Interim Final Task I Risk Assessment Amendment Number 2

Burlington Northern Livingston Shop Complex
Livingston, Montana

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Prepared by Montana Department of Environmental Quality (DEQ)

Table of Contents

1.0 Introduction

The purpose of this Interim Final Risk Assessment Amendment Number 2 (Amendment 2) is to remove vinyl chloride as a contaminant of concern (COC) for residential and commercial inhabitable structures located outside the railyard at the BNSF Livingston Shop Complex Facility (Facility). Amendment 2 also presents the Montana Department of Environmental Quality's (DEQ's) interim site-specific range of cleanup levels for tetrachloroethene (PCE) and trichloroethene (TCE) in indoor air for residential and commercial property located outside the railyard at the Facility.

The cleanup levels for the other COCs provided in the January 2010 Final Task I Risk Assessment Amendment and Montana Department of Environmental Quality Approved Remedy For Newly Identified Contaminants of Concern in Indoor Air (January 2010 Amendment), DEQ, January 2010) remain the same and are not discussed or revised in this Amendment 2. DEQ is preparing this amendment in response to the BNSF Railway Company's (BNSF's) request that DEQ re-evaluate the inclusion of vinyl chloride as a COC for inhabitable structures outside the railyard following the collection of additional data (Kennedy/Jenks, June 2010) and in response to comments received during the public comment period on the Draft Amendment 2.

2.0 Background

The remedy for indoor air selected in DEQ's 2001 Record of Decision (ROD), which is outlined in greater detail in "Task I: Basement VOC Gas Investigation and Removal" of the August 2005 Spring Statement of Work (SOW), includes indoor air sampling at certain inhabitable structures to evaluate if these structures have indoor air concentrations of COCs above screening levels (SOW at 21, ROD at 47). If an exceedance of a screening level in an inhabitable structure is identified, the exceedance must be reproducible and reasonably attributable to vapor intrusion by volatile organic compounds (VOCs) migrating from the subsurface (SOW at 21, 23, 24, Figure 1 and Table 1 of Attachment 2). If the indoor air exceedance is reproducible and attributable, BNSF must conduct additional sampling, and implement mitigation systems to meet final site-specific cleanup levels, unless the VOCs in indoor air are not related to the Facility (SOW at 23, ROD at 47).

The procedures for ambient (outdoor) air sampling, indoor air sampling, and soil gas sampling at the Facility are described in the DEQ-approved *Final Task I Supplemental Investigation Work Plan for Indoor Air* (Kennedy/Jenks, 2005) and addenda thereto (DEQ, 2006a, 2007a).

For the COCs that are identified in the ROD, this Task includes a provision for the development of alternate cleanup levels than those presented in the ROD (SOW at 21). BNSF previously developed site-specific screening levels that were included in the SOW and the SOW allows these screening levels to be used as cleanup levels. However, the SOW also allows for the development of alternate site-specific cleanup levels that comply with Attachment 2 of the SOW (SOW, Attachment 2, Section B).

In January 2009, BNSF requested that site-specific cleanup levels be developed for the Facility. DEQ developed cleanup levels that were based upon one of two things: (1) risk-based values derived to be protective of people who might be exposed to the contaminants; or (2) background concentrations of contaminants typically found in indoor air from sources not related to the railyard. The risk-based cleanup levels are calculated to meet the requirements in the ROD for the Facility and the SOW, as updated by the DEQ March 10, 2009 letter to BNSF. DEQ determined that it was necessary to update the parameters in the tables in Attachment 2 of the SOW, which must be used to calculate site-specific risk-based cleanup levels for indoor air at the Facility. These updated parameters, as well as an explanation as to why they must be used to calculate site-specific cleanup levels at the Facility, were provided in the January 2010 Amendment. DEQ is not updating these parameters in this Amendment 2. For contaminants like benzene and ethylbenzene that are typically found in indoor and outdoor air at concentrations greater than risk-based values, DEQ developed site-specific cleanup levels based upon background concentrations found in buildings with no contaminants in the soil gas beneath them. DEQ provided these cleanup levels in the January 2010 Amendment.

In 2010, BNSF collected additional indoor air, soil gas, and outdoor air samples at the Facility at DEQ's request. BNSF submitted these data to DEQ in June 2010 along with a request for DEQ to evaluate the data to determine whether certain compounds, including vinyl chloride, could be eliminated as COCs for the Facility.

3.0 Selection of COCs

Five COCs were identified for indoor air in the ROD: PCE, TCE, cis-1,2-dichloroethene (DCE), vinyl chloride, and trans-1,2-DCE (ROD at 50). These were the five COCs identified in the SOW and BNSF developed site-specific screening levels for them (SOW at 22).

As outlined in its March 10, 2009 letter and January 10, 2010 Amendment, DEQ identified two additional COCs in indoor air for both residential structures and commercial/industrial structures located on the railyard: benzene and ethylbenzene, as well as three additional COCs for indoor air in commercial/industrial structures: chloroform, 1,3,5-trimethylbenzene, and 1,2,4-trimethylbenzene. DEQ also eliminated contaminants as COCs, including the two 1,2-DCE compounds, because their indoor air concentrations did not exceed their screening levels for indoor air anywhere at the Facility.

In accordance with the ROD and the SOW, DEQ has considered the data collected during investigations at the Facility between 2005 and 2010, and DEQ has determined that all the COCs identified in the January 10, 2010 Amendment, with the exception of vinyl chloride in non-railyard structures, remain COCs for the Facility (Kennedy/Jenks, 2009d; Kennedy/Jenks, 2009f; Kennedy/Jenks, 2010). The January 10, 2010 Amendment, including the Responsiveness Summary included as Attachment 2, provided DEQ's reasoning and conclusions based on a review and consideration of the data collected through 2008. A consideration of all of the data collected through 2010 does not require a change to DEQ's reasoning and conclusions within the January 10, 2010 Amendment, except for the removal of vinyl chloride as a COC for non-railyard structures at the Facility.

DEQ is now able to eliminate vinyl chloride as a COC for non-railyard structures at the Facility because all of the data through 2010 shows that there is not an exceedance of the vinyl chloride cleanup level or screening level in an inhabitable structure that is reproducible and reasonably attributable to vapor intrusion by VOCs migrating from the subsurface (SOW at 23, ROD at 47).

BNSF sampled a total of 74 properties located near the railyard in 2010 as required by DEQ. During this sampling, BNSF was able to achieve reporting limits for vinyl chloride in soil gas samples that were below the vinyl chloride indoor air cleanup level of 0.77 micrograms per cubic meter ($\mu g/m^3$). DEQ has determined that soil gas screening levels or cleanup levels, developed using attenuation factors, are not adequately protective in determining whether vapor intrusion is occurring, and DEQ has not developed any such levels for the Facility. However, comparing the subslab soil gas sample results to the indoor air cleanup levels provides a conservative and protective way for DEQ to determine whether vapor intrusion is occurring due to subsurface contamination. A total of 181 soil gas samples were collected from beneath 74 properties. Vinyl chloride was only detected in two of the soil gas samples at concentrations of 0.42 $\mu g/m^3$ and 5.1 $\mu g/m^3$. Only one of these concentrations is above the vinyl chloride indoor air cleanup level and no vinyl chloride was detected in the indoor air samples from these two locations. BNSF has collected 497 indoor air samples from 186 locations between 2005 and 2010 and vinyl chloride was only detected above the indoor air cleanup level in samples from one location sampled in 2009. After the 2009 sampling event, all products were removed from the home and in 2010 no vinyl chloride was detected in the indoor air samples from the home. No vinyl chloride was detected in any of the four soil gas samples collected from this same location in 2009 and 2010.

Therefore, based upon this data, vinyl chloride does not meet the criteria provided in the SOW to be considered a COC for indoor air in inhabitable structures located outside the railyard. No soil gas samples were collected in 2010 from the buildings located on the railyard with the highest COC concentrations (i.e., the Electric Shop and Locomotive Shop) so vinyl chloride remains a COC for the railyard and the commercial/industrial cleanup levels provided in the January 2010 Amendment remain the same. DEQ will require additional sampling of the structures on the railyard in order to determine whether any changes to the COCs for the railyard buildings are appropriate.

The following is the list of COCs for indoor air in residential or commercial/industrial structures located outside the railyard. DEQ notes that the "ROD selected remedy requires all residences and businesses that have indoor air VOC concentrations from subsurface vapor intrusion above site-specific cleanup levels for indoor air to have a protection system installed at no cost to the owner, **unless the VOCs in indoor air are not related to the Facility** (SOW at 23) (emphasis added).

Residential COCs
Tetrachloroethene
Trichloroethene
Benzene
Ethylbenzene

While DEQ generally requires that all COCs be considered in calculating cumulative human health risks under the Comprehensive Environmental Cleanup and Responsibility Act, DEQ must also take into account concentrations of compounds that are not present due to an environmental spill or release but may be found in the environment either naturally or through anthropogenic (related to human activities) causes. For this reason, DEQ considered benzene and ethylbenzene separately from the other COCs in indoor air in non-railyard buildings. The cleanup levels for the benzene and ethylbenzene for indoor air in non-railyard buildings at the Facility are based upon typical indoor air concentrations found in Livingston, and are not revised in this Amendment 2. Please refer to the January 2010 Amendment for further information.

4.0 Exposure Assumptions

The cleanup levels are developed based upon the type and magnitude of potential current and future human exposures to the COCs (DEQ, 2005b). Exposure assumptions are combined with chemical-specific toxicity values to derive cleanup levels. Please refer to the January 2010 Amendment for more detail. DEQ is providing the information included in the January 2010 Amendment regarding the exposure assumptions in this Amendment 2. However, DEQ did not solicit additional public comment on these assumptions, because these assumptions have not changed from the assumptions used in the January 2010 Amendment. Because DEQ is not changing the cleanup levels for commercial/industrial exposure in the railyard buildings, DEQ is only providing the residential exposure parameters for non-railyard buildings here.

Exposure Time – Residents are assumed to potentially be exposed to indoor air in their homes for 24 hours a day resulting in an exposure time of 24 out of a total of 24 hours per day and a ratio of 1. This is meant to be protective of sensitive populations that may include young children, adults who stay at home, home-schooled children, or the elderly.

Exposure Frequency – Residents are assumed to be exposed to indoor air in their homes for 350 days per year allowing for two weeks away from home per year.

Exposure Duration – Residents are assumed to potentially be living in a given home for 30 years starting when someone is a baby.

Averaging Time (Cancer) – Carcinogenic risks are averaged over a lifetime, which is assumed to be 75 years based upon research conducted by the EPA. Averaging time is expressed by multiplying 75 years by 365 days per year resulting in an averaging time of 27,375 days.

Averaging Time (Non-Cancer) – Non-carcinogenic exposures are averaged over the exposure duration. The assumed duration of exposure is 30 years. The calculated non-cancer averaging time is 30 years multiplied by 365 days per year resulting in an averaging time of 10,950 days.

