

**INSERT TO ADDENDUM No. 2 to FINAL TASK I SUPPLEMENTAL  
INVESTIGATION  
WORK PLAN FOR INDOOR AIR**

**Burlington Northern Livingston Shop Complex  
Livingston, Montana**

**February 2010**

**Montana Department of Environmental Quality**

## INTRODUCTION

The specifications in this Insert clarify or supersede any conflicting specifications provided in the previously approved Final Task I Supplemental Investigation Work Plan for Indoor Air and Addendums No. 1 and 2 to it. Each section of this Insert describes a topic requiring a change or clarification. DEQ has made the following determinations based on its scientific and technical expertise and the information currently available for the Facility and vapor intrusion. However, DEQ reserves the right to require additional changes in the future if necessary to be protective, and in compliance with the Comprehensive Environmental Cleanup and Responsibility Act (CECRA), the 2001 Record and Decision and the August 2005 Statement of Work for Spring 2005 Activities (SOW).

### SITE-SPECIFIC CLEANUP LEVELS

All screening levels provided in the previous work plan and addenda as well as those included in the SOW have now been replaced with the site-specific cleanup levels 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 (Risk Assessment Amendment). These cleanup levels are provided below. As outlined in the Risk Assessment Amendment, these cleanup levels consider and incorporate Livingston-specific background levels of these contaminants, as appropriate.

<b>Residential COCs</b>	<b>Cleanup Levels (<math>\mu\text{g}/\text{m}^3</math>)</b>
Tetrachloroethene	1.46
Trichloroethene	4.3
Vinyl Chloride	0.77
Benzene	2.2
Ethylbenzene	2.3
<b>Commercial/Industrial COCs<sup>1</sup></b>	<b>Cleanup Levels (<math>\mu\text{g}/\text{m}^3</math>)</b>
Tetrachloroethene	3.1
Trichloroethene	9.1
Vinyl Chloride	4.2
Benzene	2.3
Ethylbenzene	7.3

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<sup>1</sup> The SOW requires BNSF to use residential cleanup levels on non-rail yard structures. (SOW, Attachment 2, Section B). BNSF will only be allowed to employ commercial/industrial cleanup levels for railyard structures if BNSF places DEQ-approved institutional controls on the rail yard that limit future use to industrial/commercial. (SOW, Attachment 2, Section B). If BNSF does not place institutional controls on the railyard, BNSF will be required to meet residential cleanup levels for all indoor air contaminants found in the railyard structures. (SOW, Attachment 2, Section B).

Chloroform	0.80
1,3,5-Trimethylbenzene	26
1,2,4-Trimethylbenzene	10

As provided in the SOW that BNSF agreed to follow, the residential site-specific cleanup levels apply uniformly to all residential and commercial/industrial structures with screening level exceedances due to subsurface vapor intrusion not located on the railyard. DEQ and BNSF agreed in the SOW that the commercial/industrial site-specific cleanup levels apply only to commercial/industrial structures located on the railyard.

### **FLUX CHAMBER SAMPLING**

DEQ has determined that flux chamber sampling is a screening tool with limited utility. DEQ will no longer allow flux chamber sampling for future investigation at this Facility.

### **SUBSLAB OR SOIL GAS SAMPLING**

DEQ has determined that the level of a COC in the subslab or soil gas underneath a structure provides a useful line of evidence in determining whether subsurface vapor intrusion is occurring at a structure. DEQ requires that subslab or soil gas samples be collected wherever possible, regardless of whether a crawlspace sample is collected. Examples of situations where it may not be possible to collect these samples include extremely narrow crawlspaces with limited access, slabs with radiant heat, or where access for this type of sampling is denied.

### **BASEMENT OR CRAWLSPACE SAMPLING**

DEQ has determined that a comparison of the levels of a COC in the various levels of a structure provides a useful line of evidence in determining whether subsurface vapor intrusion is occurring at a structure. In order to conduct vapor intrusion pathway analysis, DEQ requires that the lowest level of all inhabitable structures be sampled, regardless of whether the lowest level is currently inhabited.

BNSF's contractors and DEQ developed a crawlspace sampling protocol during the Task I investigations conducted in 2007, 2008 and 2009. The following is a brief description of this protocol. The crawlspace is vented as little as possible. A small opening is found and the probe with adequate tubing attached is placed in an 8-foot-long hollow three-sided metal rod. The probe is extended as far as possible toward the middle of the structure. The sample is then collected in the same manner as subslab or soil gas samples.

If both a crawlspace and a basement are present, a subslab or soil gas sample and a basement indoor air sample are preferred. If a subslab or soil gas sample cannot be obtained, a basement indoor air sample and a crawlspace sample may be collected.

