ILLINOIS POLLUTION CONTROL BOARD
May 16, 2013

IN THE MATTER OF:	)	
	)	
TIERED APPROACH TO CORRECTIVE	)	R11-9
ACTION OBJECTIVES (TACO) (INDOOR	)	(Rulemaking - Land)
INHALATION): AMENDMENTS TO 35	)	
ILL. ADM. CODE 742	)	

Adopted Rule. Final Order.

OPINION AND ORDER OF THE BOARD (by T.A. Holbrook):

The Board today adopts final amendments to the Tiered Approach to Corrective Action Objectives (TACO) rules (35 Ill. Adm. Code 742). The final amendments include the addition of a new exposure route under TACO: the indoor inhalation exposure route. To protect building occupants, this exposure route addresses the potential for vapors to migrate into buildings from subsurface volatile chemical contamination, a process commonly known as "vapor intrusion" or "VI." The amendments also reflect the addition of 13 chemicals to the TACO tables based upon the Board's latest adopted amendments to the Part 620 groundwater quality standards, Proposed Amendments to Groundwater Quality Standards (35 Ill. Adm. Code 620) (Groundwater Quality), R08-18 (Oct. 4, 2012).[1] Further, the amendments to TACO update physical and chemical parameters and revise toxicity values in accordance with the new United States Environmental Protection Agency (USEPA) hierarchy for selecting human health toxicity values. The amendments adopted today are substantively unchanged from those proposed by the Board at second notice.

This rulemaking was initiated when the Illinois Environmental Protection Agency (IEPA or Agency) filed a proposal with the Board on November 9, 2010, under Section 27 of the Environmental Protection Act (Act) (415 ILCS 5/27 (2010)). After conducting two public hearings and receiving public comment, the Board adopted first-notice amendments on April 19, 2012. After two public comments were filed during the first-notice period, further public comment was sought pursuant to a hearing officer order of August 28, 2012. On January 10, 2013, the Board adopted a *proposed* second-notice opinion and order to solicit still more public comment before proceeding with the formal adoption of second-notice rules. On March 7, 2013, the Board adopted second-notice amendments for review by the Joint Committee on Administrative Rules (JCAR).

On May 14, 2013, JCAR issued a certification of no objection concerning the amendments proposed by the Board at second notice. With this final adoption, the Board makes only minor changes to the second-notice rule amendments. The Board now files the adopted

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[1] Several scrivener's errors from R08-18, none of which have any bearing upon this TACO rulemaking, are being corrected in Technical Corrections to 35 Ill. Adm. Code 620.420, R08-18(B) (Apr. 18, 2013).

amendments with the Secretary of State for publication in the *Illinois Register* as final rules. The amendments take effect on July 15, 2013 (*i.e.*, the 60th day after the date of this order). This delayed effective date is designed to aid sites in the midst of remediation with the transition of adding an entirely new exposure route to TACO.

The final TACO amendments provide the first set of vapor intrusion rules for remediation sites in Illinois. The Tier 1 and Tier 2 remediation objectives (ROs) for the indoor inhalation exposure route apply only when the existing or potential building at issue has a full concrete slab-on-grade or a full concrete basement floor and walls. Further, an institutional control must be placed on the property whenever the TACO indoor inhalation ROs applied at the site rely upon the assumed presence of such a full concrete base. The final amendments also require the "school administrator" to notify IEPA, the school board, and every parent or legal guardian for all enrolled students when a building control technology (BCT) at the school is rendered inoperable for a period of five consecutive calendar days during the school year when school is in session. "School administrator" is defined as "the school's principal, or similar administrator responsible for the school's operations, or his or her designee."

Finally, IEPA has committed to (1) reviewing USEPA's final vapor intrusion guidance when that guidance is issued, (2) assessing whether any changes to TACO's indoor inhalation provisions are warranted, and (3), if necessary, proposing further TACO amendments to the Board.

This opinion is divided into five main parts as follows:

- First, the Board sets forth the procedural history of this rulemaking and a brief description of the predecessor rulemaking, Proposed Amendments to Tiered Approach to Corrective Action Objectives (TACO) (35 Ill. Adm. Code 742), R09-9, in which IEPA proposed but ultimately withdrew its first TACO "indoor inhalation" proposal (pp. 3-7).

- Second, the Board addresses its request for a study on the economic impact of this rulemaking, the placement into this record of documents from another rulemaking record, and a list of abbreviations frequently used in this opinion (pp. 7-9).

- Third, the Board provides background on the current TACO rules (pp. 9-11).

- Fourth, the Board gives an overview of the indoor inhalation exposure route and the final TACO amendments (pp. 11-25).

- Fifth, the Board discusses the issues in this rulemaking and its findings (pp. 25-120).

The final amendments are set forth in their entirety in the order (pp. 120-311) following this opinion's brief conclusion (p. 112).

PROCEDURAL HISTORY

IEPA filed its rulemaking proposal on November 9, 2010, which the Board docketed as R11-9. On November 18, 2010, the Board accepted the proposal for hearing. *See* Tiered Approach to Corrective Action Objectives (TACO) (Indoor Inhalation): Amendments to 35 Ill. Adm. Code 742 (Current Rulemaking), R11-9, slip op. at 1 (Nov. 18, 2010). Also on November 18, 2010, the Board granted IEPA's motion to voluntarily withdraw the first TACO "indoor inhalation" rulemaking proposal, which had been docketed as R09-9. *See* Proposed Amendments to Tiered Approach to Corrective Action Objectives (TACO) (35 Ill. Adm. Code 742) (Predecessor Rulemaking), R09-9, slip op. at 2 (Nov. 18, 2010).

Predecessor Rulemaking, R09-9

In the predecessor R09-9 rulemaking, IEPA filed a motion on October 5, 2009, to stay the indoor inhalation portion of its proposal for one year. At the time, the Board had held two public hearings and received six public comments in R09-9, but had not proceeded to first notice under the Illinois Administrative Procedure Act (IAPA) (5 ILCS 100/5-40 (2010)). IEPA sought the stay "to give itself time to evaluate serious concerns raised by USEPA over IEPA's proposed vapor intrusion rules." Predecessor Rulemaking, R09-9, slip op. at 3 (Nov. 5, 2009). USEPA had raised concerns directly with IEPA about IEPA's proposal being inconsistent with national policy and Johnson and Ettinger (1991) (J&E Model). *Id*. at 1. The Illinois Environmental Regulatory Group (IERG) supported IEPA's motion for stay. *Id*. at 3.[2] The Board granted the motion by order of November 5, 2009, requiring IEPA to file status reports every three months during the one-year stay of the indoor inhalation portion of the R09-9 rulemaking. *Id*.

On October 21, 2010, IEPA filed a motion to voluntarily withdraw the entire predecessor R09-9 rulemaking proposal. IEPA explained that substantial changes had been made to the proposal's indoor inhalation provisions to address USEPA concerns raised directly with IEPA. Predecessor Rulemaking, R09-9, slip op. at 1 (Nov. 18, 2010). IEPA stated that it would imminently file a new regulatory proposal addressing only the indoor inhalation provisions. IEPA further explained that with the passage of over two years since IEPA initially proposed the R09-9 rulemaking, the remainder of the proposal was out of date and any related amendments would be proposed a later time. *Id*. at 1-2. IEPA's motion for voluntary withdrawal was unopposed. As indicated above, the Board granted IEPA's motion by order of November 18, 2010, dismissing the predecessor rulemaking proposal and closing the R09-9 docket. *Id*. at 2.

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[2] IERG is a not-for-profit Illinois corporation affiliated with the Illinois Chamber of Commerce and is composed of 51 member companies "regulated by governmental agencies that promulgate, administer or enforce environmental laws, regulations, rules or other policies." PC15 at 1.

Current Rulemaking, R11-9

IEPA filed the R11-9 rulemaking proposal on November 9, 2010, and the Board accepted the proposal for hearing by order of November 18, 2010. *See* Current Rulemaking, R11-9, slip op. at 1 (Nov. 18, 2010).[3] The Board held two public hearings in this rulemaking. The first hearing took place in Springfield on March 29, 2011, and the second hearing took place in Chicago on May 24, 2011.[4]

On January 31, 2011, IEPA timely filed its pre-filed testimony for the first hearing. The deadline for participants to pre-file questions for IEPA's witnesses was February 28, 2011, but the Board received no pre-filed questions. To expedite the hearing process, six pages of Board staff questions for IEPA's witnesses were attached to a hearing officer order of March 24, 2011.

Three persons testified on behalf of IEPA at the first hearing: Gary King, then Manager of IEPA's Division of Remediation Management; Tracey Hurley, Environmental Toxicologist with IEPA's Toxicity Assessment Unit; and Heather Nifong, Programs Advisor for IEPA's Division of Remediation Management. Also appearing on behalf of IEPA were the following: Dr. Tom Hornshaw, Manager of IEPA's Toxicity Assessment Unit; Joyce Munie, Manager of IEPA's Remedial Project Management Section; Hernando Albarracin, Manager of IEPA's Leaking Underground Storage Tank Section; and Mohammed Rahman, Project Manager with IEPA's Leaking Underground Storage Tank Section.

Representing the Illinois Chamber of Commerce as the Chairman of the Site Remediation Advisory Committee (SRAC), Brian Martin of Ameren Services testified at the first hearing. Tr.1 at 108-09.[5] The hearing officer entered four exhibits into the record at the first hearing:

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[3] The Board cites IEPA's "Statement of Reasons" within the R11-9 proposal as "St. of Reas. at _."

[4] The first hearing transcript is cited as "Tr.1 at _," and the second hearing transcript is cited as "Tr.2 at _." The Board cites testimony pre-filed for the first hearing as "[witness] PFT1 at _," and testimony pre-filed for the second hearing as "[witness] PFT2 at _." Hearing exhibits are cited as "Exh. [#] at _."

[5] SRAC was established under Section 58.11(a) of the Act (415 ILCS 5/58.11(a) (2010)) as a 10-member committee appointed by the Governor to, among other things, "[r]eview, evaluate, and make recommendations regarding State laws, rules, and procedures that relate to site remediations." 415 ILCS 5/58.11(b)(1) (2010). SRAC members are from the Illinois State Chamber of Commerce, the Illinois Manufacturers' Association, the Chemical Industry Council of Illinois, the Consulting Engineers Council of Illinois, the Illinois Bankers Association, the Community Bankers Association of Illinois, the Illinois Association of Realtors, and the National Solid Waste Management Association. Additional groups participate on an *ad hoc* basis,

- Pre-filed Testimony of Gary King of IEPA (Exh.1 or King PFT1);
- Pre-filed Testimony of Tracey Hurley of IEPA (Exh. 2 or Hurley PFT1);
- *Errata* Sheet Number 1 of IEPA (Exh. 3); and
- "Review of the Draft 2002 Subsurface Vapor Intrusion Guidance," USEPA, OSWER [Office of Solid Waste and Emergency Response], EPA 530-D-02-004, posted Aug. 30, 2010 (Exh. 4).

IEPA timely filed its pre-filed testimony for the second hearing, as did SRAC. The deadline for participants to pre-file questions for the witnesses of IEPA and SRAC was May 12, 2011, but the Board received no pre-filed questions. To expedite the hearing process, three pages of Board staff questions for IEPA's witnesses and one page of Board staff questions for SRAC's witness were attached to a hearing officer order of May 20, 2011.

All those who testified at the first hearing also testified at the second hearing. In addition, IEPA presented the testimony of Joyce Munie, Manager of IEPA's Remedial Project Management Section. Also at hearing, Bhooma Sundar, a toxicologist with USEPA, provided verbal public comment. Ms. Sundar's comments were made on her own behalf, not on behalf of USEPA. Tr.2 at 56-57. The hearing officer entered eight exhibits into the record at the second hearing:

- Pre-filed Supplemental Testimony of Gary King of IEPA, with attachments (Exh. 5 of King PFT2);
- Pre-filed Supplemental Testimony of Heather Nifong of IEPA, with attachments (Exh. 6 or Nifong PFT2);
- Pre-filed Supplemental Testimony of Tracey Hurley of IEPA (Exh. 7 or Hurley PFT2);
- *Errata* Sheet Number 2 of IEPA (Exh. 8);
- *Errata* Sheet Number 3 of IEPA (Exh. 9);
- Pre-filed Testimony of Brian Martin of SRAC (Exh. 10 or Martin PFT2);
- "Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils," USEPA, OSWER Draft Guidance, EPA 530-D-02-004 (Nov. 2002) (SRAC witness highlighted sentence on p. 11) (Exh. 11); and
- "Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin," Wisconsin Department of Natural Resources, PUB-RR-800 (Dec. 2010) (Exh. 12).

The transcripts of the Springfield and Chicago hearings were received by the Board on April 6 and June 1, 2011, respectively, and promptly placed in the Clerk's Office On-Line (COOL) on the Board's Web site at www.ipcb.state.il.us. On April 14, 2011, IEPA filed a motion to correct the first hearing's transcript, which the hearing officer granted on the record at

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including IERG, the Illinois Petroleum Council, the Illinois Petroleum Marketers Association, and the City of Chicago. Martin PFT2 at 1.

the second hearing. Tr.2 at 7. On June 10, 2011, IEPA filed a motion to correct the second hearing's transcript, which the Board granted in its first-notice opinion.

IEPA filed three *errata* sheets, proposing rule language changes to its R11-9 proposal. *Errata* sheet number one was filed on January 31, 2011 (Exh. 3); *errata* sheet number two was filed on April 29, 2011 (Exh. 8); and *errata* sheet number three was filed on May 24, 2011 (Exh. 9). Five public comments were filed with the Board before first notice: IEPA on July 7, 2011 (PC1); Little Village Environmental Justice Organization (LVEJO) on July 13, 2011 (PC2); Raymond Reott of Reott Law Offices, LLC, on July 13, 2011 (PC3); Mr. Reott on July 22, 2011 (PC4, correcting PC3); and the City of Champaign on September 9, 2011 (PC5).

On April 19, 2012, the Board adopted its first-notice opinion and order. The amendments proposed for first notice were published in the *Illinois Register* on May 18, 2012, which began the 45-day public comment period. *See* 36 Ill. Reg. 7340 (May 18, 2012). IEPA filed public comments on May 21, 2012 (PC6) and May 25, 2012 (PC7).

On August 28, 2012, the hearing officer issued an order posing a series of Board staff questions to IEPA based upon IEPA's first-notice comments. The hearing officer directed IEPA to file a supplemental public comment with IEPA's answers to the questions. The hearing officer also provided other participants with an opportunity to file public comments responsive to IEPA's answers. IEPA filed public comments on September 14, 2012 (PC8) and September 25, 2012 (PC9). The Illinois Petroleum Council (IPC) filed a public comment on September 28, 2012 (PC10). SRAC filed a public comment on October 1, 2012 (PC11).

On January 10, 2013, the Board adopted a *proposed* second-notice opinion and order for public comment. The Board required that all public comments be filed by February 1, 2013. This supplemental period of public comment was short for two reasons. First, the issues on which the Board sought participant input were narrow relative to the breadth of the matters already covered in this rulemaking. Second, Section 5-40(e) of the IAPA (5 ILCS 100/5-40(e) (2010)) provides that "[n]o rule . . . may be adopted, or filed with the Secretary of State, more than one year after the date the first notice period . . . commenced." 5 ILCS 100/5-40(e) (2010). The first-notice amendments proposed here were published in the *Illinois Register* on May 18, 2012 (36 Ill. Reg. 7340). If the Board did not meet the one-year deadline imposed by the IAPA, the Board would need to submit another proposal to first-notice publication, which would delay final adoption of these important amendments.

IEPA filed a public comment on January 30, 2013 (PC12). On February 1, 2013, the following entities filed public comments: IPC (PC13); the Illinois Manufacturers' Association (IMA) (PC14); IERG (PC15); the Chemical Industry Council of Illinois (CICI)[6] (PC16); SRAC

[6] CICI is "a state-wide business trade association representing the chemical industry in Illinois. CICI represents 211 member companies employing over 45,648 workers at an average annual

(PC17); and the City of Chicago (PC18). The Board's January 10, 2013 proposed opinion and order for public comment was superseded by the Board's March 7, 2013 second-notice opinion and order. On May 14, 2013, JCAR issued a certification of no objection concerning the second-notice amendments. Final adoption today permits the Board to file the final amendments with the Secretary of State in time to meet the one-year deadline of Section 5-40(e) of the IAPA (5 ILCS 100/5-40(e) (2010)).

PROCEDURAL MATTERS

Economic Impact Study

As required by Section 27(b) of the Act (415 ILCS 5/27(b) (2010)), the Board requested that the Department of Commerce and Economic Opportunity (DCEO) conduct an economic impact study (EcIS) on the R11-9 rulemaking. The Board's EcIS request, dated December 1, 2010, was placed in this rulemaking's docket. On December 7, 2010, DCEO responded to the Board's request, stating that DCEO is unable to undertake the EcIS. At hearing, the hearing officer noted the Board's EcIS request to DCEO and DCEO's response, affording anyone the opportunity to testify. No one testified about DCEO's response. Tr.1 at 120-21.

Materials from Other Records

In the R11-9 rulemaking, IEPA and Mr. Reott separately filed certain of their respective materials from the predecessor R09-9 rulemaking. Specifically, IEPA filed information related to the costs of soil gas investigations (Nifong PFT2 at Exh. 2), while Mr. Reott filed his pre-filed testimony and public comment (PC4, Exhs. A, B). In addition, by order of December 8, 2010, the hearing officer in R11-9 granted IEPA's motion for relief from having to file several voluminous documents that had already been filed in R09-9. The hearing officer order directed the Clerk to place the documents into the R11-9 record and to place a copy of the order into the closed R09-9 record, which the Clerk has done. *See* 35 Ill. Adm. Code 101.306.

Because the following documents were not present in the R11-9 record but are relevant to the Board's decision-making in this rulemaking, the Board at first notice, "on its own initiative" (35 Ill. Adm. Code 101.306), incorporated into the R11-9 record these materials from the record of the then-pending Groundwater Quality, R08-18 rulemaking and the record of the closed Predecessor Rulemaking, R09-9 rulemaking:

- From R08-18, Pre-filed Testimony of Rick Cobb of IEPA (R08-18/Cobb PFT1) at 11-17 (filed May 29, 2008);

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wage of $80,748 in 726 manufacturing facilities and 877 wholesale and distribution facilities in Illinois." PC16 at 1.

- From R08-18, Pre-filed Testimony of Dr. Thomas Hornshaw of IEPA (R08-18/Hornshaw PFT1) at 5-7 (filed May 29, 2008);
- From R08-18, Pre-filed Supplemental Testimony of IEPA (R08-18/IEPA PFT2) at 5, 10 (filed July 11, 2008);
- From R08-18, IERG Public Comment (R08-18/PC2) at 7-8 (filed Sept. 12, 2008);
- From R09-9, Pre-filed Testimony of Gary King of IEPA (R09-9/King PFT1) at 2-3, 5-6, 21-22, Exh. 1 (filed Nov. 14, 2008);
- From R09-9, Pre-filed Testimony of Tracey Hurley of IEPA (R09-9/Hurley PFT1) at 7 (filed Nov. 14, 2008);
- From R09-9, IEPA's Pre-filed Responses to Pre-filed Questions (R09-9/IEPA PFR1) at 2-4, 6-8, 10, 13 (filed Jan. 15, 2009);
- From R09-9, Transcript of Jan. 27, 2009 Hearing (R09-9/Tr.1) at 16-18, 21-22, 30-32, 40-49, 58-60, 72-78, 83-85, 88-89, 92-94 (filed Feb. 5, 2009);
- From R09-9, Pre-filed Testimony of Heather Nifong of IEPA (R09-9/Nifong PFT2) at 1-3 (filed Feb. 23, 2009);
- From R09-9, Pre-filed Testimony of Tracey Hurley of IEPA (R09-9/Hurley PFT2) at 2 (filed Feb. 23, 2009);
- From R09-9, Pre-filed Testimony of Harvey Pokorny of Versar (R09-9/Pokorny PFT2) at 1 (filed Feb. 24, 2009);
- From R09-9, Pre-filed Testimony of James Olsta on behalf of CETCO Remediation Technologies and Geokinetics (R09-9/Olsta PFT2) at 2-3 (filed Feb. 24, 2009);
- From R09-9, Pre-filed Testimony of Brian Martin of SRAC (R09-9/Martin PFT2) at 2-4 (filed March 5, 2009);
- From R09-9, IEPA's Pre-filed Responses to Pre-filed Questions (R09-9/IEPA PFR2) at 3-5 (filed Mar. 12, 2009);
- From R09-9, Transcript of Mar. 17, 2009 Hearing (R09-9/Tr.2 AM at 11, 12-13, 19, 22-23, 28-30, 33, 40, 42, 46-49, 56, 68-70, 78-80, 85, 87, 91, 102, 104, 108 and R09-9/Tr.2 PM at 17-22, 48) (filed Mar. 30, 2009);
- From R09-9, Public Comment of Keith Fetzner of Environmental Resources Management, Inc. (R09-9/PC2) (filed May 5, 2009);
- From R09-9, Public Comment of CETCO Remediation Technologies (R09-9/PC3) at 1-2 (filed May 27, 2009);
- From R09-9, Public Comment of IEPA (R09-9/PC4) at 4-7, 9-10, Exh. 1 (filed May 29, 2009);
- From R09-9, Public Comment of IEPA (R09-9/PC6) (filed June 9, 2009);
- From R09-9, IEPA's Status Report (R09-9/IEPA 2-10 Status) (filed Feb. 5, 2010);
- From R09-9, IEPA's Status Report (R09-9/IEPA 8-10 Status) (filed Aug. 5, 2010);
- From R09-9, IERG's Response to IEPA's Motion for Stay (R09-9/IERG Resp.) (filed Oct. 19, 2009); and
- From R09-9, IEPA's Motion to Voluntarily Withdraw Proposal (R09-9/IEPA Mot.) (filed Oct. 21, 2010).

For ease of reference, the Board also incorporated the identifying initial page of each of these documents where it was not otherwise incorporated above. Also at first notice, the Board directed the Clerk to make a copy of these materials from the R08-18 and R09-9 records and place the copy into the R11-9 record, which the Clerk has done. *See* 35 Ill. Adm. Code 101.306. Finally, the Board directed the Clerk to create a single entry in the R11-9 docket for these incorporated materials and to physically and electronically attach the corresponding portion of the Board's first-notice opinion to the front of the incorporated materials, which the Clerk has done.

Abbreviations Used in this Opinion

Abbreviations used by the Board in this opinion include the following:

ASTM = American Society for Testing and Materials	RCRA = Resource Conservation and Recovery Act
BCT = building control technology	RBCA = Risk Based Corrective Action
BTEX = benzene, toluene, ethylbenzene, and total xylenes	RCRA = Resource Conservation and Recovery Act
C_{sat} = soil saturation limit	ROs = remediation objectives
C_v^{sat} = soil vapor saturation limit	SMD = sub-membrane depressurization
ELUC = Environmental Land Use Control	SRP = Site Remediation Program
J&E = Johnson and Ettinger	SSD = sub-slab depressurization
NAPL = non-aqueous phase liquid	SSL = Soil Screening Level
NFR = No Further Remediation	TACO = Tiered Approach to Corrective Action Objectives
OSWER = Office of Solid Waste and Emergency Response	UST = underground storage tank
RA = Remediation Applicant	VOCs = Volatile Organic Compounds

BACKGROUND ON TACO

The Board adopted the TACO rules in 1997 under Title XVII of the Act (415 ILCS 5/58-58.17 (2010)). *See* Tiered Approach to Corrective Action Objectives (TACO): 35 Ill. Adm. Code 742, R97-12(A) (June 5, 1997) (final order). The rules are set forth in Part 742 of Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 742). As IEPA noted, TACO provides "procedures for developing remediation objectives based on various risks to human health posed by environmental conditions at a site." St. of Reas. at 2. Under TACO, persons assess site conditions, evaluate the risks to human health, and propose remediation objectives to "mitigate conditions at the site so that they no longer pose a threat to human health." *Id*.

TACO is used at sites being remediated under any one of several regulatory programs:

Leaking Underground Storage Tank (UST) Program; Site Remediation Program (SRP); and Resource Conservation and Recovery Act (RCRA) Part B Permits and Closure Plans. *See* 35 Ill. Adm. Code 742.105(b). Since its adoption, TACO has been applied at sites outside of these programs. St. of Reas. at 1. As IEPA stated in the past, TACO has put "'many sites back into productive use while significantly decreasing remediation costs statewide.'" Proposed Amendments to Tiered Approach to Corrective Action Objectives (35 Ill. Adm. Code 742), R06-10, slip op. at 1 (Oct. 20, 2005) (quoting IEPA Statement of Reasons). IEPA added in the current rulemaking that "[a]s a result of TACO, we have literally been able to remediate thousands of contaminated sites and acres across a broad range of Illinois EPA cleanup programs. We address hundreds of sites each year in reaching closure with regards to those." Tr.1 at 13.

The Board has amended the TACO rules several times over the years. For example, in 2000, the Board adopted amendments proposed by IEPA that were "necessitated by new technology, science, and programmatic changes." St. of Reas. at 2. In 2002 and 2005, the Board adopted revisions to TACO proposed by IEPA "for the purpose of keeping the TACO procedures and requirements current and to improve standards and procedures so that end users of the rules can achieve accurate data results that are protective of human health." *Id*. TACO was last amended in 2007. *See* Proposed Amendments to Tiered Approach to Corrective Action Objectives (35 Ill. Adm. Code 742), R06-10 (Feb. 15, 2007).

The potential "exposure routes" presently addressed by TACO are as follows: outdoor inhalation; soil ingestion; groundwater ingestion; and dermal contact with soil. *See* 35 Ill. Adm. Code 742.115(a).[7] TACO includes options for excluding pathways from further consideration and using "area background"[8] concentrations as remediation objectives. *See* 35 Ill. Adm. Code 742.110(a).

TACO provides three alternative tiers for selecting applicable remediation objectives. Tier 1 involves comparing a site's contaminant concentrations with TACO tables of corresponding remediation objectives for residential or industrial/commercial properties. Tier 2 involves developing remediation objectives by using site-specific data and risk-based equations from the Soil Screening Level (SSL) and Risk Based Corrective Action (RBCA) models listed in

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[7] "Exposure Route" means "the transport mechanism by which a contaminant of concern reaches a receptor." 35 Ill. Adm. Code 742.200.

[8] "Area Background" is defined as "*concentrations of regulated substances that are consistently present in the environment in the vicinity of a site that are the result of natural conditions or human activities, and not the result solely of releases at the site.* [415 ILCS 5/58.2]." 35 Ill. Adm. Code 742.200.

TACO. Tier 3 allows alternative parameters and factors, unavailable under Tier 1 or Tier 2, to be considered when developing remediation objectives. *See* 35 Ill. Adm. Code 742.115

In addition, TACO provides for the use of "institutional controls" and "engineered barriers." *See* 35 Ill. Adm. Code 742.Subpart J, 742.Subpart K. An "institutional control" is "a legal mechanism for imposing a restriction on land use, as described in Subpart J [of Part 742]." 35 Ill. Adm. Code 742.200. An "engineered barrier" is "a barrier designed or verified using engineering practices that limits exposure to or controls migration of the contaminants of concern." *Id*.

OVERVIEW OF THE INDOOR INHALATION EXPOSURE ROUTE AND THE FINAL TACO AMENDMENTS

Addition of a New Pathway

The final amendments address the potential for indoor air contamination resulting from the presence of subsurface volatile chemicals. The rules do not address the remediation of contamination coming from other sources, including the building structure or products within the building. PFT1 King at 3; *see also* Tr.2 at 28-30. In adding the indoor inhalation exposure route to the TACO risk-based methodology, the new pathway will be managed in a manner similar to TACO's current exposure routes, including the following: (1) the framework of three tiers (*i.e.*, Tier 1 "look-up" tables of chemical concentrations, Tier 2 equations allowing for some site-specific data, Tier 3 site-specific risk-assessments); (2) the existence of remediation objectives based upon "residential" and "industrial/commercial" property uses; and (3) the ability to "exclude" the pathway. St. of Reas. at 2. The amendments allow for the use of "building control technologies" to mitigate the potential for contaminated soil gas entering indoor air, an approach akin to engineered barriers. *Id*. at 3. An institutional control must be placed on the property when Tier 1 or Tier 2 ROs are applied as they are based upon the assumed presence of a full concrete slab-on-grade or a full concrete basement floor and walls.

Site evaluators will assess the indoor inhalation exposure route using soil gas and groundwater sampling results and then apply a "modified J&E model" to develop ROs. St. of Reas. at 2. The modified J&E Model, which consists of 18 equations and 54 parameters, "simulates the migration of contaminants from a subsurface source to the air inside a building." *Id*. at 2-3. Similar to the SSL and RBCA models used for other pathways, the modified J&E Model parameters have "conservative default values under Tier 1 that can be substituted for site-specific conditions under Tier 2," while Tier 3 allows the use of sub-slab soil gas data and indoor air sampling. *Id*. at 3; *see also* Sections 742.900(c)(3), 742.935(c).

IEPA explained that "[t]here is no legislative or regulatory requirement to propose these amendments." St. of Reas. at 3. IEPA filed the rulemaking proposal "to broaden the exposure routes evaluated so as to fully protect public health from contaminated sites" and to add more certainty to the release of liability provided by the No Further Remediation [(NFR)] determination." *Id*. NFR Letters are issued under the Leaking UST program and SRP. *See* 35 Ill. Adm. Code 734.Subpart G, 740.Subpart F.

In the past, IEPA evaluated vapor intrusion on a limited basis, generally when major indoor inhalation risks were suspected. St. of Reas. at 3. However, according to IEPA, USEPA approaches vapor intrusion from a broader perspective, recommending that all sites be screened if there is a potential for indoor inhalation health risks. *Id*. IEPA noted that other states have had:

> public health crises and ensuing legal and financial challenges caused by vapor intrusion exposures at sites where the indoor inhalation exposure route was not evaluated as part of the regulatory cleanup prior to issuance of the No Further Remediation letter or its equivalent. *Id*.

IEPA described three important benefits that the amendments are expected to confer. First, the amendments create a better way to protect citizens from the migration of subsurface volatile chemicals into buildings. Second, the amendments give site owners and remediation applicants (RAs) expanded liability protection through the issuance of NFR Letters that address the new pathway. Third, the amendments facilitate real estate transactions, in part due to the rules' reliance upon the March 1, 2008 American Society for Testing and Materials (ASTM) E2600-08 ("Standard Practice for Assessment for Vapor Intrusion into Structures on Property Involved in Real Estate Transactions") for assessing vapor intrusion, which is being used in many parts of the country. St. of Reas. at 8; Exh. 8 at 1; R09-9/Tr.1 at 17-18, 78; R09-9/Tr.2 AM at 102.

IEPA stated that in 1997 when TACO was first adopted, IEPA intentionally did not include the indoor inhalation exposure route in its proposal. IEPA lacked confidence in the "state of the art" scientific data at the time. IEPA explained that during the intervening years, gaps in research have narrowed. Modeling is now generally accepted for use in calculating soil gas and groundwater remediation objectives for the indoor inhalation pathway, according to IEPA. St. of Reas. at 7-8. The recent publication of standard ASTM E2600-08 further outlined the science, making IEPA more comfortable with implementing the pathway in Illinois. R09-9/Tr.2 AM at 102.

<u>Instances of Vapor Intrusion Risk in Illinois</u>

By way of illustration, IEPA provided a compendium of case studies detailing remedial efforts involving the indoor inhalation pathway at seven sites in Illinois. These sites were addressed under a variety of different cleanup programs. R09-9/Tr.1 at 16-17; R09-9/King PFT1, Exh. 1. IEPA highlighted the Peoples Gas Site and the Bell Fuel Site as examples of how the lack of TACO Tier 1 ROs and a defined sampling protocol for the indoor inhalation exposure route can lead to work that is unnecessary, costly, and intrusive, while providing potentially unreliable results. R09-9/King PFT1, Exh. 1 at 1, 2, 5. These two sites are further discussed below. The other five sites are identified as follows: Acme Solvents Site in Rockford (Remedial Project Management Section, State Sites Unit); Devon Bank Site in Wheeling (Remedial Project Management Section, SRP); Chanute Air Force Base in Rantoul (Federal Site Remediation Section, Department of Defense Program); Rockford Groundwater Contamination Superfund Site in Rockford (Federal Sites Remediation Section, Superfund Program); and Premcor Refinery Site in Hartford (RCRA Corrective Action). IEPA stated that "these case studies illustrate the need for consistent and comprehensive regulations for evaluating and managing the indoor inhalation exposure route." *Id*.

The People's Gas Site in Chicago was handled by IEPA's Remedial Project Management Section under SRP. R09-9/King PFT1, Exh. 1 at 2. The site, which had been used for manufactured gas storage and distribution, was transferred to the Chicago Housing Authority and eventually developed into Bridgeport Homes. *Id*. The residential development consists of two-story brick buildings, each of which is slab-on-grade, *i.e.*, with no basements. *Id*. Soil and soil gas samples showed contamination from benzene, naphthalene, semi-volatiles, and metals. Indoor air samples were collected in 2004 from the first and second floors of five occupied and eleven unoccupied units. *Id*. IEPA explained that it "coordinated with the Illinois Department of Public Health [(IDPH)] because air samples were taken inside the residences." *Id*. The indoor air sampling results revealed "elevated naphthalene" in two unoccupied units that were being used to store construction materials and had recently undergone renovation. *Id*. IEPA and IDPH concluded that "contamination levels did not pose a threat to human health, and were probably not due to vapor intrusion." *Id*.

The Bell Fuels Site in Chicago was addressed by IEPA's Leaking UST Section. R09-9/King PFT1, Exh. 1 at 5. The site, a former fuel distribution center, is located between a residential neighborhood and a rail yard. *Id*. A UST released fuel to subsurface soil in 2000. *Id*. IEPA explained that some of the soil gas test results from samples collected in 2007 were greater than the "U.S. EPA Target Shallow Soil Gas Concentrations." *Id*. Sub-slab samples collected in each of three potentially-impacted houses detected one chemical of concern in each sample, but in concentrations less than the USEPA Target Shallow Soil Gas Concentrations. *Id*. Indoor air samples were also collected in the basement and first floor of each house, revealing at least one chemical of concern from each sample. According to IEPA, however, there may have been:

> problems with the sampling method which could have produced false positives. For example, in a house where elevated levels of benzene were found, the resident had smoked a cigarette just as the samplers arrived. Furthermore, the indoor air sampling protocol was not included with the report. *Id*.

Concept of the Indoor Inhalation Exposure Route

The concept of the indoor inhalation exposure route was summarized by IEPA's expert witness, Dr. Atul Salhotra, Director of the Risk Assessment and Management Group, a division of Gannett Fleming, Inc. Dr. Salhotra described six steps making up the pathway: (1) a source of contamination exists under the ground surface; (2) volatile chemicals volatilize and migrate from the source; (3) volatile chemicals enter the living or working space inside a building; (4) volatile chemicals mix with the indoor air; (5) volatile chemicals enter the people living or working there as they breathe; and (6) potential adverse health effects might occur based upon the toxicity of the chemicals. R09-9/Tr.1 at 60, 72-73; R09-9/Tr.2 AM at 11, 91. Dr. Salhotra explained that the J&E Model used by USEPA simulates these six steps to calculate remediation objectives based upon an acceptable level of risk. R09-9/Tr.1 at 83-85, 88.

Dr. Salhotra testified that the indoor inhalation pathway depends upon many parameters: the contaminant source (the types of chemicals and their location); the media through which the chemicals migrate (capillary fringe, vadose zone, building materials, presence of cracks, porosity, water content, permeability, organic carbon content); the characteristics of the building (type of ventilation system, size of the building, use of the building, presence of a preferential pathway that would allow vapors into the building); and atmospheric effects (temperature and pressure). R09-9/Tr.1 at 74-75. For these parameters, Dr. Salhotra noted that many factors are site-specific and cannot be easily measured, making it necessary to rely upon good professional judgment and default values. *Id*. at 76.

IEPA stated that the J&E Model is the most common model used by State environmental agencies to calculate the attenuation (decrease) of volatile chemical concentrations from the subsurface to indoor air. PFT1 King at 10. If a preferential pathway exists, IEPA noted that "the J&E model will not be used and the specific evaluation must take into account the site specific conditions, i.e. the nature and extent of the preferential pathways." R09-9/IEPA PFR2 at 3.

Dr. Salhotra added that if the indoor inhalation exposure route is not complete due to building control technologies, the exposure route would not need to be further evaluated. As such, the rules allow for methods to make the pathway incomplete, such as vapor barriers. R09-9/Tr.1 at 77, 89. To this end, the amendments include revisions to Subpart J for institutional controls and the addition of new Subpart L, which addresses building control technologies designed to mitigate the potential for volatile contaminants to enter the indoor air from the subsurface. St. of Reas. at 3; PFT1 King at 23-26.

Subpart A ("Introduction") of Part 742

Section 742.105 on the applicability of TACO includes a new subsection (i) which makes plain that an evaluation of the new indoor inhalation exposure route "addresses the potential of contaminants present in soil gas and groundwater to reach human receptors within buildings," but not "the remediation or mitigation of any contamination within a building from a source other than soil gas or groundwater, such as the building structure itself and products within the building." *See* Section 742.105(i). As amended, TACO now provides remediation objectives not only for soil and groundwater, but also for soil gas. *See* Sections 742.115(d) ("Environmental Media of Concern"), 742.225, 742.227.

In Section 742.110, which provides an "overview of the tiered approach," changes prompted by the indoor inhalation-based institutional controls are added to correspond with other cross-references to institutional controls. When using Tier 1 ROs for the indoor inhalation exposure route, which are based upon the assumed presence of a full slab-on-grade, an institutional control must be placed upon the property. Likewise, when developing ROs pursuant to Tier 2, which is based upon the assumed presence of either a full concrete slab-on-grade or a full concrete floor and walls, an institutional control must be placed upon the property.

Section 742.115(a) is amended to distinguish the new indoor inhalation exposure route from the existing outdoor inhalation exposure route. IEPA's Mr. King explained that the indoor inhalation route has two components: soil gas and groundwater. The soil gas component accounts for the migration of contaminants from the soil to soil gas to a building interior. The groundwater component accounts for the migration of contaminants from groundwater to soil gas to a building interior. PFT1 King at 2; *see also* Section 742.115(a)(5). Although the indoor inhalation route involves soil, soil gas, and groundwater, IEPA only proposed remediation objectives for soil gas and groundwater. IEPA explained that the scientific literature is skeptical about determining indoor inhalation risks based upon concentrations of volatile chemicals in soil. For soil gas and groundwater, however, the scientific literature indicates meaningful risks can be developed. PFT1 King at 2. Remediation objectives for the indoor inhalation exposure route are only for soil gas and groundwater. However, a site-specific proposal for a soil remediation objective for the indoor inhalation exposure route could be developed under Tier 3. *Id*. at 2, 22-23; *see also* Tr.1 at 51-52; Section 742.935(d).

To develop remediation objectives for the indoor inhalation route, IEPA used a "modified" J&E Model. *See* Section 742.110(c). IEPA differentiated this model from the SSL Model used for the outdoor inhalation exposure route. PFT1 King at 3. Soil gas is a medium by which both the indoor and outdoor inhalation exposure routes may be evaluated. *See* Sections 742.115(a)(4)(B), (a)(5)(A). Accordingly, provisions were added to allow the use of soil gas data when determining ROs for both the indoor and outdoor inhalation exposure routes. St. of Reas. at 9. The outdoor inhalation exposure route consists of the soil gas component (*i.e.*, migration from soil gas to outdoor air) and the soil component (*i.e.*, migration from soil through soil gas to outdoor air). *See* Section 742.115(a)(4); Tr.1 35-40.

<u>Subpart B ("General") of Part 742</u>

To support the new indoor inhalation exposure route, the Board adds to Subpart B of Part

742 the following defined terms: “Building”; “Building Control Technology”; “Capillary Fringe”; “Intrusive Activities”; “Q_{soil}”; “Rendered Inoperable”; “Saturated Zone”; “Soil Gas”; “Soil Vapor Saturation Limit”; “Unconfined Aquifer”; “Volatile Chemicals”; and “Water Table.” *See* Section 742.200; St. of Reas. at 9.

For example, “building” is defined as “a man-made structure with an enclosing roof and enclosing walls (except for windows and doors) that is fit for any human occupancy for at least six consecutive months.” *See* Section 742.200. “Building control technology” or “BCT” means “any technology or barrier that affects air flow or air pressure within a building for purposes of reducing or preventing contaminant migration to the indoor air.” *Id*. “Q_{soil}” is defined as “the volumetric flow rate of soil gas from the subsurface into the enclosed building space” and “soil gas” means “the air existing in void spaces in the soil between the groundwater table and the ground surface.” *Id*. The defined term “Volatile Organic Compounds (VOCs)” is replaced by the defined term “Volatile Chemicals.” *Id*.