5.0 Risk Levels

Site-specific risk-based cleanup levels are calculated for two types of health effects. Some compounds are known or thought to cause cancer with long term exposure. These compounds are referred to as carcinogens and they may also cause other negative health effects (U.S. EPA, 2009e). Other non-carcinogenic compounds are not likely to cause cancer but are known to cause other negative health effects (U.S. EPA, 2009e). DEQ must address both types of health effects that may be associated with compounds linked to the Facility. For compounds associated with both carcinogenic and non-carcinogenic effects, DEQ selects the lowest cleanup level that is protective of both types of effects. For non-carcinogens, DEQ selects cleanup levels that are protective of non-cancer health effects.

Long-term exposure to any concentration of a cancer-causing compound is assumed to have some risk so DEQ must choose concentrations that are very protective (U.S. EPA, 1989). The term "excess lifetime cancer risk" is used because all people have a risk of getting cancer due to genetics or other causes not related to the Facility (U.S. EPA, 1989). According to the SEER Cancer Statistics Review, American men have a 44% lifetime risk of being diagnosed with cancer, while American women have a 38% lifetime risk (NCI 2009). This is a little over a 1 in 3 chance (or 33% or 0.33) that a person will get some type of cancer at some time in his or her life. The "excess lifetime cancer risk" that is referred to here is additional risk that someone might have of getting cancer if that person is exposed to compounds linked to the Facility as described in the January 2010 Amendment and summarized above. DEQ considers an additional or excess 1 in 100,000 chance (or 0.001% or 0.00001 or 1×10^{-5}) allowable (the Montana Legislature has directed that 1×10^{-5} is an allowable risk for surface water, § 75-5-301, MCA, and based on that level, DEQ has determined that 1×10^{-5} is an appropriate risk). DEQ derives the site-specific cleanup levels such that they do not result in a cumulative excess lifetime cancer risk greater than 1 in 100,000.

The term cumulative risk means that the risks from all the different carcinogens are added together and, for the cleanup levels to be protective, the total risk cannot exceed 1 in 100,000. Therefore, if there are ten carcinogenic compounds in indoor air at a facility, cleanup levels might be calculated so that each compound represents one-tenth or a 1 in 1,000,000 risk. That way if all ten compounds are present in the indoor air at the cleanup level, the risk would still not exceed 1 in 100,000. Similarly, if there are three carcinogenic compounds in indoor air at a facility, each one might represent one-third of the total risk. If only two carcinogenic compounds are present, each one might represent half the total risk.

For non-cancer health effects, there is a concentration of each compound at which negative health effects do not appear to occur (U.S. EPA, 1989). DEQ requires cleanup levels for each compound at the Facility that are designed to prevent negative health effects to any organ in the body or any bodily function even if someone is also exposed to other compounds linked to the Facility that affect the same organ or bodily function. To do this DEQ uses a ratio, called a hazard index, to compare concentrations of contaminants at the Facility to concentrations that have not been found to cause negative health effects in scientific studies (U.S. EPA, 1989). A hazard index of 1 indicates that the concentrations at the Facility are no higher than those found to cause negative health effects (U.S. EPA, 1989). The same cumulative equations also apply to non-carcinogens. If two compounds affect the same organ of the body, each one may represent half of the total non-cancer risk for that organ.

The COCs for non-railyard structures, PCE and TCE and the former COC for these non-railyard structures, vinyl chloride, are known or thought to cause cancer with long term exposure and they all also have non-cancer effects. Both PCE and TCE can cause non-cancer effects to the nervous system with long-term exposure to levels above non-cancer-based cleanup levels. Vinyl chloride can cause non-cancer effects to the liver with long-term exposure above cleanup levels based upon non-cancer risks.

The original site-specific screening levels for these three compounds included in the SOW were derived in a manner such that the cumulative cancer risk levels would not exceed 1 in 100,000. However, BNSF used a model to develop TCE and vinyl chloride screening levels based upon groundwater concentrations so that the screening levels for these two compounds represented 90% of the total risk. The PCE screening level only represented one-tenth of the total 1 in 100,000 cancer risk (SOW at 22). When DEQ published the revised site-specific indoor air cleanup levels in the January 2010 Amendment, it revised BNSF's approach and calculated cleanup levels with each one of the compounds, PCE, TCE, and vinyl chloride, representing one-third of the total 1 in 100,000 cancer risk. Because of this change and others, all three cleanup levels were higher than the original site-specific screening levels included in the SOW. With all three compounds present, the cleanup levels based upon cancer risk were lower than those based upon non-cancer risk. Therefore, DEQ chose the cleanup levels based upon cancer risk that were also protective of non-cancer risks.

Now, because DEQ has determined that vinyl chloride does not meet the criteria of a COC for non-railyard structures as defined in the SOW, the PCE and TCE cleanup levels can each represent half of the total 1 in 100,000 cancer risk. However, what this also means is that the cleanup level for TCE that is protective of one-half of the total non-cancer risk of central nervous system effects is lower than the cleanup level that is based upon one-half of the 1 in 100,000 cancer risk. Therefore, in DEQ's Draft Final Task I Risk Assessment Number 2, DEQ chose the cleanup level for TCE based upon non-cancer risk that was also protective of cancer risk and the PCE cleanup level based upon cancer risk that was also protective of non-cancer risk. The resulting revised cleanup levels for PCE and TCE were slightly higher than those included in the January 2010 Amendment but still met the criteria for being protective of both cancer and non-cancer risks.

Following the public comment period on the Draft Final Task I Risk Assessment Amendment Number 2 and in response to certain public comments received, DEQ conducted additional research into scientific data regarding PCE and TCE. This additional research revealed potential changes that EPA may make to the toxicity information that DEQ uses to develop cleanup levels.

6.0 Toxicity Assessment

EPA has been evaluating the toxicity of PCE and TCE for many years. The toxicity values for PCE and TCE that DEQ used in the Risk Assessment Amendments are those that EPA has provided in its Regional Screening Levels tables (U.S. EPA November 2010). However, the toxicity values that EPA released in its Inter-Agency Review Drafts of the Toxicological Review of Trichloroethylene (U.S. EPA, June 2009) and the Toxicological Review of Tetrachloroethylene (U.S. EPA, June 2008) differ from those that EPA used to develop the Regional Screening Tables. These Regional Screening Levels Tables are currently used throughout the country to screen for contaminants at Superfund facilities. The EPA Toxicological Reviews are in draft form and include language stating that the documents have not been formally disseminated by EPA and they should not be cited or quoted as EPA determination or policy. However, EPA indicates that it anticipates finalizing the documents during 2011. Therefore, in order to be protective of public health, safety and welfare, rather than finalizing the cleanup levels at this time, DEQ has developed a range of cleanup levels to be used in the interim until the EPA documents are finalized. Tables 1 and 2 provide the toxicity values that DEQ used to develop its interim range of cleanup levels. It is important to note that it may be necessary for DEQ to revise and/or finalize these interim indoor air cleanup levels to address any future EPA updates to the toxicity values for PCE and TCE. If the final cleanup levels differ from those that have already received public comment, DEQ will put the final indoor air cleanup levels out for public review and comment.

7.0 Derivation of Site-Specific Cleanup Levels for Indoor Air

DEQ calculated cleanup levels for indoor air for PCE and TCE based upon cumulative excess lifetime cancer risks of 1 $x10^{-5}$ and a cumulative non-cancer risks of central nervous system effects using the equations presented in Tables 1 and 2. DEQ chose either the level protective of cancer risk or that protective of non-cancer risk, whichever was lower for each of the calculated levels. In doing so, DEQ chose the levels that would be protective of both types of health effects. The following table provides a summary of the levels calculated for each compound for each type of health effect. The lowest levels for each compound are highlighted. Please note that the lowest levels for PCE are based upon cumulative cancer risks and the lowest levels for TCE are based upon cumulative non-cancer risks.

Residential COCs Addressed in This Amendment	**Cleanup Levels Based Upon EPA Proposed Cancer Toxicity ($\mu g/m^3$)**	**Cleanup Levels Based Upon Current EPA Cancer Toxicity ($\mu g/m^3$)**	**Cleanup Levels Based Upon EPA Proposed Non-Cancer Toxicity ($\mu g/m^3$)**	**Cleanup Levels Based Upon Current EPA Non-Cancer Toxicity ($\mu g/m^3$)**
Tetrachloroethene (PCE)	**0.7**	**2.2**	8	141
Trichloroethene (TCE)	3.3	6.5	**3**	**5**

While DEQ generally requires that all COCs be considered in calculating cumulative human health risks under the Comprehensive Environmental Cleanup and Responsibility Act, DEQ must also take into account concentrations of compounds that are not present due to an environmental spill or release but may be found in the environment either naturally or through anthropogenic (related to human activities) causes. An example of this is the DEQ policy regarding arsenic in surface soil. (DEQ, 2005a). Because naturally-occurring arsenic is ubiquitous in Montana soils, DEQ has determined that it is not appropriate to consider arsenic as part of cumulative risk calculations, but instead set the arsenic action level based upon arsenic concentrations found naturally in Montana soils.

PCE is not naturally-occurring; however, it has anthropogenic sources, including certain metal degreasing or dry cleaning products. (ATSDR, September 1997). Therefore, PCE may commonly be found at low concentrations in indoor air in Livingston at concentrations near or above the 0.7 $\mu g/m^3$ level calculated based upon EPA's proposed cancer toxicity for residential exposure. As explained above, each of the cleanup levels contained in the table above are based upon the cumulative risk of PCE and TCE. Since the calculated TCE cleanup levels are higher, the same is not true for TCE. In order to consider and address any PCE concentrations in Livingston not related to vapor intrusion from subsurface contamination, DEQ calculated a typical indoor air concentration for PCE using the same methodology and data set that DEQ used to calculate the benzene and ethylbenzene cleanup levels provided in the January 2010 Amendment. In Livingston, PCE concentrations in typical indoor air at locations without detections of any subsurface vapors can range from 0.044 $\mu g/m^3$ to 1.2 $\mu g/m^3$. (Tables 3 and 4). DEQ calculated the upper prediction limit (UPL) for PCE using the data from locations in Livingston without subsurface contamination. (Table 5; U.S. EPA, 2009c). The UPL is a value that will equal or exceed any new value 95% of the time if a new sample is collected. (U.S. EPA, 2009c). Therefore, the UPL is meant to provide a reasonable estimate of what might be found in the air inside structures in Livingston without subsurface sources of vapor intrusion. (Attachment 1). The calculated UPL for PCE of 0.9 $\mu g/m^3$ based upon the data from Livingston will represent the lower end of the range of interim cleanup levels for PCE in indoor air for non-railyard buildings. Because of the uncertainty associated with the toxicity values and because it would have no impact upon current mitigation determinations, DEQ will not at this time remove PCE from the cumulative risk-based cleanup level calculations as it did benzene and ethylbenzene. Removal of PCE from the cumulative risk assessment would not change any DEQ mitigation decisions because PCE is the most prevalent contaminant associated with vapor intrusion at the Facility and its cleanup levels are lower than those for TCE.

As provided in the SOW that BNSF agreed to follow, residential site-specific cleanup levels apply uniformly to all residential and off-railyard commercial/industrial structures with screening level exceedances due to subsurface vapor intrusion. DEQ and BNSF agreed in the SOW that commercial/industrial site-specific cleanup levels apply only to commercial/industrial structures located on the railyard. The ROD and the SOW, as updated by DEQ's March 10, 2009 letter, do not provide for the performance of building-specific risk assessments on specific properties sampled by BNSF. In addition, in making decisions about indoor air mitigation, DEQ does not allow building-specific risk assessment for vapor intrusion because of the extreme variability involved and the number of factors influencing indoor air concentrations. Rather, in order to be protective of public health, safety and welfare, and conservative, DEQ requires that screening or cleanup levels (sometimes referred to as target or action levels) be applied uniformly to buildings within a given facility.

