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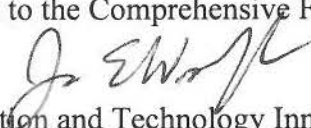
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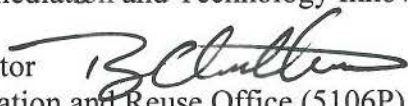
OFFICE OF
SOLID WASTE AND
EMERGENCY RESPONSE

OSWER Directive 9200.2-84

MEMORANDUM

SUBJECT: Transmittal of OSWER Directive 9200.2-84, "Assessing Protectiveness at Sites for Vapor Intrusion. Supplement to the Comprehensive Five-Year Review Guidance"

FROM: James E. Woolford, Director 
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TO: Superfund National Policy Managers, Regions 1-10

This memorandum transmits OSWER Directive 9200.2-84, entitled "Assessing Protectiveness at Sites for Vapor Intrusion. Supplement to the Comprehensive Five-Year Review Guidance."

This supplemental guidance provides recommendations for conducting five-year reviews for the vapor intrusion component of remedies in a manner similar to the review of engineering or other remedy components. This document is designed primarily for U.S. Environmental Protection Agency Remedial Project Managers.

If you have any questions, please contact David Cooper at (703) 603-8763 (cooper.davide@epa.gov) or have your staff contact Howard Fribush at (703) 603-8831 (fribush.howard@epa.gov).

Attachments

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Assessing Protectiveness at Sites for Vapor Intrusion
Supplement to the “Comprehensive Five-Year Review Guidance”

OSWER Directive 9200.2-84

Purpose

The purpose of this supplemental guidance is to provide recommendations for assessing the protectiveness of a remedy for vapor intrusion at private and federal facility Superfund sites during the five-year review process described in the *Comprehensive Five-Year Review Guidance* (EPA, 2001). It also provides recommendations for assessing protectiveness at sites where a vapor intrusion remedy has not been implemented and: 1) the vapor intrusion pathway was never adequately characterized; or 2) changes in site conditions since the last five-year review have potentially led to a complete vapor intrusion pathway.

Scope

This supplemental guidance¹ provides a recommended approach for assessing protectiveness associated with the vapor intrusion pathway and remedies. EPA plans to issue additional guidance on how to test for vapor intrusion and evaluate appropriate courses of action to address vapor intrusion exposure. Additionally, a site may have other contaminated media or exposure pathways to assess during the five-year review process. Regions should consult the *Comprehensive Five-Year Review Guidance* and other supplemental five-year review guidance for information specific to these media exposures and remedies prior to making a protectiveness determination for the site.

Overview

What Is Vapor Intrusion? For purposes of this supplemental guidance, vapor intrusion is the general term given to migration of hazardous vapors from any subsurface contaminant source, such as contaminated soil or groundwater, through the vadose zone and into the indoor air, usually of overlying buildings through openings in the building foundation (e.g., through cracks in the slab, gaps around utility lines, or elevator shafts). Contaminants that may result in vapor intrusion include volatile organic compounds (VOCs) and other vapor-forming chemicals, such as some semivolatile organic compounds, elemental mercury, and radionuclides. VOCs typically pose the most common vapor intrusion concerns.

For purposes of this guidance, having a complete vapor intrusion pathway means that humans are exposed to vapors originating from site contamination. For CERCLA sites determined to have a complete pathway, the site typically is evaluated to determine whether the pathway poses a potential risk to human health. Typically at sites where this risk is found to exist, remedial action objectives (RAOs) are established for the vapor intrusion pathway, and a remedy is selected to address it, consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and EPA Superfund guidance.

¹ This document does not substitute for statutes that EPA administers or their implementing regulations, nor is it a regulation itself. Thus, it does not impose legally binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation based upon the specific circumstances. Risk management issues should be evaluated by the site manager, with input from the site-specific teams, stakeholders, regional management, and legal staff, as appropriate. This document may be modified in the future.