Several existing definitions are being revised. For example, the definition for “residential property” is amended to acknowledge that exposure from contaminants through inhalation can occur indoors and outdoors. R09-9/Tr.1 at 48-49; R09-9/Tr.2 AM at 12-13; R09-9/Nifong PFT2 at 1; Section 742.200. The definition of “man-made pathways” is amended to explicitly include sumps and elevator vaults: “*constructed* physical conditions *that may allow for the transport of regulated substances including, but not limited to, sewers, utility lines, utility* or elevator *vaults, building foundations, basements, crawl spaces, drainage ditches,* ~~or~~ *previously excavated and filled areas*, or sumps. [415 ILCS 5/58.2].” Section 742.200.

At first notice, the Board proposed incorporating by reference ASTM E 2600-08 (“Standard Practice for Assessment for Vapor Intrusion into Structures on Property Involved in Real Estate Transactions,” approved Mar. 1, 2008) in Section 742.210. The Board’s first-notice opinion noted that the latest edition of this document is ASTM E2600-10, published in June 2010, and requested that IEPA comment on whether the more recent publication should be incorporated. In first-notice comments, IEPA agreed that the latest edition, ASTM E 2600-10, should be incorporated instead. PC7 at 1. The Board made this revision at second notice and retains it today. *See* Section 742.210.

The Board also incorporates by reference “Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils,” OSWER Draft Guidance (EPA Publication No. EPA/530D-02/004 (Nov. 2002)), among other documents. *See* Section 742.210.

Section 742.222 addresses the “soil vapor saturation limit” or “C_v^{sat},” which means “the maximum vapor concentration that can exist in the soil pore air at a given temperature and pressure.” *See* Sections 742.200, 742.222. For any volatile chemical, the soil gas remediation objective for the indoor and outdoor inhalation exposure routes developed under Tier 2 cannot exceed the soil vapor saturation limit. *See* Section 742.222.

Section 742.227 provides the sampling requirements to demonstrate compliance with Tier 1, 2, or 3 soil gas ROs for the outdoor and indoor inhalation exposure routes. At second notice, the Board deleted language from Section 742.227 that could have been misconstrued as limiting the Section to a compliance demonstration only for *Tier 1* ROs. Exterior soil gas samples are required for the outdoor inhalation exposure route. "Near-slab" soil gas samples collected outside of an existing building are required for the indoor inhalation exposure route. The Board adds language to accommodate exterior soil gas sampling at the location or "footprint" of a future building for the indoor inhalation exposure route. Any proposals to use sub-slab soil gas data for the indoor inhalation exposure route must be made under Tier 3. *See* Section 742.227.[9]

Soil gas samples for purposes of demonstrating RO compliance must be analyzed using a National Environmental Laboratory Accreditation Program (NELAP) certified laboratory. *See* Section 742.227(c). Tier 1, 2, or 3 soil gas ROs must be compared to concentrations of soil gas collected at a depth at least 3 feet below ground surface and above the saturated zone. *See* Section 742.227(d). The minimum 3-foot depth was chosen by IEPA based upon the literature, as explained by Mr. King: "Samples taken less than three feet from the ground surface can be compromised by the influence of barometric pressure fluctuations that may cause an influx of ambient air into the soil, variations of ambient temperature and precipitation." Tr.1 at 62-64. "Saturated zone" is defined as "a subsurface zone in which all the interstices or voids are filled with water under pressure greater than that of the atmosphere." *See* Section 742.200.

Subpart C ("Exposure Route Evaluations") of Part 742

When an exposure route is properly excluded from consideration, no remediation objectives need to be developed for that exposure route. *See* 35 Ill. Adm. Code 742.300. Under TACO, pathway exclusion is optional. *See* 35 Ill. Adm. Code 742.110(a). Section 742.312 sets forth the criteria for when the indoor inhalation exposure route can be excluded from consideration. The indoor inhalation pathway may be excluded when, for example, none of the "contaminants of concern" are volatile chemicals. *See* Section 742.312(a); *see also* R09-9/King PFT1 at 5-6.[10]

If volatile chemicals are present, the indoor inhalation exposure route can be excluded from consideration only if three conditions are satisfied. First, the "'speed bump'" provisions of

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[9] Demonstrating compliance with groundwater ROs is addressed under existing Section 742.225.

[10] A "contaminant of concern" means "*any contaminant that is expected to be present at the site based upon past and current land uses and associated releases that are known to the* person conducting a remediation *based upon reasonable inquiry* [415 ILCS 5/58.2]." 35 Ill. Adm. Code 742.200.

current Sections 742.300 and 742.305 (35 Ill. Adm. Code 742.300, 742.305) must be met. R09-9/King PFT1 at 5-6; *see also* Section 742.312(b)(2). This helps to ensure, among other things, that free product, certain hazardous waste, and elevated concentrations of polychlorinated biphenyls (PCBs) do not remain. R09-9/King PFT1 at 6. An additional speed bump is adopted with respect to soil gas: the concentration of any contaminant of concern in soil gas cannot exceed 10% of its Lower Explosive Limit (LEL) as measured by a hand held combustible gas indicator. *See* Section 742.305(g); *see also* R09-9/King PFT1 at 6. Second, one of the following must be satisfied: (1) no building or man-made pathway exists or will be placed above contaminated soil gas or groundwater exceeding Tier 1 standards, provided, however, that there is also no soil or groundwater contamination exceeding Tier 1 standards located 5 feet or less, horizontally, from any existing or potential building or man-made pathway; (2) a BCT under Subpart L is used; or (3) when the only contaminants of concern are benzene, toluene, ethylbenzene, and total xylenes (BTEX), a demonstration of active biodegradation has been made for BTEX such that no indoor inhalation exposure will occur. *See* Section 742.312(b)(1); *see also* St. of Reas. at 9. Third, an institutional control under Subpart J must be placed on the property. *See* Section 742.312(b)(3).

The indoor inhalation exposure route cannot be excluded by using a groundwater ordinance. An ordinance restricting the source of drinking water would not protect against migration of volatile chemicals from the groundwater into indoor air space. St. of Reas. at 11-12.

Subpart E ("Tier 1 Evaluation") of Part 742

Tier I Evaluations Generally

A Tier 1 evaluation compares the concentration of each contaminant of concern detected at a site to the applicable remediation objectives provided in various tables within Appendix B. Tier 1 Tables G, H, and I are being added and are discussed below. *See* Section 742.500(a). Tier 1 distinguishes between residential and industrial/commercial property uses of a site and, as under current TACO, an institutional control is required where ROs are based upon an industrial/commercial property use. For the indoor inhalation exposure route, Tier 1 applies only when the existing or potential building at issue has a full concrete slab-on-grade or a full concrete basement floor and walls. *See* 35 Ill. Adm. Code 742.500.

Tier 1 for the Outdoor Inhalation Exposure Route

Section 742.505 is amended to specify that for the outdoor inhalation exposure route, compliance may be determined by meeting either the soil or soil gas remediation objectives. *See* Sections 742.505(a)(1)(C), (b)(1)(C). The provision further directs the site evaluator to Table G of Appendix B for the Tier 1 soil gas remediation objectives of the outdoor inhalation exposure route, whether based upon residential property use or industrial/commercial property use, including construction workers. *See* Section 742.505(b)(1); *see also* Section 742.510(c).[11]

Tier 1 for the Indoor Inhalation Exposure Route

Section 742.505 is modified to reflect the addition of the indoor inhalation exposure route. *See* Sections 742.505(b), (c). The Tier 1 soil gas and groundwater ROs for this exposure route are based upon the assumed presence of a building with a 10-cm thick, full concrete slab-on-grade. These Tier 1 ROs apply only when the existing or potential building at issue has a full concrete slab-on-grade or a full concrete basement floor and walls. The Tier 1 soil gas and groundwater remediation objectives for the indoor inhalation pathway are listed in new Tables H and I of Appendix B. *See* Sections 742.505(b)(2), (c)(5). Use of Appendix B, Table H ("diffusion and advection") ROs requires compliance with either the soil gas ROs or the groundwater ROs. Use of Appendix B, Table I ("diffusion only") ROs requires compliance with both the soil gas ROs and the groundwater ROs.

Table H soil gas or groundwater ROs must be used when any soil or groundwater contamination (*i.e.*, exceeding Tier 1 ROs for residential property or and Tier 1 ROs for Class I groundwater) is located 5 feet or less, vertically or horizontally, from the existing or potential building or man-made pathway. In this case, the mode of contaminant transport is both "diffusion and advection." IEPA explained that the "advection component accounts for the migration of contaminants in soil gas brought about by differences in pressure gradients between the interior of a building and the soil nearest the building foundation." St. of Reas. at 5.[12] Table H provides soil gas and groundwater ROs for residential property use or industrial/commercial property use. *See* 742.Appendix B, Table H; *see also* Section 742.515(b).

Table I also provides soil gas and groundwater ROs for residential property use or industrial/commercial property use. *See* 742.Appendix B, Table I; *see also* Section 742.515(c).

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[11] Tables A and B of Appendix B for the Tier 1 soil ROs should be revised to specify "outdoor" before "inhalation," but because these tables are not currently open in this rulemaking, the Board defers these revisions to a future rulemaking.

[12] "The majority of vapor intrusion cases occur when contaminants from either the soil or groundwater enter the soil gas at the water table or in the vadose (unsaturated) zone. The contaminated soil gas then migrates under the influences of advective flow or diffusion until they escape into the atmosphere or enter the zone of influence of a building. The term 'advective flow' here refers to bulk flow driven by pressure or density differences." USEPA, "Engineering Issue: Indoor Air Vapor Intrusion Mitigation Approaches" at 3 (Oct. 2008). "Once in soil gas, deep in the soil and absent any natural or anthropogenic preferential flow conditions, diffusion dominates the soil vapor transport process; but near the building, advective flow is the dominant mechanism." *Id.*

Table I soil gas and groundwater ROs may be used only when all soil and groundwater contamination (*i.e.*, exceeding Tier 1 ROs for residential property or and Tier 1 ROs for Class I groundwater) is located more than 5 feet, vertically and horizontally, from the existing or and potential building or man-made pathway. In this case, the mode of contaminant transport is "diffusion only."[13] As an alternative to using Table I, even if no such volatile chemical contamination is present within the five-foot distance, it is permissible to use Table H.

To apply Table I soil gas and groundwater ROs, the site evaluator must show that all soil and groundwater located 5 feet or less, vertically or horizontally, from the existing or potential building or man-made pathway meets the Tier 1soil gas and groundwater ROs for residential property listed in Appendix B, Table H. *See* Sections 742.505(b)(2)(E), (c)(5)(D).

<u>Subpart F ("Tier 2 General Evaluation") of Part 742</u>

Section 742.600 specifies that for the indoor inhalation exposure route, the Tier 2 equations for developing ROs (Appendix C, Table L) apply only when the existing or potential building at issue has a full concrete slab-on-grade or a full concrete basement floor and walls. If a contaminant has both carcinogenic and non-carcinogenic effects, the more stringent RO calculated applies. St. of Reas. at 10.

<u>Subpart G ("Tier 2 Soil and Soil Gas Evaluation") of Part 742</u>

For the Tier 2 soil gas evaluation, new Section 742.712 provides the SSL soil gas equation for the outdoor inhalation exposure route and new Section 742.717 requires the use of the modified J&E Model equations for the indoor inhalation exposure route. St. of Reas. at 10. Equation J&E7 must be used when the mode of contaminant transport is both diffusion and advection, *i.e.*, the Q_{soil} value equals 83.33 cm^3/sec. Equation J&E8 may be used only when the mode of contaminant transport is diffusion only, *i.e.*, the Q_{soil} value equals 0.0 cm^3/sec. If the calculated soil gas remediation objective is greater than C_v^{sat}, then C_v^{sat} is the soil gas RO.

<u>Subpart H ("Tier 2 Groundwater Evaluation") of Part 742</u>

For the Tier 2 groundwater evaluation, new Sections 742.805(e) and 742.812 explain how to use the modified J&E Model equations for developing groundwater ROs for the indoor inhalation exposure route. St. of Reas. at 11. If the calculated groundwater RO is greater than the water solubility of that chemical, then the solubility is used as the groundwater RO.

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[13] "Under most environmental conditions, molecular diffusion in natural systems proceeds from locations of higher concentration towards locations of lower concentrations. In a typical scenario, organic vapors above a contaminated water table (high concentration) diffuse towards land surface (lower concentration)." Tillman, Weaver at 7 (Sept. 2005).

Subpart I ("Tier 3 Evaluation") of Part 742

For the Tier 3 evaluation, Section 742.935 is added to (1) provide for other situations where the indoor inhalation exposure route may be excluded, (2) describe the use of alternative BCTs for excluding the exposure route, and (3) describe the use of calculations and modeling involving soil gas data to develop ROs. St. of Reas. at 11. Under Section 742.900(c)(3), "results of indoor air sampling" can be used as additional site data "to improve or confirm predictions of exposed receptors to contaminants of concern." Exh. 8 at 3.

Subpart J ("Institutional Controls") of Part 742

Institutional controls are legal land use restrictions or requirements placed on the property. *See* 35 Ill. Adm. Code 742.200. For purposes of indoor inhalation pathway exclusion, institutional controls are needed, for example, to require the operation and maintenance of BCTs.

The final amendments add Sections 742.1000(a)(7) and (a)(8), respectively requiring the use of institutional controls whenever the indoor inhalation ROs are based upon the "diffusion only" part of the modified J&E Model and whenever ROs are based upon a BCT. St. of Reas. at 11-12. The final amendments also add Section 742.1000(a)(9), requiring an institutional control when the indoor inhalations ROs developed rely upon the assumption that the building has a full concrete slab or basement. For example, if a site uses Tier 1 or Tier 2 for indoor inhalation ROs, then the institutional control would require existing or potential buildings to have a full concrete slab-on-grade or a full concrete basement floor and walls.

References to "indoor inhalation building control technologies" and "soil gas" are added to Section 742.1010 on Environmental Land Use Controls (ELUCs). An ELUC is an instrument recorded in the chain of title for a site to limit or place requirements upon the use of the site for the protection of human health. *See* 35 Ill. Adm. Code 742.200. New Section 742.1015(j) prohibits a groundwater ordinance from being used to exclude the indoor inhalation exposure route. St. of Reas. at 11-12.

Subpart K ("Engineered Barriers") of Part 742

An "engineered barrier" is designed to limit exposure to or control the migration of contaminants of concern. *See* 35 Ill. Adm. Code 742.200. Section 742.1105(c)(3) is amended to add the word "outdoor" before "inhalation exposure route," clarifying that engineered barriers are recognized for preventing completion of the outdoor inhalation exposure route, not the indoor inhalation exposure route.

Subpart L ("Building Control Technologies") of Part 742

BCTs are an acceptable final remedial action for the indoor inhalation pathway, when coupled with institutional controls under Subpart J. An NFR Letter can be conditioned upon an approved BCT being in place and operational before human occupancy of the building at issue. R09-9/King PFT1 at 21. BCTs are not recognized for purposes of determining compliance with Tier 1 ROs.

Subpart L describes the requirements for four types of BCTs: sub-slab depressurization (SSD); sub-membrane depressurization (SMD); membrane barrier; and vented raised floors. St. of Reas. at 12; King PFT1 at 23-26. All four are economically reasonable and technically feasible. Tr.1 at 104. SSD, for example, is an active venting system for existing and new buildings, which works by drawing contaminated air from the beneath the building and venting it to the atmosphere. A membrane barrier system is for new buildings and works by physically blocking entry of volatile chemicals into the indoor air space. R09-9/King PFT1 at 22. Selection of BCTs is not limited to the four listed under Section 742.1210(c). However, other alternatives would have to be reviewed and approved under Tier 3. Tr.1 at 102-03.

Finally, if a BCT at a school is rendered inoperable for five consecutive calendar days during the school year when school is in session, then IEPA, the school board, and every parent or legal guardian for all enrolled students must be notified by the school administrator . PC7 at 7, PC8 at 4. *See* Section 742.1200(e)(3).

Appendices

To accommodate the addition of the indoor inhalation exposure route and reconcile the TACO amendments with those adopted in docket R08-18 on groundwater quality standards, the Board adopts both the addition of new tables and the revision of some existing tables. The final amendments to the Appendices include: (1) updated physical and chemical parameter values in Appendix C, Table E based upon updates in the sources IEPA uses; (2) revised toxicity values based upon USEPA's latest hierarchy; (3) the addition of 13 new chemicals as a result of their inclusion in the groundwater quality standards (35 Ill. Adm. Code 620, R08-18); (4) a new SSL equation along with the J&E equations and parameters; and (5) Tier 1 remediation objectives for the indoor and outdoor inhalation exposure routes. PFT1 Hurley at 1-2, 9; St. of Reas. at 12-14. The Appendix F model for ELUCs is also amended to reflect the new indoor inhalation exposure route. These amendments do not update ROs for the existing exposure routes, but IEPA indicated that it will submit a separate rulemaking proposal at a later date to do so. St. of Reas. at 7.

Appendix A ("General")

Table A ("Soil Saturation Limits (C_{sat}) for Chemicals Whose Melting Point is Less than 30°C"); Table E ("Similar-Acting Noncarcinogenic Chemicals"[14]); Table F ("Similar-Acting Carcinogenic Chemicals"). In Appendix A, Table A, a column is added for the "soil saturation limit" (C_{sat}) for the soil component of the groundwater ingestion exposure route. PFT1 Hurley at 6. Tables A, E, and F reflect new chemicals added to the Part 620 groundwater quality standards (35 Ill. Adm. Code 620, R08-18). PFT1 Hurley at 7. The 13 new chemicals were detected in Illinois groundwater and had sufficient toxicity values to support the development of groundwater standards. R08-18/Cobb PFT1 at 11-17; R08-18/Hornshaw PFT1 at 5-7; R08-18/IEPA PFT2 at 10.

Of the new chemicals added to the groundwater quality standards through the R08-18 rulemaking, perchlorate was not included in this TACO rulemaking because it is not a volatile chemical and molybdenum was not included because it was withdrawn from the R08-18 proposal. Ms. Hurley explained that perchlorate would be added in future TACO amendments. Tr.1 at 113-14. The remaining 13 new chemicals are: 2-butanone (methyl ethyl ketone, MEK); dicamba; dichlorodifluoromethane; p-dioxane; 1,3-dinitrobenzene; HMX (high melting explosive, octogen); isopropylbenzene (cumene); mecoprop (MCPP); 2-methylnaphthalene; RDX (royal demolition explosive, cyclonite); trichlorofluoromethane; 1,3,5-trinitrobenzene; and 2,4,6-trinitrotoluene (TNT). R08-18/Hornshaw PFT1 at 5.

Table J ("List of TACO Volatile Chemicals for the Indoor Inhalation Exposure Route"). Added to Appendix A is Table J, which lists 59 "volatile chemicals" to be evaluated for the indoor inhalation exposure route. The definition for "volatile chemicals" replaces "volatile organic compounds" (VOCs) in TACO to include other volatile contaminants subject to evaluation under the new indoor inhalation pathway that are not organic, such as mercury. R09-9/King PFT1 at 2-3; Hurley PFT1 at 7. The definition for volatile chemicals differs from USEPA's VOCs definition in its 2002 draft VI guidance.[15] IEPA's Ms. Hurley explained that USEPA's VOCs definition includes many polynuclear aromatic hydrocarbons (PNAs) that do not volatilize in a significant amount. R09-9/Hurley PFT1 at 7. Table J does not include any of the PNAs that would not volatilize. R09-9/Tr.1 at 58-59. Dr. Salhotra added that "the solubility of those chemicals is very small, so there's going to be very little of those chemicals present in the groundwater." R09-9/Tr.1 at 60.

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[14] "'Similar-Acting Chemicals' are chemical substances that have toxic or harmful effect on the same specific organ or organ system . . . ." 35 Ill. Adm. Code 742.200.

[15] USEPA, "Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils" (Nov. 2002).

IEPA chose the chemical naphthalene as a "cutoff point" in determining whether a chemical meets the definition of "volatile chemical" because naphthalene is included in both SW846 Method 8260 (volatiles) and 8270 (semi-volatiles). R09-9/Tr.1 at 59. According to IEPA's Mr. King, there may be other chemicals of concern present at a site that would meet the definition of "volatile chemicals" and yet not appear in Appendix A, Table J. Mr. King stated that "sites contaminated by those chemicals would need to request site-specific remediation objectives from IEPA." Tr.1 at 67-68; *see* Section 742.515(f) ("request site-specific remediation objectives from the Agency or propose site-specific remediation objectives in accordance with Subpart I [Tier 3] of this Part, or both.").

Table K ("Soil Vapor Saturation Limits (C_v^{sat}) for Volatile Chemicals"). Table K is added, listing the "soil vapor saturation limits" (C_v^{sat}) for the volatile chemicals, calculated from the equation J&E5. Hurley PFT1 at 8. The C_v^{sat} of the chemical becomes the soil gas RO if the calculated value exceeds the C_v^{sat} value or if there are no toxicity criteria available for the inhalation route of exposure.

Appendix B ("Tier 1 Illustrations and Tables")

In Appendix B, Table G is added to provide the "Tier 1 Soil Gas Remediation Objectives for the *Outdoor* Inhalation Exposure Route." ROs were calculated using the new SSL equation S30, added to Appendix C, Table A. Also adopted is the addition of Table H ("Tier 1 Soil Gas and Groundwater Remediation Objectives for the *Indoor* Inhalation Exposure Route – *Diffusion and Advection*") and Table I ("Tier 1 Soil Gas and Groundwater Remediation Objectives for the *Indoor* Inhalation Exposure Route – *Diffusion Only*"). Table H ROs were calculated using both diffusion and advection contaminant transport mechanisms of the J&E Model, while Table I is based upon diffusion only. Hurley PFT1 at 9-10; Tr.1 at 18.

As noted, when the calculated soil gas RO exceeds the C_v^{sat} for the chemical or when there are no toxicity criteria available for the inhalation exposure route, the soil gas RO is set at the C_v^{sat}. When the calculated groundwater RO exceeds the solubility of the chemical in water or when there are no toxicity criteria available for the ingestion exposure route, the groundwater RO is set at the solubility limit. Hurley PFT1 at 10. For chloroform, the groundwater quality standard is the RO because the calculated RO was more[16] stringent than the groundwater quality standard. *Id*.

Appendix C ("Tier 2 Illustrations and Tables")

In Table A ("SSL Equations"), a new SSL equation, S30, is added to calculate the soil gas remediation objectives for the outdoor inhalation exposure route.

[16] In its first-notice opinion, the Board incorrectly used the term "less." PC6.

In Table B ("SSL Parameters"), the source of the toxicity values is revised in light of USEPA's latest hierarchy for determining human health toxicity values under Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53, December 5, 2003. Hurley PFT1 at 11. The revised hierarchy still specifies the Integrated Risk Information System (IRIS) database as the first option for toxicity values, but second and third tiers of data sources are also included now. The second tier is USEPA's Provisional Peer Reviewed Toxicity Values (PPRTV). The third tier includes three named sources along with other sources as appropriate. Ms. Hurley explained that IEPA has adopted this hierarchy with some minor revisions. Hurley PFT1 at 3-4; R08-18/Cobb PFT1 at 11. To simplify the listing in the table for the source of toxicity values, reference is made to IEPA's website.[17] The website contains tables of toxicity values and their sources and is updated quarterly. Hurley PFT1 at 5; R09-9/Tr.2 AM at 19. Ms. Hurley confirmed that although toxicity values are updated quarterly, the website updates do not effectuate a change in the Tier 1 values in the rule. R09-9/Tr.2 AM at 22-23.

In Table E ("Default Physical and Chemical Parameters"), the default physical and chemical parameters are updated and the 13 new chemicals are added from the R08-18 groundwater quality standards, R08-18. The updated physical and chemical parameter values are a result of updates in the sources IEPA uses for information: USEPA's Superfund Chemical Data Matrix (SCDM), CHEMFATE, PhysProp, USEPA's Water9 Software for diffusivity values, and Handbook of Environmental Degradation Rates by P.H. Howard (1991) for first order degradation constant values. Hurley PFT1 at 2, 12.

In Table F ("Methods for Determining Physical Soil Parameters"), the J&E equations are added to the methods for determining physical soil parameters. Hurley PFT1 at 12.

Table L ("J&E Equations") and Table M ("J&E Parameters") reflects the J&E equations, parameters, and default values. The exposure factors are consistent with the current TACO regulations, and the toxicity factors are based upon USEPA's new hierarchy. King PFT1 at 10. Tier 2 ROs would be developed using the J&E equations along with default and site-specific parameters, as provided in Appendix C, Tables E, L, and M. King PFT1 at 15.

Appendix F ("Environmental Land Use Control")

For this institutional control, references to "soil gas" and "indoor inhalation building control technologies" are added to the model ELUC.

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[17] IEPA indicated the toxicity values and their sources are listed at http://www.epa.state.il.us/land/taco/toxicity-values.xls. R09-9/Hurley PFT2 at 1.

DISCUSSION

The Board's second-notice findings remain unchanged and are adopted at final notice. By way of background, the Board first notes that IEPA's R11-9 proposal was generally supported by most participants who testified or provided public comment in this rulemaking. *See* Exh. 10 (SRAC); PC2 (LVEJO); PC5 (City of Champaign); *see also* Tr.1 at 22-23 (USEPA). However, during the course of this proceeding, numerous specific concerns were raised by participants and the Board over aspects of and omissions from IEPA's proposal. In this part of the opinion, the Board discusses the issues in this rulemaking and the Board's findings. These matters are addressed in the following sequence:

  - Whether NFR Letters Will Specifically Refer to the New Indoor Inhalation Exposure Route When the Pathway Has Been Addressed (p. 92)
  - "Reopening" NFR Letters (p. 93)
- Definition of "Building" (pp. 94-95)
- Multi-Building Sites (p. 95)
- Building Control Technologies or "BCTs" (pp. 95-97)
- BCT Maintenance Requirements (pp. 97-104)
  - NFR Letter Conditions (pp. 97-99)
  - Voidance "Safe Harbor" (pp. 99-100)
  - Notice to IEPA of BCT Inoperability (pp. 100-104)
- Off-Site Impacts (p. 105)
  - Modeling (p. 105)
  - Environmental Land Use Controls or "ELUCs" (p. 105)
- School Sites with NFR Letters Not Addressing the Indoor Inhalation Pathway (pp. 105-110)
- "Right-to-Know" Requirements (pp. 110-111)
- Additional Chemical Constituents Adopted (pp. 111-112)
- Technical Feasibility and Economic Reasonableness (pp. 112-117)
  - Technical Feasibility (pp. 112-113)
  - Economic Reasonableness (pp. 113-117)

The Board concludes its discussion by describing some minor revisions made to the rule language previously proposed (pp. 117-120).

<u>USEPA Feedback on Proposal Development</u>

In November 2005, IEPA brought together an internal workgroup to develop a mechanism for evaluating the indoor inhalation exposure route within TACO. St. of Reas. at 4. IEPA then worked with SRAC to listen to concerns and reach agreement on key provisions. *Id*. In September 2008, IEPA filed a proposal with the Board to add the indoor inhalation exposure route to the TACO methodology, which was docketed by the Board as R09-9. *Id*.

After two hearings and the pre-first notice comment period in R09-9, USEPA informed IEPA that the IEPA's proposal was inconsistent with national policy and operation of the J&E Model. St. of Reas. at 4. On October 5, 2009, IEPA filed a motion for a partial stay of the amendments proposed in R09-9 pertaining to vapor intrusion, which the Board granted for one year with a requirement to file quarterly status reports. *Id*. at 4-5.

On January 28, 2010, IEPA contacted USEPA by telephone to communicate a summary of IEPA's strategy for addressing USEPA's concerns. On February 3, 2010, IEPA met with SRAC to present the new strategy, answer questions, and listen to comments. R09-9/IEPA 2-10 Status at 1-2. IEPA's new strategy involved making two significant changes to its original proposal in R09-9: (1) adding the *advection* component to the modified J&E Model and (2) adding soil gas remediation objectives (or "ROs") to the existing *outdoor* inhalation exposure route. St. of Reas. at 5. The first change responded to USEPA's concerns with using the J&E Model to calculate ROs without an advection component. IEPA explained that the advection component accounts for the migration of soil gas due to the differences in pressure between the building interior and the soil nearest the building foundation. *Id*. The second change would enable compliance with the outdoor inhalation exposure route to be met by using either soil or soil gas ROs. IEPA indicated this would increase the usefulness of soil gas data. *Id*.; Tr.1 at 35-40.

On May 25, 2010, IEPA met with USEPA Region 5 to discuss the changes made in response to USEPA's concerns, to answer questions, and to request USEPA's concurrence. On August 12, 2010, IEPA received a letter from USEPA commenting further and recommending changes to the revised proposal. St. of Reas. at 5; PFT1 King at 13; Exh. 2 at 1 of PFT2 King (Exh. 5); R09-9/IEPA 8-10 Status at 1-2. USEPA's August 2010 letter recognized that if Illinois did not include a vapor intrusion pathway under TACO, no mechanism existed for property owners to address vapor intrusion under any of the State's cleanup programs. King PFT2, Exh. 2 at 3. USEPA is in the process of revising its 2002 draft vapor intrusion guidance,[18] which IEPA relied upon for using the J&E Model. However, USEPA posed no objection to Illinois proceeding to adopt indoor inhalation regulations in advance of USEPA's issuance of final vapor intrusion guidance. *Id*.; King PFT1 at 4; Tr.1 at 22-23. At hearing, IEPA stated that it is "addressing hundreds of sites on an annual basis and the longer that we wait, the longer this issue is left unaddressed . . . ." Tr.1 at 23.

IEPA explained that use of the J&E Model was established in USEPA's 2002 draft vapor intrusion guidance. King PFT1 at 4. USEPA's August 12, 2010 letter recognized that without updated federal vapor intrusion guidance, IEPA believes that TACO should rely on a chemical transport model, such as the J&E Model, because it is already widely accepted. King PFT2, Exh. 2 at 3. Without the J&E Model, IEPA indicated the only other option would be to develop its own statewide database of vapor intrusion attenuation factors, at great time and expense. *Id*.[19] IEPA indicated that using USEPA's draft nation-wide attenuation factors would not mimic Illinois conditions and would not be acceptable to stakeholders or the Board. *Id*. at 8.

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[18] USEPA, "Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils," OSWER Draft Guidance, EPA Publication No. EPA/530D-01/004 (November 2002).

[19] "The term 'attenuation factor,' defined as the ratio of indoor air concentration to subsurface concentration, is used as a measure of the decrease in concentration that occurs during vapor migration . . . ." "Superfund Vapor Intrusion FAQs," USEPA (Feb. 2012) at 1, available at http://www.epa.gov/superfund/sites/npl/Vapor_Intrusion_FAQs_Feb2012.pdf.

With that understanding, USEPA supported IEPA's decision to include the advection component for shallow contaminant sources. USEPA also supported IEPA's proposal to include institutional controls as part of the management requirements (for addressing deeper sources of contamination) that would require maintenance of a minimum 5 foot distance between sources and building foundations. King PFT2, Exh. 2 at 1, 6. However, USEPA expressed concern that the proposal still did not use the advection component at depths greater than 5 feet below a building foundation. *Id*. at 1. USEPA stated that volatile contamination deeper than 5 feet could enter the advection zone and affect the rate of transport to indoor air. USEPA indicated that measurable effects in a structure have been reported from volatile contamination up to 15 feet away in the soil. *Id*. at 5.

USEPA mentioned that the USEPA Office of the Inspector General (OIG) recently issued a review of USEPA's 2002 draft vapor guidance document.[20] USEPA indicated that the OIG review suggested that more than one line of evidence would be beneficial in reducing the uncertainty involved in evaluating the vapor intrusion pathway. Based upon this, USEPA suggested modifying IEPA's proposal to require that both soil gas and groundwater remediation objectives be met if Appendix B, Table I (diffusion only) is used. King PFT2, Exh. 2 at 6. USEPA also expressed concern about the uncertainty inherent in using the J&E Model whenever the water-filled soil porosity is below 30%, the default value IEPA originally selected. *Id*. at 2, 6-7.

USEPA indicated that if IEPA incorporated USEPA's suggested modifications, the proposal would be acceptable to USEPA Region 5's RCRA program for use at RCRA corrective action sites. In addition, USEPA explained that these modifications would be consistent with the multiple lines of evidence approach recommended in the December 2009 OIG Report to reduce uncertainty when evaluating the vapor intrusion pathway. King PFT2, Exh. 2 at 2. USEPA's letter also stated that the "OSWER [Office of Solid Waste and Emergency Response] is committed to issuing the final VI [vapor intrusion] guidance by November 30, 2012.[21] When

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[20] USEPA 2009 "Evaluation Report: Lack of Final Guidance on Vapor Intrusion Impedes Efforts to Address Indoor Air Risks"; Report no. 10-P-0042; Office of the Inspector General, Washington, DC.

[21] As of this date, USEPA has not issued the final vapor intrusion guidance. USEPA now states that it "is affording the public with an opportunity to provide input on its draft final vapor intrusion guidance documents" and that "[t]he public may provide input by June 24, 2013." http://www.epa.gov/oswer/vaporintrusion/ (last updated May 9, 2013). The cited USEPA website provides links to the referenced "draft final vapor intrusion guidance documents," which links lead both to a document entitled "OSWER Final Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air (External Review Draft)" (April 11, 2013) and to another website entitled "Petroleum Vapor Intrusion (PVI) Compendium" (lasted updated May 6, 2013). *Id*. The "Petroleum Vapor Intrusion (PVI) Compendium"

this guidance becomes available, it is suggested that [IEPA] could screen sites based on default empirical attenuation factors rather than relying solely on the J&E Model." *Id*. at 6.

IEPA replied to USEPA's August 12, 2010 letter on October 15, 2010. King PFT2, Exh. 3. IEPA agreed with USEPA that multiple lines of evidence should be obtained in order to use Appendix B, Table I (diffusion only). Therefore, IEPA revised its proposal so as to require compliance with both soil gas and groundwater remediation objectives when using Table I. When asked by Board staff at hearing whether a multiple-lines-of-evidence approach requiring compliance with both soil gas and groundwater remediation objectives should be used for Appendix B, Table H (diffusion and advection) as well, IEPA replied that "indoor inhalation is not a stand-alone evaluation," but rather part of the larger evaluation process governed by TACO, which is already a multiple-lines-of-evidence evaluation. Tr.1 at 14; King PFT2 at 1-3. Mr. Martin testified that SRAC agrees that IEPA's indoor inhalation proposal, taken in context with the entire TACO process, does apply multiple lines of evidence as envisioned by USEPA. Martin PFT2 at 2.

IEPA also addressed USEPA's concern regarding the use of 30% water-filled soil porosity, noting that Illinois stakeholders raised the same concern. King PFT2, Exh. 2 at 6-7; King PFT1 at 13-14. IEPA explained that the 30% value used in its original proposal was based upon the default parameter recommended by USEPA's Soil Screening Guidance Document (1996).[22] Recognizing that the 30% figure was based upon sand, IEPA conducted further research and found that loam is actually more typical of Illinois soils. Tr.1 at 117. To be more consistent with typical Illinois soils, IEPA adjusted the water-filled soil porosity value to 15%. In turn, IEPA recalculated the remediation objectives in Appendix B, Tables H and I, which had the effect of making them more stringent by as much as 25% in Table H (diffusion and advection) and 90% in Table I (diffusion only). With the more conservative screening values, IEPA indicated that the Tier 1 tables would no longer need to be conditioned upon a site-specific water-filled soil porosity. King PFT1 at 13-14. On this note, Mr. Reott of Reott Law Offices, LLC suggested that under a new rulemaking, IEPA consider applying the new default value for water-filled soil porosity to the rest of the TACO Tier 1 values to maintain a consistent approach. PC4 at 9-10.

Regarding USEPA's reference to its impending final vapor intrusion guidance, the 2009 OIG evaluation report, and a 2010 OSWER report entitled "Review of the Draft 2002 Subsurface

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website includes a link to a document entitled "Guidance For Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank Sites" (April 2013), which is also labeled "External Review Draft."

[22] "Soil Screening Guidance: User's Guide," EPA Publication No. EPA/540/R-96/018, PB 96-963505 (April 1996). 35 Ill. Adm. Code 742.210.

Vapor Intrusion Guidance,"[23] Board staff asked IEPA to comment on how USEPA's final guidance would be considered by IEPA and whether it would warrant a new rulemaking. Tr.1 at 20-21. IEPA responded that it looked to USEPA's draft guidance quite a bit, but IEPA's R11-9 proposal differed in the approach to attenuation factors. While the USEPA guidance steers evaluations toward a national database of attenuation factors, IEPA chose to use Illinois-specific soil types and chemical-specific parameters in developing its approach to attenuation factors. Tr.1 at 21-22, 25; Tr.2 at 20-21, 24. IEPA pointed out that USEPA's 2008 database was limited to 41 sites, none of which were in Illinois. Tr.2 at 24.

The Board appreciates the initiative that IEPA took to coordinate with USEPA, SRAC, and other stakeholders on the proposal to add a vapor intrusion pathway to TACO. The Board has received no public comment from USEPA on the amendments. The Board requested that IEPA evaluate the final USEPA vapor intrusion guidance when it becomes available and timely file any proposed TACO amendments based upon that evaluation. IEPA has committed to performing the evaluation and to timely filing any appropriate amendments. PC7 at 3.

The Board reiterates its finding that the use of the J&E Model, default parameters, and Tier 1 Tables H and I is appropriate for sites in Illinois. However, this finding remains subject to the Board's discussion below concerning the applicability of Tiers 1 and 2 for indoor inhalation ROs and the use of institutional controls for this pathway.

Scope of Indoor Inhalation Exposure Route

Mr. King testified:

> We're trying to figure out whether contamination that's in the soil and groundwater is going to be causing contamination to go into a building. We're not trying to figure out whether contamination in the building is causing problems in the building. R09-9/Tr.2 PM at 48.

In R11-9, IEPA originally proposed that new subsection (i) of Section 742.105 on "Applicability" read as follows:

> <u>An evaluation of the indoor inhalation exposure route under this Part addresses the potential of contaminants present in soil gas and groundwater to reach human receptors. It does not evaluate the safety or protectiveness of buildings on or off-site.</u> Exh. 8.

At the first hearing, Board staff questioned whether the second sentence of this provision

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[23] USEPA, OSWER, "Review of the Draft 2002 Subsurface Vapor Intrusion Guidance," EPA 530-D-02-004, posted August 30, 2010 (Exh. 4).

might be inconsistent with the development of ROs under Tier 3, which can rely upon site-specific building parameters. Tr.1 at 50-51, 84. In response, IEPA filed *errata* sheet number two, proposing the following as subsection (i):

> An evaluation of the indoor inhalation exposure route under this Part addresses the potential of contaminants present in soil gas and groundwater to reach human receptors. It does not evaluate whether contamination within a building, either in the building structure itself or in products within the building may be creating human health risks. Exh. 8.

In its first-notice opinion, however, the Board found that if a site evaluator is sampling indoor air under Tier 3, whether building structures or products within the building are sources of indoor air contamination would be investigated. This would be done to establish any contaminant levels not attributable to a subsurface source of vapor intrusion. Tr.2 at 28-30. Accordingly, at first notice, the Board modified the second sentence of subsection (i) to avoid any potential conflict with such a Tier 3 investigation.

Upon additional Board staff questioning at the second hearing, IEPA agreed that the proposal was "designed to address indoor inhalation of vapors coming only from either soil gas or groundwater" and that the amendments accordingly would not apply when the contamination is not "coming from the subsurface." Tr.2 at 47. At first notice, the Board therefore changed the second sentence to avoid suggesting that the "building structure" and "products" are an exhaustive list of inapplicable contaminant sources. The Board also added the words "in buildings" to the end of the first sentence to clarify that only the "indoor air" inhalation pathway is at issue.

To better reflect IEPA's intent, the Board proposed that Section 742.105(i) read as follows at first notice:

> An evaluation of the indoor inhalation exposure route under this Part addresses the potential of contaminants present in soil gas or groundwater to reach human receptors within buildings. This Part does not address the remediation or mitigation of any contamination within a building from a source other than soil gas or groundwater, such as the building structure itself and products within the building. *See* first-notice proposed Section 742.105(i).

IEPA agreed with this language (PC7 at 3), which appears unchanged in the final rules.

100 Feet Horizontally Between Contamination and Building

Proposed Second Notice for Public Comment

The Board's *proposed* second-notice opinion of January 10, 2013, noted that during the first-notice period, IPC commented that using "source-receptor separation distances in regulatory site screening is not new." PC10 at 3. Citing USEPA's 2002 draft subsurface vapor intrusion guidance, IPC noted that USEPA "has proposed a source-receptor separation distance of 100 [feet] (30 [meters])." *Id.* According to IPC, "[t]his distance is based on the fact that vapor intrusion could not be documented at residences displaced by [greater than] 100 [feet] (30 [meters]) laterally from the interpolated edge of a chlorinated hydrocarbon ground-water plume." *Id.*

The Board also noted that at first notice, the Board proposed IEPA's suggested language at new Section 742.312(b)(1)(A) for purposes of allowing the indoor inhalation exposure route to be excluded based upon the proximity of the building to the contamination: "No building or man-made pathway exists or will be placed *above* the contaminated soil gas or groundwater." Current Rulemaking, R11-9, slip op. at 88 (Apr. 19, 2012) (emphasis added). The Board observed in its proposed second-notice opinion, however, that "[t]aken literally, this criterion could be satisfied if all volatile chemical contamination is located a few feet away horizontally from the building, *i.e.*, no part of the dissolved-phase contamination plume is located directly below the building." Current Rulemaking, R11-9, slip op. at 31 (Jan. 10, 2013). The Board therefore sought public comment on whether the potential for lateral migration of volatile contamination warranted requiring that a minimum "source-building lateral distance" be met before allowing the indoor inhalation exposure route to be excluded based upon building/contamination proximity. *Id.* at 1.

