, MCA, of CECRA, DEQ must select remedies that will 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, MCA also requires that the remedy meet applicable state or federal environmental requirements, criteria, or limitations and substantive state or federal environmental requirements, criteria, or limitations that are well-suited to site conditions.

In addition, DEQ must select a remedy that, at a minimum, protects public health, safety and welfare and the environment, and that uses permanent solutions, uses alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and 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.

CECRA, as amended, 1995 and 1999

Although not required by statute to do so (due to a 1995 legislative savings clause), the selected remedy also complies with CECRA remedy requirements as enacted by the legislature through 2001.[4] The selected remedy will 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. The selected remedy will meet applicable state or federal environmental requirements, criteria, or limitations and substantive state or federal environmental requirements, criteria, or limitations that are relevant to site conditions.

The selected remedy, considering present and reasonably anticipated future uses, and giving due considerations to institutional controls, demonstrates acceptable mitigation of exposure to risks to the public health, safety, and welfare and the environment is effective and reliable in the short -term and the long-term, is technically practicable and implementable, uses treatment technologies or resource recovery technologies if practicable, giving due consideration to engineering controls, and is cost-effective.[5] In addition, the selected remedy is acceptable to the majority of the affected community, as indicated by community members and the local government.

CERCLA

The selected remedy complies with CERCLA to the extent practicable and is also not inconsistent with the NCP (which contains the implementation regulations of CERCLA). CERCLA Section 121 requires that remedies be protective of human health and the environment, comply with applicable and relevant and appropriate requirements, are cost-effective, and utilize permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and

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4 CECRA § 75-10-721 was amended during the 1995 legislative session. *See* Chapter 584, Laws of Montana, 1995. One of the revisions pertained to the development and selection of ERCLs. However, Section 15 of Chapter 584 states that the 1995 revisions and amendments do not apply to civil actions commenced or begun prior to the effective date of the 1995 act. The complaint in State of Montana v. Burlington Northern, Inc., Burlington Northern Railroad Company and Glacier Park Company CV 88-141-H-CCL was filed December 27, 1988 and pertains to the Burlington Northern Livingston Railyard Site, and other Burlington Northern Facilities. The suit is still on going. Therefore, these ERCLs comply with CECRA as amended in 1991, rather than CECRA as amended by Chapter 584, Laws of Montana, 1995.

5 Under 75-10-721, MCA (1999), 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.

significantly reduces the volume, toxicity, or mobility of hazardous wastes as their principal element.

The following sections discuss how the selected remedy meets each of these statutory requirements.

B. Protection of Public Health, Safety, Welfare and the Environment

Both CERCLA and CECRA require present and future protection of human health and the environment as a threshold criterion. In addition, CECRA also requires present and future protection of public safety and welfare.

The selected remedy protects public health, safety, welfare, and the environment through the following:

Abandonment and replacement of VOC-contaminated municipal wells implemented under an interim action eliminated a current and potential groundwater ingestion pathway.

Temporary placement of a groundwater control area to prohibit use of groundwater for domestic use in the VOC-contaminated plume eliminates a current and potential groundwater ingestion pathway.

Source removal of VOC-contaminated soil and sludge, and in-situ SVE treatment of VOC-contaminated soil, implemented under interim actions, decreased the potential for unacceptable human health and safety risks to workers.

Source removal of the remaining VOC-contaminated soil will decrease the potential for unacceptable human health risks to workers.

Source removal of VOC-contaminated soil and sludge, in-situ SVE treatment of VOC-contaminated soil, replacement of leaking wastewater lines and manways, and retrofitting of WWTP grit chambers, all implemented actions, have aided in the elimination of the source of VOC contamination to groundwater.

Source removal of remaining VOC-contaminated soil will eliminate the source of VOC contamination to groundwater.

Source removal of VOC-contaminated soil and sludge, in-situ SVE treatment of VOC-contaminated soil, replacement of leaking wastewater lines and manways, and retrofitting of WWTP grit chambers, all implemented actions, have aided in prevention of the current and potential groundwater ingestion pathway that would pose an unacceptable human health risk.