Vapor migration from the subsurface to indoor air often is influenced by many variables, including the geology and hydrogeology of the site, building characteristics, and seasonal changes. A key concept of vapor intrusion normally is that the vapor concentrations attenuate (decrease) as the vapors migrate away from the contaminant source. The attenuation typically occurs as a result of the processes that control vapor migration in soil (e.g., diffusion, advection, sorption, and in some cases, degradation), coupled with the dilution that occurs when the vapors enter a building and mix with indoor air.

Due to these many variables, EPA currently recommends the use of multiple lines of evidence to adequately evaluate the vapor intrusion pathway and the associated potential risks to human health.² For example, it is recommended that all available data (e.g., analytical results, building type, and ventilation rates) be used in determining whether vapor intrusion is occurring and whether potential health concerns may exist as a result (ITRC 2007). Also, it is generally agreed that the use of a single data set (e.g., one sampling event, limited sampling options) to evaluate the vapor intrusion pathway is typically inadequate to support site decision making (EPA 2008). Further, the development of a conceptual site model can provide an understanding of the site setting, contaminant properties, and potential exposure pathways.

Purpose of the Five-Year Review. In general, a five-year review evaluates the implementation and performance of an overall site remedy in order to determine if the remedy is or will be protective of human health and the environment. Protectiveness is generally described in the NCP by reference to the cancer risk range and non-cancer hazard index. Evaluation of the remedy and the determination of protectiveness should be based on, and sufficiently supported by, data and observations included in the Administrative Record for the site.

The *Comprehensive Five-Year Review Guidance* addresses sites at which a remedy has been selected and/or implemented. For sites at which a vapor intrusion remedy has not been selected or implemented, but new information raises the potential for a complete vapor intrusion pathway, the five-year review process may offer an appropriate opportunity to identify issues, review data, make recommendations, and develop a protectiveness determination for vapor intrusion.

Establishing a Five-Year Review Site Team. Vapor intrusion remedy performance data, environmental data, and/or other relevant information should be assessed by the appropriate technical experts in the region. For some five-year reviews, a multi-disciplinary team is an effective way to adequately review data and evaluate the protectiveness of the vapor intrusion remedy.

Key Concepts for Incorporating Vapor Intrusion into the Five-Year Review

As discussed in the *Comprehensive Five-Year Review Guidance*, data for a review may be collected through document reviews, interviews, a site inspection, and supplemental sampling. If decision documents have identified the vapor intrusion pathway as a risk to human health at a site, the data collected should help assess whether the portion of the remedy that was designed to address the vapor intrusion pathway is operating as intended and is still ensuring protectiveness of human health.

It is possible that the vapor intrusion pathway was *not* considered at the time site-related decision documents were issued or that new site information (discovered since the decision documents were

² EPA's previously recommended approach to assessing the vapor intrusion pathway is documented in *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (EPA, 2002). This document recommended a tiered approach to assess the vapor intrusion pathway.

issued) suggests that vapor intrusion is now a potential pathway of concern at a site. At sites where a complete vapor intrusion pathway is suspected, the five-year review site team may consider whether there is adequate, appropriate data to evaluate the pathway prior to commencing the five-year review. If no or inadequate data are available, the five-year review document can make recommendations for gathering appropriate data relevant to potential vapor intrusion. Where there is adequate, appropriate data to evaluate the vapor intrusion pathway prior to commencing the five-year review, the Region may be able to minimize the need to defer a protectiveness determination if vapor intrusion is determined to be an issue.

Site Characteristics and Data. Vapor migration from the source to indoor air may be influenced by a number of factors, including hydrogeology, anthropogenic conditions, outdoor air contaminants, preferential pathways (e.g., utility lines), characteristics of individual buildings that may affect the degree vapors enter from the subsurface (e.g., building foundation and ventilation conditions), and/or seasonal and meteorological influences. By considering these factors early, EPA can minimize the likelihood of deferring a protectiveness determination due to insufficient information to evaluate whether vapor intrusion is an issue.