The Board's proposed second-notice opinion noted that vapor intrusion guidance from USEPA, Wisconsin, and Michigan make use of a 100-foot source-building lateral distance. Current Rulemaking, R11-9, slip op. at 31-32 (Jan. 10, 2013), citing "Superfund Vapor Intrusion FAQs," USEPA (Feb. 2012) at 3[24]; "Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils," OSWER Draft Guidance (EPA Publication No. EPA/530D-02/004 (Nov. 2002)) at 17 (then proposed for incorporation by reference); Exh. 12 at 6 ("Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin," Wisconsin Dept. of Nat. Res., PUB-RR-800 (Dec. 2010)); Draft "Guidance Document for the Vapor Intrusion Pathway, Michigan Dept. of Env. Qual., Remediation Division (May 2012) at 3-4, Appendix B.3 at 5, 7[25].

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[24] Available at http://www.epa.gov/superfund/sites/npl/Vapor_Intrusion_FAQs_Feb2012.pdf.

[25] Available at http://dnr.wi.gov/files/PDF/pubs/rr/RR800.pdf; available at http://www.michigan.gov/documents/deq/deq-rrd-CSI-VIGuidanceDocumentAllAppendicesExceptF_384573_7.pdf

The Board proposed for public comment the following revised Section 742.312(b)(1)(A) for VI pathway exclusion based upon building/contamination proximity:

> No building ~~or man-made pathway~~ exists or will be placed within 100 feet, horizontally, of ~~above~~ the contaminated soil gas or groundwater and no man-made pathway exists or will be placed above the contaminated soil gas or groundwater . . . . Current Rulemaking, R11-9, slip op. at 32 (Jan. 10, 2013)

Related to this 100-foot pathway exclusion language, the Board also proposed for public comment that the applicability of Tier 1 and Tier 2 indoor inhalation ROs be limited to circumstances where the existing or potential building *within 100 feet, horizontally*, of the contamination has a full concrete slab-on-grade or a full concrete basement floor and walls.

Public Comments on Proposed Second Notice

IEPA, IPC, IMA, IERG, and SRAC filed public comments explaining why they opposed the proposed 100-foot source-building horizontal distance requirement for VI pathway exclusion and Tier 1 and Tier 2 RO applicability. PC12 at 1-2; PC13 at 2; PC14 at 1; PC15 at 2-3; PC17 at 1-4. CICI filed a public comment agreeing with IMA, SRAC, and IEPA on the issue of the "Source-Building Horizontal Separation Distance Standard." PC16 at 1. The City of Chicago filed a public comment adopting the comments of IEPA and specifically noting that the City "shares the Agency's concerns about the impacts of the 100-foot buffer requirement in densely populated areas." PC18 at 1.

IEPA asserted that the 100-foot lateral separation distance "undermines the legitimacy of site characterization" under SRP and the Leaking UST Program, requirements which must be met "*before* pathway exclusion or remediation objectives may be applied." PC12 at 2-3 (emphasis added). Likewise, IMA asserted that "the use of this 100 foot criterion as an absolute standard ignores the value of the more sophisticated site assessments that are already required." PC14 at 1. SRAC noted that defining the nature and extent of contamination is "[o]ne of the initial requirements of Illinois' remedial programs, SRP, LUST, etc.," and added that "[a]n NFR letter cannot be issued until this step is complete and all potential exposure pathways have been addressed." PC16 at 3. On the other hand, IPC favored a shorter source-receptor separation distance (5 to 18 feet) for petroleum vapor sites and advocated use of the shorter distance to "eliminate unnecessary site characterization at numerous petroleum release sites." PC13 at 2; *see also* PC10 at 3 (IPC commented on source-receptor separation distances of 5 to 30 feet).

IEPA also asserted that the 100-foot lateral separation distance "compromises the economic reasonableness of the indoor inhalation pathway proposal" for "cleanup program participants, site owners, off-site property owners, potential developers, state and local transportation agencies and Illinois EPA." PC12 at 6-7. The "negative impacts" IEPA identified (*e.g.*, costs and delay for obtaining additional ELUCs) were based upon the assumption that the

100-foot separation distance would extend to off-site properties. PC12 at 7-12. SRAC raised the similar concerns over anticipated dealings with off-site owners. PC16 at 2-3.

Additionally, IEPA stated that USEPA, Wisconsin, and Michigan have used the 100-foot lateral separation "only in the context of an initial screening distance not taking into account the site specific circumstances (geology, depth to impacts, contaminants of concern, etc.)." PC12 at 3-5. IEPA contrasted the Board's proposal as requiring the 100-foot separation "to achieve compliance." PC12 at 4. Likewise, IERG asserted that in these guidance documents of USEPA and other states, "100 feet is established as a screening level, indicating that further study may be warranted; not that a remedy is necessarily required." PC15 at 2; *see also* PC16 at 3 (SRAC made same comment); PC14 at 1 (IMA noted that 100-foot horizontal distance "has been used in some other states as a screening tool to identify situations where further study is needed to determine the nature and extent of contamination").

IEPA maintained that "no scientific basis exists for imposing a 100-foot setback at all sites." PC12 at 5; *see also id*. at 6 ("one-size-fits-all additional 100-foot radius to the known extent of contamination" contradicts TACO's site-specific, risk-based approach); PC15 at 2-3 (IERG described the 100-feet as "arbitrary" and "counter to the risk-based underpinnings of TACO"); PC16 at 1 (SRAC described the 100 feet as "arbitrary and inappropriate within the context of TACO and unnecessary in protection of public health."). According to IEPA, "lateral migration of contaminants in soil gas has not been shown in the current research by USEPA." PC12 at 5, citing "Evaluation of Empirical Data to Support Soil Vapor Intrusion Screening Criteria for Petroleum Hydrocarbon Compounds," EPA 510-R-13-001 at 62-63 (Jan. 2013). IEPA added that although USEPA's 2002 draft VI guidance cites empirical data from Colorado confirming no significant indoor air concentrations in residences farther away than one house lot, a distance presumed to be approximately 100 feet, "Colorado selected 100 feet not based on multi-site comparative analyses of soil gas and groundwater data, but because that distance *marks a convenient legal property boundary*." PC12 at 6 (emphasis in original).

Lastly, IERG asserted that the 100-foot lateral separation language would "significantly change" the rules proposed at first notice and necessitate "further hearings and submission of evidence on this issue" before going forward. PC17 at 3-4.

Board Analysis of "100-Foot Rule" at Second Notice

Background. In its second-notice opinion, the Board emphasized that under the current TACO rules:

> No exposure route may be excluded from consideration until characterization of the extent and concentrations of contaminants of concern at a site has been performed. The actual steps and methods taken to characterize a site shall be

> determined by the specific program requirements under which the site remediation is being addressed." 35 Ill. Adm. Code 742.300(b).

Accordingly, site characterization pursuant to the underlying regulatory program (*e.g.*, SRP, Leaking UST Program) is a prerequisite to pathway exclusion under the existing TACO provisions. *See* 35 Ill. Adm. Code 742.310(a), 742.315(a), 742.320(a). The Board observed at second notice that site characterization was likewise proposed as a prerequisite to exclusion of the VI exposure route. *See* Section 742.312(b)(2). Regardless of pathway exclusion, which is optional under TACO (*see* 35 Ill. Adm. Code 742.110(a)), site characterization is an independent requirement of the underlying regulatory programs (*see, e.g.*, 35 Ill. Adm. Code 734.315, 734.320, 734.325, 740.420, 740.430, 740.440).

The Board recognized in its proposed second-notice opinion that the 100-foot horizontal separation distance would only allow for pathway exclusion *after* satisfaction of "the site characterization requirement of the underlying regulatory programs, such as SRP or the leaking UST program." Current Rulemaking, R11-9, slip op. at 32 (Jan. 10, 2013); *see also id*. at 17. As contemplated by the Board, measuring the 100-foot horizontal distance therefore required knowing the extent of "the contamination (*i.e.*, any exceedence of Tier 1 'diffusion and advection' ROs for volatile chemicals)." *Id*. at 32. For the "source-building lateral distance," the Board therefore conservatively considered the "source" as soil gas or groundwater concentrations in excess of these Tier 1 ROs.

As noted by the Board at second notice, USEPA recently indicated that "where there is *adequate characterization* of the contamination present," the 100-foot horizontal separation distance can be used to "screen out sites from further consideration." "Superfund Vapor Intrusion FAQs," USEPA (Feb. 2012) at 9 (emphasis added); *see also* "Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils," OSWER Draft Guidance (EPA Publication No. EPA/530D-02/004 (Nov. 2002)) at 16 ("approximately 100 ft laterally or vertically of known or interpolated soil gas or groundwater contaminants"). Accordingly, the Board's January 10, 2013 proposed opinion used the phrase "site screening" (Current Rulemaking, R11-9, slip op. at 32 (Jan. 10, 2013)), not as a means to *avoid* site characterization, but rather in the sense that once TACO's pathway exclusion requirements are met (*including* the requirement for site characterization), "then the exposure route is excluded from consideration and no remediation objective(s) need be developed for that exposure route" (35 Ill. Adm. Code 742.300(a)).

The Board chose the 100-foot lateral separation distance for public comment based upon its presence in USEPA and state guidance. As stated by USEPA, the 100-foot lateral distance is "[a] default distance adopted by many states." "Evaluation of Empirical Data to Support Soil Vapor Intrusion Screening Criteria for Petroleum Hydrocarbon Compounds," EPA 510-R-13-001, App. A at A-1 (Jan. 2013). The Board sought to contrast the first-notice language of proposed Section 742.312(b)(1)(A), which allowed for VI pathway exclusion when there is *any* horizontal separation distance between the contamination and the building.[26]

For purposes of this VI pathway exclusion, the Board intended that the then-proposed 100-foot rule would apply only to *on-site* buildings, *i.e.*, to exclude the pathway and thereby avoid having to develop ROs for the pathway, no building on the site could be located within 100 feet, horizontally, of the remaining contamination. The Board accordingly provided no discussion of the proposed 100-foot rule when addressing off-site contamination and ELUCs or additional costs. *See* Current Rulemaking, R11-9, slip op. at 82-83, 93 (Jan. 10, 2013). The 100-foot language with respect to the applicability of Tiers 1 and 2 was meant only to specify that these ROs need not be met when all contamination is beyond the 100-foot lateral distance from the building. Whether Tier 1 or Tier 2 ROs would have to be met when any contamination is within the 100-foot lateral distance from the building, whether on-site or off-site, would be dictated by the specific risks posed. However, the Board acknowledged at second notice that the January 10, 2013 rule language was ambiguous on these points and understood how the 100-foot provisions proposed for public comment generated concerns.

Even after clarifying these misunderstandings over terminology and scope, the Board was convinced by the public comments that removing the 100-foot rule language at second notice was the best course of action. In doing so, the Board relied primarily upon two factors. First, the Board found that the main purpose of the 100-foot horizontal separation distance in USEPA's 2002 VI guidance appeared to be determining *whether* detailed site characterization is warranted. That is, the 100-foot lateral distance is generally taken into account before, not after, any extensive site characterization. Second, IEPA represented that applying the 100-foot horizontal separation distance at all sites is not supported by science. The Board's March 7, 2013 opinion addressed these factors in turn before turning to the Board's remaining concern at second notice and the resulting second-notice rule language.

"Site Screening" *Before* Any Detailed Site Characterization. The Board acknowledged that the source of the 100-foot horizontal distance, USEPA's November 2002 draft subsurface VI guidance, uses the 100-foot distance as part of "Tier 1-Primary Screening," which is "designed to help *quickly* screen out sites at which the vapor intrusion pathway does not ordinarily need further consideration, and point out the sites that do typically need further consideration." "Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils," OSWER Draft Guidance (EPA Publication No. EPA/530D-02/004 (Nov. 2002)) at 14 (emphasis added); *see also id*. at 13, App. C ("Tier 2-Secondary Screening" and "Tier 3-Site Specific Pathway Assessment"). Under USEPA's "Tier 1-Primary Screening," it is recommended that the site evaluator determine whether the building is "near" subsurface contamination:

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[26] A *vertical* separation distance, no matter how great, between the contamination and the building is inadequate under Section 742.312(b)(1)(A).

> If inhabited buildings and/or future development are not located "near" the area of concern, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of the pathway should be needed. *** We recommend that an inhabited building generally be considered "*near*" subsurface contaminants if it is located within approximately 100 ft laterally or vertically of known or interpolated soil gas or groundwater contaminants . . . and the contamination occurs in the unsaturated zone and/or the uppermost saturated zone. *Id*. at 16 (emphasis in original).

Unlike a detailed site characterization, USEPA's Tier 1-Primary Screening "does not call for specific media concentration measurements for each constituent of concern." *Id*. at 7. *If* the Tier 1-Primary Screening, including the 100-foot lateral distance, "does not support a conclusion that the pathway is incomplete," USEPA *then* "recommend[s] the user proceed to [Tier 2] Secondary Screening." *Id*. at 8. USEPA's Tier 2 Secondary Screening "involves comparing measured or reasonably estimated concentrations of target chemicals in various media (groundwater, soil gas, and/or indoor air) to recommended numerical criteria." *Id*.

Wisconsin's guidance similarly calls for the VI pathway to be "investigated" *if* there are any buildings within 100 feet of a chlorinated volatile organic chemical soil source. Exh. 12 at 6 ("Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin," Wisconsin Dept. of Nat. Res., PUB-RR-800 (Dec. 2010)). Likewise, Michigan's guidance recommends "a VI receptor survey . . . to document the location of current or possible future receptors within a 100-foot radius from vapor sources" *before* conducting a "soil gas investigation," if any. Draft "Guidance Document for the Vapor Intrusion Pathway, Michigan Dept. of Env. Qual., Remediation Division (May 2012) at 3-4, Appendix B.3 at 5, 7 ("preferential pathways should be considered a viable pathway up to 100 feet from a source of vapors").

Scientific Support for the 100-Foot Lateral Distance. The Board also acknowledged at second notice that in USEPA's draft 2002 VI guidance, the specific support cited by USEPA for the 100-foot horizontal separation distance is a Colorado VI study in which "no significant indoor air concentrations [were] found in residences at a distance greater than one house lot (approximately 100 feet) from the interpolated edge of ground water plumes." "Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils," OSWER Draft Guidance (EPA Publication No. EPA/530D-02/004 (Nov. 2002)) at 17. For the proposition that "lateral migration of contaminants in soil gas has not been shown in the current research by USEPA," IEPA cited a January 2013 USEPA study, which concludes that a "[r]ecommendation of lateral distances is beyond the scope of this report." "Evaluation of Empirical Data to Support Soil Vapor Intrusion Screening Criteria for Petroleum Hydrocarbon Compounds," EPA 510-R-13-001 at 63 (Jan. 2013).

Concern Over Remaining Contamination Moving Laterally. At second notice, the Board did not construe any of the public comments filed after the January 10, 2013 proposal as taking the position that contaminated soil gas can only migrate upward at a 90 degree angle to the surface, or that impacted groundwater, itself a source of contaminated soil gas, cannot migrate laterally. In fact, the Board observed, USEPA had recently provided modeling results showing the ability of subsurface vapors to diffuse horizontally. "Conceptual Model Scenarios for the Vapor Intrusion Pathway," USEPA, EPA 530-R-10-003 (Feb. 2012) at §§ 4.2, 5.3.[27] Of course, "[v]apors can . . . migrate laterally along a preferential pathway, such as a utility corridor, within the more porous layers of soil, or beneath frozen ground, asphalt, or other barriers where vapors cannot escape (EPA 2002, 2008a)." "Superfund Vapor Intrusion FAQs," USEPA (Feb. 2012) at 4.

At hearing, Bhooma Sundar of USEPA, on her own behalf, presented verbal public comment on lateral vapor migration. Tr.2 at 25-27, 57. Ms. Sundar, a toxicologist, professor of human health risk, and project manager on vapor intrusion issues, has experience in remediating 120 homes in Hammond, Indiana for vapor intrusion. Tr.2 at 57. She commented as follows:

> [W]ith the chlorinated vapor contaminants there is no distance exclusion. Whether it is 5 feet or 30 feet vertically or 50 feet horizontally, it doesn't matter. There is a huge potential for the vapor to move horizontally and vertically into the building. Tr.2 at 59-61.

At first notice, the proposed pathway exclusion based upon building/contamination proximity read as follows:

> <u>No building or man-made pathway exists or will be placed above the contaminated soil gas or groundwater . . . .</u> First-Notice Proposed Section 742.312(b)(1)(A).

In its proposed second-notice opinion of January 10, 2013, the Board expressed concern that this language "could have been read to allow pathway exclusion based upon any horizontal separation distance greater than zero." <u>Current Rulemaking</u>, R11-9, slip op. at 32 (Jan. 10, 2013). None of the public comments filed after January 10, 2013, addressed this concern.

For purposes of the Section 742.312(b)(1)(A) pathway exclusion, the Board found at second notice that determining whether any part of the building is or will be placed "above" the volatile chemical contamination would be made when the site characterization is performed. Site characterization pursuant to the applicable underlying regulatory program (*e.g.*, SRP, Leaking UST Program) is a prerequisite to pathway exclusion, as it is under the current TACO rules. *See* Section 742.312(b)(2); *see also* 35 Ill. Adm. Code 742.310(a), 742.315(a), 742.320(a). Site characterization reveals "the extent and concentrations of contaminants of concern," but does not

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[27] Available at http://www.epa.gov/oswer/vaporintrusion/documents/vi-cms-v11final-2-24-2012.pdf.

itself include the development of ROs. 35 Ill. Adm. Code 742.300(b); *see*, *e.g.*, 35 Ill. Adm. Code 734.315, 734.320, 734.325, 740.420, 740.430, 740.440.

The Board found at second notice that if the site characterization demonstrated that no building or man-made pathway existed or would be placed "above" the current extent of volatile chemical soil gas or groundwater contamination, the first-notice rule language for Section 742.312(b)(1)(A), given its plain meaning, would allow the indoor inhalation pathway to be excluded from further consideration.[28] Accordingly, no ROs would need to be developed for the VI exposure route and, absent remediation under another TACO exposure route, subsurface concentrations of volatile chemicals *in excess of* Tier 1 ROs would be allowed to remain. In addition, the Board found that no BCT would be required to satisfy this pathway exclusion. BCTs and active biodegradation demonstrations (Section 742.312(b)(1)(B), (C)) are grounds for VI pathway exclusions *separate* from the pathway exclusion based upon building/contamination proximity. Further, Section 742.312(b)(1)(A), as proposed at first notice, lacked any explicit requirement to demonstrate future contaminant migration, unlike current pathway exclusion provisions in TACO for the groundwater ingestion pathway. *See* 35 Ill. Adm. Code 742.320.

Board Second-Notice Decision on "100-Foot Rule." The Board recognized at second notice that IEPA's ultimate issuance of an NFR Letter signifies that no remaining contamination poses a threat to human health or the environment via *any* pathway. *See, e.g.*, 35 Ill. Adm. Code 734.710, 740.610. With this in mind, the Board at second notice removed the 100-foot horizontal distance from the rules. However, as explained in detail below, the Board added VI pathway exclusion language to Section 742.312(b)(1)(A) to address its concern over the potential for remaining contamination to migrate laterally. Before turning to those discussions, the Board found that because this rulemaking involves amending only TACO, it would be inappropriate to adopt IPC's suggestion of establishing petroleum site source-receptor screening distances (5 to 18 feet) to replace site characterization requirements in the Leaking UST and SRP rules.

The 100-foot horizontal distance was not adopted by the Board at second notice because the Board found that the distance appeared to be used primarily as an *initial* screening tool in determining *whether* to conduct a detailed site characterization. USEPA guidance does indicate that a fully characterized site meeting the 100-foot lateral separation distance could be "screened out" of further VI pathway consideration at USEPA's first stage of screening. However, the guidance also suggests that a site *not* fully characterized could be so screened out by meeting the 100-foot lateral separation distance. More importantly, the Board found that the guidance indicates that if a site does *not* meet the 100-foot lateral separation distance at USEPA's first stage of screening, the site could still have the VI exposure route eliminated at a later stage *based upon further site characterization*. In other words, under USEPA guidance, a fully characterized

[28] This assumed compliance with the Section 742.305 "speed bump" requirements (page 17 above) and the placement of an institutional control on the property. *See* Sections 742.312(b)(2), (3).

site showing no threat of vapor intrusion need not meet the 100-foot lateral separation distance to avoid further action.

The Board also removed the 100-foot language because, according to IEPA, using the 100-foot horizontal distance at all sites is not supported by scientific evidence. USEPA had recently noted that "[t]he technical justification for exclusion distance criteria is relatively limited or not provided" in certain state guidance documents "given that detailed evaluations of empirical data and/or modeling studies to support inclusion or exclusion distances are a recent development." "Evaluation of Empirical Data to Support Soil Vapor Intrusion Screening Criteria for Petroleum Hydrocarbon Compounds," EPA 510-R-13-001, Appendix A at A-1 (Jan. 2013).

The Board found at second notice, however, that merely removing the 100-foot horizontal distance language left the rules ambiguous in several respects. First, the rules provide that when proceeding under Tier 1, the soil gas or groundwater ROs of Appendix B, Table H must be used when any soil or groundwater contamination is located 5 feet or less, vertically *or horizontally*, from the existing or potential building or man-made pathway. In that scenario, the mode of contaminant transport is not only diffusion but also advection. For example, a building not located "above" any contaminated soil gas or groundwater could also be located 4 feet away, horizontally, from all of the soil and groundwater contamination. The Board could find no reason why the first-notice version Section 742.312(b)(1)(A) should allow the VI pathway to be excluded when the contamination within five feet of the building foundation would otherwise dictate that the Tier 1 ROs of Appendix B, Table H be met.

Second, the Board found the delineation of the extent of contamination performed for site characterization may reveal, for example, that all contamination is set off laterally from (*i.e.*, not under) any building or man-made pathway *at that time*. These conditions would appear to satisfy Section 742.312(b)(1)(A) as originally proposed by IEPA. That provision, on its face, would merely require that no building or man-made pathway be above "the" contamination. However, the Board observed that if any modeled migration of contamination were to preclude a determination that the indoor inhalation exposure route will *remain* incomplete, this pathway exclusion would not be available.

Third, the Board found that the word "contaminated" in the first-notice version of Section 742.312(b)(1)(A) was not explained in the rule: "No building or man-made pathway exists or will be placed above the *contaminated* soil gas or groundwater." Current Rulemaking, R11-9, slip op. at 88 (Apr. 19, 2012) (emphasis added). This potential ambiguity may lead to disputes over when soil gas or groundwater should be considered "contaminated." The Board observed, however, that direction as to what the term should mean in this context could be found in both the existing and then-proposed TACO rules.

TACO presently states that "[a]ny given exposure route is not a concern if the concentration of each contaminant of concern detected at the site is below the *Tier 1 value of that given route*." 35 Ill. Adm. Code 742.500(c) (emphasis added). The current rules on pathway exclusions refer to specific *Tier 1* ROs. *See* 35 Ill. Adm. Code 742.310(c), 742.315(c), 742.320(d). Additionally, in this rulemaking, IEPA proposed that determining whether soil or groundwater "contamination" is present within the five-foot distance requires a comparison of volatile chemical concentrations to *Tier 1* ROs for residential property (Appendix B, Table A) and *Tier 1* ROs for Class I groundwater (Appendix B, Table E). *See* Sections 742.505(b)(2)(C)-(E), (C)(5)(B)-(D).

The Board found at second notice that for purposes of determining whether a building or man-made pathway is or will be located above "contaminated" soil gas or groundwater, the volatile chemical concentrations detected must be compared to residential Tier 1 indoor inhalation ROs for "diffusion and advection" (Appendix B, Table H).[29] Soil gas or groundwater exceeding any of those ROs would be considered "contaminated" for purposes of this pathway exclusion. Specifying these standards in the rule itself should ensure the proper application of Section 742.312(b)(1)(A).

Likewise, whether there is soil or groundwater "contamination" within the five-foot horizontal distance is made part of this pathway exclusion demonstration and determined in accordance with the amendments to Section 742.505, *i.e.*, by comparing the volatile chemical concentrations detected to Tier 1 ROs for residential property (Appendix B, Table A) and Tier 1 ROs for Class I groundwater (Appendix B, Table E). In the five-foot horizontal distance, soil or groundwater exceeding any of those ROs is considered "contaminated" for purposes of this pathway exclusion.

To address these concerns, the Board proposed the following changes to the Section 742.312(b)(1)(A) pathway exclusion language for second notice:

> No building or man-made pathway exists or will be placed above ~~the~~ contaminated soil gas or groundwater exceeding Tier 1 remediation objectives for residential property (Appendix B, Table H), provided, however, that there is also no soil or groundwater contamination exceeding Tier 1 remediation objectives for residential property (Appendix B, Table A) or Class I groundwater (Appendix B, Table E) located 5 feet or less, horizontally, from any existing or potential building or man-made pathway. . . . Second-notice proposed Section 742.312(b)(1)(A).

Accordingly, this pathway exclusion is available only if the existing or potential building or man-made pathway (1) would have no such soil gas or groundwater contamination under it and

[29] These are more stringent than the Tier 1 ROs for "diffusion only" (Appendix B, Table I).

(2) has no such soil or groundwater contamination within five feet of it horizontally. If these conditions along with the "speed bump" and institutional control requirements are met (page 17 above), the indoor inhalation exposure route could be excluded under Section 742.312(b)(1)(A) regardless of higher levels of contamination elsewhere on the site.[30]

Use of the J&E Model

Mr. Reott, an environmental lawyer and active participant in the original TACO rulemaking,[31] questioned IEPA's reliance on the J&E Model, asking: "Should the Board Act Now to Adopt Outdated Science?" PC4 at 2. Mr. Reott stated that "USEPA is preparing final guidance from OSWER that Illinois EPA already acknowledges will be very different from the proposed Johnson and Ettinger model." PC4 at 2, Exh. A at 1. Mr. Reott asserted that USEPA was unable to calibrate the J&E Model to actual field data at numerous sites around the country. PC4 at 2, citing Tillman and Weaver, 2005.[32] Mr. Reott indicated that in preparing the final guidance, USEPA has been studying actual homes and comparing that data to the subsurface data. PC4 at 2. Mr. Reott maintained that there is no "emergency" requiring adoption of the rule at this time, asserting that there is only "scant evidence" of any actual homes in Illinois with ongoing vapor intrusion issues other than those "driven by obvious problems . . . which already will be addressed by other aspects of the TACO program." PC4 at 3. Mr. Reott suggested that adopting a rule now would be premature and that "the Board should wait for USEPA to complete its pending guidance to evaluate a more complete record." *Id*.

IPC similarly suggests that the Board "consider a stay in the issuance of the proposed amendments until the US EPA [Office of Underground Storage Tanks] (in particular) publishes their guidance in the coming months." PC13 at 3. "This federal guidance," continues IPC, "will capture the latest science on site screening and modeling and provide the regulatory framework that many states will likely follow." *Id*.

Ms. Sundar of USEPA indicated that she anticipates the USEPA OWSER final guidance to first describe provisions for determining if volatile chemicals exist and have a potential to get into a building. Tr.2 at 61. She expected the final guidance to rely upon the generic attenuation

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[30] Even if there is contamination under the building or within the five-foot horizontal distance, VI pathway exclusion may be available through the use of a BCT or through a demonstration of active biodegradation of BTEX. *See* Sections 742.312(b)(1)(B), (C).

[31] *See* Tiered Approach to Corrective Action Objectives (TACO): 35 Ill. Adm. Code 742, R97-12(A) (Apr. 17, 1997) (second notice).

[32] J. Weaver and F. Tillman, USEPA, "Uncertainty in the Johnson-Ettinger Model for Vapor Intrusion Calculations" (Sept. 2005); F. Tillman and J. Weaver, USEPA, "Review of Recent Research on Vapor Intrusion" (Sept. 2005).

factors from the national database, which would be designed to protect 50% to 95% of homes. Tr.2 at 62, 64. She also expected the final guidance to employ the J&E Model to consider the soil type, building type, and exposure, according to Ms. Sundar. Tr.2 at 62, 66-67. Ms. Sundar then compared ROs under this TACO proposal with what she anticipates will be in USEPA's final guidance. Ms. Sundar indicated that generally, IEPA's approach for calculating ROs using the J&E Model might be less stringent than the anticipated USEPA guidance for chlorinated chemicals, but more stringent for petroleum contaminants. Tr.2 at 67-69. For petroleum contaminants, Ms. Sundar indicated USEPA is also looking at the "BioVapor" model that IEPA mentioned in its testimony. Tr.2 at 67-68, 70.

Mr. King clarified that because USEPA's approach is to provide guidance at a national level, USEPA has a different perspective. For Illinois, IEPA felt that applying a single, nationwide multiplication factor does not account for the TACO regulatory process or Illinois geology. Tr.2 at 71. However, IEPA indicated that if a remedial applicant wanted to follow the USEPA guidance as an alternative to this TACO proposal, IEPA would consider that under Tier 3. Tr.2 at 75.

The Board continues to agree with IEPA that using the J&E Model is appropriate as folded into the existing TACO scheme and tailored for Illinois-specific geology. As the Board discussed in its first-notice opinion, IEPA provided several vapor intrusion case studies in Illinois where it would have been beneficial to have regulatory standards on the indoor inhalation exposure route. The assertion that there is a dearth of ongoing vapor intrusion issues must be discounted by the lack of any requirements for vapor intrusion investigation in Illinois.

USEPA has posed no objection to Illinois proceeding to adopt indoor inhalation regulations before USEPA's issuance of final vapor intrusion guidance. King PFT2, Exh. 2 at 3; King PFT1 at 4; Tr.1 at 22-23. IEPA testified that it is "addressing hundreds of sites on an annual basis and the longer that we wait [for vapor intrusion rules], the longer this issue is left unaddressed . . . ." Tr.1 at 23. The Board again finds that earlier adoption of TACO indoor inhalation rules will lead to greater protection for building occupants and more encompassing NFR Letters sooner, as well as quicker implementation of the soil gas "right-to-know" provisions discussed below. The Board therefore declines to stay this proceeding until USEPA issues its final VI guidance. As stated above, IEPA has agreed to evaluate USEPA's final VI guidance upon its issuance and timely propose resulting TACO amendments, if any. Lastly, nothing in today's TACO amendments would preclude a site evaluator from proposing to follow USEPA guidance under TACO's Tier 3.

J&E Model Assumptions

Mr. Reott asserted that IEPA used very conservative assumptions in determining default values for the square footage of residential and commercial buildings. PC4 at 6. This TACO proposal called for a default residential building size of 1,000 x 1,000 centimeters (cm) and a default industrial/commercial building size of 2,000 x 2,000 cm. *See* 742.Appendix C, Table M. The Board noted that the default residential building size of 1,000 x 1,000 cm is approximately 1,052 square feet and the default industrial/commercial building size of 2,000 x 2,000 cm is approximately 4,304 square feet.

Mr. Reott stated that based upon 2003 U.S. Census Bureau data, the median square footage for housing units in the Chicago Metropolitan area was 2,017 square feet. PC4, Exh. A at 6. Citing statistics from the State of Michigan, Mr. Reott indicated the average size of a Midwest single-family home was 2,095 square feet in 1995, with only 11% of houses less than 1,200 square feet. According to Mr. Reott, houses with basements or crawlspaces represented 90% of houses built in the Midwest between 1975 and 1995. PC4 at 6. Mr. Reott suggested that the IEPA-proposed rules be amended to include a table for houses with basements and its "more typical" square footage, so that the Tier 1 tables could provide for the most common scenario. Mr. Reott maintained that this would be more cost-effective. PC4 at 6-7.

Mark Elliott of MH Environmental also raised the issue of IEPA's then-proposed default building sizes. At hearing in the Predecessor Rulemaking, R09-9, Mr. Elliott asked several questions as to why IEPA's proposal required a default building size to be used for both Tier 1 and Tier 2, and would only allow the size of the building to be altered under Tier 3. Mr. Elliott asserted that Tier 2 is supposed to be flexible in order to allow the use of more site-specific factors, and building size should be one of those relevant factors. Mr. Elliott expressed concern that proceeding under Tier 3 has already been very difficult. R09-9/Tr.2 AM at 46-49. Based upon Mr. Elliott's comments, Mr. Reott asked: "If that's what the building owner wants, why not give them that flexibility. It doesn't seem that difficult to administer." *Id*. at 78.

Gail Artrip of Carlson Environmental also expressed concern regarding the impact of the default building-size parameters on the calculation of Tier 2 remediation objectives. Ms. Artrip stated that "[i]n our preliminary analysis, we are finding that the building dimensions can significantly alter the Tier 2 remediation objectives." R09-9/IEPA PFR1 at 4. Specifically, Ms. Artrip commented that "[o]ur clients are industrial users, and instead of 65 feet x 65 feet x 10 feet tall (the default assumptions), tend to have buildings that are 500 ft x 500 ft x 25 ft tall, and this does have a dramatic effect on the Tier 2 indoor inhalation remediation objectives." *Id*.

IEPA responded that building size is:

> a very site-specific issue that should be addressed under a Tier 3 evaluation where all factors that are highly site-specific get addressed. If one were to alter the building size, which changes the assumptions of the J&E model, the NFR Letter would need to restrict current and future building sizes. This diminishes the usefulness of the liability release and makes it inappropriate for widespread use under Tier 2. R09-9/PC4 at 5; Tr.1 at 84.

IEPA added that allowing building-size restrictions in Tiers 1 and 2 would limit the transferability of property. R09-9/Tr.2 AM at 33, 48. SRAC agreed with IEPA's approach regarding the requirement to use the default building size under Tiers 1 and 2 "because we believe that will result in an unrestricted NFR when you use the default assumptions. We wouldn't want to see a case where NFR's become limiting to certain building size." *Id*. at 56.

During the first-notice period, the Board received no additional comment expressing concern over the conservatism of these default values. The Board stated that it understands that IEPA's proposal to use the default building sizes under Tier 1 and Tier 2 is a conservative approach. As IEPA explained, the approach avoids placing minimum-size restrictions upon any building that might be constructed over the contaminated area in the future. The Board continued at second notice to agree with the IEPA-proposed default parameters. Particularly as the indoor inhalation exposure route has never before been implemented through Board regulation, the Board found again at second notice that it would be inappropriate to provide for site-specific building-size restrictions under the widely-used Tier 1 or Tier 2 provisions at this time.[33] If, however, a given property owner is willing to place such restrictions on a future structure within an institutional control, Tier 3 can be used to evaluate site-specific scenarios.

Further, reliance upon alternate building-size restrictions would necessarily limit the scope of NFR Letters (415 ILCS 5/57.10(c), 58.10(a) (2010)), which, in turn, may limit the "transferability" of the properties at issue from a practical perspective. An NFR Letter issued under the Leaking UST Program "shall apply in favor of," among others, "[a]ny transferee of [the] owner or operator" and "[a]n owner of a parcel of real property to the extent that the no further remediation letter . . . applies to the occurrence on that parcel." 415 ILCS 5/57.10(d) (2010). An NFR Letter issued under SRP "shall apply in favor of," among others, "[a]ny transferee of the owner of the site." 415 ILCS 5/58.10(d) (2010). TACO likewise provides that "No Further Remediation Letters and Environmental Land Use Controls that meet the requirements of this Subpart [J of Part 742] and the recording requirements of the program under which remediation is being performed are transferred with the property." 35 Ill. Adm. Code 742.1000(d).

In the Predecessor Rulemaking, R09-9, Keith R. Fetzner of Environmental Resources Management, Inc. commented that IEPA's proposed equations J&E 1 and J&E 2 are not consistent with USEPA's equations because the TACO equations do not include exposure time (8 hours/24 hours for industrial-commercial worker; 24 hours/24 hours for residential) in the denominator. R09-9/PC2 at 1. According to Mr. Fetzner, omission of this value in the industrial-commercial worker calculation will result in TACO Tier 2 remediation objectives that

[33] The Tier 2 equations do account for a basement scenario. *See* Section 742.Appendix C, Tables L & M.

are more stringent than USEPA's worker ambient air screening values, essentially "allow[ing] the calculation of only residential remediation objectives." *Id*.

IEPA responded that these USEPA equations refer to the Risk Assessment Guidance for Superfund (RAGS).[34] R09-9/PC6 at 1. IEPA believes that overall, its proposal based upon the SSL guidance is more conservative and more protective than the RAGS equations using the 8-hour exposure time. IEPA pointed out that a remedial applicant can propose using the 8-hour exposure time under a Tier 3 scenario. *Id*. The Board again finds that IEPA's more stringent approach here is appropriate for widespread use, and as IEPA stated, Tier 3 is the appropriate avenue for addressing a site-specific issue where an 8-hour exposure time could be considered. The Board received no further comment on these J&E equations during the first-notice period.

"Diffusion and Advection" or "Diffusion Only"

At second notice, the Board clarified the use of the two sets of Tier 1 indoor inhalation remediation objectives (or "ROs"). These ROs are numeric volatile chemical concentrations appearing either in Appendix B, Table H, which is based upon the diffusion and advection mode of contaminant transport, or in Appendix B, Table I, which is based only upon the diffusion mode of contaminant transport.

Background

"Under most environmental conditions, molecular diffusion in natural systems proceeds from locations of higher concentration towards locations of lower concentrations. In a typical scenario, organic vapors above a contaminated water table (high concentration) diffuse towards land surface (lower concentration)." Tillman, Weaver at 7 (Sept. 2005). "Advection" refers to "the migration of contaminants in soil gas brought about by differences in pressure gradients between the interior of a building and the soil nearest the building foundation." King PFT1 at 13. "Soil gas" is defined as "the air existing in void spaces in the soil between the groundwater table and the ground surface." Section 742.200.

IEPA's Mr. King explained that Table H (diffusion and advection) is used when contamination (*i.e.*, exceeding Tier 1 ROs for residential property or and Tier 1 ROs for Class I groundwater) is within five feet of an existing or potential building or man-made pathway, while Table I (diffusion only) is used when that distance is more than 5 feet. King PFT1 at 14. IEPA

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[34] The USEPA equation referenced appears to be Equation 6, which can be found on page 14 of the "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, (Part F, Supplemental Guidance for Inhalation Risk Assessment)" available at http://www.epa.gov/oswer/riskassessment/ragsf/pdf/partf_200901_final.pdflast visited 12-20-2011.

states that "the advective force has no influence on contamination located farther than 5 feet away from a building foundation." PC12 at 14, citing USEPA in its "User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings" (2004). Mr. King added that the Table H remediation objectives are "more conservative" than the Table I remediation objectives because the ROs of Table H "reflect forces of both diffusion and advection moving contamination to the interior of a structure." King PFT1 at 14. Mr. King elaborated that the extent of the differences in ROs between Table H and Table I is "contaminant specific," with some concentrations differing by "a few multiples" and others by "an order of magnitude." *Id*. Each RO in Table H is more stringent than or equal to the RO for the corresponding chemical in Table I. *See* Appendix B, Tables H & I.

If "diffusion and advection" ROs are used, then soil gas ROs *or* groundwater ROs must be met, but if "diffusion only" ROs are used, then soil gas ROs *and* groundwater ROs must be met. King PFT1 at 14; *see* Sections 742.515(c), (d). As IEPA's Mr. King testified:

> U.S. EPA Region 5 recommended that when the Diffusion Only Table (Appendix B, Table I) is used to demonstrate compliance that compliance with both soil gas remediation objectives and groundwater remediation objectives be required. Illinois EPA agreed that multiple lines of evidence from soil gas and groundwater should be obtained prior to using Appendix B, Table I. King PFT1 at 13.

<u>Option to Use Table H</u>

The first-notice amendments provided that when diffusion and advection are at issue, the ROs listed in Appendix B, Table H "shall be used." However, as IEPA proposed, the first-notice amendments also provided that when diffusion is the only mode of contaminant transport at issue, Appendix B, Table I "shall be used." *See* first-notice proposed Sections 742.515(a), (b); *see also* first-notice proposed Sections 742.505(b), (c). As the word "shall" is usually ascribed a mandatory meaning (*see, e.g.*, <u>Heinrich v. White</u>, 2012 IL App (2d) 110564, ¶ 19), the use of the word here would have *required* that Table I be used when all contamination is located more than 5 feet from the existing or potential building, to the exclusion of the more stringent Table H.

