The Addition of a Subsurface Intrusion Component to the Superfund Hazard Ranking System (HRS)
Why Subsurface Intrusion and not Vapor Intrusion?

Vapor Intrusion

Contaminated Ground Water Intrusion
Why do we Need a Subsurface Intrusion Pathway?

• No other HRS pathway addresses VI. May be able to list via GW pathway but only if people are drinking the water.

• Installing mitigation systems does not address the underlying GW or soil vapor plume, which is long term.

• The Government Accountability Office (GAO) report of May 2010 recommended that EPA consider vapor intrusion (VI) as part of the Superfund National Priorities List (NPL) process.

• This proposed addition to the HRS, together with the VI guide, will provide a comprehensive framework to guide evaluation of subsurface intrusion sites across the country.
Scope of this Action

- SsI results in actual exposure and risk, therefore sites with potential SsI are a high priority.
- EPA does not intend to increase the number of sites on the NPL.
- Proposed and final NPL sites and accompanying potential response actions are not directly affected by this proposed rulemaking.
- There is neither a plan in place, nor resources for a systematic re-evaluation of legacy sites; as with EPA’s current strategy, reassessments may be undertaken if new information is brought to our attention.
Who Will Be Impacted?

• The proposed rule will affect only how EPA and its state and tribal Cooperative Agreement partners conduct site assessments and HRS scoring

• No direct regulatory impact to nongovernmental entities

• Listing determinations can only be made by EPA (states, tribes and other federal agencies may have input)

• Minimal impacts to other federal agencies who already identify and address SsI as part of their environmental programs

• For communities with SsI threats, this addition will afford more opportunities for investigation and potential future remediation of SsI
Scientific Integrity

Testing the Model
• Completed Sensitivity Analysis of factors and resultant scores
• Applied “real site” data for sites identified as NPL caliber but unable to score based on current model
• Conducted field pilot study of sites to include evaluation of the new Subsurface Intrusion Pathway

OSWER VI Guide
• Leveraged existing EPA VI research and models in developing the rule structure
• The June 2015 EPA OSWER VI Guide and this HRS SsI rule work in concert to establish national consistency in the evaluation of SsI threats
Why Now?

- SsI presents direct risks to human health; people generally spend the majority of their time indoors
- Difficult to avoid exposure within homes and workplaces
- Science has evolved to a point where risk can be predicted, measured and mitigated
- Considering SsI information in the HRS may lead to earlier remediation at sites where SsI exposures are of concern
- No mechanism for evaluating threats posed by SsI contamination currently exists within the HRS
- Few, if any, other regulatory programs are available that consistently investigate and permanently remediate the source of the threat when SsI is the sole exposure route
Superfund Process and the HRS

**Site Assessment Phase**
- Site Discovery
- Preliminary Assessment (PA)
- Site Inspection (SI)
- Hazard Ranking System (HRS) Scoring

**NPL Listing Process**
- Proposal to National Priorities List (NPL)
- Final Rule Adding Site to NPL

**Remedial Phase**
- Remedial Investigation/Feasibility Study (RI/FS)
- Record of Decision (ROD)
- Remedial Design/Remedial Action (RD/RA)
- Operation and Maintenance (O&M)
- Site Deletion
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$S_{GW}$

$S_{SW} = DW + HFC + ENV$

$S_{SSESI} = Resident + Nearby + Current Exposure Threat + Potential Exposure Threat$

$S_A$
Why the Soil Exposure (and not air) pathway?

• Would not change how the other pathways or the current soil exposure pathway components work – VI could be additive to the current pathway
• Soil exposure pathway is already designed as the only “exposure” pathway, thus requiring less modification than trying to fit SsI exposure scenarios into one of the “migration” pathways
• Exposure to vapors are easier to document than attributing a source to vapor migration; this minimizes site specific sampling and data collection needs and potential sampling costs
• Would only open new Subsurface Intrusion (SsI) component to public comment
• The Superfund law (CERCLA) definition of the NPL as a list of releases to the environment only includes ambient air; whereas vapor/subsurface intrusion affects indoor spaces
Overall Site Score

\[ S = \sqrt{\frac{S_{GW}^2 + S_{SW}^2 + S_{SESSI}^2 + S_A^2}{4}} \]

- Four Pathway Scores
- One Site Score
Basic Pathway Score

\[ \text{Pathway Score} = \frac{LE \times WC \times T}{\text{Scaling Factor}} \]

- **Likelihood of Exposure (LE)** = Has there been intrusion or could there be?
- **Waste Characteristics (WC)** = How much hazardous substance is there and how toxic is it?
- **Targets (T)** = Who and what is impacted and to what extent?
Considers Actual and Potential Exposures

- Extent of Observed Exposure
- Extent of Observed Subsurface Contamination
- Leaking Tanks

- Contamination Above Background (GWor SG)
- Contaminated Structure above Benchmark
- Contaminated Structure
- Unsampled Structure
- Sampled Structure with no evidence of contamination

Area of Observed Exposure (Actual Exposure - Level I and II)
Area of Subsurface Contamination (based on ground water and soil gas)
(Probable Exposure to Observed Subsurface Contamination)
Areas to be Evaluated

• **Area of Observed Exposure (AOE) (Orange)**

  – the AOE is bounded by occupied structures with documented contamination meeting observed exposure criteria; the AOE includes occupied structures which are either contaminated or inferred to be contaminated.
Areas to be Evaluated (cont.)