8.0 Implementation of Interim Cleanup Levels

DEQ will address the risks associated with PCE and TCE based upon current and proposed EPA toxicity values by implementation of a range of calculated cleanup levels. The following table provides the ranges of cleanup levels.

Residential COCs Addressed in This Amendment	**Range of Cleanup Levels ($\mu g/m^3$)**
Tetrachloroethene (PCE)	0.9 – 2.2
Trichloroethene (TCE)	3 – 5

Risks associated with PCE and TCE will be addressed using the following approach. The ROD selected remedy requires all residences and businesses that have indoor air VOC concentrations from subsurface vapor intrusion above site-specific cleanup levels for indoor air to have a protection system (mitigation system) installed at no cost to the owner, unless the VOCs in indoor air are not related to the Facility. In order to remain protective, these systems must be maintained until cleanup levels are continually met without operation of the system. BNSF shall install and maintain a mitigation system at all inhabitable residences and businesses that meet the standards in the ROD and the SOW, at no cost to the owner.

Since PCE is the most prevalent contaminant associated with vapor intrusion at the Facility and its cleanup levels are lower than those for TCE, it will drive DEQ's risk management decisions. For structures with indoor air PCE concentrations DEQ determines to be consistently below 0.9 $\mu g/m^3$, DEQ will not require further action. For structures with indoor air PCE concentrations between 0.9 $\mu g/m^3$ and 2.2 $\mu g/m^3$ that DEQ determines are reproducible and reasonably attributable to vapor intrusion by VOCs related to the Facility migrating from the subsurface, DEQ will give BNSF the option of either regularly monitoring those structures or installing mitigation systems as described in the ROD and above. However, if DEQ finalizes these interim indoor air cleanup levels (as discussed further in this document), DEQ may require mitigation of these structures as necessary to be protective of public health, safety and welfare. For those structures with PCE concentrations greater than 2.2 $\mu g/m^3$ that DEQ determines are reproducible and reasonably attributable to vapor intrusion by VOCs related to the Facility migrating from the subsurface, DEQ will require that BNSF install and maintain mitigation systems as described above.

This approach will be used until EPA makes final determinations in the Integrated Risk Information System (IRIS) regarding the toxicity of PCE and TCE. When EPA issues its final toxicity determinations, DEQ will finalize the indoor air cleanup levels for the Facility based upon the IRIS toxicity information. DEQ will then review its decisions regarding each inhabitable structure made using this interim approach to determine whether DEQ's decisions are protective and whether any changes are warranted.

9.0 References

Full citations to certain of the references cited herein can be found within the administrative record in Attachment 3 of the January 2010 Amendment. However, not all of the documents contained within the administrative record are specifically referenced within this document, because the administrative record also contains all documents DEQ relied upon or considered in developing this document. Additional references specific to this document include the following:

Agency for Toxic Substances and Disease Registry (ATSDR). September1997. Tetrachloroethylene ToxFAQs. September 1997.

Kennedy/Jenks Consultants (Kennedy/Jenks). June 2010. Task I – 2010 Soil Gas/Indoor Air Data Summary Report. June 24, 2010.

Montana Department of Environmental Quality (DEQ). January 2010. Final Task I Risk Assessment Amendment and Montana Department of Environmental Quality Approved Remedy For Newly Identified Contaminants of Concern in Indoor Air. January 2010.

DEQ. October 2010. Correspondence from Aimee Reynolds, project manager, DEQ, Helena, Montana, to BNSF Railway Company regarding BNSF Request to Recalculate Proposed Site-Specific Cleanup Levels for Indoor Air Included in the June 24, 2010 Task I – 2010 Soil Gas/Indoor Air Data Summary Report. October 25, 2010.

U.S. Environmental Protection Agency (U.S. EPA). June 2008. Inter-Agency Review Draft of the Toxicological Review of Tetrachloroethylene. June 2008.

U.S. EPA. June 2009. Inter-Agency Review Draft of the Toxicological Review of Trichloroethylene. June 2009.

U.S. EPA. November 2010. Regional Screening Levels Tables. November 2010.

TABLE 1
CANCER TOXICITY DATA -- INHALATION
BNSF Livingston Shop Complex Facility

Chemical of Potential Concern	Inhalation Unit Risk	Units	Cancer Guideline Description	Source	Date
Tetrachloroethylene	2.00E-05	(ug/m3)-1	NA	US EPA	2008
Tetrachloroethylene	5.90E-06	(ug/m3)-1	NA	CA EPA	2010
Trichloroethylene	4.00E-06	(ug/m3)-1	NA	US EPA	2009
Trichloroethylene	2.00E-06	(ug/m3)-1	NA	CA EPA	2010

NA = Not Applicable or Not Available

References

CA EPA = California EPA as referenced in the EPA Regional Screening Levels Table, November 2010

US EPA 2008 = Toxicological Review of Tetrachloroethylene (June 2008)

US EPA 2009 = Toxicological Review of Trichloroethylene (June 2009)

DEQ will update these toxicity data as necessary in the future, following the hierarchy described in OSWER Directive 9285.7-53 Human Health Toxicity Values in Superfund Risk Assessments (December 2003).

TABLE 2
NONCANCER TOXICITY DATA -- INHALATION
BNSF Livingston Shop Complex Facility

Chemical of Potential Concern	Inhalation Reference Concentration	Units	Primary Target Organ	Source	Date
Tetrachloroethylene	2.70E-01	mg/m^3	Neurotoxicity	ATSDR	2008
Tetrachloroethylene	1.60E-02	mg/m^3	Neurotoxicity	US EPA	2010
Trichloroethylene	1.00E-02	mg/m^3	Nervous system	NYDOH	2006
Trichloroethylene	5.00E-03	mg/m^3	Nervous system	US EPA	2009

References

ATSDR = Agency for Toxic Substances and Disease Registry as referenced in the EPA Regional Screening Levels Table, November 2010

NYSDOH = Center for Environmental Health, Bureau of Toxic Substances Assessment, Trichloroethene Air Criteria Document, October 2006

US EPA 2008 = Toxicological Review of Tetrachloroethylene (June 2008)

US EPA 2009 = Toxicological Review of Trichloroethylene (June 2009)

DEQ will update these toxicity data as necessary in the future, following the hierarchy described in OSWER Directive 9285.7-53 Human Health Toxicity Values in Superfund Risk Assessments (December 2003).

TABLE 3
LOCATIONS WITH NO VOC DETECTIONS IN SUBSURFACE

Location ID	Sample_ID	Sample Type	Date	PCE
131-2	09-AS-131-2	Indoor Air	2/12/2009	0.16 J
131-2	09-SG-131-2	Soil Gas	2/12/2009	<5
43	05-AS-43L	Indoor Air	12/14/2005	<0.28
44	09-AS-44	Indoor Air	3/5/2009	0.16 J
44	09-SG-44	Soil Gas	3/5/2009	<5
521	09-AS-521	Indoor Air	2/9/2009	0.12 J
521	09-SG-521	Soil Gas	2/9/2009	<5
528	09-AS-528	Indoor Air	2/25/2009	0.52
528	09-SG-528	Soil Gas	2/25/2009	<5
530	09-AS-530	Indoor Air	2/23/2009	0.065 J
530	09-SG-530	Soil Gas	2/23/2009	<5
538	09-AS-538	Indoor Air	2/11/2009	0.26
538	09-SG-538	Soil Gas	2/11/2009	<5
539	09-AS-539	Indoor Air	2/26/2009	0.068 J
539	09-SG-539	Soil Gas	2/26/2009	<5
549A	08-AS-549A	Indoor Air	2/28/2008	0.96
549A	D1-AS-02-28-08	Indoor Air	2/28/2008	1
549A	08-SG-549A	Soil Gas	2/28/2008	<5
549A	09-AS-549A	Indoor Air	2/10/2009	0.075 J
549A	09-SG-549A	Soil Gas	2/10/2009	<5
549B	08-AS-549B	Indoor Air	2/28/2008	0.056 J
549B	08-SG-549B	Soil Gas	2/28/2008	<5
552	09-AS-552	Indoor Air	2/24/2009	0.32
552	09-SG-552	Soil Gas	2/24/2009	<5
584	09-AS-584L	Indoor Air	3/16/2009	0.15 J
584	09-AS-584B	Indoor Air	3/16/2009	0.054 J
584	09-SG-584	Soil Gas	3/16/2009	<5
591	09-AS-591	Indoor Air	3/16/2009	0.068 J
591	09-SG-591	Soil Gas	3/16/2009	<5
708	09-AS-AMB-708-03-16-09	Outdoor Air	3/16/2009	6.5
708	09-AS-708	Indoor Air	3/16/2009	0.17 J
708	09-SG-708	Soil Gas	3/16/2009	<5
710	09-AS-AMB-710-02-13-09	Outdoor Air	2/13/2009	0.066 J
710	09-AS-710	Indoor Air	2/13/2009	0.24 J

TABLE 3
LOCATIONS WITH NO VOC DETECTIONS IN SUBSURFACE

710	D1-AS-02-13-08 (Dup of 09-AS-710)	Indoor Air	2/13/2009	0.21 J
710	09-SG-710	Soil Gas	2/13/2009	<5
710	09-SG-710 Dup	Soil Gas	2/13/2009	<5
721-1	09-AS-721-1L	Indoor Air	2/10/2009	0.044 J
721-1	09-AS-721-1B	Indoor Air	2/10/2009	0.044 J
721-2	09-AS-721-2L	Indoor Air	2/10/2009	0.031 J
721-2	09-AS-721DEQ-2L	Indoor Air	2/10/2009	0.06
721-2	09-SG-721-2	Soil Gas	2/10/2009	<5 (R)
721-2	09-SG-721DEQ	Soil Gas	2/10/2009	<2.9
721-2	09-SG-721-2	Soil Gas	3/3/2009	<5
735	09-AS-735L	Indoor Air	2/13/2009	0.074 J
735	09-AS-735B	Indoor Air	2/13/2009	0.091 J
735	09-SG-735	Soil Gas	2/13/2009	<5
89-1	09-AS-89-1	Indoor Air	2/26/2009	0.88
89-1	09-SG-89-1	Soil Gas	2/26/2009	<5
89-3	09-AS-89-3	Indoor Air	2/12/2009	0.088 J
89-3	09-SG-89-3	Soil Gas	2/12/2009	<5
89-3	09-SG-89-3DEQ	Soil Gas	2/12/2009	<2.9
89-4	09-AS-89-4L	Indoor Air	2/25/2009	0.078 J
89-4	09-AS-89-4B	Indoor Air	2/25/2009	0.62
89-4	09-SG-89-4	Soil Gas	2/25/2009	<5
89-4	D1-SG-02-25-09	Soil Gas	2/25/2009	<5
NE-14	08-AS-NE-14	Indoor Air	3/4/2008	0.34
NE-14	08-SG-NE-14	Soil Gas	3/4/2008	<5
SE-16	09-AS-SE-16	Indoor Air	3/3/2009	1.1
SE-16	09-SG-SE-16	Soil Gas	3/3/2009	<5
SE-18	09-AS-SE-18	Indoor Air	3/19/2009	1.2
SE-18	09-SG-SE-18	Soil Gas	3/19/2009	<5
SE-19	09-AS-SE-19	Indoor Air	3/17/2009	0.21 J
SE-19	09-SG-SE-19	Soil Gas	3/17/2009	<5
SE-25	09-AS-SE-25	Indoor Air	2/25/2009	0.27
SE-25	09-SG-SE-25	Soil Gas	2/25/2009	<5
SE-7	09-AS-SE-7L	Indoor Air	3/17/2009	0.044 J
SE-7	09-AS-SE-7B	Indoor Air	3/17/2009	0.052 J
SE-7	09-SG-SE-7	Soil Gas	3/17/2009	<5
SE-7	D2-SG-03-17-09 (Dup of 09-SG-SE-7)	Soil Gas	3/17/2009	<5