While Table H must be used when any contamination is located 5 feet or less from an existing or potential building or man-made pathway, the Board could find no reason for precluding a site evaluator from choosing to use Table H even when all contamination is located more than 5 feet away. A site evaluator may prefer to meet the more stringent Table H for any number of reasons, such as avoiding having to place an institutional control on the property ensuring no construction occurs within the five-foot uncontaminated distance, as is required when using "diffusion only" ROs. *See* 742.1000(a)(7).

The Board at second notice amended then-proposed Sections 742.505 and 742.515 to make clear that even when no contamination is located 5 feet or less from the existing or potential building or man-made pathway, the site evaluator is not compelled to use Table I, but rather can use either Table H or Table I. Table I *may* be used *only* when all contamination is located more than 5 feet from the existing or potential building or man-made pathway. *See* Sections 742.515(a), (b) *see also* Sections 742.505(b), (c). IEPA concurred with this change, noting that it "intended Section 742.Appendix B, Table H to be an allowable choice for all sites addressing this pathway." PC12 at 14, n.3.

Corresponding changes were made for Tier 2 at Sections 742.717(e) and (f), meaning that while Equation J&E7 must be used when the mode of contaminant transport is both diffusion and advection (*i.e.*, the L_T ("<u>Distance from bottom of slab to top of contamination</u>") is 5 feet or less), Equation J&E7 may also be used even where the L_T is greater than 5 feet. Equation J&E8 may be used only when the mode of contaminant transport is diffusion only, *i.e.*, where the L_T is greater than 5 feet and not where L_T is 5 feet or less. *See* Section 742.Appendix C, Tables L and M.

<u>Determining Mode of Contaminant Transport Using Soil Samples Instead of Soil Gas</u>

The first-notice amendments, in accordance with IEPA's proposal, provided that the "diffusion and advection" ROs (Table H) must be used when "soil or groundwater contamination" is within 5 feet of an existing or potential building. In its January 10, 2013 proposed second notice for public comment, the Board added the word "gas" after "soil" such that "soil gas" and "groundwater" would be the two media used by a site evaluator to determine whether the mode of contaminant transport is either "diffusion and advection" or "diffusion only."

The Board proposed this change because (1) the two components of the indoor inhalation exposure route are soil *gas* and groundwater, (2) there are Tier 1 and Tier 2 indoor inhalation provisions for only these two media (*i.e.*, soil gas and groundwater, not soil), and (3) there is skepticism over determining vapor intrusion risks based upon volatile chemical concentrations in soil.[35] The Board accordingly also proposed changing the language of the "five-foot uncontaminated distance" demonstration such that the demonstration for being able to use Table I (diffusion only) would require that no soil *gas* or groundwater within the five-foot distance exceeds the Tier 1 residential ROs for soil *gas* and groundwater *in Table H* (diffusion and advection), rather than the *soil* and Class I groundwater ROs of Tables A and E, respectively.

[35] IEPA's Mr. King testified that IEPA's scientific literature review revealed "considerable skepticism as to whether risks to human health through the indoor inhalation route can be meaningfully determined based on concentrations of volatile chemicals in soils." King PFT1 at 2.

IEPA and SRAC filed public comments explaining why each opposed these changes from "soil" to "soil gas." PC12 at 15-16; PC17 at 5-6. The City of Chicago adopted the comments of IEPA. PC18 at 1. IERG and CICI agreed with the comments of IEPA and SRAC. PC15 at 1; PC16 at 1.

IEPA stated that it "deliberately selected 'soil' and 'groundwater'" as the two media by which a site evaluator determines the mode of contaminant transport. PC12 at 15. IEPA "agrees with the skepticism" over using only soil data to calculate health risk, which is why any proposal to use soil ROs for the VI pathway must be evaluated under Tier 3. *Id*.[36] However, IEPA distinguished two types of determinations:

> [A] determination for purposes of advection that no soil or groundwater contamination within 5 feet of a building foundation exceeds the Tier l most stringent remediation objectives for the existing pathways (located at Section 742.Appendix B, Table A) is *not* a determination of compliance to qualify for an NFR Letter under the indoor inhalation pathway. Instead, it is a determination that the transport of contaminated vapors from the subsurface is limited to diffusion only migration. A Tier 1 remediation objective compliance determination for the indoor inhalation exposure route is made separately at a later date by comparing soil gas and groundwater samples collected elsewhere at the site to the remediation objectives in Section 742.Appendix B, Table I. That is, anyone who qualifies and chooses to use Table I (diffusion only), must demonstrate compliance using near-slab soil gas samples, exterior soil gas samples collected at the footprint of a potential building, or both, as well as groundwater samples. *Id*. (emphasis in original).

IEPA stated that it selected soil instead of soil gas "as the more appropriate medium in the advection determination" for three reasons: (1) using soil data supports the multiple lines of evidence approach preferred by USEPA; (2) soil sample results are a "reliable and robust way to delineate the area of contamination, especially in regards to vertical profiling (e.g., soil borings obtain multiple samples at spaced intervals to give a cross-sectional view of the contaminant plume)"; and (3) for the majority of sites, soil data are the first sample results to be obtained and, "for a strategic site evaluator, are an early indicator for how to address the indoor inhalation exposure route." PC12 at 15-16. On this last point, IEPA elaborated by way of example:

> [I]f the soil data show that advective transport would occur (*i.e.*, soil contamination is present 5 feet or less from any existing or potential building or man-made pathway), then the site evaluator may choose to install a building control technology ("BCT") as a final remedy rather than achieve the more

[36] A site-specific proposal for soil ROs can be developed under Tier 3. *See* Section 742.935(d).

> conservative remediation objectives in Section 742. Appendix B, Table H (diffusion and advection). Such a choice would eliminate the time and expense of collecting soil gas data. *Id*. at 16.

SRAC also objected to "the requirement to use soil gas to document the mode of transport through advection or diffusion alone" for the reasons identified by IEPA. PC17 at 5. SRAC added that it "discussed this issue extensively with the Agency and came to the agreement . . . that expensive soil gas sampling should be used only as a quantification tool and not a screening tool." *Id*. at 5-6. According to SRAC, the Board's January 10, 2013 proposal to require soil gas sampling in determining the mode of contaminant transport would "raise the cost of performing these assessments significantly without adding any additional measure of risk protection." *Id*. at 6.

In replacing "soil" with "soil gas," the Board was primarily concerned with the scenario of a site evaluator concluding that the mode of contaminant transport is "diffusion only" (*i.e.*, not "diffusion and advection") based solely upon there being no soil or groundwater contamination within five feet of the building foundation. The Board recognized the distinction between (1) determining which mode of contaminant transport is at issue under the five-foot rule at the stage of site evaluation and (2) determining whether applicable ROs have been met at the stage of site closure. For the former determination, implicit in the position of IEPA and SRAC is that finding no soil or groundwater contamination within five feet of a building foundation is sufficient evidence to conclude that no soil gas contamination is present within five feet of the building foundation.

The Board stated in its March 7, 2103 second-notice opinion that the Board appreciates that soil sampling is commonly performed early in site evaluations and is a reliable and economical aid in delineating the area of contamination. The Board was persuaded by the arguments of IEPA and SRAC for not requiring soil gas sampling to determine the VI mode of contaminant transport. The Board therefore replaced "soil gas" with "soil" in the five-foot rule. However, the Board found that two observations concerning soil gas sampling were warranted. First, the Board understood the comments of IEPA and SRAC as supporting the conclusion that advection and the applicability of the more stringent Table H ROs can safely be ruled out *without* any soil gas sampling when complying with the five-foot rule. Second, the Board expressed its uncertainty as to what SRAC intended by its assertion that soil gas sampling should not be used as "a screening tool." PC16 at 6. The pathway exclusion based upon building/contamination proximity (Section 742.312(b)(1)(A)) refers in part to no building or man-made pathway being above contaminated *soil gas* or groundwater. Accordingly, to establish this pathway exclusion and thereby avoid having to develop indoor inhalation ROs, the Board would expect the demonstration to include soil gas sampling.

Five-Foot Distance

As IEPA proposed, the first-notice amendments provided that the "diffusion and advection" ROs (Table H) must be used when contamination is "within" 5 feet of an existing or potential building. As the "diffusion only" ROs (Table I) may be used only when contamination is "more than" 5 feet from an existing or potential building, the Board changed "within 5 feet" to "5 feet or less" for "diffusion and advection" to avoid any conceivable confusion in deciding which table to apply.

The Board also clarified that the "diffusion and advection" ROs (Table H) must be used when *any* soil *or* groundwater contamination is located 5 feet or less, vertically *or* horizontally, from the existing or potential building or man-made pathway at issue. On the other hand, the "diffusion only" ROs (Table I) may be used only when *all* soil *and* groundwater contamination is located more than 5 feet, vertically *and* horizontally, from the existing or potential building or man-made pathway at issue. *See* Sections 742.515(a), (b); *see also* Sections 742.505(b), (c). Similar changes were made to Appendix C, Table M, where L_T is described in Q_{soil}.

Second-Notice Rule Language

The above-described changes made at second notice are reflected below with double underlines and double strikeouts.

Section 742.505 Tier 1 Soil, Soil Gas and Groundwater Remediation Objectives

b) Soil Gas

***

2) Indoor Inhalation Exposure Route

***

C) Appendix B, Table H shall be used when any soil or groundwater contamination is located ~~within~~ 5 feet or less, vertically or horizontally, from the ~~of an~~ existing or potential building or man-made pathway. ***

D) Appendix B, Table I may ~~shall~~ be used only when all soil and groundwater contamination is located ~~are~~ more than 5 feet, vertically and horizontally, from the ~~an~~ existing or potential building or man-made pathway. *** As an alternative to using Appendix B, Table I, it is permissible to use Appendix B, Table H. ***

E) To determine whether the Q_{soil} value can be set at 0.0 cm^3/sec, the site evaluator shall demonstrate that all soil and groundwater located ~~within~~ 5 feet or less, vertically or ~~and~~ horizontally, from the ~~of an~~ existing or potential building or man-made pathway meets ~~meet~~ the Tier 1 remediation objectives for residential property listed in Appendix B, Table A, and the Tier 1 remediation objectives for Class I groundwater listed in Appendix B, Table E, respectively.

~~b~~ c) Groundwater

***

5) ***

B) Appendix B, Table H shall be used when any soil or groundwater contamination is located ~~within~~ 5 feet or less, vertically or ~~and~~ horizontally, from the ~~of an~~ existing or potential building or man-made pathway. ***

C) Appendix B, Table I may ~~shall~~ be used only when all soil and groundwater contamination is located ~~are~~ more than 5 feet, vertically and horizontally, from the ~~an~~ existing or potential building or man-made pathway. *** As an alternative to using Appendix B, Table I, it is permissible to use Appendix B, Table H.

D) To determine whether the Q_{soil} value can be set at 0.0 cm^3/sec, the site evaluator shall demonstrate that all soil and groundwater located ~~within~~ 5 feet or less, vertically or ~~and~~ horizontally, from the ~~of an~~ existing or potential building or man-made pathway meets ~~meet~~ the Tier 1 remediation objectives for residential property listed in Appendix B, Table A, and the Tier 1 remediation objectives for Class I groundwater listed in Appendix B, Table E, respectively.

Section 742.515 Tier 1 Remediation Objectives Tables for the Indoor Inhalation Exposure Route

***

b~~a~~) When the mode of contaminant transport is both diffusion and advection as described in Section 742.505 (i.e., any soil or groundwater contamination is located ~~within~~ 5 feet or less, vertically or horizontally, from the ~~of an~~ existing or potential building or man-made pathway), the remediation objectives for soil gas or groundwater listed in Appendix B, Table H shall be used. ***

c~~b~~) Only when ~~When~~ the mode of contaminant transport is diffusion only as described in Section 742.505 (i.e., all soil and groundwater contamination ~~are~~ is located more than 5 feet, vertically and horizontally, from the ~~an~~ existing or potential building or man-made pathway), the remediation objectives for soil gas and groundwater listed in Appendix B, Table I may ~~shall~~ be used. ***

f) As an alternative to using Appendix B, Table I pursuant to subsection (c), it is permissible to use Appendix B, Table H pursuant to subsection (b).

***

Section 742.717 J&E Soil Gas Equations for the Indoor Inhalation Exposure Route

***

e) Equation J&E7 must be ~~is~~ used when the mode of contaminant transport is both diffusion and advection. In this scenario, the Q_{soil} value equals 83.33 cm^3/sec as described in Section 742.505.

f) Equation J&E8 may be ~~is~~ used only when the mode of contaminant transport is diffusion only. In this scenario, the Q_{soil} value equals 0.0 cm^3/sec as described in Section 742.505. As an alternative to using Equation J&E8 pursuant to this subsection, it is permissible to use Equation J&E7, in which case the Q_{soil} value equals 83.33 cm^3/sec as described in Section 742.505.

***

Parallel changes to those in Section 742.717 were made to Section 742.812(d) on J&E groundwater equations for the indoor inhalation pathway.

Concrete Slab-on-Grade and Concrete Basement Floor and Walls

Basement Occupants

The Tier 1 indoor inhalation remediation objectives proposed at first notice assume the presence of a building with "slab-on-grade" construction. *See* Current Rulemaking, R11-9, slip op. at 22 (Apr. 19, 2012). IEPA's Mr. King clarified that a slab-on-grade building is "one with a concrete floor at about the same level as the grade of the surrounding area," in contrast to a building with a basement, which "would typically be below the grade of the surrounding area." PFT1 King at 11.

Mr. King testified that a slab-on-grade building is "a more conservative scenario" than a building with a basement because "there is less air available" in the slab-on-grade building "to mix with the contamination." King PFT1 at 10; *see also* R09-9/Tr.2 AM at 33, 48. A building with a basement "assumes there is mixing of the air between the basement and the first floor." King PFT1 at 10. Mr. King noted, however, that the then-proposed ROs would apply "to both slab-on-grade buildings and buildings with basements." King PFT1 at 10-11.

At first notice, the Board requested that IEPA file a public comment to explain whether

IEPA's use of the slab-on-grade scenario is protective of basement occupants. R11-9 First Notice at 23. IEPA responded in its first-notice comment by providing a sensitivity analysis that compares the basement and slab-on-grade scenarios. PC7 at 3. Specifically, the analysis compares (1) the then-proposed Tier 1 residential indoor inhalation ROs for benzene and tetrachloroethylene (PCE) with (2) the ROs that would be developed for a residential basement scenario. *Id*.; PC7, Exh. A.

IEPA's sensitivity comparison includes soil gas and groundwater contamination ROs for the "diffusion only" mode of contaminant transport and for the "diffusion and advection" mode of contaminant transport. PC7, Exh. A. IEPA maintained that the results of its analysis support having used the slab-on-grade scenario as the basis for the Tier 1 ROs. PC7 at 2. IEPA is "confident that the proposed Tier 1 indoor inhalation remediation objectives for soil gas and groundwater are sufficiently protective of basement occupants." PC7 at 3.

The Board agreed with IEPA. The Tier 1 indoor inhalation ROs, developed through a slab-on-grade assumption, generally result in more stringent indoor inhalation ROs than if a basement is assumed. King PFT1 at 11. As IEPA explained, with a slab-on-grade building, there is less volume of building air space within which contaminated soil gas mixes than with a like building having a basement. The greater building "height" for mixing in a basement scenario leads to more attenuation of contaminated soil gas concentrations in the building, as the assumption is that there is some mixing from the basement into the first story.

The first-notice proposal, however, does not assume a greater "area of total cracks" for contaminated vapor access into houses with basements than for houses with a slab-on-grade. With the modified J&E Model used by IEPA, contaminated soil gas is assumed to enter the slab-on-grade building only at a perimeter gap between the floor slab and first-story walls, not through any cracks in the floor slab itself. The Tier 2 equation that can be used to develop ROs specifically for a basement scenario also assumes that contaminated soil gas enters the building only through the perimeter gap between the basement floor and basement walls, not through the floor itself or the walls themselves. *See* Appendix C, Table M (J&E Parameters) ("Floor-wall seam gap" designated as "w"); *see also* Appendix C, Table L (J&E Equations) (J&E14, "Area of total cracks," designated "A_{crack}").

Accordingly, the slab-on-grade scenario on which the Tier 1 ROs were based assumes less building volume for contaminant attenuation than with a basement scenario, but the same area of total "cracks" (*i.e.*, floor-wall seam gap) through which contaminated soil gas enters the building. Though other factors come in to play (*e.g.*, "Distance from bottom of slab to top of contamination" or "L_T"), the slab-on-grade scenario generally requires more stringent subsurface ROs to be protective of building occupants. Taking into account the basement space for contaminant mixing would have resulted generally in less stringent Tier 1 ROs. King PFT1 at 10-11.

This greater stringency is supported by IEPA's sensitivity analysis, comparing indoor inhalation ROs developed depending upon whether a basement or a slab-on-grade is assumed to be present. For example, for soil gas under the diffusion and advection mode of contaminant transport, the slab-on-grade RO for benzene was 0.094 milligrams per cubic meter (mg/m^3) more stringent than the basement RO, while the slab-on-grade RO for PCE was 0.123 mg/m^3 more stringent than the basement RO. For soil gas under the diffusion only mode, the slab-on-grade RO for benzene was 30.6 mg/m^3 more stringent than the basement RO, while the slab-on-grade RO for PCE was 49.7 mg/m^3 more stringent than the basement RO. PC7, Exh. A.

In this sense, the slab-on-grade assumption is, as IEPA described, the "more conservative" approach, *i.e.*, the slab-on-grade basis generally results in more stringent Tier 1 ROs, which apply to the benefit of a building's occupants, whether the building has a slab-on-grade or a basement. Based upon this record, the Board found at second notice that the slab-on-grade assumption for the Tier 1 indoor inhalation ROs is appropriate and protective of basement occupants.

In so finding, the Board was not suggesting that ROs developed specifically for a basement scenario under Tier 2 would not be protective. While Tier 1 ROs are numerical chemical concentrations set forth in "look up" tables, Tier 2 sets forth equations for developing ROs based not only upon default values but also site-specific information.[37] The Tier 2 equations, like the Tier 1 concentrations, are based upon the modified J&E Model. Tier 2 provides equations for a slab-on-grade scenario (the same equations used to develop Tier 1 ROs), as well as equations for a basement scenario. PC8 at 4. As IEPA's Mr. King testified, however, the Tier 1 ROs are "not much [more stringent] than what would be developed for a similar building with a basement." King PFT1 at 11.

Further, as IEPA points out, it appears that USEPA draws little if any distinction between slab-on-grade and basement construction. PC7 at 2-3. According to USEPA's "Vapor Intrusion Screening Level Calculator User's Guide" (Mar. 2012) (<u>USEPA VISL Mar. 2012</u>), "receptors are assumed to be occupants in buildings with poured concrete foundations," such as "basement or slab on grade foundations." <u>USEPA VISL Mar. 2012</u> at 2.

<u>Assumption of Concrete Slab-on-Grade or Concrete Basement Floor and Walls</u>

In its first-notice pubic comment, IEPA stated that under its proposal, "all buildings are assumed to have concrete foundations as *required by* Section 742.717(d)(2)." PC7 at 3 (emphasis added). Section 742.717 was newly proposed at first notice and, by its terms, "sets forth the equations and parameters to be *used to develop Tier 2 soil gas remediation objectives*

[37] Generally, a "Tier 2 evaluation is only required for contaminants of concern and corresponding exposure routes . . . exceeding the Tier 1 remediation objectives." 35 Ill. Adm. Code 742.600(b).

for the indoor inhalation exposure route using the modified J&E model." First-notice proposed Section 742.717(a) (emphasis added). The provision cited by IEPA, Section 742.717(d)(2), stated at first notice:

> d) The attenuation factor (Equation J&E7 or J&E8) accounts for the following processes:
>
> ***
>
> 2) Migration of contaminants through the earthen filled cracks in the slab-on-grade or basement floor and walls . . . . first-notice proposed Section 742.717(d)(2).

After the initial 45 days of the first-notice comment period, the Board's hearing officer issued an order on August 28, 2012, posing a series of Board staff questions to IEPA. The questions concerned, among other things, the role in the then-proposed indoor inhalation rules of concrete slabs on grade and basements with concrete floors and walls. *See* R11-9 Hearing Officer Order at 3-4 (Aug. 28, 2012) (R11-9 HOO). The order provided other participants an opportunity to comment on IEPA's responses. *Id*. at 6.

On January 10, 2013, the Board issued a proposed second-notice opinion and order for public comment, specifically seeking participant input on rule language that would do the following: (1) make Tier 1 and Tier 2 ROs for indoor inhalation applicable only to an existing or potential building that has a full concrete slab-on-grade or a full concrete basement floor and walls (collectively, "full concrete base"); and (2) require that an institutional control be placed on the property whenever the TACO indoor inhalation ROs applied at the site rely upon the assumed presence of a full concrete base. *See* Current Rulemaking, R11-9, slip op. at 1 (Jan. 10, 2013).

In its March 7, 2013 second-notice opinion, the Board first discussed whether proposed Tier 1 and Tier 2 provisions for indoor inhalation ROs should apply only to those existing or potential buildings that have full concrete bases. Next, the Board addressed whether any such limitation on applicability should be made explicit in the TACO rules and, if so, where. Finally, the Board discussed whether using Tier 1 or Tier 2 for indoor inhalation ROs should necessitate the placement of an "institutional control" on the property requiring that the building have a full concrete base.

Applicability Limited - Full Concrete Base. The August 28, 2012 order issued by the hearing officer sought comment from IEPA on whether the applicability of indoor inhalation ROs under Tier 1 or Tier 2 "should be limited to buildings with concrete slab-on-grade floors (or concrete basement floors and walls) that lack any significant openings to the subsurface." R11-9 HOO at 3-4. Responsive public comments were received from IEPA (PC8) and SRAC (PC11).

IEPA's public comment emphasized that the Tier 1 indoor inhalation ROs and the Tier 2 equations reflect the J&E Model, which relies upon the "key assumption" that existing or potential buildings have "concrete foundations." PC8 at 2-3 ("existing or potential buildings within the horizontal extent of contamination have full concrete floors"). Reliance upon this assumption, continued IEPA, is:

> not diminished by the condition of the floor because the model also assumes that cracks in the foundation exist. Illinois EPA has proposed a conservative value for the *area of total cracks* in Tier 1 and requires that same conservative value to be applied under Tier 2. PC8 at 3 (emphasis added).

IEPA explained that "a key input parameter" used in the J&E Model is "slab thickness" (designated "L_{crack}"), which is set at a default value of 10 centimeters (cm). PC8 at 2. Slab thickness is part of the equation for determining the "attenuation factor," meaning the ratio of (1) the contaminant concentration in the indoor air considered safe for humans who inhale this air to (2) the subsurface soil gas concentration. King PFT1 at 9. The attenuation factor accounts for the migration of contaminants from the subsurface source upwards "through the dirt filled cracks in the slab-on-grade or basement floor" and then the "[m]ixing of the contaminants with air inside the building." King PFT1 at 10.

IEPA stated that the J&E Model, "used to calculate indoor inhalation remediation objectives for Tier 1 and Tier 2," nevertheless "*should not be used*" in several situations: "where a building with an earthen floor exists above the contaminated area" or "where existing or potential buildings within the horizontal extent of contamination" have "earthen crawl spaces" or "partial concrete floors." PC8 at 2, 3 (emphasis added). According to IEPA, instead of using the J&E Model for buildings that do not have full concrete floors, "site evaluators should . . . exclude the indoor inhalation exposure route under Section 742.312, meet the building control technology requirements under Subpart L, or propose an alternative approach under Tier 3." PC8 at 3.

Finally, IEPA pointed to the expanded definition of "Man-Made Pathways" (PC8 at 3), which, as proposed at first notice, would include elevator vaults and sumps (Section 742.200). IEPA explained that site evaluators must account for these potential pathways "just as they are required to address man-made pathways for the other exposure routes under their respective remediation program regulations," like the Site Remediation Program (SRP) (35 Ill. Adm. Code 740) and the Leaking Underground Storage Tank (UST) Program (35 Ill. Adm. Code 734). PC8 at 3 ("Existing Part 742 [TACO] does not stipulate the method(s) by which man-made pathways are controlled."). According to IEPA, the existence of a sump, in itself, would not limit the use of Tier 1 or Tier 2 regarding the indoor inhalation exposure route. *Id*. IEPA suggested that sealing would be the most common method for addressing floor slab openings to the subsurface, such as sumps. *Id*.

SRAC agreed with IEPA that the existence of a "concrete floor/foundation" is a "key assumption of the J&E Model." PC11 at 1. SRAC maintained therefore that the use of Tier 1 or 2 indoor inhalation ROs "may not be appropriate in situations where a building with an earthen floor overlies a contaminated area." *Id*. at 1-2. SRAC added that it believes IEPA has "adequately explained how it intends to handle the existence of man-made pathways such as sumps and elevator vaults." PC11 at 2.

The Board observed at second notice that basing the Tier 1 ROs and Tier 2 equations for indoor inhalation upon the presence of a building with a full concrete floor slab is consistent with USEPA guidance, proposed to be incorporated by reference, "User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings," EPA/68/W-02/33 (Feb. 2004) (USEPA User's Guide Feb. 2004), which states:

> *Enclosed Space Floor Thickness* (Advanced Models Only) (L_{crack})
>
> Enter the thickness of the floor slab. All models operate under the assumption that the floor in contact with the underlying soil is composed of impermeable concrete whether constructed as a basement floor or slab-on-grade. The default value is 10 cm, which is consistent with J&E (1991). USEPA User's Guide Feb. 2004 at 53-54.[38]

That these proposed Tier 1 and Tier 2 rules should not be used for a building with an earthen floor, earthen crawlspace, partial concrete floor slab, or stone foundation, for example, is also in accord with USEPA guidance:

> Specific factors that may result in unattenuated or enhanced transport of vapors towards a receptor, and consequently are likely to render the VISL [Vapor Intrusion Screening Level] screening target subsurface concentrations inappropriate, include:
>
> ***
>
> - Buildings with significant openings to the subsurface (for example, sumps, unlined crawlspaces, earthen floors) or significant preferential pathways, either naturally-occurring or anthropogenic (not including typical utility perforations present in most buildings). USEPA VISL Mar. 2012 at 3.[39]

The assumptions described above and in Table 12 suggest a number of conditions

[38] USEPA's February 2004 User's Guide is a companion to USEPA's November 2002 draft vapor intrusion guidance, which is based upon the J&E Model.

[39] USEPA's March 2012 VISL Calculator User's Guide was developed based upon USEPA's November 2002 draft vapor intrusion guidance.

that preclude the use of the Non-NAPL Models as implemented by EPA. These conditions include:

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- Buildings with crawlspace structures or other significant openings to the subsurface (e.g., earthen floors, stone buildings, etc.). The [US]EPA spreadsheet only allows for either slab on grade or basement construction. USEPA User's Guide Feb. 2004 at 67, 70.

The Michigan Department of Environmental Quality (MDEQ) has taken a similar position:

> The MDEQ's J&E Model assumes that the proposed or existing structure is constructed with block or poured concrete walls and floor. Should a structure be equipped with earthen walls and/or floors, the flow of vapors into the structure will occur at a much different rate than assumed in the J&E Model. In these circumstances, the generic criteria do not apply for either the [groundwater volatilization to indoor air inhalation criteria] (Rule 714(2)(a)) or the [soil volatilization to indoor air inhalation criteria] (Rule 724(2)(a)) pathways, and a site-specific evaluation of indoor inhalation risks may be conducted. Draft "Guidance Document for the Vapor Intrusion Pathway, Michigan Dept. of Env. Qual., Remediation Division (May 2012) at 1-1.[40]

Both IEPA and SRAC, as noted, stressed the importance of the J&E Model's assumption that a concrete floor slab is present if a building is or will be located above volatile chemical contamination. The Board found in its March 7, 2013 opinion that the Tier 1 ROs and Tier 2 equations for the indoor inhalation exposure route should apply only to an existing or potential building with a full concrete slab-on-grade or a full concrete basement floor and walls.

Due to basement walls being in contact with soils, the basement scenario assumes a greater surface area of the building being at or below grade than does the slab-on-grade scenario. *See* proposed Appendix C, Table L (J&E Equations 12a & 12b, designated "A_B"). The "slab" in a basement scenario for purposes of the model consists not only of the basement floor but also the basement walls. *See* McHugh, T.E., Connor, J.A., Ahmad., F. 2004. "An Empirical Analysis of the Groundwater-to-Indoor-Air Exposure Pathway: The Role of Background Concentrations in Indoor Air." *Environmental Forensics 5:33-44.*, at 39 ("L_{crack}" is the "[e]nclosed space foundation or wall thickness").

The Board found, however, that Tier 1 and Tier 2 applicability for the indoor inhalation pathway need not be limited to buildings where concrete floors and basements walls are *at least 10-cm thick*. Although the presence of a 10-cm thick slab is an assumption of the J&E Model,

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[40] *See* footnote 25.

USEPA has found slab thickness to be a parameter of "low uncertainty and sensitivity." USEPA User's Guide Feb. 2004 at 31. Moreover, Paul C. Johnson, co-author of the J&E Model, described the reasonable range of slab thicknesses, based upon "typical construction practices," to be 15 cm to 50 cm. Johnson, P.C., "Identification of Critical Parameters for the Johnson and Ettinger (1991) Vapor Intrusion Model." American Petroleum Institute (May 2002). Under these circumstances, the expenditure of resources likely entailed in verifying that a concrete foundation is *at least 10-cm thick* appears unwarranted. The Board found that the applicability of Tiers 1 and 2 should be limited simply to existing or potential buildings with full concrete slabs on grade or full concrete basement floors and walls.

Lastly, the Board agreed with IEPA that any significant openings or significant preferential pathways to the subsurface must be addressed pursuant to the regulations of the applicable underlying program. PC8 at 3, citing, *e.g.*, 35 Ill. Adm. Code 734.330(b)(l), 740.420(b)(4). The Board further noted that "typical utility perforations," for example, would not render Tier 1 or Tier 2 inapplicable. USEPA VISL Mar. 2012 at 3. However, the Board found that a sump in a concrete floor, discussed by IEPA, would preclude the application of Tier 1 and Tier 2. USEPA specifically identifies building sumps as likely to make its J&E Model-based screening concentrations "inappropriate." USEPA VISL Mar. 2012 at 3. In addition, MDEQ recently indicated that when a sump is present in a building foundation, MDEQ's generic vapor intrusion criteria would not apply and instead a site-specific evaluation would be required. MDEQ explained that the presence of a sump is inconsistent with the assumptions of the J&E Model. *See* Draft "Guidance Document for the Vapor Intrusion Pathway, Mich. Dept. of Env. Qual., Remediation Division (May 2012) at 1-1 to 1-2, Appendix C.1 at 1.[41] The Board found when a sump is present, a site evaluator may pursue excluding the indoor inhalation exposure route, meeting BCT requirements, or proceeding under Tier 3.

Explicitly Limiting Applicability - Full Concrete Base. After seeking comment on whether the applicability of indoor inhalation ROs under Tier 1 or Tier 2 should be limited to buildings with full concrete slabs on grade or full concrete basement floors and walls, the August 28, 2012 hearing officer order inquired whether such an applicability limitation should be made explicit in the TACO rules. *See* R11-9 HOO at 3-4. The Board's January 10, 2013 proposed decision for public comment provided rule language limiting Tier 1 and Tier 2 ROs to buildings with full concrete bases. *See* Current Rulemaking, R11-9, slip op. at 47-51 (Jan. 10, 2013). The Board received responsive public comments from IMA and SRAC. PC14 at 2; PC17 at 4. IERG concurs with SRAC's comments "in whole." PC15 at 1.

In response to the hearing officer order, IEPA proposed "to more fully inform site evaluators of the J&E Model's limitations" by adding the following language to the TACO rules:

[41] *See* footnote 25.

> When evaluating the indoor inhalation exposure route, a modified Johnson and Ettinger Model (J&E Model) should be used. The J&E Model is based on an assumption that existing or potential buildings within the horizontal extent of contamination have full concrete floors. The J&E Model should not be used where existing or potential buildings within the horizontal extent of contamination have earthen crawl spaces or earthen or partial concrete floors. In such cases, site evaluators have the option of excluding the indoor inhalation exposure route under Section 742.312, meeting the building control technology requirements under Subpart L, or proposing an alternative approach under Tier 3. PC8 at 3.

IEPA stated that it "will defer to the Board's judgment as to where [in TACO] this language should be placed." *Id*.

SRAC stated its support for the "concept" of making it "clear to site evaluators that the use of the J&E Model is limited to buildings with concrete floors." PC11 at 2. However, SRAC expressed the concern that placing IEPA's proposed wording "within the [TACO] regulatory language could lead to confusion about the applicability of the limitation under various programs," such as SRP and the Leaking UST Program. *Id*. SRAC encouraged the Board to instead include the limitation as a footnote to the appropriate tables proposed in the TACO appendices, "which contain numerous footnotes describing similar limitations and clarifications regarding their appropriate use." *Id*. According to SRAC, placement of IEPA's language as a footnote would indicate that "this limitation is applicable for all programs under which the tables are being applied." *Id*.

Responding to the Board's proposed decision of January 10, 2013, IMA appeared to advocate there being no mention in the regulations of Tiers 1 and 2 applying only to buildings with full concrete bases. IMA maintained that the J&E Model "has numerous assumptions which are not otherwise required to be codified as being applicable in every case." PC14 at 2. SRAC echoed its earlier comment by stating that a footnote in the RO tables would provide "notice that the ROs are based on the full concrete base assumption." PC17 at 4.

Given the Board's finding that the Tier 1 and Tier 2 indoor inhalation provisions should apply only to existing or potential buildings with full concrete slabs on grade or full concrete floors and walls, it was plain to the Board that this limit must be set forth in the TACO rules. To not do so would risk inviting confusion, inefficiency, and the misapplication of remediation objectives to the potential detriment of human health. The Board found that language should be added to TACO stating that Tier 1 and Tier 2 apply only to an existing or potential building with a full concrete base.

SRAC did not explain why placing this applicability language in the TACO regulatory text (as opposed to solely in a TACO table footnote) could cause confusion about limiting Tier 1 and Tier 2 applicability under programs like SRP. The Board found that the applicability language should be set forth *both* in the TACO regulatory text and in footnotes to the Tier 1 and Tier 2 tables of the TACO appendices. A modified version of IEPA's more explanatory language suggested above appeared at second notice only in the appropriate table footnotes. The Board anticipated no confusion over this approach to limiting the applicability of the Tier 1 and Tier 2 indoor inhalation provisions.

Second-notice revisions to first-notice language are shown below with double underlining and double strikeouts. Also, for reasons detailed earlier in this opinion (pages 31-40 above), the Board deleted the phrase "above the contamination" from the January 10, 2013 provisions concerning the full concrete base. This was intended to avoid any unduly narrow construction of the rules in the event all contamination is outside of the building footprint but nevertheless a VI concern.

Section 742.500 Tier 1 Evaluation Overview

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c) For the indoor inhalation exposure route:

1) Appendix B, Tables H and I apply only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls; ***

Section 742.505 Tier 1 Soil, Soil Gas and Groundwater Remediation Objectives

b) Soil Gas

***

2) Indoor Inhalation Exposure Route

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B) The Tier 1 soil gas remediation objectives for this exposure route are based on a default water-filled soil porosity value of 0.15 cm^3/cm^3 and the assumed presence of a building with a 10-cm thick, full concrete slab-on-grade.

C) *** Appendix B, Table H applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. ***

D) *** Appendix B, Table I applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. ***

Parallel changes were made to then-proposed Section 742.505(c)(5) concerning groundwater remediation objectives for the indoor inhalation pathway.

Section 742.515 Tier 1 Remediation Objectives Tables for the Indoor Inhalation Exposure Route

a) For the indoor inhalation exposure route:

1) Appendix B, Tables H and I apply only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls; ***

Section 742.600 Tier 2 Evaluation Overview

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l) For the indoor inhalation exposure route:

1) Appendix C, Table L applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls; ***

Section 742.717 J&E Soil Gas Equations for the Indoor Inhalation Exposure Route

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d) The attenuation factor (Equation J&E7 or J&E8) accounts for the following processes:

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2) Migration of contaminants through the earthen filled cracks in the building's full concrete slab-on-grade or full concrete basement floor and walls; ***

g) Equations J&E9a through J&E18 calculate input parameters for either Equation J&E7 or J&E8 (the equations used to calculate an attenuation factor). These equations assume there are "n" different soil layers between the source of the contamination and the floor of the building. Equations J&E11, 16, 17 and 18 shall be used to calculate the needed parameters for each of the n layers (the general soil layer is referred to as soil layer "i" and i = 1,2, …n). Equations J&E16, 17, and 18 shall also be used to calculate needed parameters for the soil in the cracks of the ~~floor of the building~~ building's full concrete slab-on-grade or full concrete basement floor and walls (it is through these cracks that contaminated soil gas is assumed to ~~contaminants~~ flow from the subsurface ~~and~~ into the building). As reflected in Equation J&E14, the only crack assumed to be present is the floor-wall seam gap. To calculate the surface area of the enclosed space at or below grade, Equation J&E12a shall be used for a building with a full concrete slab-on-grade and Equation J&E12b shall be used for a building with a full concrete basement floor and walls.

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Section 742.805 Tier 2 Groundwater Remediation Objectives

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e) Groundwater remediation objectives for the indoor inhalation exposure route shall be developed in accordance with Section 742.812. Appendix C, Table L applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls.

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Section 742.APPENDIX B: Tier 1 Illustrations and Tables

Section 742.TABLE H: Tier 1 Soil Gas and Groundwater Remediation Objectives for the Indoor Inhalation Exposure Route – Diffusion and Advection [i]

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Chemical Name and Remediation Objective Notations

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[i] Calculated values for the remediation objectives in this table are based on the assumption that the existing or potential building has a full concrete slab-on-grade, though the remediation objectives in this table are also considered protective of occupants of buildings with full concrete basement floors and walls. This table applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. *** This table does not apply when the existing or potential building has neither a full concrete slab-on-grade nor a full concrete basement floor and walls, such as a building with an earthen crawl space, an earthen floor, a stone foundation, a partial concrete floor, or a sump. In such cases, site evaluators have the option of (1) excluding the indoor inhalation exposure route under Section 742.312, which may include meeting the building control technology requirements under Subpart L, or (2) proposing an alternative approach under Tier 3.

Like changes were made to Appendix B, Table I (diffusion only) on Tier 1 soil gas and groundwater ROs for the indoor inhalation exposure route.

Section 742.APPENDIX C: Tier 2 Tables

Section 742.Table L: J&E Equations[a]

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[a] This table contains equations based on the assumption that the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. This table applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. *** The table does not apply when an existing or potential building does not have a full concrete slab-on-grade or a full concrete basement floor and walls, such as a building with an earthen crawl space, an earthen floor, a stone foundation, a partial concrete floor, or a sump. In such cases, site evaluators have the option of (1) excluding the indoor inhalation exposure route under Section 742.312, which may

include meeting the building control technology requirements under Subpart L, or (2) proposing an alternative approach under Tier 3.

Further, in Appendix C, Table L, for the Tier 2 equations J&E12a and J&E12b concerning the surface area of enclosed space at or below grade, the Board added the words "full concrete" before "slab-on-grade" and "basement," and also added the words "floor and walls" after "basement," all as follows:

For a building with a full concrete slab-on-grade ~~building~~

For a building with a full concrete basement floor and walls

Institutional Control - Full Concrete Base.

Background. Under the current TACO rules, an "institutional control" is defined as "a legal mechanism for imposing a restriction on land use, as described in Subpart J [of TACO]." 35 Ill. Adm. Code 742.200. Institutional controls include "Environmental Land Use Controls" or "ELUCs" and may include "No Further Remediation" or "NFR" Letters. *See* 35 Ill. Adm. Code 742.1000, 742.1005. ELUCs and NFR Letters used as institutional controls are recorded for the subject property with the registrar of titles or county recorder. *See* 35 Ill. Adm. Code 734.715, 740.620, 742.1000(d), 742.1010(b).

The August 28, 2012 hearing officer order asked whether using Tier 1 or Tier 2 for indoor inhalation remediation objectives should necessitate the placement of an "institutional control" on the property, so as to require that any building at issue has either a full concrete slab-on-grade or a full concrete basement floor and walls. *See* R11-9 HOO at 3-4. The Board received responsive public comments from IEPA (PC8) and SRAC (PC11).

The Board's January 10, 2013 proposed decision for public comment found that an institutional control must be used whenever indoor inhalation ROs are based upon the assumption of the building having a full concrete base, which includes Tier 1 and Tier 2 ROs for soil gas and groundwater, whether for residential or industrial/commercial property use.[42] *See* Current Rulemaking, R11-9, slip op. at 51-59 (Jan. 10, 2013). The Board proposed rules to effectuate its finding and specifically requested additional public comment on this issue. *Id*. at 1, 56-59. IMA and SRAC filed public comments explaining why they opposed requiring an

[42] Applying industrial/commercial ROs under TACO already requires an institutional control to limit property use to industrial/commercial. *See* 35 Ill. Adm. Code 742.1000(a)(1). Indoor inhalation ROs are not provided for construction workers because "the exposure duration for indoor construction in almost all cases is less than the exposure duration for the residents or commercial workers." King PFT1 at 12.

institutional control. PC14 at 2; PC17 at 4-5. IERG concurred with SRAC's comments "in whole." PC15 at 1. CICI filed a public comment agreeing with IMA and SRAC on the issue of "Institutional Controls When Full Concrete Floor is Modeled." PC16 at 1. IEPA's public comment (PC12) in response to the January 10, 2013 order does not explicitly address the institutional control issue.