- **Area of Subsurface Contamination (ASC) (Yellow)** – An area defined by documented ground water, subslab and/or soil gas contamination meeting observed release criteria; the area of subsurface contamination is bounded by contaminated ground water, subslab, semi-enclosed or enclosed crawl spaces and/or soil gas sampling points. Populations within the area of subsurface contamination are considered potentially exposed populations.
Observed Exposure

• **Direct observation** – Contaminants observed to be entering a structure. Can be documented by measuring air levels above sumps or cracks in foundations.

• **Chemical Analysis** – Indoor air samples taken are significantly above background levels.

• Must show attribution from the underlying contamination.
Waste Characteristics

Based on 3 factors: Toxicity, Degradation, and Hazardous Waste Quantity

- **Toxicity** - calculated the same for all pathways

- **Degradation** – accounts for the breakdown of some contaminants in soils
Waste Characteristics (cont.)

- **Hazardous Waste Quantity** - because this is an exposure pathway, the HWQ is based upon the amount of hazardous substances that the targets could be exposed to as opposed to going back to original sources (i.e., drums, landfills, etc.)

- HWQ based on concentration of contaminants in air, volume, or area of structures in the AOE and ASC.
Targets

• Targets based on Level I, Level II and potential

• Level I – population living in structure where an observed release has been found above benchmarks
  – Count population in structure X 10

• Level II – population living in structure where observed release has been found but not above benchmarks
  – Count population in structure
Targets - Potential

• Only considering targets above actual contamination in ASC (i.e., ground water or soil vapor plume)
• Not considering potential migration of plumes like in GW pathway
• “Attenuation factors” depending on how deep and in what media
• Workers are counted the same as residents but dependent upon hours (e.g., divide population by 3 for a full time worker).
Multi-Story Structures

Example 1 – Occupied multi-story subunit structure with indoor sampling completed, sampling in an unoccupied basement.

Example 2 – Occupied multi-story subunit structure with sampling on the first floor.

Example 3 – Occupied multi-story subunit structure with sampling in the basement level and on the first floor.

Example 4 – Occupied multi-story subunit structure with sampling in the basement level and on the first floor.

Contaminant Plume (Ground Water or Soil Gas)
- Occupied Space in the Area of Observed Exposure (AOE) Subject to Level I Contamination
- Occupied Space in the Area of Observed Exposure (AOE) Subject to Level II Contamination
- Sampled Area but Not Living Space with Contaminated Gaseous Indoor Air Sample Meeting Observed Release Criteria
- Occupied Space in the Area of Subsurface (ASC) Inferred as Subject to Potential Contamination
- Occupied Space in the Area of Observed Exposure (AOE) Inferred as Subject to Level II Contamination
Status

- The proposed rule was published in the *Federal Register* on February 29
- There is a 60-day public comment period that will end April 29 @ 11:59PM.
- Expecting about a year to respond to comments and finalize the rule
EPA Seeks Input on the Following:

• “Is there a way to determine the presence and extent of biologically active soil at a site during a limited site investigation? If so, what soil characteristics should EPA consider?”

• “How could EPA further take into account the differences in dilution and air exchange rates in large industrial buildings as compared to smaller residential and commercial structures when calculating the hazardous waste quantity for the HRS SsI Addition?”
EPA Seeks Input on the Following:

• “The HRS SsI Addition considers source strength in delineating ASCs and AOEs in scoring likelihood of exposure, in assigning waste quantity specifically when estimating hazardous constituent quantity and in weighting targets in an ASC. The HRS algorithm for all pathways incorporates the consideration of source strength in determining an HRS site score. Could EPA further take into account source strength in performing an HRS evaluation?”
Guidance

• There are plans to supplement the PA and SI guidance to include sampling for subsurface intrusion.

• A Technical Support Document is also be available in regulations.gov- provides more detail on each of the factors in the subsurface intrusion pathway.

• Currently, there is plenty of VI guidance available – both State and Federal
EPA Websites

• EPA HQ website which includes guidance documents:
  • http://www.epa.gov/superfund/hrs-subsurface-intrusion
  • https://www.regulations.gov for submitting comments and viewing comments from the public
Questions/Comments?