## RADON-222 SAMPLING

Based on the available information, DEQ has determined that it will not allow the use of radon attenuation factors to determine whether vapor intrusion of contaminants of concern is occurring in structures at this Facility. As DEQ has previously stated, it has determined that radon attenuation data do not provide reliable, useful information in Livingston to predict how much tetrachloroethene (PCE), the primary contaminant of concern, would be expected to be present in indoor air from vapor intrusion. Upon review of BNSF's May 9, 2006 Technical Memorandum conveying the Analytical Results for Soil Gas, Flux Chamber, and Indoor Air Samples Collected 5 April 2006 to 8 April 2006, DEQ noted that the radon concentrations found in samples collected in 2006 were extremely variable. In order to predict vapor intrusion, radon concentrations should be uniformly distributed. Uniform production of radon is not what exists in Livingston. The radon attenuation factors BNSF calculated for Livingston in this Technical Memorandum and in BNSF's Draft Task I Supplemental Investigation Report range over three orders of magnitude. DEQ also determined that in order to use radon as a tracer, a spatial analysis, paired with lithological analysis of the soil type, including porosity and moisture content, must be conducted. BNSF has not done this analysis. For these reasons, DEQ determined that the use of radon as a tracer is not appropriate and DEQ did not include this analysis in the approved 2007 Addendum No. 2 to Final Task I Supplemental Investigation Work Plan for Indoor Air.

In addition, DEQ questions the utility of radon for this purpose at any facility. ITRC Vapor Intrusion Guidance from January 2007 states that "naturally occurring compounds (e.g., Rn-222) can be used **in some cases**" (emphasis added) but cautions that "the method assumes that the tracer and subsurface contaminants move into the building at the same rate." Analyses conducted by DEQ show that no such correlation exists. References previously provided by BNSF provide significant reasons for not applying radon data in the manner suggested by BNSF.

One study referenced by BNSF contains conclusions that are seriously flawed in that they are based upon average radon attenuation factors when the ranges for the 6 buildings sampled were incredibly variable. (McHugh, TE., Hammond, D.E., Nickels, T and Hartman, B. 2008. "Use of Radon Measurements for Evaluation of Volatile Organic Compound (VOC) Vapor Intrusion." Environmental Forensics (The Association for Environmental Health and Sciences, AEHS, and International Society of Environmental Forensics, ISEF.) 9:1, 107-114). One home sampled is represented as having a range of radon concentrations in the subslab of 14 to 122 pCi/L, with a range indoors of 0.4 to 0.8 pCi/L. Another building had a range of concentrations in the subslab from 261 to 1,143 pCi/L with a range indoors of 0.7 to 0.9 pCi/L. These data show that subslab radon concentrations varied as much as 82% between samples within a particular structure. The range of attenuation factors for these two structures would be 0.0006 to 0.06. It would not even be possible to predict the radon concentration in one area of these buildings using the attenuation factor from another area, much less any VOC concentration, and any prediction one might make could be incorrect by orders of magnitude and therefore significantly unprotective.

BNSF has also previously referenced the Assessment of Vapor Intrusion in Homes Near the Raymark Superfund Site Using Basement and Sub-Slab Air Samples by the US Environmental Protection Agency. (U.S. Environmental Protection Agency (U.S. EPA). 2006a. Assessment of

Vapor Intrusion Near the Raymark Superfund Site Using Basement and Sub-Slab Air Samples, EPA/66/R-05/147 (March 2006)). This document states, "...when basement/sub-slab air concentration ratios were compared for radon and indicator VOCs, a statistical non-equivalency occurred at three out of four locations evaluated." Statistical tests and even visual dissimilarity between the two sets of data were noted in the study. The study concluded that "Further research is needed at other sites containing indicator VOCs to determine the usefulness of radon in assessing vapor intrusion." No such indicator compounds exist in Livingston.

This Insert is meant to clearly state that radon analyses will NOT be used in DEQ's decision-making at this Facility. If BNSF continues to conduct this unnecessary sampling, DEQ requires that any Summa canisters used to collect samples for both VOCs and radon be analyzed for VOCs first before any radon analysis to ensure the integrity of the VOCs samples.

### **MULTIPLE LINES OF EVIDENCE IN LIEU OF ATTENUATION FACTOR**

DEQ has determined that the use of empirical data is a better approach than relying upon a generic attenuation factor that has not been shown to be supported by the site-specific data at the Facility. DEQ does not approve of the use of generic attenuation factors applied to subslab or soil gas samples for vapor intrusion decision-making at the Facility. Generic attenuation factor may be a useful tool for screening in some situations. However, empirical data must be considered. Empirical data from Livingston indicates that using this attenuation factor for final decision-making is not appropriate. (Kennedy/Jenks Consultants. 2009. Data provided via Livshare website, the website that Kennedy/Jenks has established to provide data to DEQ and provided. 2009). One important fact, in particular, is that DEQ has found that most of the homes in Livingston do not have complete slabs. This attenuation factor, if applicable at all, would only apply to structures with full slabs. Therefore, DEQ does not approve of the use of the previously-approved 0.02 attenuation factor for any analysis at this Facility. Instead DEQ uses a multiple lines of evidence approach in vapor intrusion decision-making. This process is generally depicted in the attached December 2009 Draft Flowchart of DEQ Vapor Intrusion General Decision-Making Process.

### **ADDITIONAL SAMPLING REQUIREMENTS**

DEQ has determined that fixed gas concentrations in subsurface samples are a useful line of evidence in determining subsurface vapor intrusion. DEQ requires that subsurface samples be analyzed for fixed gases. This data may be collected using field instruments and must be reported along with the other data for the investigation.