TABLE 4
TYPICAL LIVINGSTON TETRACHLOROETHENE INDOOR AIR DATA SET

Location ID	Sample_ID	Date	PCE
131-2	09-AS-131-2	2/12/2009	0.16 J
43	05-AS-43L	12/14/2005	<0.28
44	09-AS-44	3/5/2009	0.16 J
521	09-AS-521	2/9/2009	0.12 J
528	09-AS-528	2/25/2009	0.52
530	09-AS-530	2/23/2009	0.065 J
538	09-AS-538	2/11/2009	0.26
539	09-AS-539	2/26/2009	0.068 J
549A	D1-AS-02-28-08	2/28/2008	1
549A	09-AS-549A	2/10/2009	0.075 J
549B	08-AS-549B	2/28/2008	0.056 J
552	09-AS-552	2/24/2009	0.32
584	09-AS-584L	3/16/2009	0.15 J
591	09-AS-591	3/16/2009	0.068 J
708	09-AS-708	3/16/2009	0.17 J
710	D1-AS-02-13-08 (Dup of 09-AS-710)	2/13/2009	0.24 J
721-1	09-AS-721-1L	2/10/2009	0.044 J
721-2	09-AS-721DEQ-2L	2/10/2009	0.06
735	09-AS-735L	2/13/2009	0.074 J
89-1	09-AS-89-1	2/26/2009	0.88
89-3	09-AS-89-3	2/12/2009	0.088 J
89-4	09-AS-89-4L	2/25/2009	0.078 J
NE-14	08-AS-NE-14	3/4/2008	0.34
SE-16	09-AS-SE-16	3/3/2009	1.1
SE-18	09-AS-SE-18	3/19/2009	1.2
SE-19	09-AS-SE-19	3/17/2009	0.21 J
SE-25	09-AS-SE-25	2/25/2009	0.27
SE-7	09-AS-SE-7L	3/17/2009	0.044 J

TABLE 5
STATISTICAL SUMMARY OF TYPICAL LIVINGSTON TETRACHLOROETHENE CONCENTRATIONS

	PCE
# samples	28
freqency of detection	96%
minimum concentration (ug/m^3)	0.044
maximum concentration (ug/m^3)	1.2
Outlier at 5% found	No
95% UPL (ug/m^3)	0.9

All samples collected from locations with soil gas/subslab concentrations below detection limits.
95% UPL = 95% Upper Prediction Limit is the value that will equal or exceed any new value 95% of the time if a new sample is collected.

ATTACHMENT 1

PROUCL CALCULATIONS

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
Number of Bootstrap Operations	2000

PCE

General Statistics			
Number of Valid Data	28	Number of Detected Data	27
Number of Distinct Detected Data	24	Number of Non-Detect Data	1
		Percent Non-Detects	3.57%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.044	Minimum Detected	-3.124
Maximum Detected	1.2	Maximum Detected	0.182
Mean of Detected	0.29	Mean of Detected	-1.78
SD of Detected	0.343	SD of Detected	1.018
Minimum Non-Detect	0.28	Minimum Non-Detect	-1.273
Maximum Non-Detect	0.28	Maximum Non-Detect	-1.273
Background Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.696	Shapiro Wilk Test Statistic	0.916
5% Shapiro Wilk Critical Value	0.923	5% Shapiro Wilk Critical Value	0.923
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.284	Mean (Log Scale)	-1.786
SD	0.338	SD (Log Scale)	1
95% UTL 90% Coverage	0.892	95% UTL 90% Coverage	1.013
95% UPL (t)	0.87	95% UPL (t)	0.948
90% Percentile (z)	0.717	90% Percentile (z)	0.604
95% Percentile (z)	0.84	95% Percentile (z)	0.868
99% Percentile (z)	1.07	99% Percentile (z)	1.715
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	-0.233	Mean in Original Scale	0.283
SD	0.775	SD in Original Scale	0.338
95% UTL with 90% Coverage	1.161	95% UTL with 90% Coverage	1.009
		95% BCA UTL with 90% Coverage	1.1
		95% Bootstrap (%) UTL with 90% Coverage	1.13
95% UPL (t)	1.11	95% UPL (t)	0.945
90% Percentile (z)	0.76	90% Percentile (z)	0.601
95% Percentile (z)	1.042	95% Percentile (z)	0.865
99% Percentile (z)	1.57	99% Percentile (z)	1.712
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.968	Data follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	0.299		
nu star	52.25		
A-D Test Statistic	1.349	Nonparametric Statistics	
5% A-D Critical Value	0.772	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.158	Mean	0.284
5% K-S Critical Value	0.173	SD	0.332
Data follow Appx. Gamma Distribution at 5% Significance Level		SE of Mean	0.064
		95% KM UTL with 90% Coverage	0.881
Assuming Gamma Distribution		95% KM Chebyshev UPL	1.757
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	0.859
Mean	0.286	90% Percentile (z)	0.709
Median	0.16	95% Percentile (z)	0.83
SD	0.337	99% Percentile (z)	1.056
k star	0.996		
Theta star	0.287	Gamma ROS Limits with Extrapolated Data	
Nu star	55.79	95% Wilson Hilferty (WH) Approx. Gamma UPL	0.865
95% Percentile of Chisquare (2k)	5.977	95% Hawkins Wixley (HW) Approx. Gamma UPL	0.876
		95% WH Approx. Gamma UTL with 90% Coverage	0.903
90% Percentile	0.658	95% HW Approx. Gamma UTL with 90% Coverage	0.919
95% Percentile	0.857		
99% Percentile	1.318		

Note: DL/2 is not a recommended method.

ATTACHMENT 2

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY FOR FINAL DRAFT TASK I RISK ASSESSMENT AMENDMENT NUMBER 2

1.0 INTRODUCTION

The Montana Department of Environmental Quality (DEQ) solicited public comment on the October 2010 Final Draft Task I Risk Assessment Amendment Number 2 (Amendment 2) for the Burlington Northern Livingston Shop Complex Facility (Facility) during a public comment period that ran from October 24, 2010 to November 23, 2010. DEQ received written comments from three entities during the public comment period. DEQ also held a public meeting on November 3, 2010, in which DEQ discussed the proposed cleanup levels, as well as other issues related to the Facility, but did not accept oral public comment at the public meeting.

1.1 Community Involvement Background

It is the intent of DEQ that the citizens of Montana have the opportunity to be actively involved in the DEQ decision-making process with respect to state Superfund sites. The 2001 Record of Decision (ROD) (DEQ, 2001) also provided for public comment on any risk assessment amendments.

1.2 Notification of Public Comment Period

Printed notices were published in the Bozeman Daily Chronicle and the Livingston Enterprise, daily newspapers, and on DEQ's website. DEQ sent notice of the public comment period and the November 3, 2010 meeting to the approximately 400 people on its mailing list for the Facility, including members of local government. DEQ also provided notice to the Associated Press and other state and local news organizations for media distribution. In addition, DEQ provided a copy of the document to the Park County Environmental Council for its review.

1.3 Explanation of Responsiveness Summary

All comments received during the public comment period on Amendment 2 have been reviewed and considered by DEQ in the decision-making process and are addressed in this Responsiveness Summary. To assist in developing responses, DEQ added its own numbering to comments where appropriate to add clarity. Each specific written comment is stated verbatim. In order to avoid duplication of some responses, similar comments are usually addressed only once for the first occurrence of the comment and thereafter referenced to the appropriate response. All documents cited in DEQ's responses are part of the administrative record that is included in Amendment 2 or as Attachment 3 of the Final Task I Risk Assessment Amendment and Montana Department of Environmental Quality Approved Remedy for Newly Identified Contaminants of Concern in Indoor Air.

As a note for the entire responsiveness summary, the term facility as it is used here is defined in Section 75-10-701(4), Montana Code Annotated (MCA) to include any site or area where hazardous or deleterious substances have come to be located. When DEQ refers to the previously and currently operating railyard and not the entire Facility, it refers to it as "the railyard," not "the Facility." In responding to these comments, DEQ interprets BNSF's use of the terms "onsite" and "offsite" to mean "on the railyard" or "off the railyard," either of which may be part of the Facility if hazardous or deleterious substances have come to be located there.

Nearby Property Owner: A nearby property owner submitted the following articles and reference materials as written comments.

DeBolt, Daniel. *Latest Study Says TCE Worse Than Thought – Conclusions Could Lead EPA to Propose Tougher Regulations*. Mountain View Voice. January 29, 2010.

Colorado Department of Public Health and Environment. *Policy on an Interim Risk Evaluation and Management Approach for TCE.* August 20, 2004.

Siegel, Lenny. *Getting the Fox Out of the Henhouse: Restoring the Integrity of EPA's Process for Determining the Toxicity of Industrial and Military Chemicals.* Testimony by Lenny Siegel, Executive Director Center for Public Environmental Oversight before the Subcommittee on Investigations and Oversight House Committee on Science and Technology. June 12, 2008.

Siegel, Lenny. *[CPEO-BIF] EPA Interim Guidance on TCE and Vapor Intrusion.* March 20, 2009.

Siegel, Lenny. *A Stakeholder's Guide to Vapor Intrusion*. November 2009.

These documents and articles were submitted without any additional text or explanation, although certain sections were underlined, highlighted or otherwise called out. DEQ has reproduced those sections of text here. DEQ will respond to all such sections specifically, and will attempt to respond to all portions of the documents that directly address DEQ's Draft Final Task I Risk Assessment Amendment 2. DEQ will not respond to the portions of the documents that generally address topics related to vapor intrusion, but do not specifically bear on DEQ's proposal to remove vinyl chloride as a contaminant of concern (COC) for residential and commercial property located outside the railyard at the Facility and present new site-specific cleanup levels for tetrachloroethene (PCE) and trichloroethene (TCE) in indoor air for residential and commercial property located outside the railyard at the Facility. However, not commenting on general unrelated vapor intrusion issues should not be construed as DEQ's agreement with any conclusions or descriptions in the documents.