Factors that influence vapor migration	Geology and hydrogeology Anthropogenic conditions Outdoor air contaminants Preferential pathways (e.g., utility lines) Characteristics of individual buildings (e.g., foundation, ventilation) Seasonal and meteorological influences
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The Region typically should review the site characteristics and other available information as part of the preliminary technical assessment to determine whether adequate data exist to identify an actual or potential vapor intrusion pathway. For those sites where a vapor intrusion pathway may represent a risk to human health, the Region should assess whether that portion of the remedy originally selected and designed to address the vapor intrusion pathway is operating as intended, and if so, assess whether the vapor intrusion remedy is still protective of human health, also taking into account sensitive populations (such as the very young, the elderly, pregnant women, and the immunocompromised). Particular attention should be given to identifying data in the potential or actual vapor intrusion receptor area, for example, presence of shallow wells present, or whether soils on or near the vapor intrusion properties of interest have been characterized. Information that may be useful in evaluating the site, and developing or updating the conceptual site model for the vapor intrusion pathway includes, but is not limited to, the following:

Nature and Extent of Contamination: <i>Depth and areal extent</i> of VOCs and other vapor-forming chemicals
<ul style="list-style-type: none"> • <i>Concentrations</i> of these contaminants in groundwater, soil and soil gas (vertical and lateral extent), sub-slab soil gas, indoor air (including crawlspace), and outdoor air (e.g., ambient background, air in the immediate vicinity of building including the air intake system) • Recent groundwater or soil-to-air modeling • Laboratory data, location of drinking water or public water wells

Natural / Physical Characteristics:

Geology – types, distribution, and permeability of unconsolidated materials, bedrock, and subsurface materials

- *Hydrogeology* – depth to groundwater, direction and rate of flow, recharge rates, presence or absence of preferential flow zones and low permeability lenses, hydraulic conductivity and gradient, vadose zone/aquifer material
- *Seasonal changes* – effect of precipitation on water table levels, temperature fluctuations between summer and winter, barometric pressure.

Building Characteristics and Property Use(s):

- *Onsite structures* – design and construction (e.g., slab on grade, basement, crawl space), integrity of the bottom floor and foundation (e.g., cracks and other openings present, unfinished dirt floor), heating and building ventilation (including operation of heating, ventilation, and cooling (HVAC) systems), sumps, utility corridors, elevator shafts
- *Land use* for the area overlying subsurface contamination – historic, current, and reasonably anticipated potential future uses (if known), operation of daycare facilities within onsite businesses
- *Zoning* for the area overlying subsurface contamination, as well as any institutional controls (ICs) that serve to limit future development

Vapor Intrusion Remedy Performance (as related to the source):

- Pressure differential
- Mitigation system discharge performance (i.e., concentration of vapors being discharged)
- Operating fan
- Indoor air concentrations

Document Review. In the five-year review process, it generally is important to review documents associated with the remedial action(s) to assess activities taken that may address or affect existing or potential vapor intrusion exposure pathways. Potentially useful information can include preliminary remediation goals (PRGs) and remedial action objectives (RAOs), contaminant cleanup levels, overall site remedy decision documents, site implementation documents, overall site remedy performance documents, and legal and enforcement documents. Additionally, if vapor intrusion-related data are mentioned in the list of Operations and Maintenance (O&M) requirements, these data reports can be highlighted for assessing potential vapor intrusion pathways. See the appropriate appendix of the *Comprehensive Five-Year Review Guidance* for specific information regarding the review of documents related to the five-year review process.

Assessing the Protectiveness of the Vapor Intrusion Remedy

The site characteristics and data collected during the literature review, interviews, site inspection, and supplemental sampling generally should be evaluated to assess the protectiveness of the selected response action. The three technical assessment questions (Questions A, B and C) described in the *Comprehensive Five-Year Review Guidance* and *Frequently Asked Questions About Vapor Intrusion* provide a recommended framework for organizing and evaluating the data and information to help

ensure all relevant issues can be considered when determining the protectiveness of the overall site remedy during the five-year review. Both existing and potential vapor intrusion exposure pathways generally should be assessed during the document review; the possible existence of a vapor intrusion pathway may not have been considered prior to the five-year review. When answering the three recommended technical assessment questions, the Region should be able to evaluate whether an actual or potential vapor intrusion exposure at the site affects the ability of the overall site remedy to ensure protectiveness of human health and the environment. Answering the three questions generally should allow the Region to reach appropriate conclusions for the five-year review report by identifying relevant issues, making follow-up recommendations, and assessing the protectiveness of the overall site remedy. These recommended steps are summarized in the following sections.