Source removal of remaining VOC-contaminated soil followed by monitored natural attenuation will prevent the current and potential groundwater ingestion pathway that would pose an unacceptable human health risk.

Source removal of VOC-contaminated soil and sludge, in-situ SVE treatment of VOC-contaminated soil, replacement of leaking wastewater lines and manways, and retrofitting of WWTP grit chambers, all implemented under interim actions, are aiding in restoration of groundwater to its beneficial use within a reasonable time.

Source removal and treatment of the remaining VOC-contaminated soil followed by monitored natural attenuation will restore groundwater to its beneficial use within a reasonable time.

Removal of underground storage tanks and associated piping, source removal of certain petroleum-contaminated soils, installation of track pans, and related actions, implemented actions, will aid in restoration of groundwater to its beneficial use within a reasonable time.

Limited source removal of free product from groundwater implemented under an interim action has aided in restoration of groundwater to its beneficial use.

Source removal of free product from groundwater followed by MNA will restore groundwater to its beneficial use within a reasonable time.

Removal of petroleum-contaminated gravel from the Yellowstone River and plugging of the discharge line implemented under an interim action prevented the release of contaminated materials into surface waters.

Removal of visible asbestos from the surface of the cinder pile implemented under an interim action aided in the prevention of the current and potential air pathway that would pose an unacceptable human health risk.

Covering, revegetating the cinder pile, fencing and applying deed restrictions, eliminates the current and potential air pathways that would pose an unacceptable human health risk.

Venting of households with unacceptable levels of VOCs in indoor air, implemented under an interim action, eliminated a current and potential air pathway that would pose an unacceptable human health risk.

Venting of any additional households with unacceptable levels of VOCs in indoor air, will eliminate a potential air pathway that would pose an unacceptable human health risk.

Remediation of the PAH-contaminated soil will prevent the current and potential human ingestion surface soil pathway for workers that would pose an unacceptable safety and human health risk.

Remediation of TPH-contaminated soil will prevent the current and potential human ingestion surface soil pathway for workers that would pose an unacceptable safety and human health risk.

Remediation of any lead-contaminated soil will prevent the current and potential human ingestion surface soil pathway for workers that would pose an unacceptable safety and human health risk.

Temporary placement of ICs to prohibit use of groundwater for domestic use in the diesel plumes eliminates a potential groundwater ingestion pathway.

C. Compliance with Environmental Requirements, Criteria and Limitations

The final determination of Environmental Requirements, Criteria and Limitations ("ERCLs") are listed in Appendix A of this ROD. The selected remedy will comply with all applicable and well-suited ERCLs. The remedy will also comply with all applicable and *relevant* ERCLs under CECRA, as revised (but inapplicable to this site).[6] In addition, the remedy will also comply with all applicable relevant and appropriate requirements under CERCLA. No waiver of ERCLs or ARARs is necessary. Some significant ERCLs and ARARs compliance issues are discussed below, although the discussion is not all-inclusive. The full ERCLs are set forth in Appendix A.

<u>Groundwater</u>

For VOCs and SVOCs, the contaminant-specific ERCLs to comply with which will guide the remedial action are the standards specified in Circular WQB-7.

Certain actions (source removal of VOC-contaminated soil and sludge, in-situ SVE treatment of VOC-contaminated soil, replacement of leaking wastewater lines and manways, and retrofitting of WWTP grit chambers), coupled with the remedial actions set forth in the selected remedy (source removal and treatment of the remaining VOC-

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[6] In CECRA (1999), "relevant" has replaced "well-suited." CECRA (1999) also gives DEQ the discretion not to require compliance with relevant requirements. DEQ does not have such discretion under CECRA (1993) and has determined that all relevant requirements will have to be met. "Relevant" is not defined in CECRA (1999), but seems to be substantially similar to the first prong of CERCLA's "relevant and appropriate." CERCLA's NCP defines "relevant" as "addressing similar situations or problems." 55 Fed.Reg. 8743 (March 8, 1990). DEQ has determined that it is identified well-suited requirements set forth in Appendix A of the ROD both address similar situations or problems and are well suited to the particular site. Therefore, the ERCLs comply with both CECRA (1999) and CERCLA as well as CECRA (1993).

contaminated soil followed by monitored natural attenuation) will lead to compliance with WQB-7 human health groundwater standards within a reasonable time.