Comment #1: "The recent EPA report does not explicitly propose new standards for drinking water. But it does propose new standards for indoor air levels of TCE vapors, expressed in ranges which allow environmental advocates to call for heightened cleanup efforts. For residential areas, indoor air standards could go from 1 microgram per cubic meter to a range between 0.24 and 0.96 micrograms per cubic meter. Standards for business could go from 5 micrograms per cubic meter to a range between 2.5 and 9.8 micrograms per cubic meter. The difference between the standards for homes and businesses is partly due to the effects TCE has on children, Stralka said." (DeBolt, 2010)

Response: Comment noted. DEQ developed the Interim Task I Risk Assessment Amendment Number 2 in response to this and other comments on Amendment 2. In order to address this and other comments received, DEQ conducted additional research into EPA toxicity values, including contacting the Mr. Stralka of EPA quoted in the highlighted paragraph. In this paragraph, Mr. Stralka was referring to the EPA Toxicological Review of Trichloroethylene dated June 2009 (U.S. EPA, June 2009). DEQ used the toxicological values for TCE provided in this document to develop some of the cleanup levels included in the Interim Task I Risk Assessment Amendment Number 2. Please note that the indoor air standards Mr. Stralka mentioned were based upon a 1×10^{-6} risk and were not based upon cumulative effects of TCE and other contaminants of concern. DEQ developed its site-specific cleanup levels based upon a cumulative 1×10^{-5} risk and cumulative non-cancer risks. The Montana legislature chose this 1×10^{-5} risk level for the Montana Human Health Water Quality Standards (Section 75-5-301, MCA), and based on that level, DEQ has determined that 1×10^{-5} is an appropriate risk level for the indoor air cleanup level. It is also important to note that PCE, not TCE, will drive DEQ's risk management decisions at the Facility since it is more prevalent at concentrations that are within the risk range developed by DEQ in its Interim Task I Risk Assessment Amendment Number 2.

Comment #2: "The key element of the memo is the establishment of an interim action level of For TCE in indoor residential air: 1.2 micrograms per cubic meter (µg/m^3), based upon California EPA's inhalation unit risk value." (Siegel, March 2009)

Response: Comment noted. The toxicity values referenced in this document and used to develop the 1.2 µg/m^3 are the same ones DEQ used to develop the proposed cleanup levels presented in Amendment 2. The difference between the level referenced in Comment 2 and the cleanup level in Amendment 2 is due to the fact that the level of 1.2 µg/m^3 is based upon a 1 x 10^{-6} risk and is not based upon cumulative effects of TCE and other contaminants of concern. DEQ developed its site-specific cleanup levels based upon a cumulative 1 x 10^{-5} risk and cumulative non-cancer risks. DEQ bases its cleanup levels on a 1 x 10^{-5} risk level because the Montana legislature chose this level for the Montana Human Health Water Quality Standards (Section 75-5-301, MCA). Again, it is important to note that PCE, not TCE, will drive DEQ's risk management decisions at the Facility since it is more prevalent at concentrations that are within the risk range developed by DEQ in its Interim Task I Risk Assessment Amendment Number 2. This Comment 2 did not require a revision to the document.

Comment #3: "In the long run, I still argue that homes and other sensitive uses should be mitigated wherever indoor contamination levels caused by vapor intrusion exceeds toxic concentrations in outdoor air, if mitigation is practical. The goal should be to eliminate the exposure, not to find a numerical level that scientists have calculated to be within risk ranges set by policy-makers.

Furthermore, homes, businesses, and schoolrooms that test below the 1.2 µg/m^3 threshold, may still require mitigation, for either of two reasons: 1) Soil gas levels beneath the structures may be high enough to cause vapor intrusion should a crack or hole open up in the slab, floor, or basement wall. Or 2) the building or room may be located among other structures that test high enough to require mitigation. Measurements vary over time, and occupants and property-owners should not be told they do not qualify for a depressurization system when their neighbors on two sides do. " (Siegel, March 2009)

Response: Comment noted. Please see DEQ's previous comment response regarding the 1.2 µg/m^3 level. The ROD and SOW outline when an inhabitable structure must be mitigated. The ROD selected remedy requires all residences and businesses that have indoor air VOC concentrations from subsurface vapor intrusion above site-specific cleanup levels for indoor air to have a protection system (mitigation system) installed at no cost to the owner, unless the VOCs in indoor air are not related to the Facility. In order to remain protective, these systems must be maintained until cleanup levels are continually met without operation of the system. BNSF shall install and maintain a mitigation system at all inhabitable residences and businesses with indoor air levels resulting from VOCs from subsurface vapor intrusion above site-specific cleanup levels for indoor air, at no cost to the owner. DEQ uses a multiple lines of evidence approach in its vapor intrusion decisions that is designed to eliminate exposure to vapors from subsurface sources related to the Facility. As stated in response to previous comments, PCE, not TCE, will drive DEQ's risk management decisions at the Facility. This Comment 3 did not require a revision to the document.

Comment #4: "Our experience with vapor intrusion investigations indicates that no single media data set, whether it be ground water, soil gas, sub-slab gas or indoor air, can be used reliably to fully evaluate the potential for risks from VI above health risk-based levels due to the large number of variables affecting the transport of vapors from the subsurface to indoor air and the confounding influence of indoor sources of common subsurface contaminants. Our investigations have found that spatial and temporal impacts on volatile organic chemical (VOC) concentrations are highly variable. Some of this variability is due to vertical and horizontal differences in subsurface conditions and the differences in structural conditions, such as foundation cracks, and ventilation rates from one building to another.

Variation in weather conditions, such as rainfall and barometric pressure, can also have a significant impact." (Siegel, March 2009)

Response: Comment noted. As stated in previous responses, DEQ uses a multiple lines of evidence approach in its vapor intrusion decisions. This approach is outlined in DEQ's December 2009 Draft Flowchart of DEQ Vapor Intrusion General Decision-Making Process, which is provided in the January 2010 Final Task I Risk Assessment Amendment and Montana Department of Environmental Quality Approved Remedy For Newly Identified Contaminants of Concern in Indoor Air (January 2010 Amendment). The multiple lines of evidence approach is designed to address exposure to vapors above the indoor air cleanup levels from subsurface sources related to the Facility. DEQ requires multiple rounds of sampling for each structure and each round of sampling includes indoor air samples, soil gas samples, outdoor air samples, weather monitoring, evaluation of structural conditions, and a property owner survey. DEQ considers all these factors and any other relevant information in its vapor intrusion decision-making. This Comment 4 did not require a revision to the document.

Comment #5:   **"**In January 2003, EPA scientists convened a public meeting in my community of Mountain View, California to discuss the emerging pathway of vapor intrusion at a number of local TCE cleanup sites. Over 400 people attended. EPA scientists explained that TCE was now considered 5 to 65 times as toxic as previously believed, and they introduced a screening level for TCE in indoor air, .017 micrograms per cubic meter ($\mu g/m^3$), corresponding to a one-in-a-million ("ten to the minus six") excess lifetime cancer risk. In fact, most EPA regions adopted that number as a provisional goal." (Siegel, 2008)

Response: The toxicity value referenced here is not currently used by EPA, nor is it the proposed toxicity value referenced in the Toxicological Review of Trichloroethylene (U.S. EPA, June 2009). EPA no longer stands behind the toxicity value stated in Comment #5. Please refer to previous DEQ responses regarding the 1×10^{-6} risk level and the fact that PCE, not TCE, will drive DEQ's risk management decisions at the Facility. This Comment 5 did not require a revision to the document.

Comment #6: "Back home in Mountain View, EPA adopted an interim action level of 1.0 $\mu g/m^3$ for TCE in indoor air. EPA explained the status of the health standard in its June 2004 *Draft First Five-Year Review Report for the Middlefield-Ellis-Whisman (MEW) Superfund Study Area, Mountain View, California*:

> EPA's ORD [Office of Research and Development] and OSWER [Office of Solid Waste and Emergency Response] have requested additional external peer review of the draft TCE Health Risk Assessment by the National Academy of Sciences. Consequently, review of the toxicity value for TCE may continue for a number of years. In the interim, because of the uncertainties associated with the draft TCE Health Risk Assessment, EPA Region 9 is considering both the draft TCE Health Risk Assessment toxicity values, as well as the California TCE toxicity value (similar to EPA's previously listed TCE toxicity value from 1987), in evaluating potential health risks from exposure, and in making protectiveness determinations." (Siegel, 2008)

Response: The California toxicity value referenced in Comment #6 is that used by the EPA in its Regional Screening Levels. This is the same toxicity value DEQ used in its Amendment 2 and that DEQ used to calculate the high end of the range of TCE cleanup levels included in the Interim Task I Risk

Assessment Amendment Number 2. In addition, please refer to DEQ's previous responses regarding the fact that PCE, not TCE, will drive DEQ's risk management decisions at the Facility.

Comment #7: "Determining whether contamination levels in the soil gas and/or indoor air are high enough to require a response is no simple question. Many regulatory agencies set an action level equal to the concentration believed to trigger an excess lifetime cancer risk of one in a million, or ten-to-the minus-six (10-6). This means that if a million people are exposed to the specified concentration round-the-clock for thirty years (or longer with some agencies), then one additional person is expected to contract cancer as a result of that exposure. As of 2009, the prevailing indoor air action level used by EPA and most states with active vapor intrusion programs for TCE is 1.0 to 1.2 micrograms per cubic meter ($\mu g/m^3$)—equivalent to .2 parts per billion by volume (ppbv). In November 2009, however, U.S. EPA issued a draft Toxicological Review of TCE. If finalized, the new cancer value for TCE would lower the indoor air action level to .25 $\mu g/m^3$ or below. For PCE it is .41 $\mu g/m^3$ (.06 ppbv)." (Siegel, November 2009)

Response: Please refer to previous DEQ responses.

Resource Technologies, Inc. on behalf of the Park County Environmental Council (PCEC)

Comment #8: The subject document was prepared by MDEQ and amends the list of contaminants of concern (COCs) for indoor air in structures located off of the railyard by removing vinyl chloride from the list. MDEQ also conducted a public meeting on November 3, 2010 to explain the amendment. BNSF requested that vinyl chloride and certain petroleum hydrocarbons (including benzene and ethylbenzene) be removed from the list of COCs for indoor air in structures located off of the railyard. MDEQ justified the removal of vinyl chloride from the list of COCs by citing data that shows that "there is not an exceedance of the vinyl chloride cleanup level or screening level in an inhabitable structure that is reproducible and reasonably attributable to vapor intrusion by VOCs migrating from the subsurface." MDEQ did not remove the petroleum hydrocarbons (benzene and ethylbenzene) from the COC list.

Based on the data I've reviewed, the removal of vinyl chloride from the list of indoor air COCs is reasonable and continued inclusion of vinyl chloride on the list cannot be justified for structures off of the railyard. We also agree that MDEQ is justified in keeping the petroleum hydrocarbon compounds on the list.

The removal of vinyl chloride from the list of COCs for indoor air in structures located off of the railyard necessitates recalculating the site-specific cleanup levels that are based on cumulative risk. The cleanup levels for PCE and TCE increase as a result since vinyl chloride is no longer considered to be a contributing risk factor in the calculation. The resulting calculated action levels for PCE and TCE are consistent with established methodology and regulatory constraints. As such, I only have the two following comments to offer:

Response: Comment noted and DEQ appreciates PCEC's input.