Technical Assessment Questions. As indicated above, answering the following three recommended technical assessment questions should help the Region evaluate whether an actual or potential vapor intrusion exposure at the site might affect the ability of the overall site remedy (or the vapor intrusion component of the overall remedy) to ensure protectiveness of human health and the environment. The Region should include language clearly articulating what site characteristics, data, and lines of evidence the site team used to reach its protectiveness determination; supporting information should be included in the administrative record file for the site. The *Comprehensive Five-Year Review Guidance* describes a number of items to consider in answering Questions A, B, and C. This section lists additional items to consider when answering the questions in the context of a vapor intrusion remedy and pathway.

Question A: Is the remedy functioning as intended by the decision documents?

When you ask...	For vapor intrusion, factors you should consider may include whether...
<p><i>Question A:</i> <i>Is the remedy functioning as intended by the decision documents?</i></p>	<p>Can available data, such as periodic system monitoring, O&M, and physical changes in building construction, be used to assess the effectiveness of the vapor intrusion remedy? Specifically,</p> <ul style="list-style-type: none"> • Are performance standards being met? Are indoor air concentrations below action levels? Are new chemicals being used or detected in the facility or buildings? Are the groundwater and vapor plumes contained? • Are O&M activities maintaining the effectiveness of the vapor intrusion remedy? Do exhaust fans operate continuously? Is the exhaust pipe still in place? Are broken components replaced or fixed as soon as possible? • Have physical changes in buildings decreased the effectiveness of the vapor intrusion remedy? Have new cracks appeared in floors or basement walls? Have new utilities been connected? Have additions been constructed on buildings with mitigation systems?

<p><i>Question A:</i> Is the remedy functioning as intended by the decision documents?</p>	<p>Have the institutional controls (ICs) for the vapor intrusion portion of the remedy been implemented? If so, are they helping to minimize the potential for exposure to vapor intrusion over the long term by, for example, restricting or preventing potential impacts from vapor intrusion?³ Are ICs helping to protect the integrity of engineered controls? Do the ICs provide adequate notice to parties of the potential impacts from vapor intrusion?</p> <ul style="list-style-type: none"> • Are there problems with the vapor intrusion remedy that could ultimately lead to the overall site remedy not being protective or question the protectiveness of the overall site remedy? Do residents regularly turn the exhaust fans off? Is the groundwater plume not contained? Are other actions (e.g., additional response actions, including ICs) necessary to ensure that there are no exposure pathways that could result in unacceptable risks?
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Question B – Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Question B normally is appropriate at sites where a remedy for vapor intrusion has been implemented, as well as: 1) sites where vapor intrusion was determined not to pose a risk to human health at the time of decision document signature; and 2) sites where the vapor intrusion pathway was never evaluated, but the presence of vapor-forming chemicals and potential receptors raise the possibility of a completed vapor intrusion pathway.

The Region should evaluate remedy objectives and risk assessment assumptions to ensure that the vapor intrusion pathway has been adequately assessed and that the current overall site remedy selected in the decision document(s) is protective of human health and the environment. In cases where the vapor intrusion pathway has not been addressed, the response to this question should include an evaluation of available data and the collection of additional data to determine if a complete vapor intrusion exposure pathway exists, and if so, whether it results in an unacceptable risk which warrants use of CERCLA response authority.

When you ask...	For vapor intrusion, factors you should consider may include whether...
<p><i>Question B:</i> Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?</p>	<ul style="list-style-type: none"> • Was vapor intrusion evaluated in the baseline human health risk assessment? • Was the potential or actual vapor intrusion pathway adequately assessed, and is the vapor intrusion remedy (if

³ For additional information, see *Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites (Interim Final)* (EPA-540-R-09-001 / OSWER 9355.0-89; November 2010).