For the diesel plume, the ERCLs to comply with and which will guide the remedial action are the water quality standards, such as specified in section 75-5-605, MCA (which prohibits the causing of pollution) and section 75-5-303, MCA (nondegradation) and the federal and state underground storage tank regulations. The federal regulations specifically require removal of free product to the maximum extent practicable as determined by the implementing agency, which leads to effective corrective action.

Certain actions (removal of underground storage tanks and associated piping, source removal of certain petroleum-contaminated soils, installation of track pans, limited source removal of free product) have helped in compliance with water quality standards. The remedial actions set forth in the selected remedy (source removal of free product from groundwater and soil to cleanup levels followed by monitored natural attenuation) will comply with the federal and state underground storage tank regulations and will lead to compliance of water quality requirements within a reasonable time.

Surface Water

There are no known exceedances of surface water quality standards. Although remediation of surface water is not a component of the selected remedy, certain actions, such as washing of equipment that has come into contact with hazardous waste, will involve water handling. The selected remedy requires that all water quality standards be met and that any discharge occurs under an appropriate MPDES permit.

Asbestos

For the cinder pile, the ERCLs to comply with and which will guide the remedial action are the standards specified in the State solid waste regulations.

The interim action (removal of visible asbestos from the surface of the cinder pile) followed by remedial actions set forth in the selected remedy (covering and revegetating the cinder pile, fencing and applying restrictive covenants) will comply with the State solid waste regulations.

RCRA Requirements

The selected remedy calls for excavation of VOC-contaminated soils and off-site disposal of all solid and hazardous wastes except for the cinder pile and ex-situ soils treated to below cleanup levels.

Certain of the wastes at the site demonstrate the characteristic of toxicity, and are therefore characteristic hazardous wastes upon excavation. The site also contains F001 and F002, which are listed hazardous wastes for chlorinated solvents. The various media and wastes at the site contaminated by the F001 and F002 wastes are also hazardous wastes pursuant to 40 CFR 261 upon excavation. The RCRA requirements are applicable requirements for the treatment, storage and disposal of these wastes.

Properly implemented, the selected remedy complies with RCRA Subtitle C requirements.

Worker Safety

The safety regulations are not ERCLs but are independently applicable. They are included in this section however, because of their import (since the remedial action will occur at an operating rail facility). The selected remedy will comply with all federal and state safety laws. In addition, the selected remedy requires compliance with the operator's health and safety manual. In this way, the selected remedy assures both worker safety and environmental compliance.

D. 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 effectiveness proportionate to its 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 effectiveness of the selected remedy. The detailed evaluation of the balance of these criteria among the alternatives considered is set forth in the final feasibility study reports and in Section IX, Summary of Comparative Analysis of Alternatives, of this ROD.[7]

The estimated cost of the selected remedy is $2,229,028. To a large extent, the remedy relies on monitored natural attenuation after initial source removal rather than pump and treat technologies. In addition, asbestos waste is capped rather than removed and the diesel recovery is being implemented in a phased approach, building

[7] Under section 75-10-721, MCA (1999), 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. Although not applicable to this selected remedy due to the 1995 savings clause, the selected remedy is cost-effective under this criterion as well. Of those alternatives that are protective of public health, safety and welfare and the environment, and comply with ERCLs, DEQ has determined that the selected remedy provides the best balance of incremental costs and incremental risk reduction 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. The detailed evaluation of the balance of these criteria among the alternatives considered is set forth in Section IX, Summary of Comparative Analysis of Alternatives, and discussed in Section X, Selected Remedy, of this ROD.