Public Comments on "Full Concrete Base" Institutional Control Issue. In response to the hearing officer order, IEPA stated that it does not support an institutional control. PC 8 at 2. IEPA stressed that the full concrete base is just an assumption of the J&E Model, does not serve as an "engineered barrier,"[43] and is "in no way considered a remedy for the indoor inhalation exposure route." *Id*. SRAC agreed with IEPA that an institutional control requiring a full concrete base is "unnecessary." PC11 at 2. SRAC reiterated that the assumption is "only a condition" of the J&E Model, and all remediation objectives are based upon assumptions that may not always exist on-site. *Id*. According to SRAC, "[t]he Remedial Applicant is responsible for evaluating the site conditions appropriately and demonstrating that each potential exposure pathway has been addressed." *Id*. SRAC maintained that if a new building was constructed without a full concrete base and was "determined to pose a hazard to public health," IEPA "retains the right to void the NFR letter, as with any other exposure pathway." *Id*. at 3, citing 35 Ill. Adm. Code 734.720, 740.625.

Responding to the Board's January 10, 2013 order, IMA stated that it believes an "unrestricted" NFR Letter should be issued when all Tier 1 or Tier 2 ROs are met. PC14 at 2. In support, IMA made three assertions against the institutional control requirement. First, IMA maintained that the J&E Model "has numerous assumptions" not required to be "applicable in every case." *Id*. Second, IMA posited that including a deed restriction "has the potential to impose a significant adverse impact on the property value." *Id*. Third, IMA asserted that the institutional control is "not necessary to achieve program goals" because, for example, IEPA has the authority to void an NFR Letter "for various exposure pathways if it finds that significant assumptions are no longer valid at the site." *Id*.

SRAC also supported the "unrestricted" NFR Letter, maintaining "[t]here is no reason that relying on the full concrete base assumption needs to be embodied in an institutional control." PC17 at 4. According to SRAC, "[i]mposing a deed restriction requiring a concrete base would be detrimental to the value of the property." *Id*. SRAC emphasized that a full concrete base is "just one of the many assumptions" of the J&E Model. *Id*. SRAC noted that IEPA, in calculating the indoor inhalation ROs, assumed default sizes for industrial/commercial and residential buildings, yet "there was no need to impose building size restrictions as institutional controls under Tier 1 or 2." *Id*.

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[43] "Engineered Barrier" is defined as "a barrier designed or verified using engineering practices that limits exposure to or controls migration of the contaminants of concern." 35 Ill. Adm. Code 742.200.

SRAC asserted that the J&E Model, "taken as a whole," is "very conservative" and "intended to be adequately protective even if all of the assumptions underlying the model are not true in each and every case." PC17 at 4. SRAC argued that "only the most significant conditions, such as use and the maintenance of required barriers should be included" in an institutional control. *Id*.

Board Analysis of "Full Concrete Base" Institutional Control Issue. In its March 7, 2013 second-notice opinion, the Board observed that under existing TACO rules, once Tier 1 remediation objectives are met for a given exposure route, the exposure route "is not a concern" and "no further evaluation of that route is necessary." 35 Ill. Adm. Code 742.500(c). Similarly, "[w]hen contaminant concentrations do not exceed remediation objectives developed under one of the tiers . . ., further evaluation under any of the other tiers is not required." 35 Ill. Adm. Code 742.110(e).

The Tier 1 indoor inhalation ROs assume the presence of a building with a full concrete slab-on-grade above the contamination, though these ROs are also considered protective of occupants in buildings with a full concrete basement floor and walls. Tier 2 provides equations for the development of indoor inhalation ROs based upon the assumption of either a full concrete slab-on-grade or a full concrete basement floor and walls.

The Board found that even if a site achieves Tier 1 or Tier 2 indoor inhalation ROs, current and future buildings *without* such a slab-on-grade or basement might be located, for example, over remaining concentrations of volatile chemicals. In the view of IEPA and others, once all contaminant concentrations at the site meet Tier 1 or Tier 2 residential indoor inhalation ROs "for diffusion and advection," an "unrestricted" NFR Letter could be issued by IEPA, *i.e.*, this site would not be encumbered by any use limitation. Years later, however, the site could be sold and developed as a residence with an earthen crawlspace overlying the remaining levels of contaminants.[44] The Board found at second notice that the record of this rulemaking fails to establish that the indoor inhalation exposure route would not be a concern for occupants of such a future residence.

On the other hand, in this example, an institutional control would require either a full concrete slab-on-grade or a full concrete basement floor and walls for any residence to be built in a location where the remaining concentrations of volatile chemicals present a VI concern. The institutional control would provide notice of these site conditions, in the property record, informing a would-be developer and prospective homebuyers. IEPA could approve removing

[44] USEPA states that "[a]ccording to the U.S. Census Bureau (2006), about 26% of U.S. single-family housing units have a crawl space." "Conceptual Model Scenarios for the Vapor Intrusion Pathway," USEPA, EPA 530-R-10-003 (Feb. 2012) at 6, available at http://www.epa.gov/oswer/vaporintrusion/documents/vi-cms-v11final-2-24-2012.pdf.

the full concrete base institutional control if further evaluation and, potentially, subsurface remediation or BCT installation demonstrates that the earthen crawlspace of the residence would pose no indoor inhalation concern. Neither SRAC nor IMA identified a legal mechanism, like an institutional control, that would trigger the further site evaluation implied in their public comments.

The Board also found that the rationales of IEPA, SRAC, and IEPA for why the Board should not require an institutional control, if accepted, would justify eliminating many if not all institutional controls. IEPA explained that the full concrete base is "strictly an assumption of the J&E Model." PC8 at 3. SRAC agreed with IEPA and elaborates that "[t]his approach is no different than any other exposure pathway as all remediation objectives are based on assumptions that may not hold true in every case." PC11 at 2. IMA made the same argument. PC14 at 2. However, while some assumptions underlying remediation objectives have not necessitated institutional controls, other assumptions have. The fact that the presence of a concrete slab-on-grade *is an assumption* on which the proposed Tier 1 ROs are based cannot alone justify not requiring an institutional control. Institutional controls apply *only* when ROs are based upon specified assumptions. Section 742.1000(a) of TACO states:

a) Institutional controls in accordance with this Subpart must be placed on the property *when remediation objectives are based on any of the following assumptions*:

1) Industrial/Commercial property use;

2) Target cancer risk greater than 1 in 1,000,000;

3) Target hazard quotient greater than 1;

4) Engineered barriers;

5) The point of human exposure is located at a place other than at the source;

6) Exclusion of exposure routes; or

7) Any combination of the above. 35 Ill. Adm. Code 742.1000(a) (emphasis added).

In addition, pointing out that the J&E Model has numerous assumptions not required to be placed in an institutional control does not address whether the full concrete base assumption should be placed in an institutional control. The Board recognized that many existing TACO remediation objectives were derived from conservative assumptions that do not warrant the imposition of institutional controls. However, IEPA's Mr. King highlighted various conservative "building-specific" assumptions or "default values" underlying the indoor inhalation ROs, without mentioning the assumption of a concrete slab-on-grade:

> length of building (L_B), width of building (W_B), height of building (H_B), surface area of enclosed space at or below grade (A_B), and building ventilation rate (Q_{bldg}). *** The actual values of these parameters do not have a great impact on the remediation objective; however, the default values are based on a conservative representation of the type of buildings *that are or may be present at the site in the future*. Without these conservative values, *restrictions would be required* on the minimum size of a building that can be constructed over the contaminated area. King PFT1 at 11 (emphasis added).

The Board found at second notice that this record does not demonstrate that the concrete slab-on-grade assumption is so conservative as to not warrant a property use limitation. Presumably, a more conservative approach for this parameter in developing the Tier 1 indoor inhalation ROs might have been to assume, for instance, that an earthen crawlspace without ventilation is present[45] or that more cracks exist than the floor-wall seam gap. The Board found that the full concrete base institutional control requirement is in accord with IEPA's statement that "[t]he J&E Model *should not be used* where existing or potential buildings within the horizontal extent of contamination have earthen crawl spaces or earthen or partial concrete floors." PC8 at 3 (emphasis added). IEPA made no such statement with respect to any other assumption of the J&E Model.

IEPA, SRAC, and IMA did not give reasoning specific to the concrete slab-on-grade assumption of Tier 1 or Tier 2, or the Tier 2 assumption of a full concrete basement floor and walls, that would distinguish these assumptions from others that do require an institutional control. For example, IEPA did not provide a sensitivity analysis comparing the impact on indoor inhalation ROs of assuming a full concrete slab-on-grade versus an earthen crawlspace, or a full concrete basement floor and walls versus an earthen crawlspace. This lack of specific

[45] "Conceptual Model Scenarios for the Vapor Intrusion Pathway," USEPA, EPA 530-R-10-003 (Feb. 2012) at 6 ("[T]he vapor concentration distribution in the subsurface below the building and the contaminant emission rates into the crawl space can differ if there is no foundation concrete slab acting as a cap and a barrier for upward contaminant transport. Although the vapor concentrations in the subsurface below a crawl space could be lower than the ones below a slab-floored basement or a slab-on-grade foundation, the contaminant emissions into the crawl spaces could be higher. The ventilation rate of the crawl space and the nature and condition of the crawl space floor (e.g., concrete slab, concrete skim-coat, plastic water-vapor barrier, dirt) are key parameters affecting the air concentration that may eventually intrude into the building above."), available at http://www.epa.gov/oswer/vaporintrusion/documents/vi-cms-v11final-2-24-2012.pdf.

reasoning and sensitivity analysis with respect to the full concrete base assumption was identified by the Board in its January 10, 2013 proposal for public comment (*see* Current Rulemaking, R11-9, slip op. at 55 (Jan. 10, 2013)) and yet not addressed in any of the subsequent public comments. The Board found to be unsubstantiated SRAC's implication that the J&E Model's conservatism "as a whole" warrants having no full concrete base institutional control. PC17 at 4. Both IEPA and SRAC have described the full concrete base as a "key assumption." PC8 at 2; PC11 at 1.

The Board also could not reconcile the position of IEPA, SRAC, and IMA with IEPA's proposal, adopted at first notice, to require an institutional control whenever a site uses indoor inhalation ROs based upon the "diffusion only" mode of contaminant transport. As proposed at first notice, when "diffusion only" indoor inhalation ROs are used, an institutional control would be required to condition use of the site "such that no future buildings or manmade pathways can be located within 5 feet of the contamination." King PFT1 at 14. Specifically, the Board at first notice adopted IEPA's proposal to amend Section 742.1100 as follows:

a) Institutional controls in accordance with this Subpart must be placed on the property when remediation objectives are based on any of the following assumptions:

***

7) Use of remediation objectives based on a diffusion only mode of contaminant transport for the indoor inhalation exposure route; ***

As indicated by IEPA's Mr. King, the premise for requiring this institutional control is that the "diffusion only" remediation objectives were developed based upon the assumption that all contamination is more than 5 feet away, vertically and horizontally, from the existing or potential building or man-made pathway. This institutional control is therefore designed to ensure that the site is not used in a manner inconsistent with the basis upon which the applied ROs were developed. If a building were to be present within 5 feet of the contamination, the assumption of the uncontaminated five-foot distance is rendered invalid and the advection mode of contaminant transport also becomes a concern.

Similarly, the Board proposed at second notice that when indoor inhalation remediation objectives are based upon the assumption of a full concrete slab-on-grade or a full concrete basement floor and walls, an institutional control is required. The institutional control conditions use of the site such that the existing or future building at issue cannot have, for example, an earthen crawlspace, an earthen floor, a partial concrete floor, or a stone foundation. As discussed, IEPA acknowledged that the J&E Model should not be used in such situations.

On this record, the Board found at second notice that the J&E Model's assumption of either a full concrete slab-on-grade or a full concrete basement floor and walls becomes invalid for a given site where the building has, for instance, an earthen crawlspace above the contamination. That the slab-on-grade and basement are not engineered barriers or remedies is inconsequential. The full concrete base bears upon attenuation and, consistent with the floor-wall seam gap assumption, is not considered to render the exposure route incomplete like a BCT. IEPA proposed requiring an institutional control when the "diffusion only" remediation objectives are used, even though the uncontaminated five-foot distance is neither an engineered barrier nor a remedy. Further, IEPA's ability to void an NFR Letter if a future building or man-made pathway encroaches within that five-foot distance does not justify failing to require the "diffusion only" institutional control.

The Board further observed that TACO already provides that an institutional control "must be placed on the property" when remediation objectives are based upon an assumption that "[t]he point of human exposure is located at a place other than at the source." 35 Ill. Adm. Code 742.1000(a)(5). "Point of human exposure" is defined as follows:

> the points at which human exposure to a contaminant of concern may reasonably be expected to occur. The point of human exposure is at the source, unless an institutional control limiting human exposure for the applicable exposure route has been or will be in place, in which case the point of human exposure will be the boundary of the institutional control. Point of human exposure may be at a different location than the point of compliance. 35 Ill. Adm. Code 742.200.

The Board found that for the indoor inhalation exposure route, the contamination source is the subsurface soil gas or groundwater, but the point of human exposure is inside the building where occupants breathe contaminated soil gas. IEPA's public comments were in accord with this finding. *See* PC7 at 1-2 ("no one is exposed to the chemicals in soil gas or groundwater while these media are still in the ground. Human contact with the chemicals in soil gas or groundwater occurs only after the chemicals potentially migrate indoors."); PC12 at 12-13. Therefore, Section 742.1000(a)(5) alone would *require* an institutional control here.

The Board further found that it is inadequate to *only* place language in TACO about the limited applicability of these indoor inhalation ROs. Given the potential health risks to building occupants, the Board declined to assume that the TACO regulations will necessarily be read by property owners or transferees, particularly where an NFR Letter has been issued that is silent on the need for a full concrete base and that indicates the site poses no health threat. *See* 35 Ill. Adm. Code 734.710, 740.610. The notice provided by an institutional control is warranted. The logic for requiring an institutional control when using "diffusion only" ROs applies here as well.

Accordingly, the Board proposed a new subsection (a)(9) to Section 742.1000 at second notice:

a) Institutional controls in accordance with this Subpart must be placed on the property when remediation objectives are based on any of the following assumptions:

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9) For the indoor inhalation exposure route, the presence of a building with a full concrete slab-on-grade or a full concrete basement floor and walls;

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Pursuant to Section 742.1000(a)(9), if a site uses Tier 1 or Tier 2 for indoor inhalation ROs, the institutional control would require the existing or potential building at issue to have a full concrete slab-on-grade or a full concrete basement floor and walls.

Use of Table H (diffusion and advection) requires an institutional control imposing the full concrete base requirement (Section 742.1000(a)(9)), while use of Table I (diffusion only) requires an institutional control imposing *both* the requirement of the full concrete base and the prohibition of construction within the uncontaminated five-foot distance (Sections 742.1000(a)(7) and (a)(9)). As it would vary from site to site, the actual language of land use limitations or requirements imposed through institutional controls is not specified in TACO. *See* 35 Ill. Adm. Code 742, Subpart J.

Section 742.1000(a)(9) applies not only when Tier 1 or Tier 2 is used for indoor inhalation ROs, but also whenever Tier 3 is used to develop ROs based upon the assumed presence of a full concrete slab-on-grade or a full concrete basement floor and walls. *See* King PFT1 at 21 ("Section 742.1000(a)(7) makes it clear that any time the diffusion only mode of transport is used (whether under Tier 1, 2, or 3) an institutional control will be necessary.").

The Board recognized that Section 742.1000(a)(9) would impose a land use restriction when residential remediation objectives are achieved. Section 742.1000(a)(7), however, does that as well. The Board found that commenters' claims that the full concrete base institutional control might adversely impact property values are not supported in this record; even if they were supported, they would not alone preclude requiring an institutional control. Moreover, the indoor inhalation pathway is expected to be the decisive exposure route at only a small percentage of sites (Tr.1 at 105) and NFR Letters, which would normally include this institutional control, are already required to be recorded pursuant to the Leaking UST Program and SRP (35 Ill. Adm. Code 734.715, 740.620).

The Board found that avoiding the potential health risk to building occupants from vapor intrusion outweighs the policy in favor of unencumbered property use. This caution was especially warranted here as the Board adds an entirely new, and in some ways unique, exposure route to TACO:

The VI pathway presents unique challenges compared with other potential

> pathways of human exposure to environmental contaminants. VI affects indoor air, which is the air that people breathe for the most hours each day. Whereas the risks posed by potential ingestion and skin exposures to contaminated groundwater and soil can be mitigated by personally avoiding contact with these media, individuals cannot avoid exposures to indoor air in their homes or workplaces, if contaminated vapors are present. While contaminated soils can be removed to minimize exposure and alternative water supplies can be provided, it is not possible for occupants to discontinue breathing contaminated air and it is not practical to provide an alternative breathing supply. "Superfund Vapor Intrusion FAQs," USEPA (Feb. 2012) at 4.

As noted, the Board's January 10, 2013 opinion solicited additional public comment on the merits of having a rule through which "an institutional control would have to be placed on the property whenever the TACO indoor inhalation ROs applied at the site rely upon the assumed presence of a building with a full concrete slab-on-grade or a full concrete basement floor and walls." Current Rulemaking, R11-9, slip op. at 1 (Jan. 10, 2013). IEPA's public comment did not respond directly to this request. IEPA did state, however, that "by way of these comments," IEPA "will provide its position and justification on *those issues that it believes are critical to the proposal*." PC12 at 1 (emphasis added). The Board found it reasonable to conclude from this statement and IEPA's silence on the issue in its most recent public comment that IEPA accepts the full concrete base institutional control. The Board further noted that IEPA's position against this institutional control (PC8 at 2) was taken before the Board's then-proposed finding that an institutional control is required here, pursuant to Section 742.1000(a)(5) of the existing TACO rules, as the point of human exposure is located at a place other than at the source (*see* Current Rulemaking, R11-9, slip op. at 56 (Jan. 10, 2013)). The Board stated that it believes that if IEPA disagreed with this then-proposed finding, IEPA would have taken the opportunity of its most recent public comment to point that out to the Board.

Finally, the Board emphasized that IEPA has already indicated that it will review USEPA's impending vapor intrusion guidance to assess whether the guidance indicates the need for revision to the TACO indoor inhalation rules. Also, based upon past experience with TACO, implementation of these new TACO provisions may reveal, over time, the merits in making further changes. The Board noted that it anticipates that IEPA, consistent with IEPA's resources, will timely propose any necessary amendments to these TACO indoor inhalation rules, including the institutional control language. Should a future rulemaking record demonstrate that no significant health risk is posed to building occupants by the absence of a full concrete base, then the Section 742.1000(a)(9) institutional control trigger could be revisited. The Board found at second notice that this record lacks that demonstration.

Additional second-notice changes prompted by the full concrete base institutional controls were added to the first-notice rules to correspond with other cross-references to institutional controls. These changes are highlighted below with double underlining and double strikeouts.

Section 742.110 Overview of Tiered Approach

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b) A Tier 1 evaluation compares the concentration of contaminants detected at a site to the corresponding remediation objectives for residential and industrial/commercial properties contained in Appendix B, Tables A, B, C, D ~~and~~ E, G, H and I. To complete a Tier 1 evaluation, the extent and concentrations of the contaminants of concern, the groundwater class, the land use classification, human exposure routes at the site, and, if appropriate, soil pH, must be known. If remediation objectives are developed based on industrial/commercial property use, then institutional controls under Subpart J are required. For the indoor inhalation exposure route, institutional controls under Subpart J are required to use remediation objectives in Appendix B, Table H or Table I.

c) A Tier 2 evaluation uses the risk based equations from the Soil Screening Level (SSL Model) and Risk Based Corrective Action (RBCA Model) and modified Johnson and Ettinger Model (J&E Model) documents listed in Appendix C, Tables A, ~~and~~ C, and L respectively. In addition to the information that is required for a Tier 1 evaluation, site-specific information is used to calculate Tier 2 remediation objectives. As in Tier 1, Tier 2 evaluates residential and industrial/commercial properties only. If remediation objectives are developed based on industrial/commercial property use, then institutional controls under Subpart J are required. For the indoor inhalation exposure route, institutional controls under Subpart J are required to develop remediation objectives pursuant to Appendix C, Table L. ***

Section 742.505 Tier 1 Soil, Soil Gas and Groundwater Remediation Objectives

b) Soil Gas

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2) Indoor Inhalation Exposure Route

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C) *** Pursuant to Section 742.1000(a)(9), soil gas remediation objective determinations relying on Appendix B, Table H require the use of institutional controls in accordance with Subpart J.

D) *** Pursuant to Sections 742.1000(a)(7) and (a)(9), ~~S~~soil gas remediation objective determinations relying on Appendix B, Table I ~~this table~~ require the use of institutional controls in accordance with Subpart J. ***

~~b~~ c) Groundwater

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5) For the groundwater component of the indoor inhalation exposure route, the Tier 1 groundwater remediation objectives are listed in Appendix B, Tables H and I. ***

B) *** Pursuant to Section 742.1000(a)(9), groundwater remediation objective determinations relying on Appendix B, Table H require the use of institutional controls in accordance with Subpart J.

C) *** Pursuant to Sections 742.1000(a)(7) and (a)(9), ~~G~~groundwater remediation objective determinations relying on Appendix B, Table I ~~this table~~ require the use of institutional controls in accordance with Subpart J. ***

The above second-notice language was paralleled in Sections 742.500 (Tier 1 Evaluation Overview), Section 742.515 (Tier 1 RO Tables for the Indoor Inhalation Exposure Route), 742.600 (Tier 2 Evaluation Overview), Section 742.605 (Land Use), Section 742.700 (Tier 2 Soil and Soil Gas Evaluation Overview), 742.805 (Tier 2 Groundwater ROs), Appendix B (Tier 1 Tables H and I), and Appendix C (Tier 2 Table L (J&E Equations)).

Finally, for consistency, the Board amended the proposed "diffusion only" institutional control trigger at then-proposed Section 742.1000(a)(7), with second-notice changes indicated by double strikeout and double underline:

a) Institutional controls in accordance with this Subpart must be placed on the property when remediation objectives are based on any of the following assumptions:

***

7) ~~Use of remediation objectives based on a~~A diffusion only mode of contaminant transport for the indoor inhalation exposure route; ***

Biodegradation

Prior to first notice, Mr. Reott pointed out that USEPA's 2004 User's Guide[46] indicates that the J&E Model should not be used for UST sites with petroleum contamination. PC4 at 3. During the first-notice comment period, IPC also expressed reservations about using the J&E Model for petroleum hydrocarbons. IPC asserted that attenuation factors, like those used in the

[46] "Users Guide for Evaluating Subsurface Vapor Intrusion in Buildings" USEPA, EPA/68/W-02/33 (Feb. 2004) at 67. PC4 at 3; *see also* Section 742.210.

J&E Model, have limited applicability for reactive and biodegradable volatile chemicals. PC10 at 1-2. IPC commented that "source-receptor separation distances" of 50 to 30 feet for dissolved-phase petroleum hydrocarbon sources have been proposed or adopted by state and federal agencies as a means of "regulatory site screening" for petroleum hydrocarbon releases. *Id*. at 3. According to IPC, "[n]o cases of vapor intrusion are reported in the literature from dissolved-phase petroleum hydrocarbon sources separated vertically from building foundations." *Id*. at 2. IPC also suggested that consideration should be given to having "separate screening criteria for UST and non-UST sites." *Id*. at 6.

During the supplemental public comment period for the proposed second notice, IPC reiterated that "[a]ttenuation factors, while perhaps appropriate for non-reactive VOCs (*i.e.*, chlorinated hydrocarbons), have been shown to have limited applicability for reactive VOCs (*i.e.*, petroleum hydrocarbons)." PC13 at 2. According to IPC, attenuation factors for petroleum hydrocarbons are "depth dependent (i.e., vary depending on source-separation distance), not constant as assumed within the TACO Tier 1 Framework." *Id*. The J&E Model, continued IPC, is not validated by field data and has been found to "vastly over-predict indoor air concentrations" at petroleum release sites due to the model's "exclusion of biodegradation." *Id*. at 3.

IPC suggested that if attenuation factors are retained, a "'bioattenuation'" factor should be used to account for "the additional attenuation resulting from biodegradation." PC13 at 2-3, citing the California "Low-Threat Closure Policy" 1,000x bioattenuation factor for petroleum VI screening. Applying a 1,000x bioattenuation factor, continues IPC, "would increase the Tier 1 Soil Gas Remediation Objectives (ROs) values listed in Table H by several orders of magnitude." *Id*. at 2. IPC also proposed that "BioVapor" be considered to develop "screening criteria," adding that USEPA's Office of Underground Storage Tanks is "finalizing the recoding of BioVapor and planning to make the code available to the public later this year." *Id*.

IEPA explained that regardless of whether contamination comes from a UST, for petroleum constituents, biodegradation is a factor. R09-9/Tr.2 AM at 28-29; Tr.1 at 69. IEPA stated the J&E Model assumes the contaminant source is infinite, with no biodegradation as the vapors migrate through the vadose zone. King PFT1 at 17; R09-9/Tr.1 at 92-94. IEPA noted that over the last few years, research has shown that benzene, toluene, ethylbenzene, and total xylenes (BTEX) degrade in soil as they move upward through the vadose zone from contaminated groundwater, as long as the soil above the groundwater is not contaminated and has sufficient oxygen levels. Tr.1 at 69. IEPA added that research has not shown active biodegradation relative to any of the other volatile chemicals listed in the proposal. Tr.1 at 73.

To account for the potential biodegradation of the petroleum constituents BTEX, IEPA proposed provisions allowing for the indoor inhalation pathway to be excluded based upon a demonstration of active biodegradation. King PFT1 at 7. Although a biodegradation demonstration could be submitted under Tier 3, IEPA proposed this under Subpart C, "Exposure

Route Evaluations." IEPA mentioned that one model gaining acceptance in active biodegradation demonstrations is "BioVapor - A 1-D Vapor Intrusion Model with Oxygen-Limited Aerobic Biodegradation, Version 2.0" by the American Petroleum Institute, 2009. *Id*.[47]

If a demonstration of active biodegradation is used to exclude the indoor inhalation pathway, IEPA explained that a clean layer of soil above the contamination would need to be maintained to allow for the occurrence of biodegradation. This requirement would need to be incorporated into an institutional control under existing Section 742.1000(a)(6) (35 Ill. Adm. Code 742.1000(a)(6) "[e]xclusion of exposure routes"). King PFT1 at 8. IEPA added that the BioVapor model would not be suitable for evaluating the outdoor inhalation pathway because the BioVapor model uses the J&E Model equations and the outdoor inhalation pathway relies upon the SSL equations, and the two cannot be mixed. Tr.1 at 70-71.

Where a BCT is required as part of the NFR determination, IEPA noted that the site owner would have the opportunity to re-evaluate the site if circumstances change and the contaminants have attenuated or degraded. IEPA indicated that the content of the NFR Letter could be changed under such circumstances. R09-9/Tr.2 AM at 29-30.

The Board again found at second notice that it is appropriate to provide a regulatory mechanism for excluding the indoor inhalation pathway based upon a demonstration of active biodegradation for BTEX contaminants. Because the J&E Model does not account for biodegradation, the approach taken at first and second notice adequately addressed the concern that the J&E Model not be used at sites with UST petroleum contamination. Recent research indicates that BTEX can degrade in soil and the BioVapor model is gaining acceptance. Further, the active biodegradation demonstration would be subject to IEPA approval. In addition, USEPA Region 5 did not object to the biodegradation aspect of the proposal in its dealings with IEPA.

Finally, for excluding the indoor inhalation pathway as IPC suggested, the Board found that a bioattenuation factor is not sufficiently developed in this rulemaking's record to support a specific regulatory standard at this time. As IPC acknowledged, California's 1,000x bioattenuation factor would apply only if "aerobic conditions in the unsaturated zone . . . and the lack of an unsaturated zone petroleum source . . . can be demonstrated." PC13 at 3. The Board found that biodegradation claims are best addressed through the proposed pathway exclusion based upon a demonstration of active biodegradation of BTEX. *See* Section 742.312(b)(1)(C). Nothing in that rule languageprecludes a site evaluator from proposing the use of a bioattenuation factor or the BioVapor model as part of the active biodegradation demonstration. *See* KingPFT1 at 7 (rule is "drafted broadly enough to accommodate different models as they emerge in the future"). Alternative pathway exclusion options are provided through building/contamination proximity (Section 742.312(b)(1)(A)) and BCTs (Section

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[47] The "BioVapor" model is available at http://www.api.org. PFT1 King at 7.

742.312(b)(1)(B)). The Board noted that it values IPC's views on the matter and encouraged IPC to participate before the Board if any TACO amendatory rulemaking stemming from USEPA's issuance of final subsurface VI guidance.

Non-Aqueous Phase Liquids

IPC asserted that "[t]he risk for vapor intrusion is fundamentally different" when the source of hydrocarbon contamination is dissolved as opposed to a non-aqueous phase liquid (NAPL). PC10 at 3. For NAPL, continued IPC, the source concentrations are usually much higher and distributed above the capillary zone, contributing to a higher rate of diffusion over a more sustained period of time than with a dissolved source. PC10 at 3-4. IPC suggested "very clear guidance" should be given for assessing source type "during the initial stages of site investigation given the implications for site risk." PC10 at 6. IPC cautioned that it is difficult to distinguish between NAPL and dissolved-phase sources based upon groundwater sampling, citing studies indicating that "hydrocarbon concentrations in soil gas are poorly correlated with concentrations in groundwater." PC10 at 5-6. IPC conceded, however, that groundwater concentration measurements would be "another line of evidence to help distinguish between dissolved and residual-phase hydrocarbon sources." PC10 at 7.

In its January 10, 2013, second-notice proposal for public comment, the Board sought public comment on whether soil gas ROs capped at the "soil vapor saturation limit" (C_v^{sat}) account for the presence of free product (*i.e.*, non-aqueous phase liquids or "NAPLs"). *See* Current Rulemaking, R11-9, slip op. at 1 (Jan. 10, 2013). "Free Product" means "a contaminant that is present as a non-aqueous phase liquid for chemicals whose melting point is less than 30°C (e.g., liquid not dissolved in water)." 35 Ill. Adm. Code 742.200.

IEPA commented that the modified J&E model, as well as the SSL and RBCA models in the current TACO rules, "operate on the similar assumption that a two-phase system does *not* exist." PC12 at 13 (emphasis added). Therefore, these models, continued IEPA, "assume an equilibrium" between (1) contaminants that exist as vapors in soil pores, (2) contaminants that adhere to soil particles, and (3) contaminants that dissolve into water within soil pores. *Id*. However, a two-phase system *is* assumed to occur for soil, according to IEPA, when the concentration of any organic contaminant of concern exceeds its "soil saturation limit" or "C_{sat}." *Id*. On this point, IEPA looked to the proposed C_{sat} definition:

> C_{sat} means the contaminant concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and *saturation of soil pore air* have been reached. Above the soil saturation concentration, the assumptions regarding vapor transport of air and/or dissolved phase transport to groundwater (for chemicals that are liquid at ambient soil temperatures) do not apply, and alternative modeling approaches are required. *Id*. at 13-14 (emphasis added by IEPA).

IEPA stated that the definition of "soil vapor saturation limit" or "C_v^{sat}" "applies this same principle" to the soil vapor phase: "'the maximum vapor concentration that can exist in the *soil pore air* at a given temperature and pressure." *Id*. at 14 (emphasis added by IEPA).

Citing then-proposed Section 742.717(i), IEPA maintained that soil gas ROs for the indoor inhalation exposure route "cannot exceed the soil vapor saturation limit; otherwise, the assumptions of the modified J&E model would be violated." PC12 at 14. In addition, IEPA concurred with the Board's January 10, 2013 clarification that a groundwater RO greater than a chemical's solubility is not allowed for the VI pathway. *Id*., citing Current Rulemaking, R11-9, slip op. at 62-63 (Jan. 10, 2013). IEPA asserted that "the limits C_{sat}, C_v^{sat}, and solubility must all be satisfied" and, "taken together[,] should preclude a two-phase system." PC12 at 14. IEPA concluded that no additional requirements are necessary. *Id*. IERG and the City of Chicago agreed with the comments of IEPA. PC15 at 1; PC18 at 1.

SRAC emphasized that "the presence of free product is precluded as a TACO "'speed bump.'" PC17 at 5. SRAC asserted that the capping of the soil gas ROs "is simply to reflect a physical reality that when a calculated risk-based RO exceeds the saturation limit (the maximum possible soil vapor concentration), the RO [must] be capped at that saturation limit because it is physically impossible for that value to be exceeded." PC17 at 5. IERG agreed with the comments of SRAC. PC15 at 1; PC16 at 1.

The Board recognized that conditions "particularly difficult to verify in the field include the presence of residual non-aqueous phase liquids (NAPLs) in the unsaturated zone . . . ." USEPA User's Guide Feb. 2004 at 70. However, TACO does not specify "[t]he actual steps and methods taken to characterize a site." 35 Ill. Adm. Code 742.120. Those "are determined by the requirements applicable to the specific program under which site remediation is being addressed." *Id*.; *see, e.g.*, 35 Ill. Adm. Code 734.210(b)(6), (h)(4)(B), 734.215, 734.315(a)(2) (Leaking UST Program), 35 Ill. Adm. Code 740.415 *et seq*. (SRP); *see also* Tr.2 at 13-16.

TACO does provide that "[c]haracterization of the extent and concentrations of contamination at a site shall be performed before beginning development of remediation objectives" (35 Ill. Adm. Code 742.120) and that "evaluation of exposure routes . . . is required for all sites when developing remediation objectives or excluding exposure pathways" (35 Ill. Adm. Code 742.115(a)(2)). If volatile chemicals are present, the indoor inhalation exposure route cannot be excluded from consideration unless Sections 742.300 and 742.305 (35 Ill. Adm. Code 742.300, 742.305) are met: "these are the 'speed bumps' to prevent free product," *i.e.*, NAPL must be removed before the pathway can be excluded. King PFT1 at 5-6; *see also* Section 742.312(b)(2). Though pathway exclusion is optional under TACO (*see* 35 Ill. Adm. Code 742.110(a)), the requirements to address free product exist independently of TACO in the underlying regulatory programs, such as SRP and the Leaking UST Program (*see, e.g.*, 35 Ill. Adm. Code 734.215, 734.310-345,734.710, 740.415-740.455, 740.610).

For soil gas ROs, the amendments introduce "C_v^{sat}," about which IEPA's Mr. King testified:

> Section 742.222 provides methods for determining the soil vapor saturation limit [C_v^{sat}] and parallels Section 742.220, which is used for determining the soil saturation limit. The soil vapor saturation limit is the maximum vapor concentration that can exist in the soil pore air at a given temperature and pressure. *** For the indoor inhalation exposure route, *soil gas remediation objectives cannot exceed the soil vapor saturation limit*; otherwise, the assumptions of the modified J&E model would be violated. King PFT1 at 4-5 (emphasis added); *see also* Section 742.200 (definition of "soil vapor saturation limit"), Section 742.222 (determination of soil vapor saturation limit).

Ms. Hurley of IEPA reiterated that if the calculated Tier 1 soil gas RO exceeds the C_v^{sat} value of the chemical in soil gas, then "the C_v^{sat} value is shown as the remediation objective." Hurley PFT1 at 9. The same holds true for soil gas ROs developed under Tier 2. *See* Section 742.717(i) (Tier 2 soil gas equations, J&E5). "Capping the remediation objectives in this way," continued Ms. Hurley, "precludes a two-phase system, or free product." Hurley PFT1 at 9; *see also* Section 742.Appendix A, Table K (soil vapor saturation limits for volatile chemicals); Section 742.Appendix B, Table H (Tier 1, diffusion and advection, footnote f), Table I (Tier 1, diffusion only, footnote g); Section 742.Appendix C, Table L (equation J&E5), Table M (J&E parameters).

For the soil ROs for the outdoor inhalation exposure route and the soil component of the groundwater ingestion exposure route, the Tier 1 and Tier 2 ROs are capped at the "soil saturation limit" (C_{sat}) to preclude free product (*i.e.*, NAPLs). The definition of C_{sat} is amended to indicate that above the soil saturation concentration, alternate modeling approaches are required. *See* Sections 742.200, 742.220(a). The change makes the definition consistent with existing rule language. *See* 35 Ill. Adm. Code 742.Appendix B, Table A (footnote d), Table B (footnote d). Vapor intrusion modeling on NAPLs is provided in the USEPA User's Guide (Feb. 2004), which is incorporated by reference in proposed Section 742.210. Regarding the outdoor and indoor inhalation exposure routes, soil gas ROs for Tier 1 and Tier 2 are capped at C_v^{sat}. *See* Sections 742.222, 742.600(e)(4), 742.717(i); Section 742.Appendix B, Table G (footnote e), Table H (footnote f), Table I (footnote g).

Finally, a groundwater RO for the vapor intrusion pathway that exceeds the water solubility of that chemical is not allowed. If the calculated groundwater RO would be greater than the water solubility of the chemical, then the solubility is used as the groundwater RO. *See* Section 742.812(e); Section 742.Appendix B, Table H (Tier 1, diffusion and advection, footnote g), Table I (Tier 1, diffusion only, footnote h); Section 742.Appendix C, Table E (solubility in water). The Board added language to Section 742.812(e) on J&E groundwater equations at second notice to track the corresponding language in Section 742.717(i) on J&E soil gas equations:

e) A groundwater remediation objective that exceeds the water solubility of that chemical (refer to Appendix C, Table E for solubility values) is not allowed. If the calculated groundwater remediation objective is greater than the water solubility of that chemical, then the solubility is used as the groundwater remediation objective.

For these reasons, the Board found at second notice that based upon this record, no additional TACO amendments were warranted being proposed at that time. The Board noted that it appreciates IPC's concerns and encouraged both IPC and IEPA to review the adequacy of site characterization steps and methods for NAPLs in the relevant rules of the underlying regulatory programs that use TACO.

Indoor Air Sampling

During the Predecessor Rulemaking, R09-9, Harvey Pokorny of Versar suggested that the proposed rules should include a Tier 1 remediation objectives table for indoor air. Mr. Pokorny advocated the exclusion of the vapor intrusion pathway through the use of indoor air data that would not require additional subsurface testing. Mr. Pokorny stated that without a set of Tier 1 ROs for indoor air, a property owner with an NFR Letter would have no way of proving vapor intrusion is not a problem without obtaining additional subsurface data. Mr. Pokorny explained that as a part of a property transaction due diligence, a Phase I Environmental Site Assessment conforming to the standard ASTM 1527-05 is typically performed. According to Mr. Pokorny, if a potential vapor intrusion issue is identified, the user is referred to the standard ASTM E2600-08, which advocates the use of indoor air sampling. Mr. Pokorny asserted that Tier 1 indoor air ROs would provide a simple and affordable pathway exclusion. R09-9/Pokorny PFT2 at 1.

Mr. Reott asserted that indoor air sampling assesses the air that people are breathing and is a better way of considering actual exposure. Mr. Reott asked: "Why use a model to try to predict the number, when you have the actual number?" R09-9/Tr.2 AM at 108. Mr. Reott also provided another perspective on indoor air sampling, suggesting that false positives should not undermine the usefulness of negative results that confirm the absence of contaminants. Mr. Reott maintained that modeling requires numerous assumptions that are of "questionable reliability." PC4 at 5. Mr. Reott suggested that "[a]ny proposed indoor air quality rule should include a provision that a representative negative indoor air sample should prevail over the predicted value based on sampling other media outside the living space." *Id*.

James Olsta, P.E., representing CETCO Remediation Technologies and Geokinetics (CETCO/Geokinetics), pointed out that although indoor air sampling can identify an existing problem, it cannot anticipate one in advance. Mr. Olsta stated that "[i]t is often necessary to evaluate site conditions for a proposed building and determine [if] mitigative measures are required. Problems identified after the completion of construction are typically more difficult to address." R09-9/Tr.2 PM at 18-19.

Early on in formulating its rule proposal, IEPA considered but rejected using indoor air data as a general method to demonstrate compliance with remediation objectives under Tier 1 or 2. Though not initially proposed by IEPA, the amendments at first and second notice specifically provide that indoor air data can be used under Tier 3. IEPA reasoned that indoor air samples are susceptible to bias from other indoor sources, such as household chemicals, and indoor air sampling tends to interfere with building occupants, requiring site evaluators to obtain access to indoor space. King PFT1 at 15; Nifong PFT2 at 4; Exh. 8 at 3; R09-9/Tr.1 at 44. Additionally, IEPA stated that indoor air sampling data, if used, should not be used alone, but in conjunction with soil gas and groundwater sampling data. R09-9/PC4 at 7. IEPA continued:

> If soil gas or soil and groundwater sample results are greater than the remediation objectives and indoor air sample results are less than the calculated remediation objectives, the potential exists that contaminants may enter the building. There is no guarantee that the building will not develop cracks and leaks in the future. *Id.* at 9.