*Question B:
Are the exposure assumptions,
toxicity data, cleanup levels,
and RAOs used at the time of
the remedy selection still valid?*

one is in place) protective of human health and the environment?

Do the exposure assumptions made at the time of the overall site remedy decision remain unchanged?

- If the potential for a vapor intrusion pathway exists (e.g., vapor-forming chemicals remain in the subsurface and potential receptors are present), does assessment of available data confirm that the pathway is complete using the appropriate guidelines (e.g., EPA, 2002)? Does vapor intrusion present an unacceptable risk, including to sensitive populations, that warrants use of CERCLA response authority? Are there any environmental justice concerns?
- Have potential or actual vapor intrusion exposure pathways been identified at the site that had not been previously considered? Have site conditions changed (e.g., new buildings or building modifications, changes in land use or zoning, or additional upgradient sources) that may present a potential vapor intrusion risk?
- Do the RAOs adequately address potential risk, based on current land use and reasonably anticipated future land use?
- Are the toxicity values and algorithms used originally to estimate risk from exposure to indoor air still appropriate?
- Have new contaminants or contaminant sources been identified?
- Are there unanticipated toxic byproducts of the response action not previously addressed by the decision documents? If byproducts are as or more toxic than the contaminant(s) of concern, are they being addressed?
- Are the cleanup levels included in the decision documents to address vapor intrusion still valid, including cleanup levels for source materials and other calculated cleanup numbers (sub-slab, indoor air, etc.)?
- Do components of the existing overall site remedy, even if not specifically designed to eliminate a vapor intrusion exposure pathway, currently prevent a potential vapor intrusion pathway or provide protection under a future vapor intrusion scenario?

Question C – Has any other information come to light that could call into question the protectiveness of the remedy?

Question C normally is appropriate at sites where a remedy for vapor intrusion has been implemented as well as: 1) sites where vapor intrusion was determined not to pose a risk to human health at the time of decision document signature; and 2) sites where the vapor intrusion pathway was never evaluated, but the presence of vapor-forming chemicals and potential receptors raise the possibility of a completed pathway.

When you ask...	For vapor intrusion, factors you should consider may include whether...
<p><i>Question C:</i> <i>Has any other information come to light that could call into question the protectiveness of the remedy?</i></p>	<p>Have potential or actual vapor intrusion exposure pathways been adequately addressed by an existing remedy (even if that remedy was not originally intended to address vapor intrusion)?</p> <ul style="list-style-type: none"> • Have new homes or other buildings been built at the site? • Has the groundwater plume migrated or has the water table risen or changed substantially? • Have any natural disasters, such as flooding or earthquakes, occurred, and if so, have they affected the integrity of buildings or impacted vapor intrusion remedies?

Developing Conclusions for the Five-Year Review

The conclusions of the five-year review generally should include: 1) an identification of issues; 2) recommendations and follow-up actions; and 3) a determination of whether the vapor intrusion component and the overall site remedy are, or are expected to be, protective of human health and the environment. These conclusions should be documented in the five-year review report as a technical assessment summary. Please refer to Section 4.4 in the *Comprehensive Five-Year Review Guidance* (EPA, 2001) for a more detailed discussion of identifying issues and developing recommendations.

If issues are identified that may prevent the response action from being protective, now or in the future, these issues and the follow-up recommendations and actions generally should be documented in the corresponding sections of the five-year review report. The issues and recommendations sections typically provide a summary of items that could affect current or future protectiveness at the site, and normally include milestone dates for completion of actions to help ensure protectiveness.

Where possible, recommendations for gathering additional information (e.g., lines of evidence to evaluate current or future vapor intrusion risks) should be specific about the type of data needed. For example, a recommendation to "Collect groundwater samples at the surface of the groundwater to better assess the uppermost lens of contamination" generally is more useful than a recommendation that just states "Conduct a vapor intrusion investigation."