on knowledge gained in the previous phase. Each of these offers a cost-effective alternative as the selected remedy while still assuring a remedy that will attain a degree of cleanup that is protective of public health, safety, and welfare and the environment as well as compliance with applicable state or federal ERCLs and substantive state or federal ERCLs that are well suited to site conditions. Source removal, although causing greater short-term costs, significantly reduces long-term costs and also allows the remedy to avoid pump and treat technologies. Short-term costs due to worker safety concerns provide added protection in proportion to its costs. Some of the costs referenced by the commenter, such as spotter costs, were included in the cost estimates. The additional cost of long-term monitoring is reasonably related to the greater overall effectiveness of the selected remedy.

E. Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent practicable to which permanent solutions, alternative treatment technologies or resource recovery technologies can be utilized. Of those alternatives that attain a degree of cleanup protective of public health, safety, and welfare and the environment, and comply with ERCLs, DEQ has determined that the selected remedy provides the best balance of trade-off in terms of long-term effectiveness and permanence, reduction in toxicity, mobility or volume through treatment short-term effectiveness, implement ability and cost while also considering community acceptance and CERCLA's statutory preference for treatment as a principal element in the remedy. The detailed evaluation of the balance of these criteria among the alternatives considered is set forth in the final feasibility study reports and is summarized in Section IX, Summary of Comparative Analysis of Alternatives, of this ROD. Community acceptance is discussed in Section III of the ROD and the Response Summary.

The selected remedy includes removal and treatment of contaminated media and removal of diesel in the groundwater. These actions will permanently and significantly reduce the principal threats posed by the soil and groundwater. By using treatment of contaminated media, the selected remedy provides the most effective and permanent treatment of any of the alternatives considered and complies with CERCLA's preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as their principal element. Through reprocessing of removed diesel, the selected remedy provides resource recovery to the maximum extent practicable. The other alternatives considered for VOC-contaminated soil and groundwater which were protective of public health, safety and welfare and the environment, and complied with ERCLs did not provide a similar reduction in toxicity, mobility and volume as did the selected remedy. For diesel-contaminated media, the other alternatives considered which were protective of public health, safety and welfare and the environment, and complied with ERCLs, the selected remedy offers cleanup of soils and the most effective removal of free product.

With regard to the short-term effectiveness of the remedy, including consideration of the risks involved to workers and the community as the remedy is being implemented, DEQ has spent significant effort in crafting a protective remedy that also assures protection of public health, safety, and welfare and compliance with ERCLs. The safety measures are set forth in Section X, Selected Remedy, of the ROD.

The remedy utilizes alternative treatment technologies. In the diesel alternative, the remedy employs soil venting once free product is removed to the maximum extent practicable. Soil venting is an alternative treatment technology designed to utilize existing soil microbes to degrade petroleum hydrocarbons in the subsurface.

XII. DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the site was released for public comment on September 22, 1998. The plan identified alternative 6 for soil and groundwater and modified F for diesel fuel as DEQ's preferred remedy for the BN Livingston Complex. DEQ has reviewed all written and oral comments for the Proposed Plan submitted during the public comment period. The following specific changes have been made from the proposed plan.

A. Indoor Air / Basement Gas

In response to several commenters' requests to reevaluate the protectiveness of indoor air sampling, DEQ has determined further sampling beyond that noted in the Proposed Plan is necessary.

It has been approximately eight years since the last sampling event occurred for indoor air. In that time, much scientific research has focused on this area. Sampling methods and analysis have improved, and the risk evaluation for indoor air has evolved since that time.

The ROD sets forth EPA Region IX PRGs as screening levels for ambient air. These PRGs address both carcinogenic and noncarcinogenic risk, and are therefore protective of human health for indoor air.