Comment #9: Certain language should be changed to remove any potential ambiguity regarding the scope of the amendment. Specifically, as presented in the first paragraph in the Section 1.0, the term "Facility" refers to the BNSF Livingston Shop Complex Facility that includes the railyard as well as the properties outside the railyard. The third paragraph in Section 3.0 removes vinyl chloride as a COC "for the Facility" in the first and last sentences. The intent of this amendment is clearly stated in other sections to address indoor air quality in buildings located outside the railyard. The term "Facility" should be replaced in the third paragraph of Section 3.0 with something like "indoor air in structures located off of the railyard."

Response: DEQ has clarified the language in the Interim Risk Assessment Amendment Number 2.

Comment #10: Continued air monitoring should be offered in structures that have data that exceed the previous action levels but do not exceed the amended action levels. Valid data should be presented showing reproducible results that demonstrate that indoor air concentrations in these structures are not attributable to the Facility or are not reasonably expected to exceed the amended action levels before they are no longer monitored.

Response: In its Interim Risk Assessment Amendment Number 2, DEQ has established a range of cleanup levels for indoor air. In this document, DEQ states that, "For structures with indoor air PCE concentrations between 0.9 $\mu g/m^3$ and 2.2 $\mu g/m^3$ that DEQ determines are reproducible and reasonably attributable to vapor intrusion by VOCs related to the Facility migrating from the subsurface, DEQ will give BNSF the option of either regularly monitoring those structures or installing mitigation systems as described above." This language addresses PCEC's comment.

Kenney/Jenks Consultants on behalf of the BNSF Railway Company (BNSF)

DEQ received comments on Amendment 2 from Kenney/Jenks Consultants on behalf of the BNSF Railway Company (BNSF). These comments were attached to a letter responding to DEQ's comments on BNSF's Task I – 2010 Soil Gas/Indoor Air Data Summary Report. Since BNSF's cover letter does not relate directly to Amendment 2, DEQ has not included them in this Responsiveness Summary. DEQ will respond to BNSF directly regarding the issues BNSF raises in its cover letter. BNSF's comments on Amendment 2 are provided below.

Comment #11: Background - On October 25, 2010, MDEQ issued a letter to BNSF that responds to the "Task I – 2010 Soil Gas/ Indoor Air Data Summary Report" submitted by BNSF in June 2010 and provides a "Draft Final Task I Risk Assessment Amendment Number 2," which represents a modification to the prior risk assessment issued by MDEQ in January 2010. In the Risk Assessment Addendum Number 2, MDEQ agrees to eliminate vinyl chloride (VC) as a residential Contaminant of Concern (COC) for the purpose of vapor intrusion investigations. Accordingly, the applicable cleanup levels for the two remaining indoor air COCs that may pose a carcinogenic risk (i.e., PCE and TCE) have been recalculated by MDEQ to correspond to excess lifetime carcinogenic risks of 0.5E-5 individually and 1.0E-5 in combination. However, MDEQ has further adjusted the applicable indoor air cleanup level for TCE downward to account for the hazard quotient for non-carcinogenic effects. The Risk Assessment Addendum Number 2 presents new indoor air cleanup levels for PCE and TCE of 2.2 $\mu g/m^3$ and 5.0 $\mu g/m^3$, respectively. The indoor air cleanup levels for the other residential and non-residential COCs are understood to remain as specified in the "Final Task I Risk Assessment Amendment" of January 2010.

The MDEQ transmittal letter further responds to the prior comments by BNSF regarding procedures for evaluation of the vapor intrusion pathway. Technical comments regarding the recent MDEQ correspondence and Task I Risk Assessment Addendum Number 2 are summarized below.

Detailed commentary on the prior Task I Risk Assessment documents issued by MDEQ were provided by BNSF in a letter issued on October 23, 2009, and the Task I Soil Gas/ Indoor Air Data Summary Report, issued June 24, 2010. In this current text, we refer to these prior submittals for purpose of efficiency.

Response: DEQ responses to BNSF's comments on the January 2010 Amendment are provided in the Responsiveness Summary (Attachment 2) of said document, and referenced and incorporated herein. DEQ also incorporates its October 25, 2010 comments on the Task I Soil Gas/ Indoor Air Data Summary Report dated June 24, 2010.

Comment #12: Proposed Residential Indoor Air Cleanup Limits for PCE and TCE We agree with the MDEQ decision to eliminate VC as a residential COC for the indoor air pathway for the reasons discussed in the Task I Risk Assessment Amendment Number 2. However, we find that the proposed indoor air cleanup limits for TCE and PCE do not conform to a cumulative excess lifetime carcinogenic risk of 1.0E-5, as specified by MDEQ in the ROD. Specifically, the lifetime cancer risk attributable to TCE at its proposed cleanup level (5 µg/m^3) is 3.8E-6, while the lifetime cancer risk for PCE at its proposed cleanup level (2.2 µg/m^3) is 5.1E-6. Together, the cumulative cancer risk associated with TCE and PCE at their respective MDEQ cleanup levels is 8.9E-6, not 1E-5.

Alternative cleanup values can be applied for TCE and PCE while still achieving the goal of being protective of both non-cancer and cancer risks. The table below shows a range of combinations of TCE and PCE cleanup levels that satisfy both the non-carcinogenic of being protective of both non-cancer and cancer risks. The table below shows a range of combinations of TCE and PCE cleanup levels that satisfy both the non-carcinogenic limit for TCE (TCE < 5 µg/m^3 in indoor air, to achieve hazard quotient < 1) and the cumulative carcinogenic risk limit for PCE and TCE combined (cumulative excess lifetime risk < 1E-5).

TCE Cleanup Level in Indoor Air (µg/m^3)	**PCE Cleanup Level in Indoor Air (µg/m^3)**	**Cumulative Excess Lifetime Cancer Risk**
0	4.4	1E-05
0.5	4.2	1E-05
1	4.1	1E-05
2	3.7	1E-05
3	3.4	1E-05
5	2.7	1E-05

Note that, if the TCE cleanup level is set to the proposed MDEQ level of 5 µg/m^3, then a cancer-risk based cleanup level of 2.7 µg/m^3 for PCE (not 2.2 µg/m^3, as proposed by MDEQ) is calculated to meet the cumulative risk limit of 1E-5. However, beyond this simple correction, we ask MDEQ to use an equally protective and more appropriate combination of the TCE and PCE indoor air cleanup levels. Specifically, TCE rarely, if ever, has been measured in excess of 1 µg/m^3 in indoor air in the residential buildings sampled and tested to date. Consequently, the combination of TCE and PCE indoor air cleanup levels of 1 µg/m^3 and 4.1 µg/m^3, respectively, would better match the observed conditions in the study area and would reduce the potential to trigger possible mitigation actions for residences where such actions would not be necessary to meet the specified criteria for protection of human health; i.e., conditions do not exceed a cumulative risk limit of 1E-5 or applicable hazard quotient of 1.0.

Response: DEQ developed the Interim Task I Risk Assessment Amendment Number 2 in response to comments on Amendment 2. As stated in Amendment 2, DEQ developed the TCE indoor air cleanup level to be protective of non-cancer risks, as well as cancer risks. The non-cancer risk cleanup level number is lower than the cancer risk cleanup level number for TCE, which is why the cumulative cancer risk of TCE and PCE is less than 1 x 10^{-6} risk. As part of the development of the Interim Task I Risk Assessment Amendment Number 2, DEQ conducted additional research into EPA toxicity values, including an evaluation of the EPA Toxicological Reviews of Tetrachloroethylene and Trichloroethylene dated June 2008 and June 2009, respectively (U.S. EPA, June 2008 and U.S. EPA, June 2009). DEQ used the toxicological values for PCE and TCE provided in these documents to develop some of the cleanup levels included in the Interim Task I Risk Assessment Amendment Number 2. As this comment suggests, BNSF is aware that PCE, not TCE, will drive DEQ's risk management decisions at the Facility since it is more prevalent at concentrations that are within relevant risk-based cleanup level ranges. DEQ has evaluated the option of adjusting the PCE cleanup level based upon the reduction of the TCE cleanup level to address non-cancer effects. DEQ determined that at the lower end of the interim cleanup level range, this would have no effect given that DEQ has already adjusted the PCE cleanup level to account for typical indoor air concentrations of PCE in Livingston. Given that the EPA has proposed significantly lowering the toxicity values for PCE, DEQ has determined that no other adjustments are appropriate at this time.

Comment #13: Residential COCs for Indoor Air: Retention of Benzene and Ethylbenzene The Task 1 Risk Assessment Addendum Number 2 deletes VC as a residential COC but retains benzene and ethylbenzene, based upon the assertion that, for both of these compounds, "there is an exceedance of the indoor air screening level and this exceedance is reproducible and reasonably attributable to vapor intrusion…" (MDEQ Letter of October 25, 2010, page 2, Comment 6). Based on the extensive data collected to date, we question the assertion that there is any residential structure where an exceedance of the indoor air cleanup levels for benzene or ethylbenzene is "reasonably attributable to vapor intrusion." As detailed in our prior submittals, the ubiquitous benzene and ethylbenzene vapors in indoor air are clearly unrelated to releases from the rail yard facility, as demonstrated by the following facts:

Response: DEQ notes that BNSF's comments are not directly pertinent to Amendment 2 because Amendment 2 does not address the benzene or ethylbenzene indoor air cleanup levels. However, DEQ will briefly respond to the issues that BNSF raises related to ethylbenzene and benzene. Additionally, BNSF is mainly providing the same comments that it previously submitted on DEQ's January 2010 Amendment. Where appropriate, DEQ will simply reference its prior responses to BNSF comments that are contained in the January 2010 Amendment.

As stated in the SOW and DEQ's January 2010 Amendment, site-specific cleanup levels must be developed for a contaminant in indoor air if DEQ identifies an exceedance of a screening level in an inhabitable structure and the exceedance is reproducible and reasonably attributable to vapor intrusion by VOCs migrating from the subsurface. Ethylbenzene and benzene meet this standard because these contaminants are present in indoor air in certain locations above the screening levels and in higher concentrations beneath these same structures. Also, benzene and ethylbenzene are present in contaminated media at the Facility. Therefore, DEQ must identify these contaminants as COCs for the Facility.

Some of the detected concentrations of all the COCs DEQ has identified meet the criteria provided in the SOW; however, it is clear that some concentrations of the COCs may be the result of other sources. In addition, DEQ uses a weight-of-evidence approach for decision-making related to indoor air contamination. A weight of evidence approach (also known as a multiple lines of evidence approach) generally means that DEQ considers all available evidence—including indoor air concentrations, subslab concentrations (concentrations of contaminants found beneath the slab of structures), soil gas probe data, ambient air concentrations, groundwater data, soil concentrations, and sampling results from nearby buildings—in its decision-making, but DEQ does not rely on any one data set to the exclusion of the other data.