Identify Issues	Examples of vapor intrusion issues that may be identified include:
	<p>Vapor intrusion risks have not yet been assessed, or additional lines of evidence are needed to assess vapor intrusion risks.</p> <ul style="list-style-type: none"> • Groundwater contaminated with VOCs is migrating towards offsite buildings and may present future vapor intrusion risk. • ICs are not implemented or are inadequate to restrict or provide notice on land or building use over or near a plume of vapor-forming chemicals. • Inadequate O&M of physical structures is occurring, such as the vapor exhaust pipe and fan. • Inadequate monitoring activities to determine the protectiveness of the vapor intrusion remedy (e.g., scheduled air sampling or pressure differential monitoring is not being conducted according to decision documents)

Develop Recommendations	The following are types of recommendations that, depending on site-specific circumstances, generally are considered appropriate as part of a five-year review:
	<ul style="list-style-type: none"> • Vapor intrusion risks need to be assessed. • Additional lines of evidence are needed to accurately assess vapor intrusion risks. • Monitor groundwater to ensure migration of VOCs do not reach offsite buildings. • Improve O&M and monitoring activities to ensure vapor intrusion remedies continue to operate as planned in a manner that will meet RAOs (e.g., replace broken fans or broken exhaust pipes, patch new holes in floors or in vapor barriers). • Implement ICs to provide conditions on risks from new construction in the area of a VOC plume.

Determine Protectiveness. The five-year review should take into account the protectiveness for the vapor intrusion remedy in addition to the protectiveness of the other components of the remedy when determining the overall protectiveness of the site or operable unit. The different protectiveness statement options for a five-year review are: 1) protective; 2) will be protective upon completion of the remedial action; 3) protective in the short term; 4) protectiveness deferred until further information is obtained; and 5) not protective.

For the vapor intrusion component, as with other remedy components, the determination whether the vapor intrusion remedy remains protective of human health and the environment should be based generally on the answers to Questions A, B, and C and the information obtained in the process of answering them. At sites where vapor intrusion risks have not been assessed, Questions B and C can help evaluate whether response actions (e.g., collecting lines of evidence) are needed to assess vapor intrusion risks and ensure protectiveness at the site.

The following table generically describes possible situations and how they may affect remedy protectiveness determinations. Site-specific vapor intrusion-related characteristics, available data, and remedy components normally should all be taken into account when evaluating protectiveness. For consistency, Regions are encouraged to use the recommended model protectiveness statements as described in the *Comprehensive Five-Year Review Guidance*. For operable unit (OU)-specific and site-wide protectiveness guidelines, please review the appropriate section of the *Comprehensive Five-Year Review Guidance*.

Protectiveness Determination	Potential or Actual Vapor Intrusion Conditions at the Site
Protective	<p>Data collected and assessed show no potential or actual vapor intrusion exposure pathway exists, based on:</p> <ul style="list-style-type: none"> - Data reviewed during the five-year review process which indicate that the current RAOs address vapor intrusion and are being met by the remedy; - The vapor intrusion remedy is functioning as intended to meet the RAOs; or - Other remedy components (that do not explicitly address the vapor intrusion pathway) effectively mitigate the vapor intrusion risk.
Will be protective upon completion of the remedial action	<p>Data collected and assessed show implementation of remedy components that will prevent a potential or actual exposure pathway is underway and expected to be protective upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.⁴</p>

⁴ The “will be protective” determination generally is appropriate for sites that have not yet met the construction completion milestone as per Exhibit 4-6 of the *Comprehensive Five-Year Review Guidance*. (EPA 540-R-01-007 / OSWER 9355.7-03B-P; June 2001).