The Proposed Plan had discussed confirmation sampling of those residences that contained the highest levels of contaminants in past sampling events followed by further action if levels are not acceptable. In addition to the proposed plan, the ROD requires further basement gas sampling at representative basements within the VOC plume to determine if residences or businesses have levels above EPA Region IX PRGs for ambient air. All residences and businesses determined to have basement gas levels above EPA Region IX PRGs for ambient air will have a removal system installed at no cost to the owner. In order to remain protective, these systems must be maintained until cleanup levels are continually met without operation of the system.

By requiring remedial action to mitigate unacceptable risks under both residential and commercial/industrial scenarios, the ROD is protective of human health.

B. PAH Contaminated Soils Within the Railyard

Upon further review of the BRA, an unacceptable potential current and future carcinogenic risk was noted to exist to railyard workers from PAH contaminated soils. Although this risk was identified in the BRA, neither the FS nor the Proposed Plan addressed this risk.

In calculating the ROD cleanup level from the BRA, it was noted that dermal exposure was not included as a pathway in the BRA assumptions. Dermal exposure would now be considered a standard pathway in this type of risk determination. Therefore, the ROD contains the cleanup levels derived from the BRA exposure parameters, but including dermal exposure as a pathway. The ROD requires approved sampling be performed, and remedial alternatives be evaluated for addressing this risk as part of remedial design. Evaluation of remedial alternatives will involve public input.

One alternative to be considered in the evaluation of alternatives is hot spot removal within railyard property. The evaluation of remedial alternatives will be followed by implementation of approved remedial action that will achieve the ROD cleanup levels.

By requiring remedial action to mitigate unacceptable risks under a commercial/ industrial scenario, the ROD is protective of human health.

C. Lead-Contaminated Soil

A new source of contamination at the site was noted on C&P Packing's property late last year, which includes a previously unidentified contaminant: lead. The ROD requires approved sampling to confirm this contamination. Since lead was not previously identified as a contaminant of concern, neither the BRA, the FS nor the Proposed Plan addressed this contamination. DEQ has determined that the commercial/industrial levels established in the Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to assessing Risks Associated with Adult Exposures to Lead in soil, including the Guidance Document for contaminated soils are the screening and potential cleanup levels for lead in soils. The cleanup level for contaminated groundwater will be WQB-7, as set forth in the ERCLs.

If either lead contamination of soil or groundwater is confirmed, the ROD requires remedial alternatives be evaluated for addressing the contamination as part of the remedial design, followed by implementation of approved remedial action to meet cleanup levels.

By requiring approved remedial action to meet cleanup levels, the ROD protects human health and the environment. (The ROD supports residential cleanup levels found in EPA Region IX PRGs for contaminated soils should a cleanup in a residential area later be discovered.)

D. Better Definition of the Plumes

The Proposed Plan called for a well use survey on the east side of the Yellowstone River and a small area northwest of the city shops. However, the present well inventory is over ten years old and it is unclear that any remaining private wells within the plume are used solely for irrigation. In response to public comment, the ROD therefore expands the survey requirement to include all wells within the plume boundaries. A revised well use survey for water use within the plume must be performed, with information on plume boundaries assisting with the identification. Consistent with the proposed plan, the ROD requires that users of contaminated groundwater within the plume be provided an alternate water supply, usually city hook up, at no cost to the well user.

As part of remedial design, the ROD requires development of a VOC plume map, which defines the outer reaches of the VOC-contaminated plume and the levels within.

For effective remedial action, The ROD also requires better definition of the free product plume (including depths) and more current information on the dissolved phase plume.

By requiring better definition of the plumes and well uses as part of remedial design, the ROD protects human health and the environment by better defining where remedial action must occur.

E. Removal of the Cinder Pile

The Proposed Plan called for removal of the cinder pile should future development occur. The volume of material in the cinder pile is estimated at 202,000 cubic yards. DEQ has determined it would not be cost-effective to remove the pile and may actually increase airborne asbestos and public health risk if the cinder pile is moved off-site.

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