In accordance with the ROD and the SOW, DEQ has considered the data collected during investigations at the between 2005 and 2010, and DEQ has determined that all the COCs identified in the January 2010 Amendment, with the exception of vinyl chloride in non-railyard structures, remain COCs for the Facility (Kennedy/Jenks, 2009d; Kennedy/Jenks, 2009f; Kennedy/Jenks, 2010). The January 2010 Amendment, including the Responsiveness Summary included as Attachment 2, provided DEQ's reasoning and conclusions based on a review and consideration of the data collected through 2008. A consideration of all of the data collected through 2010 does not require a change to DEQ's reasoning and conclusions within the January 2010 Amendment, except for the removal of vinyl chloride as a COC for non-railyard structures at the Facility.

• *Comment # 13(a) Benzene and Ethylbenzene Not Associated with Affected Groundwater Plume Off-Site of Rail Yard:* Within the period of 1992 to the present benzene and ethylbenzene have not been detected in any of the hundreds of groundwater samples collected off the rail yard and within the boundaries of the affected PCE/TCE groundwater plume or in the vicinity of the diesel LNAPL plume. Indeed, the only detection of these petroleum hydrocarbon compounds in groundwater off the rail yard are trace levels (benzene: 0.12 µg/L, toluene: 0.3 µg/L, and xylene: 0.16 µg/L, all j-flagged and still pending data validation) at an irrigation well (Well 18D11) located outside the rail yard plume and unrelated to the rail yard facility. See Table 1.

- **Response to Comment # 13(a):** Please see DEQ's responses to BNSF's comments on DEQ's January 2010 Amendment, including General Comment # 6(a). The data provided by BNSF does not require a change to DEQ's original responses to this same comment. As DEQ has stated previously, it agrees that detected benzene and ethylbenzene concentrations in groundwater located beneath non-railyard property are limited; however, one likely reason for this is that BNSF does not analyze groundwater samples from beneath free petroleum product. Without sampling results from areas containing free petroleum product that support this contention, it is not appropriate to state that benzene and ethylbenzene are not found in the groundwater at the Facility.

• *Comment # 13(b) Diffusion Bag Sampling:* Passive diffusion bag (PDB) sampling conducted at 5 locations in December 2007 and August 2008 (L-87-5, 89-3, 07-8, 07-9, 07-115), and at 1 location in February 2009 and July 2010 (89-3) found no detectable concentrations of benzene or ethylbenzene, confirming that these compounds are not associated with the affected groundwater plume.

- **Response to Comment # 13(b):** Please see DEQ's responses to BNSF's comments on DEQ's January 2010 Amendment, including General Comment # 6(b). BNSF provides no new or additional data or information, and DEQ's responses remain the same.

• *Comment # 13(c) LNAPL Testing*: LNAPL testing conducted within the area of the diesel NAPL plume off the rail yard (EX-19, EX-50) confirms that there is no detectable benzene in the NAPL at either location and only a minor concentration of ethylbenzene (3.1 mg/kg) in 1 of 2 locations.

- **Response to Comment # 13(c):** The detection limits of 1 mg/kg or 1,000 µg/kg for light non-aqueous phase liquid (LNAPL) benzene and ethylbenzene analyses conducted at the Facility are too high to determine conclusively that the compounds are not present at concentrations that could result in vapor intrusion. In fact, the concentration of 3.1 mg/kg or 3,100 µg/kg ethylbenzene in LNAPL referenced in BNSF's comment could represent a source of vapor intrusion. BNSF has not sampled the LNAPL in all the wells located within the plume. Additional LNAPL sampling would likely result in additional detections of these compounds. In fact, BNSF fails to note the concentration of 42 mg/kg or 42,000 µg/kg ethylbenzene found in LNAPL collected from well EX-8 located within the track area at the railyard.

• *Comment # 13(d) No Vapor Migration*: Scientific studies demonstrate that, due the limited diffusion of volatile organics in subsurface soils, affected groundwater poses no risk of vapor intrusion at a distance of 100 feet (or less) from the plume. See BNSF submittal of October 23, 2009.

- **Response to Comment # 13(d):** DEQ agrees that petroleum compound vapors degrade more readily than chlorinated solvents in an aerobic environment such as that found in Livingston. DEQ has never asserted that all of the benzene and ethylbenzene detected in indoor air or subslab samples in Livingston are related to the Facility. However, under the SOW, these compounds require site-specific screening or cleanup levels. The Risk Assessment Amendments are not meant to identify distances from contamination where vapor intrusion is likely, or to identify properties for mitigation. Please refer to DEQ's responses to BNSF's comments on DEQ's January 2010 Amendment, including General Comment # 6(d).

• *Comment # 13(e) No Relation of Off-Site Subsurface Vapor Levels to Rail Yard*: Analysis of soil gas and sub-slab vapor results from the hundreds of sampling locations completed to date show there to be no relationship of benzene and ethylbenzene concentrations with distance from the rail yard property, proving that there is no migration of vapors from the rail yard to off-site locations. See BNSF submittals of October 23, 2009, and June 24, 2010. See also Table 2.

- **Response to Comment # 13(e):** DEQ disagrees with BNSF's assertions regarding Table 2. In fact, BNSF's Table 2 provides information in support of DEQ's assertion that under the SOW, these compounds require site-specific screening or cleanup levels. Table 2 states that benzene and ethylbenzene were detected in the indoor air in 92-100% of the structures, and in the subsurface (both subslab and soil gas) in 57-66% of the structures sampled, which would tend to indicate that at least some of the structures at the Facility have indoor air exceedances attributable to subsurface vapor intrusion. Further, as DEQ has stated previously, including in DEQ's response to BNSF's Comment # 6(a) on DEQ's January 2010 Amendment, DEQ has not included chloroform, 1,2,4-trimethylbenzene, or 1,3,5-trimethylbenzene COCs for non-railyard properties. Again as stated many times in the administrative record, commercial/industrial cleanup levels apply only to railyard buildings. Also, please refer to DEQ's responses to BNSF's comments on DEQ's January 2010 Amendment, including General Comment # 6(e). BNSF has provided no information or data that requires a change to DEQ's original responses to this same comment.

• *Comment # 13(f) No Relation between Soil or Subslab Gas and Indoor Air*: An analysis of the concentration of benzene in soil gas, subslab gas and indoor air shows there is no correlation indicating vapor intrusion of benzene. The same is true of ethylbenzene concentrations in soil gas, subslab gas and indoor air. See BNSF submittal of October 23, 2009.

- **Response to Comment # 13(f):** Please refer to DEQ's responses to BNSF's Comments on DEQ's January 2010 Amendment, including DEQ's responses to General Comment # 6. BNSF provides no new or additional data or information, and DEQ's response to this comment remains the same.

• *Comment # 13(g) Background Indoor Air Levels*: The benzene and ethylbenzene concentrations measured in indoor air at residential locations are generally consistent with background levels of these compounds reported in indoor air quality surveys throughout the country, including surveys in Montana. See BNSF submittal of October 23, 2009.

- **Response to Comment # 13(g):** Please see DEQ's response to BNSF's comments on DEQ's January 2010 Amendment, including General Comment #2. BNSF provides no new or additional data or information, and DEQ's response to this same comment remains the same. As stated in DEQ's previous response, DEQ developed the benzene and ethylbenzene indoor air cleanup levels based upon typical indoor air concentrations found in Livingston where no compounds were detected in soil gas beneath the structures. The cleanup levels calculated based upon the upper prediction limit of these concentrations are 2.2 μgm^3 benzene and 2.3 μgm^3 ethylbenzene. These concentrations are at the lowest end of the range of background concentrations reported by EPA based upon EPA's database. The concentrations found in Livingston are similar to those found elsewhere in Montana. DEQ does not agree that the range of background concentrations found across the country is comparable to that found in Livingston. Indoor air in Livingston does not typically contain concentrations as high as those included in EPA's database.

• *Comment # 13(h) Higher Frequency of Detection in Indoor Air than Subsurface*: For the period of 1988 through 2010 the frequency of detection in indoor air is far greater than in either soil gas or sub-slab vapors, demonstrating the presence of indoor sources.

Compound	Frequency of Detection in Residential Indoor Air	Frequency of Detection in Residential Sub-Slab Vapor	Frequency of Detection in Soil Gas on Rail Yard	Frequency of Detection in Soil Gas off Rail Yard
Benzene	99%	66%	36%	70%
Ethylbenzene	92%	58%	24%	34%

Note: Percent detection calculated as number of detections divided by number of samples analyzed for each compound for the time period of 1988 through 2010.

- **Response to Comment # 13(h):** Please see DEQ's response to BNSF's comments on DEQ's January 2010 Amendment, including General Comment # 6(c). The data that BNSF provides regarding frequency of detection of these contaminants in indoor air versus detections in the subsurface is not relevant to the SOW requirements and does not require a change to DEQ's prior response to this same comment. Under the SOW, site-specific cleanup levels must be developed for a contaminant in indoor air if DEQ identifies an exceedance of a screening level in an inhabitable structure and the exceedance is reproducible and reasonably attributable to vapor intrusion by VOCs migrating from the subsurface. Ethylbenzene and benzene meet this standard because these contaminants are present in indoor air in certain locations above the screening levels and in higher concentrations beneath these same structures.

  • *Comment # 13(i) Indoor Sources of Benzene and Ethylbenzene*: Household products that are known sources of benzene and ethylbenzene vapors have been identified in many, if not all, of the residential properties in which indoor air sampling has been conducted to date. See BNSF submittals of October 23, 2009, and June 24, 2010.

- **Response to Comment # 13(i):** DEQ agrees that there are many indoor sources of benzene and ethylbenzene in household products. As stated above, this comment is not directly related to Amendment 2. To address the presence of secondary indoor air sources, DEQ uses multiple lines of evidence when evaluating vapor intrusion. At the Facility, Occupied Dwelling Questionnaires are provided to and completed by property owners where indoor air samples are collected. These questionnaires are designed to identify secondary indoor sources of contaminants. BNSF's contractor helps property owners fill out these questionnaires as a measure of ensuring the accuracy of these questionnaires. DEQ will continue to consider these questionnaires when determining whether vapor intrusion is occurring. While benzene and ethylbenzene are detected in many residential structures near the railyard, the detections are not as frequently above DEQ's cleanup levels. That is because DEQ's cleanup levels account for typical benzene and ethylbenzene concentrations in indoor air that is not impacted by vapor intrusion. Please refer to DEQ's responses to BNSF's comments on DEQ's January 2010 Amendment.

Comment # 13 Conclusion: The MDEQ letter of October 25, 2010, suggests that BNSF does not cite to particular data in support of these assertions. To the contrary, we have based our findings on the thousands of measurements of groundwater, soil gas, sub-slab vapor, and indoor air conducted to date for this investigation, all of which have previously been submitted to MDEQ. If helpful to MDEQ, we are prepared to once again point to the specific data that demonstrate that benzene and ethylbenzene in indoor air at residential locations is not associated with releases on the rail yard property. These compounds should not be included as residential COCs.

Response to Comment # 13 Conclusion: BNSF's June 24, 2010 submittal stated that specific indoor sources of these petroleum hydrocarbons "were routinely measured in residential and commercial structures, and the level of petroleum hydrocarbons measured in indoor air from these indoor source was significant relative to DEQ's cleanup levels." BNSF has never submitted data specific to indoor sources of petroleum hydrocarbons. If BNSF is referring to indoor air sample concentrations, DEQ has reviewed that information and made determinations that indoor sources were contributing to air concentration where appropriate. As stated above, DEQ has also considered property owner questionnaire information in which indoor sources may be identified. However, neither of these is the same as collecting sample data directly from an indoor source, which BNSF's statement implies that it has done. If BNSF has collected this data, it has not provided it to DEQ. Moreover, this type of data would only provide one additional line of evidence that could be used for vapor intrusion decision-making. The fact that indoor sources are present in a structure does not preclude the fact that vapor intrusion may also be occurring. DEQ has and will continue to consider all relevant lines of evidence in its decision-making regarding all the COCs for indoor air at the Facility.