IEPA's expert witness, Dr. Salhotra, explained that different states use different combinations of approaches for evaluating vapor intrusion, from having indoor air standards to standards that apply to soil gas, soil, or groundwater. R09-9/Tr.1 at 83-84. Because indoor air sampling is disruptive and other options exist, IEPA indicated that in other states, indoor air is normally evaluated as a last step, after everything else has been characterized. R09-9/Tr.2 AM at 85; Nifong PFT2, Exh. 3 at 2 ("Indoor air requires 3 trips to a house: one to meet with the residents and perform a products survey, one to deploy the canisters, & one to collect the canisters.").

Although indoor air sampling is not technically difficult, Dr. Salhotra described how difficult analyzing the data would be. Dr. Salhotra testified that "the chemicals that we are dealing with oftentimes are not so unique that we wouldn't have them inside the building, so that makes it very difficult to evaluate the data and to determine what is the cause of the problem, if there is one." R09-9/Tr.1 at 83-84. Dr. Salhotra provided examples:

> The same benzene that we consider a contaminant, [if] we have a leak of gasoline, is also the chemical that is generated if someone smokes inside a house. The same solvents, PCE [perchloroethylene], that we consider a contaminant is the chemical that dry-cleaners use to clean our clothes. *Id.* at 76-77.

IEPA is "very concerned" that if there were "indoor air provisions under Tier 1 or Tier 2," "you would be chasing many false positives and driving the costs of the investigation far higher than what [they] need to be to address this pathway." Tr.1 at 43. IEPA indicated false negatives also pose potential problems. R09-9/Tr.1 at 46, 88. According to IEPA, a proposal focused on sampling indoor air would result in a significant increase in the costs of a site investigation. Tr.1 at 112. IEPA also indicated that USPEA did not express any concern with IEPA over the absence of an indoor air sampling provision in the proposed rulemaking. Tr.1 at 46.

When asked if IEPA had been notified of any concerns from the regulated community, environmental groups, or the community at large regarding the lack of a proposed requirement for indoor air sampling, IEPA replied that it had not. Mr. King did indicate that he was aware of a citizens group in Champaign that had raised this as an issue in a newspaper, but the group had not made any formal comment to IEPA. Tr.1 at 80-81. Mr. Reott briefly referred to the situation of residents in Hartford "who have lived for years with the effects of gasoline vapors in their homes." PC4, Exh. A at 7. Mr. Reott asserted that "[t]his serious problem is atypical" and "can be readily dealt with by the existing regulatory mechanisms." *Id.*; R09-9/Tr.2 AM at 80.

IEPA reviewed indoor air sampling provisions for California, Minnesota, New Jersey, and New York. Tr.1 at 46- 47.[48] IEPA pointed out that each of these states has prepared vapor intrusion "guidance," but none has regulations in place. Nifong PFT2 at 1-2. Moreover, other states' indoor inhalation guidance tends to be in "stand-alone" form, like USEPA's approach, *i.e.*, not incorporated into an existing regulatory structure like TACO. Tr.1 at 15. In the guidance documents for California, Minnesota, New Jersey, and New York, indoor air sampling is typically the last step during the investigation of the vapor intrusion pathway. In all four states, if indoor air sampling is deemed warranted, the no further remediation determination is based upon compliance with the indoor air provisions. Nifong PFT2 at 1-2. To demonstrate "the complexities of indoor air sampling and the disruption it causes to people whose homes and businesses are being sampled," IEPA submitted the Minnesota Pollution Control Agency's "Indoor Air Quality Survey" and "Instructions for Occupants." *Id.*, Exh. 1.

IEPA maintained that its proposal better suits Illinois than programs in other states because the proposal is designed as follows: (1) to work within the context of TACO and the regulatory programs that rely upon TACO; (2) to use multiple lines of evidence (soil gas data to compliment soil and groundwater data); (3) to discourage, for reasons articulated, the use of indoor air data except under Tier 3; (4) to use a modified J&E Model instead of a default attenuation factor applied uniformly to every site; and (5) to provide for pathway exclusion through the use of building control technologies. R09-9/PC4 at 10.

Mr. Martin testified that SRAC agrees with IEPA's position that indoor air sampling

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[48] In the Predecessor Rulemaking, R09-9, IEPA's expert, Dr. Salhotra, summarized indoor air sampling provisions for Minnesota, Indiana, Ohio, Kansas, and Missouri. R09-9/Tr.1 at 85-89; R09-9/PC4, Exh. 3.

should not be provided for under Tier 1 or 2. He added that if indoor air sampling is found to be necessary at a specific site, the sampling can be proposed under Tier 3. Martin PFT2 at 3; Tr.2 at 52. Based upon his experience, Mr. Martin has found indoor air sampling to be inherently uncertain due to indoor chemical use (*e.g.*, "paint, pesticides (with volatile organic carriers), cleaning products, personal hygiene products, tobacco use"). Martin PFT2 at 3. Mr. Martin explained that even with a survey of the premises prior to sampling, distinguishing VOCs generated indoors from those originating in the subsurface might be "impossible." *Id*. Mr. Martin testified that because of these complicating factors, "groundwater, soil and/or soil gas sampling can provide data that are more reliable for the assessment of potential environmental exposure." *Id*. at 3-4. Mr. Martin suggested that it would be a "technical leap" to undertake indoor air sampling absent the establishment of a "completed pathway" in the context of the full TACO framework. *Id*. at 4; Tr.2 at 50-52. IEPA added that a completed pathway is "where contaminants have mobilized from the subsurface and have moved through the subsurface and then into the building structure where then they can be breathed within the air within that structure." Tr.2 at 48.

During the first-notice period, the Board received no additional comment on indoor air sampling. At first notice, the Board recognized, as Mr. Reott observed, that indoor air sampling assesses the air that people are breathing. As Mr. Olsta stated, however, indoor air sampling cannot anticipate a problem. R09-9/Tr.2 AM at 108; R09-9/Tr.2 PM at 18-19. Indoor air sample results indicating that no problem exists might be misleading—contaminated soil gas can subsequently enter the building as cracks develop in the building's foundation. For these reasons, the Board again found at second notice that Mr. Pokorny's suggestion to develop Tier 1 indoor air ROs in order to establish a pathway exclusion would not be appropriate. The Board emphasized that Tier 3 specifically references indoor air sample results as site data that may be accepted for evaluation. *See* Section 742.900(c)(3); *see also* Nifong PFT2 at 4; Exh. 8 at 3.

<u>"Similar-Acting Chemical" Provisions</u>

In its first-notice opinion, the Board requested that IEPA's public comment address whether TACO provisions on "similar-acting chemicals" would apply with respect to ROs for the indoor inhalation exposure route and, if so, how they would apply. *See* <u>Current Rulemaking</u>, R11-9, slip op. at 21 (Apr. 19, 2012). "'Similar-Acting Chemicals' are chemical substances that have toxic or harmful effect on the same specific organ or organ system . . . ." 35 Ill. Adm. Code 742.200.

IEPA responded that the similar-acting chemical provisions should not apply to the soil gas or groundwater ROs for the VI pathway because "no one is exposed to the chemicals in soil gas or groundwater while these media are still in the ground." PC7 at 1-2. IEPA explained that human contact with the chemicals in soil gas or groundwater "occurs only after the chemicals potentially migrate indoors." *Id*. at 2. IEPA elaborated:

> This follows the reasoning behind not applying the provisions on similar-acting chemicals to the soil component of the groundwater ingestion route of exposure; human contact with a chemical for this pathway occurs only after the chemical migrates to the groundwater and someone drinks the contaminated groundwater. *Id*.

In its January 10, 2013 second-notice proposal for public comment, the Board solicited additional public comment on the potential applicability of similar-acting chemical provisions when developing soil gas and groundwater ROs under Tier 1, 2, or 3 for the indoor inhalation exposure route:

> given that Johnson & Ettinger Equations 1 and 2 provide "indoor air remediation objectives" ($RO_{\text{indoor air}}$, mg/m^3) for carcinogenic and noncarcinogenic contaminants, respectively, *at the point of human exposure*, which are then used in the calculation of the soil gas and groundwater ROs. Current Rulemaking, R11-9, slip op. at 1 (Jan. 10, 2013) (emphasis added).

IEPA maintained that the similar-acting chemical provisions should not apply to soil gas or groundwater ROs for the indoor inhalation pathway under Tier 1, 2, or 3. PC12 at 12. IEPA advocated applying the similar-acting chemical provisions only "to environmental media to which someone is actually being exposed." *Id*. Accordingly, IEPA continued, current Section 742.505(b)(3) on Tier 1 evaluations has requirements for mixtures of similar-acting chemicals in Class I groundwater at the point of human exposure, while current Section 742.805(c) on Tier 2 evaluations has requirements for mixtures of similar-acting chemicals in Class I groundwater at the point of human exposure. *Id*. In contrast, according to IEPA, humans are not directly exposed to soil contaminants for the soil component of the groundwater ingestion exposure route:

> [T]he contaminants in the soil must be transported to groundwater for ingestion. This factor offers a layer of safety. The same can be said for the volatile chemicals in soil gas and groundwater for the indoor inhalation pathway. No one is being exposed to the volatile chemicals in soil gas and groundwater until those volatile chemicals are inside a building. The soil gas and groundwater are just a means of transport for the volatile chemicals to reach a point of human exposure inside a building. Once the volatile chemicals are inside a building, and someone is exposed to the chemicals by inhaling the air in the building, then the similar acting provisions are applied to the indoor air that is being inhaled if calculating indoor air remediation objectives as allowed under Tier 3. *Id*. at 12-13.

IERG and the City of Chicago agreed with the comments of IEPA. PC15 at 1; PC18 at 1. SRAC concurred with IEPA's "rationale and conclusion that the similar-acting chemical provisions should not apply in developing soil gas and groundwater ROs for the indoor inhalation pathway under Tier 1, 2, or 3." PC17 at 5. IMA believed that the similar-acting chemical provisions would apply "only to the media to which humans are directly exposed," such as "inhalation exposure inside a building," but not to "the means of transport which are the soil gas and groundwater." PC14 at 2. CICI concurred with IEPA, SRAC, and IMA with respect to "Whether to Apply Similar-Acting Chemical Provisions When Developing Remediation Objectives." PC16 at 1.

The Board agreed with the commenters and stated at second notice that it appreciates their insights. Not requiring similar-acting chemical provisions when developing soil gas and groundwater ROs under Tier 1, 2, or 3 for the VI exposure route is consistent with TACO's current approach to the soil component of the groundwater ingestion pathway. There, similar-acting chemical provisions are not required for soil ROs as there is no direct human exposure to the soil, *i.e.*, the soil is solely a means for transporting the chemicals to the groundwater. However, if the chemicals reach the groundwater, human exposure occurs by drinking the groundwater. In that instance, the similar-acting chemical provisions do apply to the groundwater being consumed.

Likewise, with the VI pathway, there is no direct human exposure to the soil gas or groundwater, *i.e.*, the soil gas and groundwater are solely a means for transporting the chemicals to the indoor air. However, if the chemicals reach the indoor air, human exposure occurs by breathing. In that instance, should indoor air ROs be developed under Tier 3, similar-acting chemicals would have to be addressed, as noted by IEPA and IMA.

NFR Letters and the New Indoor Inhalation Exposure Route

Location of Contamination and Buildings

During the Predecessor Rulemaking, R09-9, IERG asked what an NFR Letter would contain where there is no building on-site, but future building construction is anticipated in both a known location and an unknown location on the site. R09-9/IEPA PFR1 at 6-7. IEPA responded that it "intends for the entire site to be safe for current and future building occupants, regardless of where those buildings are located." *Id*. at 7. IEPA elaborated:

> At a site with no existing buildings, the NFR letter may require installation of a building control technology [BCT] for a future building. If a site owner prefers not to install the BCT, they have the option of re-enrolling the site and cleaning up the remaining contamination so that an institutional control is no longer necessary. *Id*.

IEPA also stressed that "the location of an existing building does not control evaluation of the indoor inhalation exposure route" and that IEPA's "approach to management of the indoor inhalation pathway is site-wide and based on the location of the contaminant source." *Id*.

At hearing, IERG asked whether the location of contaminants relative to the location of a building would be a determining factor in issuing an NFR Letter. R09-9/Tr.1 at 30. Specifically, Alec Davis, counsel for IERG, provided a hypothetical in which an existing building does not overlie the contaminated portion of the site: the northern half of the site, which has a building, is not contaminated, but the southern half of the site is contaminated. *Id*. Mr. King responded that an NFR Letter could issue in the described situation, but that an institutional control would be required for the southern half of the site. R09-9/Tr.1 at 30-31.

When asked by IERG about contamination extending off-site, IEPA explained that under the Leaking UST Program, "the site evaluator must either clean up the contamination or negotiate an ELUC [Environmental Land Use Control]." R09-9/Tr.1 at 21.[49] Under SRP, continued IEPA:

> the site evaluator need only actively remediate the on-site contamination to qualify for an NFR letter. The NFR letter issued by [SRP] will not, however, release the site from any off-site liability. For both programs, the absence of any buildings, on-site or off-site, does not matter when performing the site investigation. *Id*. at 21-22

The Board continued at second notice to agree with IEPA's general statement that after the indoor inhalation exposure route is addressed, the "entire site" would be safe for occupants of current and future buildings located anywhere on the site, assuming compliance with the NFR Letter or other applicable institutional control. However, to place this general statement in context, certain differences in the underlying regulatory programs were emphasized by the Board. IEPA's testimony on the contrasting ways that off-site contamination might be handled under the Leaking UST Program and SRP suggested some of those distinctions. *See* 35 Ill. Adm. Code 734.350 ("best efforts" at off-site access), 734.710(d).

When there has been a petroleum release from a UST, the Act and Board regulations impose an affirmative obligation on the UST owner or operator to perform "corrective action" in order to address the "occurrence." *See* 415 ILCS 5/57.6, 57.7 (2010); 35 Ill. Adm. Code 734,

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[49] An "Environmental Land Use Control" or "ELUC" is defined as "an instrument that meets the requirements of this Part [742] and is placed in the chain of title to real property that limits or places requirements upon the use of the property for the purpose of protecting human health or the environment, is binding upon the property owner, heirs, successors, assigns, and lessees, and runs in perpetuity or until the Agency approves, in writing, removal of the limitation or requirement from the chain of title." 35 Ill. Adm. Code 742.200. ELUCs may be used when NFR Letters are not available, such as when contamination has migrated off-site, or when NFR Letters are not issued in the underlying remediation program (*e.g.*, RCRA). *See* 35 Ill. Adm. Code 742.1010(a).

Subparts B and C. For successfully-completed corrective action, the NFR Letter issued under the Leaking UST Program is worded accordingly and would include the following statement:

> [T]he Agency's issuance of the No Further Remediation Letter signifies that, except for *off-site contamination related to the occurrence that has not been remediated due to denial of access to the off-site property*:
>
> 1) *All statutory and regulatory corrective action requirements applicable to the occurrence have been complied with;*
>
> 2) *All corrective action concerning the remediation of the occurrence has been completed; and*
>
> 3) *No further corrective action concerning the occurrence is necessary for the protection of human health, safety and the environment*. 35 Ill. Adm. Code 734.710(d) (italics indicate statutory language at 415 ILCS 5/57.10(c) (2010)).

RCRA Part B permits and closure plans also impose affirmative obligations. *See* 35 Ill. Adm. Code 724, 725; *see also* 35 Ill. Adm. Code 742.1010(c)(2)(B).

SRP, on the other hand, is "an entirely voluntary program." Site Remediation Program and Groundwater Quality (35 Ill. Adm. Code 740 and 35 Ill. Adm. Code 620), R97-11, slip op. at 1 (Feb. 6, 1997); *see also* 415 ILCS 5/58.1, 58.3 (2010); 35 Ill. Adm. Code 740.105. Under SRP, the "Remediation Applicant" (RA) identifies the "remediation site"[50] and the "recognized environmental conditions"[51] for which the RA seeks an NFR Letter. *See* 35 Ill. Adm. Code 740.210, 740.430. This potentially limited nature of a remediation under SRP is reflected in the scope of the resulting NFR Letter:

[50] "Remediation site" is defined as "the single location, place, tract of land, or parcel or portion of any parcel of property, including contiguous property separated by a public right-of-way, for which review, evaluation, and approval of any plan or report has been requested by the Remediation Applicant in its application for review and evaluation services. This term also includes, but is not limited to, all buildings and improvements present at that location, place, or tract of land." 35 Ill. Adm. Code 740.120.

[51] "Recognized environmental condition" means "the presence or likely presence of any regulated substance or pesticide under conditions that indicate a release, threatened release or suspected release of any regulated substance or pesticide at, on, to or from a remediation site into structures, surface water, sediments, groundwater, soil, fill or geologic materials. The term shall not include *de minimis* conditions that do not present a threat to human health or the environment." 35 Ill. Adm. Code 740.120.

> *A statement that the [A]gency's issuance of the No Further Remediation Letter signifies a release from further responsibilities under* the *Act in performing the approved remedial action and shall be considered prima facie evidence that the site does not constitute a threat to human health and the environment and does not require further remediation under the Act* if *utilized in accordance with the terms of the No Further Remediation Letter*. If the remediation site includes a portion of a larger parcel of property or if the RA has elected to limit the recognized environmental conditions and related contaminants of concern to be remediated, or both, the No Further Remediation Letter shall be limited accordingly by its terms . . . .
>
> ***
>
> *If only a portion of the site or only selected regulated substances* or pesticides *at a site were the subject of corrective action*, the No Further Remediation Letter may contain *any other provisions agreed to by the Agency and the RA.* 35 Ill. Adm. Code 740.610(a)(4), (b) (italics indicate statutory language at 415 ILCS 5/58.10(a)(4), (b)(10) (2010)).

Accordingly, the RA in SRP can limit the "remediation site" to a portion of any parcel of property and limit the "recognized environmental conditions" to be remediated at that remediation site. If the RA chooses to do so, the "No Further Remediation Letter shall be limited accordingly." 35 Ill. Adm. Code 740.610 (a)(4); *see* Site Remediation Program and Groundwater Quality (35 Ill. Adm. Code 740 and 35 Ill. Adm. Code 620) (SRP), R97-11, slip op. at 20 (Apr. 17, 1997); *see also* SRP, R97-11, slip op. at 21 (Feb. 6, 1997). The Board at first notice asked for comment on whether the indoor inhalation pathway may be excluded from the RA's remedial action plan so as to render the pathway beyond the scope of the requested NFR Letter.

IEPA responded that "[t]he regulated community may not pick and choose which pathways they wish to address and, likewise, cannot request an NFR Letter limited to a specific pathway." PC7 at 3-4. The Board at second notice agreed with IEPA's comment that a site evaluator cannot pick which exposure route it wishes to address. Therefore, in SRP, once the RA has selected the remediation site and recognized environmental conditions, all TACO exposure routes must be addressed. *See* 35 Ill. Adm. Code 740.210, 740.610, 742.110(a), 742.115.

Timing of Implementation

Mr. Martin testified that implementing these TACO amendments could impact on-going projects, "for which the clean-up efforts have proceeded and been completed under the currently applicable regulations, but which have not yet received their NFR letter, requiring them to return to their sites and perform additional work." R09-9/Martin PFT2 at 3. Mr. Martin asserted:

> It seems unfair to require responsible parties, who have diligently complied with the regulatory requirements applicable at the time of their action, to be denied an NFR letter on the basis that the Agency was still considering their completion report at the time these proposed amendments are adopted. *Id*.

To provide a degree of certainty to those with on-going remediation projects, Mr. Martin asked that the Board consider "a schedule for implementation in the final regulation." R09-9/Martin PFT2 at 3-4. Mr. King responded that TACO itself does not impose those types of regulatory timing requirements, and that such a revision would need to be considered under SRP. R09-9/Tr.2 AM at 40. However, Mr. King explained that IEPA began the transition process for the new vapor intrusion pathway some time ago by notifying persons conducting cleanups that there is a pending new exposure route and affording them the opportunity to address the pathway based upon draft criteria. *Id*. at 40-41 ("there's been considerable lead time relative to completing projects under the existing rules"); *see also* PC7 at 4. According to Mr. King, if there are current sites that have not addressed the indoor inhalation pathway, it is because they chose not to do so. *Id*. at 41. IEPA's preferred approach to this TACO rule transition would be to establish an effective date that is 60 days after the amendments are adopted. Tr.1 at 94.

At first notice, the Board found that a delay between final adoption and these TACO amendments taking effect would help to accommodate persons who wish to submit remediation completion documentation to IEPA in order to receive an NFR Letter, but without complying with the indoor inhalation exposure route rules. The Board agreed with SRAC and IEPA that where a site owner has finished the cleanup work and submitted a completion report, it would be unfair to require the site owner to "start over." Tr.1 at 96.

The Board found that because it has never before amended TACO to add an entirely new exposure pathway, there are pragmatic reasons for having a 60-day delay in the effective date of the TACO amendments. As to the adequacy of the time period for persons to submit completion reports, the Board noted that this rulemaking has been pending since the proposal's filing on November 9, 2010, which was preceded by IEPA outreach, as well as the R09-9 proposal. Notice of the pending addition of the new pathway has also been given through the websites of the Board and IEPA and through the *Illinois Register*. The Board reiterated at second notice that providing an extra 60 days after final adoption before the amendments take effect should further ease the transition for sites near closure.

At first notice, the Board found that "the law that is on the books as of the time an application or request is made to the Agency is the law that governs that application or request." <u>Tiered Approach to Corrective Action Objectives (TACO): 35 Ill. Adm. Code 742</u>, R00-19(A), slip op. at 12 (Nov. 16, 2000) (replacing restrictive covenants, deed restrictions, and negative easements with ELUCs as institutional control); *see also* 35 Ill. Adm. Code 742.1010(b)(5) ("The requirements of this Section apply only to those sites for which a request for a no further remediation determination has not yet been made to the Agency by January 6, 2001."). The same approach would apply here with respect to the submission to IEPA of completion reports (*e.g.*, corrective action completion reports under 35 Ill. Adm. Code 734.345(a), remedial action completion reports under 35 Ill. Adm. Code 740.455).

The Board reiterated at second notice that none of the TACO amendments will be "on the books" until the date 60 days after final rule adoption, which date the Board specifies in this final order. IEPA's first-notice comment is in accord:

> [A]nything submitted to Illinois EPA (e.g., applications or completion reports) prior to the delayed 60-day effective date would fall under the law that existed prior to these [] amendments. Likewise, if an application, plan, or report is submitted to the Illinois EPA subsequent to the delayed 60-day effective date, then the submitter should be prepared to comply with all new amendments, including addressing the new indoor inhalation pathway. PC7 at 3-4.

IEPA also echoed its earlier testimony and comments that "the regulated community has been on notice of the proposed changes for a considerable amount of time" and that "if parties wish to follow the old law, they should have all remediation activities completed and all reports submitted to the Illinois EPA prior to the final effective date established by the Board." PC7 at 4. The Board received no first-notice comments in opposition to either having a delayed effective date or making that timeframe 60 days in length.

The structure of TACO does not lend itself to placing within the rules an effective date for an entirely new exposure route. Instead, by so specifying in this rulemaking, the Board makes all of the TACO amendments effective as of a date certain 60 days after the final rules are adopted. *See* 5 ILCS 100/5-40(d) (2010) ("Each rule hereafter adopted under this Section is effective upon filing [with the Office of the Secretary of State] unless a later effective date is required by statute or is specified in the rulemaking."). The amendments take effect on July 15, 2013.

Whether NFR Letters Will Specifically Refer to the New Indoor Inhalation Exposure Route When the Pathway Has Been Addressed

For sites that have chosen to address the vapor intrusion pathway before the amendments become effective, Mr. King testified that IEPA is already including language in the NFR Letters specifying that the indoor inhalation pathway has been addressed. R09-9/Tr.2 AM at 42.

IEPA indicated that once the rules go into effect, NFR Letters would not routinely refer specifically to the indoor inhalation exposure route, just as currently-issued NFR Letters do not routinely refer specifically to the other exposure routes. R09-9/Tr.1 at 31-32. However, if a site owner requests that the vapor intrusion pathway be specifically mentioned in the NFR Letter, IEPA indicated that it would accommodate the request. *Id*.

<u>"Reopening" NFR Letters</u>

IEPA noted that the States of New York and New Jersey were reopening "a huge number of closed sites to relook at the indoor inhalation component." R09-9/Tr.1 at 66. In the <u>Predecessor Rulemaking</u>, R09-9, when prompted by questions from IERG about a hypothetical leaking UST site that had already received an NFR Letter, IEPA explained:

> The Agency's intent is not to reopen [a leaking UST] site, due to an indoor inhalation issue, for which an NFR Letter has been issued. If the tank owner or operator wishes to address an indoor inhalation issue at a [leaking UST] site and to obtain a new NFR Letter, the owner or operator would need to enroll the site in the Agency's Site Remediation Program (or Voluntary Cleanup Program). R09-9/IEPA PFR2 at 4.

In the current rulemaking, IEPA stated that it does not plan to reopen any post-NFR sites "unless we obtain new site-specific information indicating an indoor inhalation problem." Tr.1 at 92. IEPA envisioned that such information might come about from a citizen complaining to IEPA or from a new owner re-evaluating the site. R09-9/Tr.1 at 67. IEPA maintained that if a leaking UST site with an NFR Letter were later enrolled in SRP to address these TACO indoor inhalation pathway amendments, the resulting costs would not be eligible for reimbursement from the UST Fund. R09-9/IEPA PFR2 at 5.

Mr. Reott stated that as of 2009, IEPA had issued over 2,600 NFR Letters. Even if the IEPA does not reopen the NFR determinations on its own, Mr. Reott noted that parties in commercial transactions often do. Mr. Reott explained that "[e]specially in the current lending climate, lenders likely will insist that property buyers supply new NFR letters addressing the indoor inhalation pathway if there is any chance that the pathway poses an additional risk to the lender's collateral." PC4, Exh. A at 7. Mr. Reott predicted that as properties change hands, they will be re-evaluated to determine if NFR Letters need to be reopened. *Id*.

The Board agreed at first notice with IEPA's reasoning for not systematically reopening thousands of already-issued NFR Letters based solely upon the addition of the vapor intrusion pathway to TACO. Tr.1 at 92. IEPA has represented that it has a program for randomly inspecting post-NFR sites with engineered barriers and that BCT sites will be added to that inspection program. Property transactions may initiate NFR Letter re-evaluations under SRP, as Mr. Reott noted. Further, legal remedies are available should threatening circumstances be discovered at sites with pre-vapor intrusion NFR Letters, including NFR Letter voidance and enforcement actions. The Board has received no first-notice comments on the question of automatically reopening NFR Letters.

<u>Definition of "Building"</u>

The term "building" is central to the proposal for adding the indoor inhalation exposure route to TACO. IEPA's proposed definition of "building" read as follows:

> <u>"Building" means a man-made structure with an enclosing roof and enclosing walls, except for windows and doors, that is intended for or supports any human occupancy for more than six consecutive months.</u>

IEPA did not base its proposed definition upon assumptions about human exposures to vapor intrusion. Tr.1 at 53. Instead, IEPA concentrated upon the potential for permanent human occupancy and determined that six consecutive months would be "a reasonable time frame that would indicate an intention of a permanency to the structure." Tr.1 at 53-54.

Regarding the "intended for" language of the definition, Mr. King was asked at hearing whose intent would be controlling, to which Mr. King replied that it would be IEPA's obligation to determine that "when something is proposed." Tr.1 at 55. As to the "supports" language, Mr. King testified that whether a structure is "[f]it for occupancy" is determinative, even if the structure is in fact not occupied for six consecutive months. Tr.1 at 54-55.

The Board found at first notice that IEPA's proposed definition of "building" makes common sense, but to better reflect IEPA's meaning as revealed at hearing, the Board replaced the words "intended for or supports" with "fit for" human occupancy. The Board noted that it appreciates that IEPA must make case-by-case determinations when investigative and remedial plans are submitted, but the Board found at first notice that the question of intent introduces a potential ambiguity that could lead to disagreements in implementation. Additionally, the Board noted that the word "supports" could be misread to suggest an "actual occupancy" test. The Board found at first notice that the word "fit" is less ambiguous. To further clarify, the Board also replaced the words "more than" with "at least" six consecutive months. No participant took issue with the language of IEPA's definition. At first notice, the Board proposed the following language with which IEPA concurs (PC7 at 4):

> <u>"Building" means a man-made structure with an enclosing roof and enclosing walls, except for windows and doors, that is fit for any human occupancy for at least six consecutive months.</u> *See* first-notice proposed Section 742.200.

The Board received no first-notice comments taking issue with this definition. The Board proposed the definition for second notice with a minor change for clarity. To avoid the awkward sentence structure resulting from the phrase "except for windows and doors" being set off with commas, the Board at second notice set off the phrase parenthetically. The intent behind the phrase remained the same: to make clear that while the structure must have fully-enclosing walls to come within the definition of "building," the existence of windows or doors within those walls would not disqualify the structure from being a "building." Likewise, a "skylight" window located in a fully-enclosing roof would not place the structure outside of the definition of "building."

Multi-Building Sites

At hearing, Board staff asked how IEPA envisioned the new rules being implemented at a site with multiple buildings. Board staff noted that USEPA's Office of Solid Waste and Emergency Response or "OSWER" review document mentions observations showing that adjacent buildings overlying similar subsurface contaminant concentrations can have very different indoor air concentrations based upon various factors due to vapor intrusion. Tr.1 at 66-67. IEPA responded that each building on a site would have to be evaluated separately, *i.e.*, one building cannot be considered representative of another building on the site. Tr.1 at 67.

The Board continued at second notice to agree with IEPA's observation. As IEPA further acknowledged, one building on a site might be addressed under Appendix B, Table H (because soil or groundwater contamination is within 5 feet of the building or), while another building on the same site is addressed under Appendix B, Table I (because all soil and groundwater contamination is more than 5 feet from the building). Tr.1 at 67-68.

Building Control Technologies or "BCTs"

During the Predecessor Rulemaking, R09-9, CETCO/Geokinetics raised an issue regarding IEPA's proposed specifications for sub-membrane depressurizations systems. The proposed language in R09-9 at Section 742.1210(c)(2)(B) provided for "[a] cross-laminated polyethylene membrane liner at least 0.15 mm (or 6 mil) thick." The parallel language in R11-9 at Section 742.1210(c)(2)(B) provides for "[a] cross-laminated polyethylene membrane liner at least 0.10 mm (or 4 mil) thick." Based upon its experience, CETCO/Geokinetics maintained that the rate at which organic vapors can pass through a 6-mil low density polyethylene membrane can be orders of magnitude greater than for a 60-mil membrane, which CETCO/Geokinetics claimed is more conventional. Additionally, CETCO/Geokinetics stated that the thinner 6 to 10-mil membranes are more prone to damage during construction than the more typical 60-mil membranes used for vapor mitigation. R09-9/Olsta PFT2 at 2.

Mr. Olsta, on behalf of CETCO/Geokinetics, explained that a thickness less than 60 mil would result in an increase in diffusion and a decrease in puncture-resistance during construction. R09-9/Tr.2 PM at 21-22. Mr. Olsta testified as follows:

> Of the thousand+ structures with 6 and 10-mil vapor barriers that we have performed post-construction testing on to date, we have yet to find a single installation that did not have an unacceptably high rate of membrane holes/open penetrations for a VOC barrier application. This is in contrast to standard 60-mil

membranes where holes/open penetrations are rare. R09-9/Olsta PFT2 at 2.

Additionally, according to CETCO/Geokinetics, the smoke testing required under Section 742.1210(c)(2)(F) would be difficult and not fully effective because a 6-mil barrier is so light, it would be lifted off the sub-grade. *Id*. at 3.

During an R09-9 hearing, IEPA remarked to CETCO/Geokinetics: "We were concerned about the feasibility of installing a 60 mil liner, basically, in a crawl space, and we talked at break about that. I was wondering if you could comment on that." R09-9/Tr.2 PM at 20-21. CETCO/Geokinetics cited three installations where it spray-applied a 60-mil membrane in basements and indicated that a 60-mil membrane could also be installed over a prepared dirt crawl space. R09-9/PC3 at 1-2. CETCO/Geokinetics estimated that 90% of its past VOC and methane vapor intrusion mitigation projects have used a minimum 60-mil thickness membrane, and none have used membranes thinner than 12 mil. *Id*. at 2.

As proposed by IEPA, the Board's first-notice proposal decreased the minimum membrane thickness of a sub-membrane depressurization system from 0.15 mm (6 mil) in R09-9 to 0.10 mm (4 mil) in R11-9 under Section 742.1210(c)(2)(B). However, the Board requested that IEPA's first-notice comment provide support for 4-mil thickness and address CETCO/Geokinetics' advocacy of a minimum 60-mil thick membrane.

In its first-notice comments, IEPA stated that it decided to decrease membrane thickness from 6 mil to 4 mil based upon the recommendation of David Folkes of EnviroGroup Limited. IEPA consulted with Mr. Folkes because of his experience in mitigating hundreds of houses affected by vapor intrusion from the Redfield Rifle Scope facility in Denver, Colorado. PC7 at 5.[52] Additionally, IEPA stated that USEPA has also recommended using a 4 mil cross-laminated membrane for sub-membrane depressurization systems. *Id*.[53] IEPA also cited guidance from the New York State Department of Health, which recommends a minimum 3-mil cross-laminated

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[52] IEPA referred to "Design, Effectiveness, and Reliability of Sub-Slab Depressurization Systems for Mitigation of Chlorinated Solvent Vapor Intrusion," by David J. Folkes, P.E., presented at USEPA Seminar on Indoor Air Vapor Intrusion, San Francisco (Dec. 4, 2002), Dallas (Jan. 15, 2003), & Atlanta (Feb. 26, 2003), USEPA Office of Research & Development. PC7 at 5.

[53] IEPA referred to USEPA's "Radon Reduction Techniques for Existing Detached Houses" (1993), Technical Guidance 3rd Ed. for Active Soil Depressurization Systems at 232, affirmed by the Interstate Technology and Regulatory Council's "Vapor Intrusion Pathway: A Practical Guide" (2007) at 53. PC7 at 5.

polyethylene membrane for sub-membrane depressurization systems. PC7 at 5-6.[54]

IEPA inquired again of CETCO/Geokinetics regarding the company's 60-mil membrane recommendation. PC7 at 6. According to IEPA, Mr. Kevin Lea of Geokinetics responded that "Geokinetics stands by its original testimony in recommending a 60 mil membrane for the sub-membrane depressurization system." *Id*. IEPA disagreed with the opinion of CETCO/Geokinetics and added that none of the sources relied upon by IEPA "has a commercial interest in recommending a minimum membrane thickness." *Id*.

The Board observed that the 4-mil membrane specifications of the first-notice proposal are supported by guidance documents of USEPA, the Interstate Technical and Regulatory Council, and the New York State Department of Health. *See* PC7 at 6. At second notice, the Board retained 4 mil as the minimum cross-laminated polyethylene membrane thickness for a "sub-membrane depressurization system" or "SMD" system. The Board emphasized that this membrane does not constitute a "membrane barrier system" BCT under the proposed rules but rather is part of an SMD system BCT. A membrane barrier system must be at least 60-mil thick and is placed *below a concrete slab* during construction. *See* Section 742.1210(c)(3). In contrast, the minimum 4-mil membrane that is part of an SMD is not installed sub-slab but instead is placed over a geotextile, which is itself installed over exposed earthen material (*e.g.*, crawlspace). *See* Section 742.1210(c)(2). This minimum 4-mil membrane "liner," which is drawn down when depressurization is activated, has a PVC pipe sealed to it for exhausting vapors to the outside of the building. *Id*. USEPA has recognized these markedly different membrane thicknesses called for depending upon whether the BCT involved is a membrane barrier system or an SMD system. *See* "Engineering Issue: Indoor Air Vapor Intrusion Mitigation Approaches," USEPA, EPA/600/R-08-115 (Oct. 2006) at 22.

BCT Maintenance Requirements

NFR Letter Conditions

IEPA provided a list of the maintenance requirements for BCTs, as outlined in Section 742.1210, which would be specified in the NFR Letter's "Conditions and Terms of Approval." The maintenance conditions address the four BCTs explicitly authorized by the proposed rule: sub-slab depressurization systems; sub-membrane depressurization systems; membrane barrier systems; and vented raised floors. Nifong PFT2 Exh. 5. These BCT maintenance conditions for an NFR Letter read as follows:

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[54] IEPA referred to "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" (Oct. 2006) at 62, New York State Department of Health, Center for Environmental Health, Bureau of Environmental Exposure Investigation. PC7 at 5-6.

Sub-slab depressurization (SSD) systems:
A Sub-slab depressurization system capable of achieving measurable vacuum below the slab placed in accordance with Section 742.1210(c)(1) shall be functional and effectively maintained according to the specification of the manufacturer. If at any time SSD is rendered inoperable, the responsible party shall notify building occupants and workers in advance of intrusive activities, enumerating the contaminants of concern known to be present, and shall require building occupants and workers to implement protective measures consistent with good industrial hygiene practice.

Sub-membrane depressurization (SMD) systems:
A Sub-membrane depressurization system capable of achieving measurable vacuum at the furthest edges of the polyethylene membrane liner placed in accordance with Section 742.1210(c)(2) shall be functional and effectively maintained according to the specification of the manufacturer. If at any time SMD is rendered inoperable, the responsible party shall notify building occupants and workers in advance of intrusive activities, enumerating the contaminants of concern known to be present, and shall require building occupants and workers to implement protective measures consistent with good industrial hygiene practice.

Membrane barrier systems:
A membrane barrier with a thickness of not less than 1.5 mm (or 60 mil) placed below concrete slabs in accordance with Section 742.1210(c)(3) must remain sealed to walls and any penetrating pipes according to membrane manufacturer/installer recommendation. Construction activities following membrane installation shall not damage, puncture, or tear the membrane or otherwise compromise its ability to prevent the migration of volatile chemicals. If at any time the membrane barrier system is rendered inoperable, the responsible party shall notify building occupants and workers in advance of intrusive activities, enumerating the contaminants of concern known to be present, and shall require building occupants and workers to implement protective measures consistent with good industrial hygiene practice.

Vented raised floors:
An interconnected void system below the slab and at least one three-inch diameter riser pipe for each 5,000 square feet area venting to the atmosphere above the roof line placed in accordance with Section 742.1210(c)(4) shall be properly maintained according to manufacturer/installer recommendation. If at any time the vented raised floor system is rendered inoperable, the responsible party shall notify building occupants and workers in advance of intrusive activities, enumerating the contaminants of concern known to be present, and shall require building occupants and workers to implement protective measures consistent with

good industrial hygiene practice. Nifong PFT2, Exh. 5.

The terms “intrusive activities” and “rendered inoperable” are also used in Section 742.1200(e). By “intrusive” activities, IEPA clarified that it means activities that “would affect the potential of flow of contaminants into a building such as somebody disturbing the foundation or if they have to go below the basement level or go below the foundation to repair utilities or install utilities.” Tr.2 at 33. Accordingly, intrusive activities would not include, for example, collecting air samples in office space where occupants are located. Tr.2 at 33-34. A BCT may be “rendered inoperable” intentionally (*e.g.*, shut down as part of routine maintenance) or not (*e.g.*, becomes inoperable due to malfunction or power failure). Tr.2 at 32-33.

At first notice, the Board solicited public comment on whether the terms “intrusive activities” and “rendered inoperable” should be defined in the proposed rules. In its first-notice comment, IEPA responded that defining these terms would be prudent and proposed the following language for TACO:

> <u>“Intrusive activities” means activities that would affect potential flow of contaminants into a building (e.g., breaching the integrity of a foundation due to repairs or installation of utilities).</u>
>
> <u>“Rendered inoperable” means having become unable to operate effectively, including, but not limited to, being shut down as part of routine maintenance or due to a malfunction, power failure, or vandalism.</u> PC7 at 6.

The Board found that defining these terms in TACO would clarify the rules. The Board included IEPA’s proposed definitions at second notice under Section 742.200.

<u>**Voidance “Safe Harbor”**</u>

Mr. Reott expressed concern over BCT maintenance and NFR Letter voidance. PC4 at 3. Mr. Reott noted that in general, the failure to maintain any required engineered barrier is grounds for voiding the NFR Letter, but failure to maintain a BCT is a more complex issue because some BCTs are not passive. *Id*. Certain BCTs require “ongoing mechanical operations.” PC4 at 4.

Mr. Reott commented that the rules should address, first, how long a system could be shut down before the NFR Letter is voided and, second, notice requirements concerning a shutdown. Mr. Reott asserted that “[s]ome period of time should be built in to the regulation to allow for a maintenance or malfunction incident to continue without having an effect on the NFR letter.” PC4 at 4. Mr. Reott proposed allowing a 7-day period to reestablish the BCT without impacting the NFR Letter. Mr. Reott suggested that after the 7-day “safe harbor,” the responsible party should have to notify IEPA in order to maintain the NFR Letter. *Id*. Mr. Reott explained that this would enable IEPA to consider the need for immediate action and would provide a means for the NFR Letter to remain in effect as long as the responsible party takes appropriate action. *Id*.