<p>Protective in the short term (List in the protectiveness statement the follow-up actions that need to be taken in order for the remedy to be protective in the long-term.)</p>	<p>Data collected and assessed show:</p> <ul style="list-style-type: none"> - A potential or actual vapor intrusion exposure pathway exists but current site conditions prevent exposure (e.g., buildings currently are unoccupied but land use may change, or the HVAC system is currently operating but a determination needs to be made if an operating HVAC is needed for long-term protectiveness); - A vapor intrusion exposure pathway does not currently exist but due to the potential for changes in site conditions, a future assessment could be deemed appropriate (e.g., future construction; development of foundation cracks; inadequate O&M plan) - Current engineering control is preventing exposure in the short term, but ICs are not in place to protect against future exposure; or - A potential or actual vapor intrusion exposure pathway is prevented because of existing engineering or administrative actions that are not in a decision document.
<p>Protectiveness deferred until further information is obtained (Provide a timeframe for when a protectiveness determination will be made.)</p>	<p>Available data are insufficient to determine whether there is a potential or actual vapor intrusion exposure pathway, and further evaluations are necessary</p>
<p>Not protective (List in the protectiveness statement the actions that must be taken to ensure protectiveness. Include an anticipated timeframe for completing the actions and when the remedy will be protective.)</p>	<p>Data collected and assessed shows:</p> <ul style="list-style-type: none"> - An actual vapor intrusion exposure pathway is causing unacceptable exposures to receptors, either because no existing remedy components are in place to address them or existing remedy components are not functioning as intended to meet the RAOs; or - The existing cleanup level in the original decision document is no longer protective. The vapor intrusion remedy cannot meet a new cleanup level (based on a new ARAR or IRIS value, for example), and the previous cleanup level is no longer protective.

Technical Support. In order to assist with the protectiveness determination for five-year reviews at sites with potential or actual vapor intrusion exposure pathways, Regional and Headquarters members of the Vapor Intrusion Forum and the Five-Year Review Team are available to provide technical

assistance to site teams to develop optimal strategies for site investigation. Contacts for the Vapor Intrusion Forum can be found via EPA's Vapor Intrusion website at <http://www.epa.gov/superfund/sites/npl/hrsaddition.htm#5yr>, and contacts for the Five-Year Review Teams for specific sites can be found via EPA's Five-Year Review website at <http://www.epa.gov/superfund/cleanup/postconstruction/5yr.htm>.

References

EPA, 1999. *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*. (EPA 540/R-98/031 / OSWER 9200.1-23P; July). Available at: <http://www.epa.gov/superfund/policy/remedy/sfremedy/supersede.htm>

EPA, 2001. *Operation and Maintenance in the Superfund Program*. (EPA 540-F-01-004 / OSWER 9200.1-37FS; May 2001). Available at: <http://www.epa.gov/superfund/cleanup/postconstruction/operate.htm>

EPA, 2001. *Comprehensive Five-Year Review Guidance*. (EPA 540-R-01-007 / OSWER 9355.7-03B-P; June). Available at: <http://www.epa.gov/superfund/cleanup/postconstruction/5yr.htm>

EPA, 2002. *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils*. (EPA530-D-02-004; November). Available at: <http://www.epa.gov/osw/hazard/correctiveaction/eis/vapor/complete.pdf>

ITRC 2007. *Vapor Intrusion Pathway: A Practical Guideline*. Available at: <http://www.itrcweb.org/Documents/VI-1.pdf>

EPA 2008. *Brownfields Technology Primer: Vapor Intrusion Considerations for Redevelopment*. (EPA 542-R-08-001; March). Available at: <http://www.brownfieldstsc.org/topicsDetail.cfm?tabs=2&q=&topicID=3>

EPA, 2009. *Assessing Protectiveness for Asbestos Sites: Supplemental Guidance to Comprehensive Five-Year Review Guidance*. (OSWER Directive #9355.7-03B-P; October). Available at <http://www.epa.gov/superfund/health/contaminants/asbestos/pdfs/AsbestosFYRSuppGuid.pdf>

EPA, 2010. *Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites* (Interim Final). (EPA-540-R-09-001 / OSWER 9355.0-89; November).

EPA, 2011. *Recommended Evaluation of Institutional Controls: Supplement to the "Comprehensive Five-Year Review Guidance"* (OSWER Directive 9355.7-18, September). Available at: <http://www.epa.gov/superfund/cleanup/postconstruction/641333.pdf>

EPA 2012. *Frequently Asked Questions About Vapor Intrusion*. Available at: http://www.epa.gov/superfund/sites/npl/Vapor_Intrusion_FAQs_Feb2012.pdf

EPA, 2012. *Comprehensive Five-Year Review Guidance*. (in development). Will be available at: <http://www.epa.gov/superfund/cleanup/postconstruction/5yr.htm>