Comment #14: Commercial/Industrial COCs for Indoor Air In prior comments, BNSF has recommended that compounds other than PCE and TCE are inappropriate for designation as indoor air COCs for commercial/ industrial properties, specifically for the railyard property. See BNSF submittals of October 23, 2009, and June 24, 2010. In the recent Risk Assessment Addendum Number 2, MDEQ has made no change in the commercial/ industrial COC list, which currently includes benzene, ethylbenzene, VC, chloroform, 1,2,4-trimethylbenzene (TMB), and 1,3,5-TMB, in addition to PCE and TCE. The MDEQ letter of October 25, 2010, indicates that, because no soil gas samples were analyzed on the rail yard in 2010, MDEQ has not considered this issue at this time. We wish to respond to MDEQ by noting, first, that soil gas data were collected from the soil vapor extraction (SVE) system on the rail yard in 2010 and, secondly, irrespective of additional data collection in 2010, the hundreds of groundwater and soil gas samples collected and analyzed on the rail yard property prior to 2010 are sufficient to demonstrate that only PCE and TCE are significant with regard to vapor intrusion on the rail yard property.

In this regard, designation of benzene, ethylbenzene, VC and chloroform as commercial/industrial COCs is particularly problematic, as the inclusion of these compounds in the calculation of a cumulative excess lifetime carcinogenic risk limit (i.e., 1E-5) significantly and unnecessarily reduces the allowable cleanup levels for actual COCs, PCE and TCE. In the current submittal, we ask that MDEQ consider the following facts which demonstrate that VC and chloroform are not associated with the affected groundwater plume and cannot reasonably be attributed to vapor intrusion to indoor air:

- *Groundwater Plume Characteristics*: PCE and TCE are characteristic of the onsite affected groundwater zone, being detected in 83% and 72%, respectively, of the groundwater samples collected and analyzed to date for these compounds on the rail yard property. In contrast, the chloroform and VC are detected in relatively few groundwater samples collected from monitoring points on the rail yard (chloroform: 25 of 1450 samples analyzed, i.e., 2%; and VC: 112 of 1450 samples analyzed; i.e., 9%). Furthermore, chloroform has never been detected in groundwater at levels in excess of the applicable drinking water limit in groundwater monitoring conducted since 1987. Chloroform is known to be associated with water purification and can be present in groundwater, soil vapor or indoor air due to tap water releases.

- *Diffusion Bag Samples*: Passive diffusion bag (PDB) sampling conducted at 5 locations in December 2007 and August 2008 (L-87-5, 89-3, 07-8, 07-9, 07-115), and at 1 location in February

2009 and July 2010 (89-3) found no detectable concentrations of VC or chloroform, confirming that these compounds are not associated with the affected groundwater plume.

• *Detections in Indoor Air and Subsurface Vapors*: VC has never been detected in any of the 315 subslab vapor or soil gas samples collected and analyzed for vinyl chloride to date on the rail yard property. In indoor air on the rail yard, VC has never been detected in excess of the proposed MDEQ cleanup limit among 33 indoor air samples analyzed to date. Chloroform has been found to exceed the proposed indoor cleanup level in only 1 of 27 the indoor samples collected and analyzed for chloroform to date on the rail yard facility.

• *SVE Vapor Analyses*: In 2010, analysis of the soil vapors extracted from the subsurface by the Soil Vapor Extraction (SVE) system on the rail yard property found no detectable concentrations of chloroform or VC in the influent vapor to the SVE treatment system, and only trace levels of VC (i.e., 0.056 $\mu g/m^3$ to 0.27 $\mu g/m^3$) in the mid-point samples collected between the two carbon absorption units. By comparison, PCE and TCE have both been detected in all influent SVE samples at concentrations ranging from 3100 to 23,000 $\mu g/m^3$ for PCE and 130 to 680 $\mu g/m^3$ for TCE.

The additional soil vapor analyses conducted in 2010 are consistent with the prior findings and support the conclusion that VC and chloroform are not associated with the affected groundwater zone or reasonably attributable to vapor intrusion and therefore should not be retained as COCs for the commercial/ industrial buildings on the rail yard property. Again, if helpful to MDEQ, we are prepared to again point to the specific data that support these findings.

Response: DEQ notes that this comment is not directly relevant to Amendment 2, because Amendment 2 did not address any commercial indoor air cleanup levels. However, in response to this comment and in order to address issues related to current and future railyard building usage, DEQ will require that BNSF resample the railyard building previously sampled with the exception of the Recreation Center. DEQ requires that these buildings be heated for at least two weeks prior to sampling to simulate conditions that may exist when the buildings are in use. DEQ recognizes that the Locomotive Shop is already in use; however any unheated areas of the building that are not currently in use that would be heated if they were in use must be heated. DEQ will provide specific sampling requirements in its cover letter to BNSF. Once these additional sample data are available, DEQ will agree to re-evaluate the list of COCs and the cleanup levels for the commercial/industrial railyard buildings, as appropriate. Because this sampling and re-evaluation of the COCs should be adequate to respond to Comment #14, DEQ will not address each individual point raised in the comment.

Comment #15: Significance of Indoor Air Cleanup Levels The MDEQ Task I Risk Assessment Addendum Number 2 implies a degree of certainty in the toxicity information used in calculating the cleanup levels that is not warranted. After reading the Draft Addendum, we are concerned that members of the general public may erroneously conclude that air concentrations of the chemicals of concern that exceed the cleanup levels will be associated with known health effects in humans. This is not the case. The MDEQ relies on toxicity information supplied by USEPA in its Integrated Risk Information System (also called "IRIS") to calculate cleanup levels. The USEPA states:

> *In general IRIS values cannot be validly used to accurately predict the incidence of human disease or the type of effects that chemical exposures have on humans. This is due to the numerous uncertainties involved in risk assessment, including those associated with extrapolations from animal data to humans and from high experimental doses to lower environmental exposures. The organs affected and the type of adverse effect resulting from chemical exposure may differ between study animals and humans. In addition, many factors besides exposure to a*

chemical influence the occurrence and extent of human disease. (accessed at http://www.epa.gov/iris/limits.htm on November 15, 2010)

Due to the limitations identified by USEPA, the cleanup levels calculated by MDEQ cannot be used to predict the incidence or types of health effects in humans.

Response: Comment noted. DEQ used the most reliable and appropriate toxicity data available to develop indoor air cleanup levels in Amendment 2, and subsequently in the Interim Task I Risk Assessment Amendment Number 2. DEQ then uses these indoor air cleanup levels to make decisions regarding the protection of human health, including whether to require mitigation or resampling at an inhabitable structure, or whether a certain structure requires no further action.

TABLES 1 & 2 SUBMITTED BY BNSF RAILWAY COMPANY:

TABLE 1
Frequency of Detection of COCs in On-Site and Off-Site Groundwater Samples: VOCs Identififed by MDEQ as Constiteunts of Concern for Indoor Air

BNSF Livingston Rail Yard & Shops Complex, Livingston, MT

		On-Site Groundwater Samples			***Off-Site Groundwater Samples***		
Constituent of Concern (COC)	**Sample Medium**	**No. of Samples Tested**	**No. of Detections**	**% Detected**	**No. of Samples Tested**	**No. of Detections**	**% Detected**
Tetrachloroethene (PCE)	GW	1450	1198	83%	967	557	58%
Trichloroethene (TCE)	GW	1450	1048	72%	967	201	21%
Vinyl Chloride	GW	1450	112	8%	967	3	0.3%
Benzene	GW	1021	18	2%	713	1	0.1%
Ethyl Benzene	GW	1021	42	4%	713	0	0%
Chloroform *	GW	1450	25	2%	967	11	1%
1,2,4-Trimethylbenzne *	GW	426	29	7%	344	0	0%
1,3,5-Trimethylbenzne *	GW	426	11	3%	348	0	0%

Note:
1) * COC identified for Commercial/ Industrial exposure scenraio only
2) Results for samples collected July 1987 to July 2010

TABLE 2
Frequency of Detection of COCs in On-Site and Off-Site Indoor Air, Sub-Slab Vapor, & Soil Gas Samples
VOCs Identififed by MDEQ as Constiteunts of Concern for Indoor Air

BNSF Livingston Rail Yard & Shops Complex, Livingston, MT

		On-Site Vapor Samples			*Off-Site Vapor Samples*		
Constituent of Concern (COC)	**Sample Medium**	**No. of Samples Tested**	**No. of Detections**	**% Detected**	**No. of Samples Tested**	**No. of Detections**	**% Detected**
Tetrachloroethene (PCE)	Indoor Air	33	32	97%	687	555	81%
Tetrachloroethene (PCE)	Subslab/Soil Gas Vapor	76	75	99%	455	359	79%
Tetrachloroethene (PCE)	Soil Gas	256	177	69%	128	103	80%
Trichloroethene (TCE)	Indoor Air	33	31	94%	602	389	65%
Trichloroethene (TCE)	Subslab/Soil Gas Vapor	76	67	88%	455	128	28%
Trichloroethene (TCE)	Soil Gas	256	105	41%	128	33	26%
Vinyl Chloride	Indoor Air	33	17	52%	528	60	11%
Vinyl Chloride	Subslab/Soil Gas Vapor	74	0	0%	391	3	1%
Vinyl Chloride	Soil Gas	241	0	0%	128	0	0%
Benzene	Indoor Air	30	30	100%	472	467	99%
Benzene	Subslab/Soil Gas Vapor	76	43	57%	453	297	66%
Benzene	Soil Gas	208	74	36%	122	85	70%
Ethyl Benzene	Indoor Air	30	30	100%	486	446	92%
Ethyl Benzene	Subslab/Soil Gas Vapor	76	49	64%	453	263	58%
Ethyl Benzene	Soil Gas	208	50	24%	122	42	34%
Chloroform *	Indoor Air	27	7	26%	241	66	27%
Chloroform *	Subslab/Soil Gas Vapor	72	19	26%	283	154	54%
Chloroform *	Soil Gas	82	15	18%	44	8	18%
1,2,4-Trimethylbenzne *	Indoor Air	27	25	93%	241	160	66%
1,2,4-Trimethylbenzne *	Subslab/Soil Gas Vapor	72	52	72%	283	245	87%
1,2,4-Trimethylbenzne *	Soil Gas	82	57	70%	44	41	93%
1,3,5-Trimethylbenzne *	Indoor Air	27	25	93%	241	125	52%
1,3,5-Trimethylbenzne *	Subslab/Soil Gas Vapor	72	42	58%	283	201	71%
1,3,5-Trimethylbenzne *	Soil Gas	82	12	15%	44	16	36%

Note:
1) * COC identified for Commercial/ Industrial exposure scenraio only
2) Results for samples collected 1988 to April 2010