The Board received no comments during the first-notice period on the issue of a voidance "safer harbor." The Board reiterated that BCTs, like engineered barriers, require effective maintenance. The BCT maintenance conditions for NFR Letters would require that BCTs be maintained in accordance with manufacturer or installer specifications. These conditions contemplate potential BCT inoperability, but that event does not result in automatic voidance of the NFR Letter. *See* 35 Ill. Adm. Code 734.720, 740.625. The Board again found at second notice that this record does not demonstrate the need for, or prudence of, fixing a time period of seven days or otherwise during which BCT inoperability cannot be a ground for IEPA to initiate the process of voiding an NFR Letter. In addition, the Board noted that the failure to install a BCT as required by an NFR Letter is also grounds for voidance. *See* Section 742.1220(f).

<u>Notice to IEPA of BCT Inoperability</u>

IEPA explained that when a BCT becomes inoperable, there is currently no requirement that the responsible party notify IEPA. Tr.2 at 34-35, 44. IEPA stated that after an NFR Letter is issued for a site (post-NFR site), the only notifications to IEPA that are required under SRP or the Leaking UST program are (1) that the NFR Letter was recorded and (2) that the municipality was notified if a groundwater ordinance is used as an institutional control. Tr.2 at 43-44.

IEPA does conduct random inspections of post-NFR sites to assess whether engineered barriers are being maintained as required, and BCT follow-up inspections would become part of that program. Tr.2 at 36-37, 40-41. Mr. King further testified about inspection priorities:

> [W]e've also tried to have our follow-up inspections focus on sites where there . . . might be an increased risk situation. For instance, . . . if we've issued an NFR letter to a site where there's a school at and there's an engineered barrier as part of the construction activities, that would be a site that would tend to get more focus relative to looking at the engineered barrier post NFR situation and that would be the type of site as well that if we had a BCT involved, we would want to have a higher priority as far as a follow-up inspection. Tr.2 at 37-38

Mr. King added that "the compliance rate has been very high" and "it's very rare that we have to take some kind of direct action relative to sites after an NFR letter has been issued." Tr.2 at 36. However, IEPA did indicate that there is a point at which failure to correct a problem would result in voidance of an NFR Letter or an enforcement case for violating the terms of the NFR Letter. Tr.2 at 44.

When asked, Mr. King did not support requiring that the responsible party notify IEPA if a BCT becomes inoperable:

> We've already gone through an analysis of the site. There's been appropriate cleanup activities that have occurred. It didn't seem to fit with the way the programs operate to have those kinds of notices coming in. What would we do with them? We're not going to immediately every time there's some question about utilities being worked on, we're not going to want to get a notice and then send people out and have somebody check on that or have to worry about whether people are sending them notices. It just seemed like a paperwork exercise that was not going to lead to more protection of human health [and] the environment. Tr.2 at 35.

When asked whether the responsible party should be required to notify IEPA if a BCT becomes inoperable *at a school site*, Mr. King did not believe such notice is warranted but indicated that the issue might be revisited depending upon experiences with implementing the new rules. Tr.2 at 38-39. In response to concerns about the greater susceptibility of children at school sites, Mr. King explained that the TACO program is already designed relative to the most sensitive uses. Tr.2 at 39. However, Mr. King added that if the perceived risk related to a particular project was greater, no rule would prohibit IEPA from including a notice requirement as a condition of an NFR Letter. Tr.2 at 40.

The Board found at first notice that the lack of any vapor intrusion mitigation regulations may partially explain IEPA's lack of experience with BCT inoperability concerns. Further, as Keith Harley, counsel for LVEJO, pointed out, the protectiveness of an NFR Letter issued based upon a BCT is undercut if the BCT becomes inoperable. Tr.2 at 39. Mr. King testified that the SRP provisions for schools (35 Ill. Adm. Code 740, Subpart H) might be a better place than TACO to house requirements for school site BCT-inoperability notice, were they to be put in regulatory text. Mr. King noted that IEPA anticipates proposing Part 740 amendments related to BCTs. Tr.2 at 40, 43. The Board observed that Part 740 requirements, however, would not apply to school sites in the Leaking UST Program, which are generally subject to Part 734 (35 Ill. Adm. Code 734). *See* 35 Ill. Adm. Code 740.105(a)(3). In contrast, TACO applies to SRP and the Leaking UST Program, as well as RCRA sites. *See* 35 Ill. Adm. Code 742.105(b).

The Board noted in its first-notice opinion that Mr. King's testimony on SRP's school-specific provisions highlights the regulatory emphasis on heightened environmental protections for school children. This emphasis is also reflected in IEPA's prioritization of its post-NFR site inspections. The Board requested at first notice that IEPA's public comment address whether there are any disadvantages to requiring IEPA to be notified of BCT inoperability at school sites. The Board expressed appreciation for IEPA's concerns about resource preservation and creating a mere "paperwork exercise." The Board observed, however, that these concerns would be at least partially allayed because the notice would not involve all post-NFR sites with BCTs, but rather just a particularly susceptible subset of the universe of post-NFR sites. Moreover, the Board noted that IEPA is aware of site conditions at each post-NFR school site, having issued the NFR Letter, which should help inform IEPA about how to respond to a notice.

Additionally, the Board's first-notice opinion sought public comment from IEPA and others addressing proposed Section 742.1200(e)(3), which the Board added at first notice. The first sentence of the new provision stated: "For a school, the site owner/operator shall notify the Agency upon any building control technology being rendered inoperable." The Board requested that IEPA's considerations of this notice language include whether the notice trigger should depend upon the duration of BCT inoperability and whether the notice requirement should vary depending upon the type of BCT at issue. The Board also asked that IEPA's public comment include revised BCT maintenance conditions for such school-site NFR Letters, reflecting the additional notice requirement.

In its initial first-notice comment, IEPA suggested the following alternative to the Board's language for the first sentence of proposed Section 742.1200(e)(3): "For a school, the site owner/operator shall notify the Agency, *the school board, and every parent or legal guardian for all enrolled students* when a building control technology is rendered inoperable *for a period of five days over any six month period*." PC7 at 7 (emphasis added). IEPA noted that because, by definition, a building must be fit for human occupancy for at least six consecutive months, the five-day period would account for a chronic exposure scenario, rather than an acute one. PC7 at 7-8. IEPA also suggested that requiring notification of the school board and parents or guardians of enrolled students would prompt action at the local level to address the problem. PC7 at 8.

After the initial 45 days of the first-notice comment period, the hearing officer issued the order concerning the full concrete base, discussed above, which also posed a series of Board staff questions to IEPA about BCTs at school sites. *See* R11-9 HOO at 4-6. The order provided other participants an opportunity to comment on IEPA's responses. *Id*. at 6.

In response to hearing officer order questions about the notice trigger under IEPA's alternative language, IEPA modified its suggested first sentence of proposed Section 742.1200(e)(3):

> For a school, the site owner/operator shall notify the Agency, the school board, and every parent or legal guardian for all enrolled students when a building control technology is rendered inoperable for a period of five consecutive days during the school year when school is in session ~~over any six month period~~. PC8 at 4.

IEPA stated that it intended the original "period of five days" to mean five consecutive days, "not five days of inoperability cumulatively in any six month period." PC8 at 4. IEPA further intended that those five consecutive days triggering notice need only be five calendar days during the school year when school is in session, so "[t]his would include weekends because schools routinely are open on weekends for sporting events, dances, plays, and other school functions." PC8 at 5. IEPA did not mean for the five consecutive days to be counted "when school is out of session for extended periods such as holiday breaks," but "[i]f a school holds classes during the summer, the five-day period would apply." *Id*.

By using the term "day" of inoperability, IEPA intended to trigger the notice requirement when a BCT is rendered inoperable for:

> any length of time per day for five consecutive days. Therefore, the inoperability does not need to last 24 hours, nor does it need to last the entire duration of a school day. So long as there are periods of inoperability every day for five consecutive days while school is in session, the notice requirement would be triggered. For example, if a BCT shut down on a Tuesday at 2 p.m. and was inoperable for three hours but started working again and then broke down on Wednesday, Thursday, Friday and Saturday at different intervals, then the notice requirement would be triggered. On the other hand, if the inoperability only lasted Tuesday through Friday (no matter what the duration of failure), the notice requirement would not be triggered. If the system shut down again on Sunday, the five-day period would start over.
>
> In conclusion, any occurrence of inoperability, regardless of its duration, would result in the date of occurrence being deemed a "day" of inoperability. PC8 at 6.

In its most recent public comment, IEPA proposed one additional change to the notice requirement for BCT inoperability at schools. PC12 at 16-17. Instead of requiring the "site owner/operator" to provide the notification, IEPA stated that it believes that "the school administrator" should do so "because the school administrator has direct oversight of the building and is the entity most responsible for daily operation and maintenance of the BCT." *Id*. IEPA explaineds that there may be properties where the site owner/operator is not the school administrator. *Id*. IERG and the City of Chicago agree with the comments of IEPA. PC15 at 1; PC18 at 1.

The Board received no public comments responsive to IEPA's proposed school "BCT inoperability" notice language or IEPA's related interpretations. The Board expressed that it appreciates IEPA's thoughtful explanations concerning the temporal aspects of the notice requirement and found that some of the clarifications should be codified in TACO to avoid uncertainty in implementation. The Board agreed with the language ultimately proposed by IEPA and adopted it at second notice with a few explanatory additions. For example, to clarify who would be the "school administrator" subject to the notification requirement, the Board defined the term as follows: "the school's principal, or similar administrator responsible for the school's operations, or his or her designee." This definition borrows language from Illinois statutes concerning schools. *See* 720 ILCS 5/21-5.5(a) (2010) ("'School administrator' means the school's principal, or his or her designee."); 820 ILCS 147/10(e) ("'School administrator' means the principal or similar administrator who is responsible for the operations of the school.").

Changes to first-notice language appear in double underline and double strikeout:

> For a school, the school administrator ~~site owner/operator~~ shall notify the Agency ~~upon any~~, the school board, and every parent or legal guardian for all enrolled students when a building control technology ~~being~~ is rendered inoperable for a period of five consecutive calendar days during the school year when school is in session. For purposes of the preceding sentence, any occurrence of inoperability, regardless of its duration, results in the date of the occurrence constituting a day of inoperability. *** For purposes of this subsection, the term "school administrator" means the school's principal, or similar administrator responsible for the school's operations, or his or her designee. Second-notice proposed Section 742.1200(e)(3).

In response to the hearing officer order question about school "BCT inoperability" notice language in an NFR Letter, IEPA stated that its proposed first sentence to Section 742.1200(e)(3) would be added to the NFR Letter's BCT maintenance conditions, but without the opening phrase "For a school." PC9. The Board concurred but suggested that the NFR Letter track the first two sentences of Section 742.1200(e)(3) quoted above and proposed for second notice.

Finally, for purposes of this new notice requirement only, the Board's first-notice amendments at Section 742.1200(e)(3) added the definition of "school" from Section 740.800(b) of SRP:

> [T]he term 'school' means any public educational facility in Illinois, including grounds and/or campus, consisting of students, comprising one or more grade groups or other identifiable groups, organized as one unit with one or more teachers to give instruction of a defined type. Public educational facility includes, but is not limited to, primary and secondary (kindergarten[-]12th grade), charter, vocational, alternative, and special education schools. Public educational facility does not include junior colleges, colleges, or universities. 35 Ill. Adm. Code 740.800(b).

The Board solicited public comment on the proposed use of this SRP language at then-proposed Section 742.1200(e)(3). In its first-notice comments, IEPA agreed with the Board's addition of the SRP "school" definition (PC7 at 8), which was proposed for second notice.

Off-Site Impacts

Modeling

IEPA testified about determining risk posed by the indoor inhalation pathway to off-site properties. To determine if off-site properties are at risk from indoor inhalation route exposures, IEPA explained that site evaluators have the option of "running TACO equation R26, collecting groundwater samples, or collecting soil gas samples at the down gradient property boundary." R09-9/IEPA PFR1 at 2. For the indoor inhalation exposure route, IEPA stated that soil gas data would "trump" groundwater data and R26 modeling results, and that groundwater data would "trump" R26 modeling results. *Id*.

IEPA stressed that when either soil gas or groundwater data are used to demonstrate compliance, the "number of sampling rounds" would be determined by the program under which the site is being remediated. R09-9/Nifong PFT2 at 2-3. IEPA added that "soil gas or groundwater samples collected after a recent spill or release may not represent the actual impact from contaminants migrating in groundwater," noting that "[r]epeat samples may be necessary to address this time lapse and ensure that the migration of the contaminant plume is fully evaluated." *Id*. at 3.

Environmental Land Use Controls or "ELUCs"

IEPA explained that for every exposure route, it is the NFR Letter that addresses on-site contamination, while the ELUC addresses off-site contamination. ELUCs for the indoor inhalation route would be the same as ELUCs for any other exposure route. R09-9/IEPA PFR1 at 7-8. According to IEPA, "ELUCs are required anytime off-site contamination above the remediation objectives is left in place." *Id*. at 8. IEPA indicated that it intends to amend the model ELUC language as necessary to address the vapor intrusion pathway. *Id*.

Amendments to the model ELUC at Appendix F were not included in IEPA's proposal. The Board included at first notice an amended Appendix F, adding references (1) to "soil gas" where soil and groundwater are currently referenced and (2) to "indoor inhalation building control technologies" where engineered barriers are currently referenced. Similar changes are proposed for Section 742.1010 on ELUCs. In its first-notice comments, IEPA agreed with the amendments to the model form. PC7 at 8.

School Sites with NFR Letters Not Addressing the Indoor Inhalation Pathway

The Little Village Environmental Justice Organization (LVEJO), a "community-based, not-for-profit environmental advocacy organization," raised the issue of school sites that have already received No Further Remediation (NFR) Letters but where the indoor inhalation exposure route was not investigated. PC2 at 1. LVEJO's objective is to ensure that children, a "particularly vulnerable population," are "not exposed to hazardous substances through vapor intrusion into school buildings constructed on brownfield sites." PC2 at 1. According to LVEJO, "[i]t is common for schools to be constructed on brownfield sites." PC2 at 2.

Based upon what it described as a "cursory search" of IEPA's on-line database, LVEJO identified 45 school sites that are or were enrolled in SRP. PC2 at 2-3 (sites listed). Most of these sites are in Chicago while others are located in Cicero, East St. Louis, Joliet, Lake Forest, LeRoy, New Lenox, Orland Park, and Woodstock. PC2 at 3. For school sites that have received NFR Letters, LVEJO noted that almost all of the NFR Letters are conditioned upon an institutional control (ordinance prohibiting groundwater use) and an engineered barrier. *Id*. According to LVEJO:

> For these schools, the use of an institutional control to address groundwater means that groundwater contamination may not have been assessed and almost certainly was not remediated prior to site reuse as a school. The prevalence of engineered barriers suggest subsurface contamination may not have been removed or otherwise remediated, on the theory that surface excavation coupled with a barrier eliminates the bioavailability of subsurface contaminants. PC2 at 3-4.

The new emphasis on the indoor inhalation pathway, continued LVEJO, poses "fundamental questions about the adequacy of these existing institutional controls and engineered barriers." PC2 at 4. LVEJO expressed concern that IEPA's proposal did not address any notification, screening, or assessment of these schools to determine if the indoor inhalation pathway might threaten students. *Id*. LVEJO complained that IEPA did not even propose to produce a guidance document with "a description of the measures that can be used or retrofitted at schools to mitigate the hazards of vapor intrusion." *Id*.

LVEJO stressed that school sites are different from other categories of sites that have received NFR Letters. First, LVEJO noted that schools are places of "mass exposure," where tens of thousands of children could be exposed. PC2 at 4. Second, LVEJO stated that schools are places of "concentrated exposure" as children will spend hundreds of hours in the school each year for years. *Id*. Third, LVEJO proffered that schools are places of "involuntary exposure" because children must attend. *Id*. Fourth, LVEJO cited USEPA, "Child-Specific Exposure Factors Handbook" (2008) to conclude that children are more vulnerable than adults are to exposure from environmental toxins. PC2 at 5-6. Fifth, LVEJO stated that "children cannot protect themselves" and instead rely upon school officials and parents: "Absent direction from the IPCB to IL EPA, these adults will have no reason to know that vapor intrusion is a potential hazard and to fulfill their duty to ensure children in their care are protected." PC2 at 6. Lastly, LVEJO recounted that the Board has long recognized that different protocols might be necessary "to protect children in school settings by contrast to all other categories of sites," citing the existing "school-specific site remediation standards" at 35 Ill. Adm. Code 740.800 (SRP). *Id*.

LVEJO went on to describe methods identified by the State of Wisconsin to address vapor intrusion at existing buildings. LVEJO characterized the methods as "practical" and referred to the December 2010 guidance document entitled "Addressing Vapor Intrusion at Remediation Sites and Redevelopment Sites in Wisconsin." PC2 at 6-9. Based upon these methods, LVEJO proposed screening and, if necessary, mitigation for Illinois school sites that relied upon institutional controls or engineered barriers, "leaving subsurface soil and groundwater as potential sources of vapor intrusion." PC2 at 9. To this end, LVEJO urged the Board "to issue a regulatory mandate that directs the IL EPA to develop and implement a plan that will address the risks posed by vapor intrusion in schools that have completed the SRP, but were not required to assess or control the potential risks to children posed by vapor intrusion." *Id*.

In its rulemaking proposal, IEPA referred to "comments, issues and concerns raised by U.S. EPA, SRAC, and the regulated community." St. of Reas. at 7. However, IEPA did not identify whether schools were among the regulated community included in its outreach efforts. Further, it is unclear in this record whether school sites would regularly be subject to property transactions that might prompt NFR Letter re-evaluation.

At first notice, the Board stated that it shares LVEJO's concerns that those responsible for school sites with pre-vapor intrusion NFR Letters may be unaware that the indoor inhalation pathway was not evaluated. The Board noted that IEPA maintains records on each of these sites for which NFR Letters have issued under SRP or the Leaking UST Program. At first notice, the Board found that it would be prudent for IEPA to promptly notify these schools about the new indoor inhalation exposure route and the manner in which that pathway might be addressed. The Board requested that IEPA describe in its public comment how IEPA planned to provide this notice.

The Board also requested at first notice that IEPA's public comment include a list of all schools in Illinois to which NFR Letters have been issued or which are subject to an Environmental Land Use Control or "ELUC,"[55] indicating which of those sites, if any, have already directly addressed the indoor inhalation exposure route. The Board requested that IEPA include every "school" as that word is defined in SRP (35 Ill. Adm. Code 740.800(b)), though the Board's request includes both SRP and the Leaking UST Program.[56] In addition, to the

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[55] *See* footnote 49.

[56] SRP defines "school" as "any public educational facility in Illinois, including grounds and/or campus, consisting of students, comprising one or more grade groups or other identifiable groups, organized as one unit with one or more teachers to give instruction of a defined type. Public educational facility includes, but is not limited to, primary and secondary (kindergarten [-]12th grade), charter, vocational, alternative, and special education schools. Public educational

extent IEPA has the information reasonably available, the Board asked that IEPA include any school that has been issued a release pursuant to Section 4(y) of the Act (415 ILCS 5/4(y) (2010)).

In its first-notice comments, IEPA responded as follows:

> The Board's proposition to notify schools individually of the addition of the indoor inhalation exposure route to TACO is problematic for the following reasons: (1) [IEPA] cannot assure every school is on the list; (2) the chemicals of concern at the school site may not be volatile chemicals; (3) volatile chemicals that are present may not be in the area of a building where children attend classes; and (4) the original cleanup may have already addressed the pathway. PC7 at 10.

Alternatively, IEPA suggested that it notify schools about the new indoor inhalation exposure route through the Illinois State Board of Education (ISBE) and other statewide educational organizations by "distributing fact sheets that contain information about the new pathway and how the pathway might be addressed." PC7 at 10. IEPA added that "[t]his information will also be posted on Illinois EPA's website." *Id*.

IEPA conducted a multi-step screening of its databases in response to the Board's request. IEPA expressed concern, however, about its ability to identify all schools that might be affected. IEPA stated that because its SRP database does not identify schools "as a unique field," IEPA searched other fields in the database for the terms "school," "university," "college," "academy," "education," and "public building commission." PC7 at 9.[57] IEPA explained that the Public Building Commission sites were included in the search because "most are developed as schools; however, some of these sites were intended as police district headquarters or engine companies and were deleted." *Id*. IEPA noted that because of the nature of the search, the resulting list of 80 SRP sites "contains significantly more sites than the definition [of school] encompasses." PC7, Exh. B ("SRP School List"). IEPA also searched its Leaking UST Program database and found 423 "probable school sites" that have received an NFR Letter or a "4(y)

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facility does not include junior colleges, colleges, or universities." 35 Ill. Adm. Code 740.800(b); *see also* 415 ILCS 5/58.16 (2010) (pre-construction and pre-occupancy requirements for public school buildings located in whole or in part in county with population of more than 3,000,000).

[57] The definition of "school" (which is the current definition from SRP) provides that it "does not include junior colleges, colleges, or universities." Section 742.1200(e)(3); *see also* 35 Ill. Adm. Code 740.800(b) (SRP definition of "school" same).

letter."[58] PC7 at 9, Exh. C ("[Leaking] UST Program School List").

IEPA stressed that it cannot guarantee all schools, as defined in 35 Ill. Adm. Code 740.800(b), were identified in the provided SRP School List and Leaking UST Program School List. PC7 at 9-10. The database searches were complicated by the prospect of schools entering IEPA programs under different names. PC7 at 9-10. Additionally, schools adjacent to a leaking UST site might have entered into an agreement with a tank owner or operator to accept institutional controls (*e.g.*, ELUCs), but this information is not tracked by IEPA. PC7 at 10.

The Board noted that it appreciates IEPA's efforts in systematically reviewing its databases to compile lists of potentially affected schools. IEPA did not suggest that notice not be given to school sites with NFR Letters that may never have assessed the indoor inhalation pathway. However, for practical reasons well-articulated by IEPA, all such sites cannot be identified in IEPA's databases with certainty. In addition to the difficulties cited by IEPA, the Board observed that some of the sites on IEPA's SRP School List and Leaking UST Program School List may no longer be used for schools. Further, there may be sites that IEPA did not add to either list because the sites entered the IEPA program when privately owned, before they became the locations of schools. Likewise, some brownfields cleanups may have taken place without any IEPA oversight.

LVEJO raised the issue of school sites that have NFR Letters but that had not been investigated for the indoor inhalation exposure route. The Board continued to share LVEJO's concerns that those responsible for these school sites may be unaware that the indoor inhalation pathway was not evaluated. The Board also continued to believe that it would be prudent for these persons to be promptly notified about the new indoor inhalation exposure route and how they can go about assessing it. Such notification is necessary precisely because these sites *may* have volatile chemical contamination, *may* have a school building located over or near such contamination, and *may* have an NFR Letter despite there having been no investigation of the indoor inhalation pathway.

The Board conceded that a targeted mailing to the 503 sites on IEPA's compiled lists would likely prove to be at once under-inclusive and over-inclusive. The Board was persuaded that IEPA's alternative proposal for notifying schools should be implemented and requested at second notice that IEPA do so as promptly as its resources allow. LVEJO filed no public comment in opposition to IEPA's alternative proposal for notification. The alternative is designed to notify *all* schools, which would necessarily include those properties that have pre-vapor intrusion NFR Letters and are currently being used for schools. The hearing officer added

[58] Section 4(y) of the Act states that "[t]he Agency shall have authority to release any person from further responsibility for preventive or corrective action under this Act following successful completion of preventive or corrective action undertaken by such person upon written request by the person." 415 ILCS 5/4(y) (2010).

ISBE to the R11-9 notice list to ensure that it receives a copy of this decision.

The Board expressed its understanding that in addition to the placement of fact sheets on the IEPA website, IEPA's alternative proposal for notification would entail requesting that ISBE cause all schools in the State to receive the IEPA fact sheets. The Board asked that these IEPA fact sheets include the following: (1) an explanation of how the new indoor inhalation exposure route can be addressed at sites for which NFR Letters or the like were issued without this new pathway having been evaluated properly or at all; and (2) a way to contact IEPA for further information. The Board noted that it does not believe that the alternative proposal for notification and the use of the SRP School List and Leaking UST Program School List are mutually exclusive. The Board requested that IEPA include on its fact sheets not only links to IEPA's publicly-searchable SRP and Leaking UST Program databases, but also a link to the IEPA website where the SRP School List and Leaking UST Program School List would be posted. The Board recognized that the website posting of these compiled lists would need to be accompanied by appropriate caveats. However, that the lists are probably not perfect was not considered by the Board to be a reason to disregard them entirely. The Board stated that it believes it likely that among the sites on the SRP School List and the Leaking UST Program School List is a number of sites currently used for schools that would benefit from having this information (LPC #, site name, street address, city) readily available. The Board further stated that it believes that this extra step is warranted based upon the addition of an entirely new exposure route and the concerns over children being exposed through that pathway. In its most recent public comment, IEPA concurred with all of the Board's requests. PC12 at 16.

Finally, as IEPA explained, anyone with an NFR Letter who wishes to obtain a new NFR Letter addressing the indoor inhalation exposure route could enroll the site in SRP. R09-9/IEPA PFR2 at 5; R09-9/IEPA PFR1 at 6-7; *cf*. 415 ILCS 5/57.18 (2010). Therefore, for a school or any other site with an NFR Letter, the regulatory framework is presently in place to evaluate the new pathway. Where such an evaluation is pursued, the Board noted at first notice that necessarily, some environmental data would already exist for each of these sites. Costs for soil gas investigation and mitigation would be expected to be on the order of those presented below in the discussion of economic reasonableness.

"Right-to-Know" Requirements

During the Predecessor Rulemaking, R09-9, Mr. Reott provided information on then-pending House Bill 4021, which based notification requirements in the Act upon Tier 1 soil gas remediation objectives. Mr. Reott asserted that the proposed Tier 1 objectives overstate the risk. Consequently, Mr. Reott expressed concern that if the proposed Tier 1 objectives are adopted, they will "force many more public notifications for an overstated risk." PC3, Exh. B at 2. In particular, Mr. Reott pointed to communities with groundwater ordinances that would be subject to new "right-to-know" requirements. Mr. Reott added that the proposed Tier 1 objectives would create a "new unnecessary notice burden" and costs associated with the right-to-know requirements. *Id*.

The Board observed at first notice that House Bill 4021 was passed and became effective August 24, 2009, as Public Act 96-603. The amendment added "soil gas contamination" language to the Section 25d-3(a)(1) notification requirements of the Act:

> (a) Beginning January 1, 2006, if the Agency determines that:
>
> > (1) Soil contamination beyond the boundary of the site where the release occurred, *soil gas contamination beyond the boundary of the site where the release occurred*, or both pose a threat of exposure to the public above the appropriate Tier 1 remediation objectives, based on the current use of the off-site property, adopted by the Board under Title XVII of this Act, the Agency shall give notice of the threat to the owner of the contaminated property . . . . 415 ILCS 5/25d-3(a)(1) (2010) (emphasis added).

The Board noted in its first-notice opinion that before Public Act 96-603, Section 25d(a)(1) called for notice, in specified circumstances, of "soil contamination," the Tier 1 objectives for which have been in effect for some 15 years. Likewise, Section 25d-3(a)(2) has long required notice concerning groundwater contamination exceeding the Board's Class I standards. *See* 415 ILCS 5/25d-3(a)(1) (2010). The burden of providing the soil gas notification lies with IEPA, is statutorily-mandated, and is incremental. IEPA noted that until the current rulemaking is adopted, "there is nothing that effectuates [the soil gas] part of the right to know provision. So that's again another reason to push forward on something here." Tr.1 at 82.

As discussed, the Board found that the proposed Tier 1 indoor inhalation remediation objectives are appropriate. At hearing, IEPA represented that it would file a proposal to amend the Board's Part 1600 community relations rules (35 Ill. Adm. Code 1600) once the indoor inhalation provisions of TACO are adopted. Tr.2 at 19. As acknowledged by IEPA, even before any Part 1600 amendments are adopted, the "soil gas" notice language of the Act itself will be implemented by IEPA based upon the final TACO Tier 1 indoor inhalation ROs. *Id*. During the first-notice period, the Board received no public comments about any of these "right-to-know" issues.

Additional Chemical Constituents Proposed

IEPA proposed adding 13 chemical constituents to the TACO rules based upon the same chemicals being added to Part 620 through Groundwater Quality, R08-18. The premise for adding these chemicals to the groundwater quality standards was that the chemicals had been detected in Illinois groundwater. IEPA explained that a "master list" was developed and cross-referenced with toxicity data to determine if sufficient toxicity information was available to support developing a groundwater quality standard. R08-18/Hornshaw PFT1 at 5; R08-18/IEPA PFT2 at 10. IEPA indicated at hearing that the Board should incorporate supporting information from the R08-18 docket into the Predecessor Rulemaking, R09-9. R09-9/Hurley PFT2 at 2.

The Board adopted final Part 620 groundwater quality amendments on October 4, 2012. *See* Groundwater Quality, R08-18 (Oct. 4, 2012). Of the new chemicals added through the R08-18 rulemaking but that are not already in TACO, IEPA did not propose to add perchlorate at this time. Ms. Hurley explained that perchlorate is not a volatile chemical and therefore would not be part of the indoor inhalation exposure route. Because IEPA re-filed the Current Rulemaking, R11-9, mainly to address the vapor intrusion pathway, perchlorate was not included. Ms. Hurley indicated that perchlorate would be included in a future TACO proposal. Tr.1 at 113-14.

During the Predecessor Rulemaking, R09-9, IERG reiterated its concern regarding the addition of new chemicals for regulation in R08-18. R09-9/IERG Resp. at 2. IERG expressed concern over the procedure that IEPA used to define contaminants as being "commonly detected" in Illinois groundwater. R08-18/PC2 at 7-8. IERG suggested that IEPA analyze whether the diversity of locations indicated the need for a State-wide standard. *Id*.

In Groundwater Quality, R08-18, the Board addressed IERG's concern and found that "it is consistent with the IGPA [Illinois Groundwater Protection Act] and the Act to supplement the groundwater quality standards with chemical constituents from the Agency's master list for which toxicity information is available in USEPA's nationally-accepted and peer-reviewed IRIS [Integrated Risk Information System] or PPRTV [Provisional Peer Reviewed Toxicity Values]." *See* Groundwater Quality, R08-18, slip op. at 11-14 (Oct. 20, 2011). For purposes of the TACO amendments at second notice, the Board reiterated its finding that it is appropriate to include these chemicals in TACO in order to provide remediation objectives.

Technical Feasibility and Economic Reasonableness

Section 27(a) of the Act directs the Board to take into account the "technical feasibility and economic reasonableness of measuring or reducing the particular type of pollution" when conducting a substantive rulemaking. 415 ILCS 5/27(a) (2010). Section 27(b) of the Act requires the Board to determine whether a proposed substantive regulation "has any adverse economic impact on the people of the State of Illinois." 415 ILCS 5/27(b) (2010). For the reasons below, the Board again finds that the amendments proposed are technically feasible and economically reasonable and will not have an adverse economic impact on the People of Illinois. *See* 415 ILCS 5/27(a), (b) (2010).

Technical Feasibility

Nothing in this rulemaking record indicates that the second-notice proposal is technically infeasible. Several participants previously voiced concern over the J&E Model. The Board finds, however, that the modified J&E Model, as a component of the existing TACO framework, is appropriate for Illinois sites, subject to the institutional controls called for by these amendments. The Board continues to agree with the default parameters for Tiers 1 and 2 and the provision for BTEX biodegradation demonstrations. Further, on the Board's request, IEPA committed to evaluating the final USEPA vapor intrusion guidance upon its issuance. IEPA also stated in this rulemaking that if a site evaluator wishes to follow USEPA guidance as an alternative to Tier 1 or Tier 2, the site evaluator may make that proposal to IEPA under Tier 3. Tr.2 at 75.

The record establishes that BCTs, soil gas collection, and soil gas analyses are being undertaken in the environmental field. Tr.1 at 103-04, 107, 109; Nifong PFT2; Martin PFT2 at 4. The Board declined to adopt Tier 1 indoor air tables, but agreed with IEPA's *errata* allowing for indoor air sampling under Tier 3. At first notice, the Board requested that IEPA support the proposed minimum membrane thickness under Section 742.1210(c)(2)(B), which IEPA did as discussed above. In response to suggestions from SRAC and IEPA, the Board at first notice included the 60-day delay in rule effectiveness, which was repeated at second notice and is set today as July 15, 2013. To assist the regulated community in implementing the new indoor inhalation exposure route, the Board noted that IEPA plans to prepare issue-specific "fact sheets" as they are needed. Tr.1 at 49.

Based upon this record, the Board again finds that the TACO amendments proposed below are technically feasible.

<u>Economic Reasonableness</u>

The Board requested that DCEO conduct an economic impact study (EcIS) of the proposed rules on December 1, 2010. On December 7, 2010, DCEO responded to the Board's request, stating that DCEO could not undertake an EcIS. Tr.1 at 120-21. As the Board discussed in its first-notice opinion, however, several participants presented pertinent economic information during the course of this rulemaking and the <u>Predecessor Rulemaking</u>, R09-9. The Board received no public comments concerning economic reasonableness during the first-notice period.

IEPA reintroduced detailed cost information related to soil gas investigations that had been provided in R09-9 by Dr. Salhotra. Nifong PFT2 at 2, Exh. 2; R09-9/PC4, Exh. 1. Cost summaries were derived from four Illinois case studies, with two sites each involving a single commercial building and the other two sites each involving three residences. On a per-site basis, costs by type were as follows: planning, project management, and report preparation ranged from $10,395 to $25,691; field labor ranged from $2,977 to $8,400; field supplies and equipment ranged from $303 to $1,534; drilling, sampling, and well installation ranged from $2,111 to $5,100; laboratory analyses ranged from $2,066 to $5,325. Nifong PFT2, Exh. 2. Total costs for these soil gas investigations ranged from $23,609 to $89,666 per site.

IEPA supplemented these costs with cost estimates for soil gas and indoor air sampling and analysis, prepared by Dr. Blayne Hartman, a vapor intrusion consultant with Hartman Environmental Geoscience. Nifong PFT2, Exh. 3. On a unit-cost basis, Dr. Hartman estimated the following:

- Utility location clearance: $500 to $750
- Soil gas sample collection (by hand equipment): $1,500/day for 10 to 15 samples
- Soil gas sample collection (by direct-push rigs): $1750 to $2,000/day for 15 to 20 samples
- Soil gas analysis (VOCs): $125 to $250/sample
- Soil sample analysis for physical properties: $250/sample
- Indoor air sample collection: consultant's time to make 3 trips - one to meet residents, one to deploy sample collection canisters, one to collect the canisters
- Indoor air sample analysis (VOCs): $250 to $300/sample
  Nifong PFT2, Exh. 3. at 1-2.

Dr. Hartman noted that these costs could be 10 to 20% higher if paid for through a consultant, *i.e.*, not paid directly to the sampling firm and laboratory. *Id*. at 2.

Mr. Martin provided cost information for soil gas investigations based upon his experience. Although costs vary with the size and complexity of the investigation, "a soil gas investigation with labor, equipment and report preparation can be $5,000 per day with an additional $200 analytical cost per soil gas sample." Martin PFT2 at 4. Mr. Martin testified about one completed soil gas investigation that cost approximately $22,000, which included analysis of 10 soil gas samples and report preparation. This cost was in addition to the cost for "routine site investigation pursuant to existing TACO requirements." *Id*. at 4-5; Tr.1 at 109.

IEPA also provided cost estimates for various building control technologies designed to reduce or eliminate the potential for vapor intrusion impacts. The estimates are from the Interstate Technology and Regulatory Council's document entitled "Vapor Intrusion Pathway: A Practical Guideline" (Jan. 2007), which is incorporated by reference:

- Passive barrier — $0.50 - $5/ft^2
- Passive venting — $0.75-$5/ft^2
- Sub-slab depressurization — $1-$5/ft^2 ($1-$2/ft^2 for residential)
- Sub-membrane depressurization — $1-$6 ($1.50-2/ft^2 for residential)
- Sub-slab pressurization — $1-$5/ft^2
- Building pressurization — $1-$15/ft^2
- Indoor air treatment — $15,000 - $25,000 per application (not atypical)
- Sealing of building envelope — $ Dependent on extent of sealing required
  Nifong PFT2 at 3, Exh. 4.

During the R09-9 hearing, Mr. Olsta, for CETCO/Geokinetics, testified that the installed cost of a 60-mil spray-applied or high-density polyethylene vapor barrier is typically about $1.50 to $2.25 per square foot. The installed cost of a 6 to 10- mil low-density polyethylene vapor barrier with overlapped or taped seams is typically about $0.30 to $0.50 per square foot. The lower end of the ranges is associated with larger installations such as a warehouse, while the higher end of the ranges would be more typical of a single-family residence. R09-9/Tr.2 PM at 17-18. Mr. Olsta explained that the installation costs for sub-slab depressurization systems is often lower than those for sub-membrane systems, but the long-term operating and maintenance costs are typically higher. As a result, the net present values for both systems are comparable and typically range from $1.50 to $3.50 per square foot of slab-on-grade area. *Id*. at 19-20.

Mr. Reott commented on Mr. Martin's cost testimony, stating that $22,000 for a soil gas investigation is "a significant cost that will have an adverse impact on the ability to develop some Brownfield sites . . . ." PC4 at 9. Mr. Reott further stated that the proposed amendments would have the most significant impact in communities that have adopted IEPA-approved ordinances prohibiting the use of groundwater for drinking water purposes. PC4 at 7. Mr. Reott maintained that the proposal will force many sites, particularly in the City of Chicago, to collect "expensive, unnecessary groundwater data." PC4 at 7-8; R09-9/Tr.1 at 40, 42. According to Mr. Reott, "[f]or every site that participates in an [A]gency supervised cleanup process, there are literally tens if not hundreds of sites that are evaluated and remediated based upon [the] Tier 1 numbers without any [A]gency involvement." PC4, Exh. A at 2. Mr. Reott asserted that the stringency of the proposed Tier 1 values "would drive people into cleaning up groundwater in much of Illinois . . . that would be otherwise not dealt with in the current scenarios that are out there." R09-9/Tr.2 AM at 68-70; PC4, Exh. A at 3, Tables.

IEPA sought to "rebut Mr. Reott's argument that most of the State has a groundwater ordinance." R09-9/PC4 at 5. IEPA stated:

> In fact, as of April 2009, according to the Secretary of State's website, there are 1,209 incorporated areas in the State of Illinois. Of those, approximately 139 towns and cities in Illinois have an approved citywide ordinance for purposes of an acceptable institutional control under TACO. An additional 61 towns or cities have only an approved limited area ordinance under TACO. Of those 61 towns and cities with approved limited area ordinances, 39 have only 1 area of the town covered; 10 have 2 areas covered; 5 have 3 areas covered; 1 has 4 areas covered; 3 have 5 areas covered; 2 have 7 areas covered; and 1 has 9 areas covered. This in no way comes close to "most of Illinois" being covered by a groundwater ordinance. Therefore, the Illinois EPA contends that its proposal to address this medium for purposes of the indoor inhalation exposure route is a critical element of the proposal. *Id.*

The Board observed at first notice that even if a groundwater ordinance prohibits the installation of drinking water wells, contaminated groundwater may nevertheless produce soil gas. The City of Champaign asserted that "it is prudent and desirable for the indoor inhalation exposure route to be evaluated prior to a contaminated site's use of the City's groundwater restriction ordinance as an institutional control." PC5 at 1 (City Council Bill No. 2011-148, passed Aug. 2, 2011).

Mr. Reott stated that energy costs will increase with the use of BCTs that pump air through the building. R09-9/Tr.2 AM at 79. IEPA responded that such a system would normally use a small fan and the costs would be minimal. Mr. King added: "[I]f you compare the cost for a building control technology against the cost of addressing a potential serious illness for residents of a home, I think it's quite inexpensive." *Id*. at 87. IEPA testified that it found the four BCTs listed in the proposal to be economically reasonable. Tr.1 at 104.

Mr. Reott asserted that the financial impact of the proposed rule would primarily affect the UST Fund and sites within the City of Chicago. Mr. Reott asked IEPA if it had analyzed the impact of the proposed rule on the UST Fund. R09-9/Tr.1 at 40. IEPA indicated no such analysis had been done, primarily because the petroleum contaminants typically associated with the UST Fund are not as significant as the chlorinated compounds when addressing the indoor inhalation exposure pathway. *Id*.

IEPA stated that remediation costs would be expected to vary widely depending upon the characteristics of the site and contamination, as well as the willingness of affected property owners to accept BCTs and institutional controls. R09-9/IEPA PFR1 at 13. However, according to Mr. King, the indoor inhalation exposure route would probably be the "driver" of site cleanups on only a small percentage of sites. Mr. King testified: "If it's the driver on more than 10 percent, I would be surprised." Tr.1 at 105.

In addition, IEPA maintained that requiring indoor air sampling under Tier 1 or Tier 2 would significantly increase the costs of site investigations, far above what is necessary to address this pathway. Tr.1 at 43, 112; R09-9/Tr.1 at 46, 88. IEPA also noted that other states have experienced legal and financial challenges from vapor intrusion exposures where the indoor inhalation exposure route *was not* evaluated prior to closures. St. of Reas. at 3. The absence of TACO provisions for the vapor intrusion pathway can lead to work that is unnecessary, costly, and intrusive, while providing results that may be unreliable.

Along with better protecting building occupants from migrating volatile chemicals, the addition of the vapor intrusion pathway is expected to facilitate property transactions and provide expanded liability relief to property owners. St. of Reas. at 8. Institutional controls have long been a part of TACO, including when ROs are based upon engineered barriers or industrial/commercial property use. NFR Letters, which would typically include the full concrete base restrictions, must already be recorded under SRP and the Leaking UST Program rules. *See* 35 Ill. Adm. Code 734.715, 740.620. IEPA concluded that "the public policy argument for adding this exposure route far outweighs any additional costs that may be incurred as a result of its addition to the regulations." R09-9/PC4 at 4.

Based upon the record, the Board again finds that these amendments are economically reasonable and will not have an adverse economic impact on the People of Illinois.

Minor Revisions

Names for Chemicals

At the Board's request, IEPA provided the common names for the explosive chemicals added to Part 620 in Groundwater Quality, R08-18. R08-18/IEPA PFT2 at 5; R08-18/Hornshaw PFT1 at 5. For ease of understanding, the Board included the common names in the first-notice amendments to Part 742 and repeated them at second notice as follows:

- Proposed Appendix A, Table E
  Mecoprop (MCPP)
  High Melting Explosive, Octogen (HMX)
  Royal Demolition Explosive, Cyclonite (RDX)
  2,4,6-trinitrotoluene (TNT)

- Proposed Appendix C, Table E
  High Melting Explosive, Octogen (HMX)
  Mecoprop (MCPP)
  Royal Demolition Explosive, Cyclonite (RDX)
  2,4,6-trinitrotoluene (TNT)

Additionally, because *"cis-"* and *"trans-"* should be italicized consistently, the Board made the following revisions in chemical names at second notice:

Appendix A, Table E, Similar-Acting Noncarcinogenic Chemicals

Circulatory System
cis~~cis~~-1,2-Dichloroethylene (ingestion only)

Gastrointestinal System
1,3-Dichloropropene (*cis*~~cis~~ + *trans*~~trans~~) (ingestion only)

Mortality
trans~~trans~~ -1,2-Dichloroethylene

Respiratory System
trans~~trans~~ -1,2-Dichloroethylene (inhalation only)
1,3-Dichloropropene (*cis*~~cis~~ + *trans*~~trans~~) (inhalation only)

Appendix A, Table F, Similar-Acting Carcinogenic Chemicals

Bladder
1,3-Dichloropropene (*cis*~~cis~~ + *trans*~~trans~~) (ingestion only)

Appendix A, Table J, List of TACO Volatile Chemicals for the Indoor Inhalation Exposure Route

cis~~cis-~~-1,2-Dichloroethylene
trans~~Trans-~~-1,2-Dichloroethylene
1,3-Dichloropropylene (*cis*~~cis~~ + *trans*~~trans~~)

Appendix A, Table K, Soil Vapor Saturation Limits (C_v^{sat}) for Volatile Chemicals

cis~~cis-~~-1,2-Dichloroethylene
trans~~trans-~~-1,2-Dichloroethylene
1,3-Dichloropropylene (*cis*~~cis~~ + *trans*~~trans~~)

Appendix B, Table G, Tier 1 Soil Gas Remediation Objectives for the Outdoor Inhalation Exposure Route

cis~~cis-~~-1,2-Dichloroethylene
trans~~trans-~~-1,2-Dichloroethylene
1,3-Dichloropropylene (*cis*~~cis~~ + *trans*~~trans~~)

Appendix B, Table H, Tier 1 Soil Gas and Groundwater Remediation Objectives for the Indoor Inhalation Exposure Route – Diffusion and Advection

cis~~cis-~~-1,2-Dichloroethylene
trans~~trans-~~-1,2-Dichloroethylene
1,3-Dichloropropylene (*cis*~~cis~~ + *trans*~~trans~~)

Appendix B, Table I, Tier 1 Soil Gas and Groundwater Remediation Objectives for the Indoor Inhalation Exposure Route – Diffusion Only

cis~~cis-~~-1,2-Dichloroethylene
trans~~trans-~~-1,2-Dichloroethylene
1,3-Dichloropropylene (*cis*~~cis~~ + *trans*~~trans~~)

Appendix C, Table E, Default Physical and Chemical Parameters

> *cis*~~Cis~~-1,2-Dichloroethylene
> *trans*~~Trans~~-1,2-Dichloroethylene
> 1,3-Dichloropropylene (*cis*~~cis~~ + *trans*~~trans~~)

Greek Notation for J&E Parameters

Appendix C, Table M ("J&E Parameters") lists the symbols for porosity with a Greek capital letter Theta "Θ." The notations for porosity in the current Part 742 language and new Appendix C, Table L ("J&E Equations") use a Greek lower case letter Theta "θ" and are consistent with USEPA's guidance incorporated by reference, "User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings" (Feb. 22, 2004). At first notice, the Board revised the symbols for porosity to use the Greek lower case letter Theta "θ" throughout Table M.

References to Part 734 Leaking UST Regulations and Repealed Part 732

Where Section 742.1010 (35 Ill. Adm. Code 742.1010) on ELUCs presently refers to the leaking UST rules at Parts 731 and 732 (35 Ill. Adm. Code 731, 732), the Board added at first notice reference to the more recently-adopted leaking UST rules at Part 734 (35 Ill. Adm. Code 734). TACO's applicability provision already refers to Part 734. *See* 35 Ill. Adm. Code 742.105(b)(1). The Board at second notice also deleted references in the TACO rules to the Part 732 leaking UST rules because those rules were repealed, effective March 19, 2012. *See* 36 Ill. Reg. 4894 (Mar. 30, 2012); *see also* Sections 742.105(b)(1), 742.1010(c)(2)(A).[59]

Other Corrections

At second notice, the Board made several changes for purposes of consistency within the amendments. For the required contents of various Tier 3 or BCT proposals to IEPA, the first-notice rules sometimes called for information on "[t]he extent of contamination" or "[t]he *current* extent of contamination," but then elsewhere would call for "[t]he current extent *and modeled migration* of contamination." In addition, there were rules that required information on "[g]eology, including soil *parameters*," but then another rule called for "[g]eology, including soil *types*." *See* first-notice proposed Sections 742.920(b), (c), 742.935(b)-(e), 742.1205(b), (c) (emphasis added). As it was not apparent why these submittal-content requirements should vary, the Board reconciled the provisions at second notice to make them more inclusive or descriptive.

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[59] Section 742.1005(a) should be revised to specify "734" instead of "732," but because this Section is not currently open in this rulemaking, the Board defers this revision to a future rulemaking.

Additionally, the Board at second notice corrected two typographical errors in then-proposed Section 742.717(i): "<u>saturated vapor concentration (C_v^{sat}, Equation J&E6b)</u>" should read "<u>soil vapor saturation limit (C_v^{sat}, Equation J&E5)</u>" while "<u>subsurface temperature specified in 742.717(g)</u>" should read "<u>subsurface temperature specified in subsection (h)</u>."

CONCLUSION

The Board adopts final amendments to the Part 742 TACO rules. Among this rulemaking's more substantial modifications is the addition of the indoor inhalation exposure route and corresponding Tier 1 soil gas and groundwater remediation objectives. The final amendments also reflect the addition of 13 chemicals to the TACO tables, update physical and chemical parameters, and revise toxicity values. In addition, to ease the transition of adding a new exposure route to TACO, the amendments have a 60-day delayed effective date and therefore take effect on July 15, 2013. For final adoption, the Board makes no substantive changes, and only minor revisions, to the second-notice rule language.

As proposed at second notice, three significant changes to the first-notice rule language are adopted as final amendments today. First, the Tier 1 and Tier 2 ROs for the indoor inhalation exposure route apply *only* when the existing or potential building at issue has a full concrete slab-on-grade or a full concrete basement floor and walls. *See, e.g.*, Sections 742.505(b)(2)(C), 742.600(l)(1). Second, an institutional control must be placed on the property whenever the indoor inhalation ROs applied at the site rely upon the assumed presence of a building with a full concrete slab-on-grade or a full concrete basement floor and walls (*e.g.*, Tier 1 and Tier 2 ROs). *See* Section 742.1000(a)(9). Third, in the event of BCT inoperability at a school, the final amendments require the "school administrator" (rather than the "site owner/operator") to provide notification, and when doing so, to notify not only IEPA, but also the school board and every parent or legal guardian for all enrolled students. The notification of BCT inoperability is triggered by the BCT being rendered inoperable for a period of five consecutive calendar days during the school year when school is in session. "School administrator" is defined as "the school's principal, or similar administrator responsible for the school's operations, or his or her designee." *See* Section 742.1200(e)(3).

These final amendments provide the first set of vapor intrusion rules for remediation sites in Illinois. To ensure that these rules reflect the latest science, IEPA has committed to reviewing the final vapor intrusion guidance of USEPA when that guidance is issued and proposing any warranted changes to TACO's indoor inhalation provisions.

ORDER

The Board adopts the following amendments to the TACO rules (35 Ill. Adm. Code 742) and directs the Clerk to submit the amendments to the Secretary of State for publication in the *Illinois Register* as final rules. Adopted additions to Part 742 are underlined and adopted deletions appear stricken.

SUBTITLE G: WASTE DISPOSAL
CHAPTER I: POLLUTION CONTROL BOARD
SUBCHAPTER f: RISK BASED CLEANUP OBJECTIVES

PART 742
TIERED APPROACH TO CORRECTIVE ACTION OBJECTIVES

SUBPART A: INTRODUCTION

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742.100	Intent and Purpose
742.105	Applicability
742.110	Overview of Tiered Approach
742.115	Key Elements
742.120	Site Characterization

SUBPART B: GENERAL

Section	
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742.205	Severability
742.210	Incorporations by Reference
742.215	Determination of Soil Attenuation Capacity
742.220	Determination of Soil Saturation Limit
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742.230	Agency Review and Approval

SUBPART C: EXPOSURE ROUTE EVALUATIONS

Section	
742.300	Exclusion of Exposure Route
742.305	Contaminant Source and Free Product Determination
742.310	Outdoor Inhalation Exposure Route
742.312	Indoor Inhalation Exposure Route
742.315	Soil Ingestion Exposure Route
742.320	Groundwater Ingestion Exposure Route

SUBPART D: DETERMINING AREA BACKGROUND

SUBPART E: TIER 1 EVALUATION

SUBPART F: TIER 2 GENERAL EVALUATION

SUBPART G: TIER 2 SOIL AND SOIL GAS EVALUATION

SUBPART H: TIER 2 GROUNDWATER EVALUATION

SUBPART I: TIER 3 EVALUATION

SUBPART J: INSTITUTIONAL CONTROLS

SUBPART K: ENGINEERED BARRIERS

SUBPART L: BUILDING CONTROL TECHNOLOGIES

AUTHORITY: Implementing Sections 22.4, 22.12, Title XVI, and Title XVII and authorized by Sections 27 and 58.5 of the Environmental Protection Act [415 ILCS 5/22.4, 22.12, 27, and 58.5 and Title XVI and Title XVII].

SOURCE: Adopted in R97-12(A) at 21 Ill. Reg. 7942, effective July 1, 1997; amended in R97-12(B) at 21 Ill. Reg. 16391, effective December 8, 1997; amended in R97-12(C) at 22 Ill. Reg. 10847, effective June 8, 1998; amended in R00-19(A) at 25 Ill. Reg. 651, effective January 6, 2001; amended in R00-19(B) at 25 Ill. Reg. 10374, effective August 15, 2001; amended in R00-19(C) at 26 Ill. Reg. 2683, effective February 5, 2002; amended in R06-10 at 31 Ill. Reg. 4063, effective February 23, 2007; amended in R11-09 at 37 Ill. Reg. _______, effective ______.

SUBPART A: INTRODUCTION

Section 742.105 Applicability

a) Any person, including a person required to perform an investigation pursuant to the Illinois Environmental Protection Act [415 ILCS 5] (Act), may elect to proceed under this Part to the extent allowed by State or federal law and regulations and the provisions of this Part and subject to the exceptions listed in subsection (h) below. A person proceeding under this Part may do so to the extent such actions are consistent with the requirements of the program under which site remediation is being addressed.

b) This Part is to be used in conjunction with the procedures and requirements applicable to the following programs:

1) Leaking Underground Storage Tanks (35 Ill. Adm. Code 731~~, 732,~~ and 734);

2) Site Remediation Program (35 Ill. Adm. Code 740); and

3) RCRA Part B Permits and Closure Plans (35 Ill. Adm. Code 724 and 725).

c) The procedures in this Part may not be used if their use would delay response action to address imminent and substantial threats to human health and the environment. This Part may only be used after actions to address such threats have been completed.

d) This Part may be used to develop remediation objectives to protect surface waters, sediments or ecological concerns, when consistent with the regulations of other programs, and as approved by the Agency.

e) A no further remediation determination issued by the Agency prior to July 1, 1997 pursuant to Section 4(y) of the Act or one of the programs listed in subsection (b) of this Section that approves completion of remedial action relative to a release shall remain in effect in accordance with the terms of that determination.

f) Site specific groundwater remediation objectives determined under this Part for contaminants of concern may exceed the groundwater quality standards established pursuant to the rules promulgated under the Illinois Groundwater Protection Act [415 ILCS 55] as long as done in accordance with Sections

742.805 and 742.900(c)(9). (See 415 ILCS 5/58.5(d)(4))

g) Where contaminants of concern include polychlorinated byphenyls (PCBs), a person may need to evaluate the applicability of regulations adopted under the Toxic Substances Control Act (15 USC ~~U.S.C.~~ 2601).

h) This Part may not be used in lieu of the procedures and requirements applicable to landfills under 35 Ill. Adm. Code 807 or 811 through 814.

i) An evaluation of the indoor inhalation exposure route under this Part addresses the potential of contaminants present in soil gas or groundwater to reach human receptors within buildings. This Part does not address the remediation or mitigation of any contamination within a building from a source other than soil gas or groundwater, such as the building structure itself and products within the building.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.110 Overview of Tiered Approach

a) This Part presents an approach for developing remediation objectives (see Appendix A, Illustrations A and B) that include an option for exclusion of pathways from further consideration, use of area background concentrations as remediation objectives and three tiers for selecting applicable remediation objectives. An understanding of human exposure routes is necessary to properly conduct an evaluation under this approach. In some cases, applicable human exposure routes ~~route(s)~~ can be excluded from further consideration prior to any tier evaluation. Selecting which tier or combination of tiers to be used to develop remediation objectives is dependent on the site-specific conditions and remediation goals. Tier 1 evaluations and Tier 2 evaluations are not prerequisites to conducting Tier 3 evaluations.

b) A Tier 1 evaluation compares the concentration of contaminants detected at a site to the corresponding remediation objectives for residential and industrial/commercial properties contained in Appendix B, Tables A, B, C, D, ~~and~~ E, G, H and I. To complete a Tier 1 evaluation, the extent and concentrations of the contaminants of concern, the groundwater class, the land use classification, human exposure routes at the site, and, if appropriate, soil pH, must be known. If remediation objectives are developed based on industrial/commercial property use, then institutional controls under Subpart J are required. For the indoor inhalation exposure route, institutional controls under Subpart J are required to use remediation objectives in Appendix B, Table H or Table I.

c) A Tier 2 evaluation uses the risk based equations from the Soil Screening Level (SSL) model, ~~and~~ Risk Based Corrective Action (RBCA) model and modified Johnson and Ettinger (J&E) model documents listed in Appendix C, Tables A, ~~and~~ C and L, respectively. In addition to the information that is required for a Tier 1 evaluation, site-specific information is used to calculate Tier 2 remediation objectives. As in Tier 1, Tier 2 evaluates residential and industrial/commercial properties only. If remediation objectives are developed based on industrial/commercial property use, then institutional controls under Subpart J are required. For the indoor inhalation exposure route, institutional controls under Subpart J are required to develop remediation objectives pursuant to Appendix C, Table L.

d) A Tier 3 evaluation allows alternative parameters and factors, not available under a Tier 1 or Tier 2 evaluation, to be considered when developing remediation objectives. Remediation objectives developed for conservation and agricultural properties can only be developed under Tier 3.

e) Remediation objectives may be developed using area background concentrations or any of the three tiers if the evaluation is conducted in accordance with applicable requirements in Subparts D through I. When contaminant concentrations do not exceed remediation objectives developed under one of the tiers or area background procedures under Subpart D, further evaluation under any of the other tiers is not required.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.115 Key Elements

To develop remediation objectives under this Part, the following key elements shall be addressed.

a) Exposure Routes

1) This Part identifies the following as potential exposure routes to be addressed:

A) Outdoor inhalation~~Inhalation~~;

B) Indoor inhalation;

C~~B~~) Soil ingestion;

D~~C~~) Groundwater ingestion; and

E~~D~~) Dermal contact with soil.

2) The evaluation of exposure routes under subsections (a)(1)(A), (a)(1)(B), ~~and~~ (a)(1)(C) and (a)(1)(D) ~~of this Section~~ is required for all sites when developing remediation objectives or excluding exposure pathways. Evaluation of the dermal contact exposure route is required for use of RBCA equations in Appendix C, Table C or use of formal risk assessment under Section 742.915.

3) The groundwater ingestion exposure route is comprised of two components:

A) Migration from soil to groundwater (soil component); and

B) Direct ingestion of groundwater (groundwater component).

4) The outdoor inhalation route is comprised of two components:

A) Migration from soil through soil gas to outdoor air (soil component); and

B) Migration from soil gas to outdoor air (soil gas component).

5) The indoor inhalation exposure route is comprised of two components:

A) Migration from soil gas to indoor air (soil gas component); and

B) Migration from groundwater through soil gas to indoor air (groundwater component).

b) Contaminants of Concern

The contaminants of concern to be remediated depend on the following:

1) The materials and wastes managed at the site;

2) The extent of the no further remediation determination being requested from the Agency pursuant to a specific program; and

3) The requirements applicable to the specific program, as listed at Section 742.105(b) under which the remediation is being performed.

c) Land Use

The present and post-remediation uses of the site where exposures may occur shall be evaluated. The land use of a site, or portion thereof, shall be classified as one of the following:

1) Residential property;

2) Conservation property;

3) Agricultural property; or

4) Industrial/commercial property.

d) Environmental Media of Concern

This Part provides procedures for developing remediation objectives for the following environmental media:

1) Soil;

2) Soil gas;

3) Groundwater.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

SUBPART B: GENERAL

Section 742.200 Definitions

Except as stated in this Section, or unless a different meaning of a word or term is clear from the context, the definition of words or terms in this Part shall be the same as that applied to the same words or terms in the Act.

"Act" means the Illinois Environmental Protection Act [415 ILCS 5].

"ADL" means Acceptable Detection Limit, which is the detectable concentration of a substance that is equal to the lowest appropriate Practical Quantitation Limit

(PQL) as defined in this Section.

"Agency" means the Illinois Environmental Protection Agency.

"Agricultural Property" means any real property for which its present or post-remediation use is for growing agricultural crops for food or feed either as harvested crops, cover crops or as pasture. This definition includes, but is not limited to, properties used for confinement or grazing of livestock or poultry and for silviculture operations. Excluded from this definition are farm residences, farm outbuildings and agrichemical facilities.

"Aquifer" means *saturated (with groundwater) soils and geologic materials which are sufficiently permeable to readily yield economically useful quantities of water to wells, springs, or streams under ordinary hydraulic gradients.* (Illinois Groundwater Protection Act [415 ILCS 55/3(a)])

"Area Background" means *concentrations of regulated substances that are consistently present in the environment in the vicinity of a site that are the result of natural conditions or human activities, and not the result solely of releases at the site.* [415 ILCS 5/58.2]

"ASTM" means the American Society for Testing and Materials.

"Board" means the Illinois Pollution Control Board.

"Building" means a man-made structure with an enclosing roof and enclosing walls (except for windows and doors) that is fit for any human occupancy for at least six consecutive months.

"Building Control Technology" means any technology or barrier that affects air flow or air pressure within a building for purposes of reducing or preventing contaminant migration to the indoor air.

"Cancer Risk" means a unitless probability of an individual developing cancer from a defined exposure rate and frequency.

"Cap" means a barrier designed to prevent the infiltration of precipitation or other surface water, or impede the ingestion or inhalation of contaminants.

"Capillary Fringe" means the zone above the water table in which water is held by surface tension. Water in the capillary fringe is under a pressure less than atmospheric.

"Carcinogen" means *a contaminant that is classified as a category A1 or A2 carcinogen by the American Conference of Governmental Industrial Hygienists; a category 1 or 2A/2B carcinogen by the World Health Organization's International Agency for Research on Cancer; a "human carcinogen" or "anticipated human carcinogen" by the United States Department of Health and Human Service National Toxicological Program; or a category A or B1/B2 carcinogen* <u>or as "carcinogenic to humans" or "likely to be carcinogenic to humans"</u> *by the United States Environmental Protection Agency in the integrated risk information system or a final rule issued in a Federal Register notice by the USEPA.* [415 ILCS 5/58.2]

"Class I Groundwater" means groundwater that meets the Class I: Potable Resource Groundwater criteria set forth in 35 Ill. Adm. Code 620.

"Class II Groundwater" means groundwater that meets the Class II: General Resource Groundwater criteria set forth in 35 Ill. Adm. Code 620.

"Conservation Property" means any real property for which present or post-remediation use is primarily for wildlife habitat.

"Construction Worker" means a person engaged on a temporary basis to perform work involving invasive construction activities including, but not limited to, personnel performing demolition, earth-moving, building, and routine and emergency utility installation or repair activities.

"Contaminant of Concern" or "Regulated Substance of Concern" means *any contaminant that is expected to be present at the site based upon past and current land uses and associated releases that are known to the* person conducting a remediation *based upon reasonable inquiry*. [415 ILCS 5/58.2]

"County Highway" means county highway as defined in the Illinois Highway Code [605 ILCS 5].

"District Road" means district road as defined in the Illinois Highway Code [605 ILCS 5].

"Engineered Barrier" means a barrier designed or verified using engineering practices that limits exposure to or controls migration of the contaminants of concern.

"Environmental Land Use Control" means an instrument that meets the requirements of this Part and is placed in the chain of title to real property that limits or places requirements upon the use of the property for the purpose of protecting human health or the environment, is binding upon the property owner, heirs, successors, assigns, and lessees, and runs in perpetuity or until the Agency approves, in writing, removal of the limitation or requirement from the chain of title.

"Exposure Route" means the transport mechanism by which a contaminant of concern reaches a receptor.

"Federally Owned Property" means real property owned in fee by the United States of America on which institutional controls are sought to be placed in accordance with this Subpart.

"Federal Landholding Entity" means that federal department, agency, or instrumentality with the authority to occupy and control the day-to-day use, operation and management of Federally Owned Property.

"Free Product" means a contaminant that is present as a non-aqueous phase liquid for chemicals whose melting point is less than 30°C (e.g., liquid not dissolved in water).

"GIS" means Geographic Information System.

"GPS" means Global Positioning System.

"Groundwater" means underground water which occurs within the saturated zone and geologic materials where the fluid pressure in the pore space is equal to or greater than atmospheric pressure. [415 ILCS 5/3.64]

"Groundwater Quality Standards" means the standards for groundwater as set forth in 35 Ill. Adm. Code 620.

"Hazard Quotient" means the ratio of a single substance exposure level during a specified time period to a reference dose for that substance derived from a similar exposure period.

"Highway" *means any public way for vehicular travel which has been laid out in pursuance of any law of this State, or of the Territory of Illinois, or which has been established by dedication, or used by the public as a highway for 15 years, or which has been or may be laid out and connect a subdivision or platted land with a public highway and which has been dedicated for the use of the owners of* *the land included in the subdivision or platted land where there has been an acceptance and use under such dedication by such owners, and which has not been vacated in pursuance of law. The term "highway" includes rights of way, bridges, drainage structures, signs, guard rails, protective structures and all other structures and appurtenances necessary or convenient for vehicular traffic. A highway in a rural area may be called a "road", while a highway in a municipal area may be called a "street".* (Illinois Highway Code [605 ILCS 5/2-202])

"Highway Authority" means *the Department* of Transportation *with respect to a State highway;* the Illinois State Toll Highway with respect to a toll highway; *the County Board with respect to a county highway or a county unit district road if a discretionary function is involved and the County Superintendent of Highways if a ministerial function is involved; the Highway Commissioner with respect to a township or district road not in a county unit road district; or the corporate authorities of a municipality with respect to a municipal street.* (Illinois Highway Code [605 ILCS 5/2-213])

"Human Exposure Pathway" means a physical condition which may allow for a risk to human health based on the presence of all of the following: contaminants of concern; an exposure route; and a receptor activity at the point of exposure that could result in contaminant of concern intake.

"Industrial/Commercial Property" means any real property that does not meet the definition of residential property, conservation property or agricultural property.

"Infiltration" means the amount of water entering into the ground as a result of precipitation.

"Institutional Control" means a legal mechanism for imposing a restriction on land use, as described in Subpart J.

<u>"Intrusive activities" means activities that would affect potential flow of contaminants into a building (e.g., breaching the integrity of a foundation due to repairs or installation of utilities).</u>

"Land Use Control Memoranda of Agreement" mean agreements entered into between one or more agencies of the United States and the Illinois Environmental Protection Agency that limit or place requirements upon the use of Federally Owned Property for the purpose of protecting human health or the environment.

"Man-Made Pathways" means *constructed* physical conditions *that may allow for the transport of regulated substances including, but not limited to, sewers, utility* *lines, utility* or elevator *vaults, building foundations, basements, crawl spaces, drainage ditches,* ~~*or*~~ *previously excavated and filled areas* or sumps. [415 ILCS 5/58.2]

"Natural Pathways" means *natural* physical conditions that may allow *for the transport of regulated substances including, but not limited to, soil, groundwater, sand seams and lenses, and gravel seams and lenses.* [415 ILCS 5/58.2]

"Person" means an *individual, trust, firm, joint stock company, joint venture, consortium, commercial entity, corporation (including a government corporation), partnership, association, state, municipality, commission, political subdivision of a state, or any interstate body including the United States government and each department, agency, and instrumentality of the United States.* [415 ILCS 5/58.2]

"Point of Human Exposure" means the points at which human exposure to a contaminant of concern may reasonably be expected to occur. The point of human exposure is at the source, unless an institutional control limiting human exposure for the applicable exposure route has been or will be in place, in which case the point of human exposure will be the boundary of the institutional control. Point of human exposure may be at a different location than the point of compliance.

"Populated Area" means:

> an area within the boundaries of a municipality that has a population of 10,000 or greater based on the year 2000 or most recent census; or
>
> an area less than three miles from the boundary of a municipality that has a population of 10,000 or greater based on the year 2000 or most recent census.

"Potable" means *generally fit for human consumption in accordance with accepted water supply principles and practices.* (Illinois Groundwater Protection Act [415 ILCS 55/3(h)])

"PQL" means practical quantitation limit or estimated quantitation limit, which is the lowest concentration that can be reliably measured within specified limits of precision and accuracy for a specific laboratory analytical method during routine laboratory operating conditions in accordance with "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", EPA Publication No. SW-846, incorporated by reference in Section 742.210. When applied to filtered water samples, PQL includes the method detection limit or estimated detection limit in accordance with the applicable method revision in: “Methods for the Determination of Organic Compounds in Drinking Water”, Supplement II”, EPA Publication No. EPA/600/4-88/039; “Methods for the Determination of Organic Compounds in Drinking Water, Supplement III”, EPA Publication No. EPA/600/R-95/131, all of which are incorporated by reference in Section 742.210.

“Q_{soil}” means the volumetric flow rate of soil gas from the subsurface into the enclosed building space.

“RBCA” means Risk Based Corrective Action as defined in ASTM E-1739-95, as incorporated by reference in Section 742.210.

“RCRA” means the Resource Conservation and Recovery Act of 1976 (42 USC ~~U.S.C.~~ 6921).

“Reference Concentration” or “RfC” means an estimate of a daily exposure, in units of milligrams of chemical per cubic meter of air (mg/m^3 ~~(3)~~), to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a portion of a lifetime (up to approximately seven years, subchronic) or for a lifetime (chronic).

“Reference Dose” or “RfD” means an estimate of a daily exposure, in units of milligrams of chemical per kilogram of body weight per day (mg/kg/d), to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a portion of a lifetime (up to approximately seven years, subchronic) or for a lifetime (chronic).

“Regulated Substance” means *any hazardous substance as defined under Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (P.L. 96-510) and petroleum products including crude oil or any fraction thereof, natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).* [415 ILCS 5/58.2]

“Rendered inoperable” means having become unable to operate effectively, including, but not limited to, being shut down as part of routine maintenance or due to a malfunction, power failure, or vandalism.

“Residential Property” *means any real property that is used for habitation by individuals, or* where children have the opportunity for exposure to contaminants through ~~soil~~ ingestion or inhalation (indoor or outdoor) at educational facilities, health care facilities, child care facilities or ~~outdoor~~ recreational areas. [415 ILCS 5/58.2]

"Right of Way" means *the land, or interest therein, acquired for or devoted to a highway*. (Illinois Highway Code [605 ILCS 5/2-217])

"Saturated Zone" means a subsurface zone in which all the interstices or voids are filled with water under pressure greater than that of the atmosphere.

"Similar-Acting Chemicals" are chemical substances that have toxic or harmful effect on the same specific organ or organ system (see Appendix A.Tables E and F for a list of similar-acting chemicals with noncarcinogenic and carcinogenic effects).

"Site" means *any single location, place, tract of land or parcel of property, or portion thereof, including contiguous property separated by a public right-of-way*. [415 ILCS 5/58.2]

"Slurry Wall" means a man-made barrier made of geologic material which is constructed to prevent or impede the movement of contamination into a certain area.

"Soil Gas" means the air existing in void spaces in the soil between the groundwater table and the ground surface.

"Soil Saturation Limit" or "C_{sat}" means the contaminant concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached. Above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals that are liquid at ambient soil temperatures) do not apply, and alternative modeling approaches are required ~~soil pore air and pore water are saturated with the chemical and the adsorptive limits of the soil particles have been reached~~.

"Soil Vapor Saturation Limit" or "C_v^{sat}" means the maximum vapor concentration that can exist in the soil pore air at a given temperature and pressure.

"Solubility" means a chemical specific maximum amount of solute that can dissolve in a specific amount of solvent (groundwater) at a specific temperature.

"SPLP" means Synthetic Precipitation Leaching Procedure (Method 1312) as published in “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods”, USEPA Publication No. SW-846, as incorporated by reference in Section 742.210.

“SSL” means Soil Screening Levels as defined in USEPA’s Soil Screening Guidance: User's Guide and Technical Background Document, as incorporated by reference in Section 742.210.

“State Highway~~highway~~” means State highway as defined in the Illinois Highway Code [605 ILCS 5].

“Stratigraphic Unit” means a site-specific geologic unit of native deposited material and/or bedrock of varying thickness (e.g., sand, gravel, silt, clay, bedrock, etc.). A change in stratigraphic unit is recognized by a clearly distinct contrast in geologic material or a change in physical features within a zone of gradation. For the purposes of this Part, a change in stratigraphic unit is identified by one or a combination of differences in physical features such as texture, cementation, fabric, composition, density, and/or permeability of the native material and/or bedrock.

“Street” means street as defined in the Illinois Highway Code [605 ILCS 5].

“TCLP” means Toxicity Characteristic Leaching Procedure (Method 1311) as published in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", USEPA Publication No. SW-846, as incorporated by reference in Section 742.210.

“Toll Highway~~highway~~” means toll highway as defined in the Illinois Highway Code [605 ILCS 5].

“Total Petroleum Hydrocarbon” or “TPH” means the additive total of all petroleum hydrocarbons found in an analytical sample.

“Township Road~~road~~” means township road as defined in the Illinois Highway Code [605 ILCS 5].

“Unconfined Aquifer” means an aquifer whose upper surface is a water table free to fluctuate under atmospheric pressure.

“Volatile Chemicals” means chemicals with a Dimensionless Henry’s Law Constant of greater than 1.9 x 10^{-2} or a vapor pressure greater than 0.1 Torr (mmHg) at 25°C. For purposes of the indoor inhalation exposure route, elemental mercury is included in this definition.

~~"Volatile Organic Compounds (VOCs)" means organic chemical analytes identified as volatiles as published in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", USEPA Publication No. SW-846 (incorporated by reference in Section 742.210), method numbers 8011, 8015B, 8021B, 8031, 8260B, 8315A, and 8316. For analytes not listed in any category in those methods, those analytes which have a boiling point less than 200° C and a vapor pressure greater than 0.1 Torr (mm Hg) at 20° C.~~

"Water Table" means the top water surface of an unconfined aquifer at atmospheric pressure.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.210 Incorporations by Reference

a) The Board incorporates the following material by reference:

Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs), U.S. Environmental Protection Agency, 1600 Clifton Road, Mailstop F32, Atlanta, Georgia 30333, (770) 488-3357 (November 2007).

ASTM International. ~~American Society for Testing and Materials,~~ 100 Barr Harbor Drive, West Conshohocken~~,~~ PA 19428-2959, (610) 832-9585.

ASTM D 2974-00, Standard Test Methods for Moisture, Ash and Organic Matter of Peat and Other Organic Soils, approved August 10, 2000.

ASTM D 2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), approved February 10, 2000.

ASTM D 1556-00, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method, approved March 10, 2000.

ASTM D 2167-94, Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method, approved March 15, 1994.

ASTM D 2922-01, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth), approved June 10, 2001.

ASTM D 2937-00e1, Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method, approved June 10, 2000.

ASTM D 854-02, Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer, approved July 10, 2002.

ASTM D 2216-98, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass, approved February 10, 1998.

ASTM D 4959-00, Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating, approved March 10, 2000.

ASTM D 4643-00, Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method, approved February 10, 2000.

ASTM D 5084-03, Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, approved November 1, 2003.

ASTM D 422-63 (2002), Standard Test Method for Particle-Size Analysis of Soils, approved November 10, 2002.

ASTM D 1140-00, Standard Test Methods for Amount of Material in Soils Finer than the No. 200 (75 μm) Sieve, approved June 10, 2000.

ASTM D 3017-01, Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth), approved June 10, 2001.

ASTM D 4525-90 (2001), Standard Test Method for Permeability of Rocks by Flowing Air, approved May 25, 1990.

ASTM D 2487-00, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System), approved March 10, 2000.

ASTM D 1945-03, Standard Test Method for Analysis of Natural Gas by Gas Chromatography, approved May 10, 2003.

ASTM D 1946-90, Standard Practice for Analysis of Reformed Gas by Gas Chromatography, approved June 1, 2006.

ASTM E 1527-00, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, approved May 10, 2000. Vol. 11.04.

ASTM E 1739-95 (2002), Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, approved September 10, 1995.

ASTM E 2121-09, Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings, approved November 1, 2009.

ASTM E 2600-10, Standard Practice for Assessment for Vapor Intrusion into Structures on Property Involved in Real Estate Transactions, approved June 2010.

API. American Petroleum Institute, 1220 L Street, NW, Washington DC 20005-4070 (202) 682-8000.

BIOVAPOR-A 1-D Vapor Intrusion Model with Oxygen-Limited Aerobic Biodegradation, Version 2.0 (January 2010).

Barnes, Donald G. and Dourson, Michael. (1988). Reference Dose (RfD): Description and Use in Health Risk Assessments. Regulatory Toxicology and Pharmacology. 8, 471-486.

EPRI. Electric Power Research Institute. 3420 Hillview Avenue, Palo Alto, California 94304. (650) 855-2121.

Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Soil in Illinois: Background PAHs, EPRI, Palo Alto CA, We Energies, Milwaukee WI and IEPA, Springfield IL: 2004. 1011376.

Reference Handbook for Site-Specific Assessment of Subsurface Vapor Intrusion to Indoor Air, Electric Power Research Institute (EPRI), Inc., Program No. 1008492 (March 2005).

GPO. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20401, (202) 783-3238.

USEPA Guidelines for Carcinogenic Risk Assessment, 51 Fed. Reg. 33992-34003 (September 24, 1986).

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", USEPA Publication number SW-846 (Third Edition, Final Update IIIA, April 1998), as amended by Updates I, IIA, III, and IIIA (Document No. 955-001-00000-1).

"Methods for the Determination of Organic Compounds in Drinking Water", EPA Publication No. EPA/600/4-88/039 (December 1988 (Revised July 1991)).

"Methods for the Determination of Organic Compounds in Drinking Water, Supplement I", EPA Publication No. EPA/600/4-90/020 (July 1990).

"Methods for the Determination of Organic Compounds in Drinking Water, Supplement II", EPA Publication No. EPA/600/R-92/129 (August 1992).

"Methods for the Determination of Organic Compounds in Drinking Water, Supplement III", EPA Publication No. EPA/600/R-95/131 (August 1995).

"Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G-9, QAOO Update," EPA/600/R-96/084 (July 2000). Available at www.epa.gov/quality/qs-docs/g9-final.pdf.

"Assessment of Vapor Intrusion in Homes Near the Raymark Superfund Site Using Basement and Sub-Slab Air Samples", EPA Publication No. EPA/600/R-05/147 (March 2006).

"Model Standards and Techniques for Control of Radon in New Residential Buildings" EPA Publication No. EPA/402/R-94/009 (March 1994).

"Radon Reduction Techniques for Existing Detached Houses: Technical Guidance (Third Edition) for Active Soil Depressurization Systems", EPA Publication No. EPA/625/R-93/011 (October 1993).

Illinois Environmental Protection Agency, 1021 N. Grand Ave East, Springfield IL 62701, (217) 785-0830.

"A Summary of Selected Background Conditions for Inorganics in Soil", Publication No. IEPA/ENV/94-161 (August 1994).

IRIS. Integrated Risk Information System, National Center for Environmental Assessment, U.S. Environmental Protection Agency, 26 West Martin Luther King Drive, MS-190, Cincinnati, OH 45268, (513) 569-7254.

"Reference Dose (RfD): Description and Use in Health Risk Assessments", Background Document 1A (March 15, 1993).

"EPA Approach for Assessing the Risks Associated with Chronic Exposures to Carcinogens", Background Document 2 (January 17, 1992).

Johnson, Paul C. (2005). Identification of Application Specific Critical Inputs for the 1991 Johnson and Ettinger Vapor Intrusion Algorithm. Ground Water Monitoring and Remediation. 25(1), 63-78.

Murray, Donald M. and Burmaster, David E. (1995). Residential Air Exchange Rates in the United States: Empirical and Estimated Parametric Distributions by Season and Climatic Region. Risk Analysis. 15(4), 459-465.

Nelson, D.W., and L.E. Sommers (1982). Total carbon, organic carbon, and organic matter. In: A.L. Page (ed.), Methods of Soil Analysis. Part 2. Chemical and Microbiological Properties. 2nd Edition, pp. 539-579, American Society of Agronomy. Madison, WI.

NTIS. National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4600.

"Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites," USEPA Office of Emergency and Remedial Response, OSWER 9285.6-10 (December 2002), PB 2003-104982.

"Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils", OSWER Draft Guidance. EPA Publication No. EPA/530D-02/004 (November 2002).

"Exposures Factors Handbook, Vol. I: General Factors", EPA Publication No. EPA/600/P-95/002Fa (August 1997).

"Exposures Factors Handbook, Vol. II: Food Ingestion Factors", EPA Publication No. EPA/600/P-95/002Fb (August 1997).

“Exposures Factors Handbook, Vol. III: Activity Factors”, EPA Publication No. EPA/600/P-95/002Fc (August 1997).

“Risk Assessment Guidance for Superfund, Vol. I: Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors”, OSWER Directive 9285.6-03 (March 1991).

“Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites~~,~~”, EPA Publication No. EPA/600/8-85/002 (February 1985), PB 85-192219.

~~"Risk Assessment Guidance for Superfund, Volume I; Human Health Evaluation Manual (Part A)", Interim Final, EPA Publication No. EPA/540/1-89/002 (December 1989).~~

~~"Risk Assessment Guidance for Superfund, Volume I; Human Health Evaluation Manual, Supplemental Guidance, Dermal Risk Assessment Interim Guidance", Draft (August 18, 1992).~~

“Risk Assessment Guidance for Superfund, Vol. I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) ~~Interim~~ Final”, EPA Publication No. EPA/540/R/99/005 (~~September 2001~~ July 2004).

“Risk Assessment Guidance for Superfund, Vol. 1: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment) Final”, EPA Publication No. 540-R-070-002 (January 2009).

“Soil Screening Guidance: Technical Background Document”, EPA Publication No. EPA/540/R-95/128, PB 96-963502 (May 1996).

“Soil Screening Guidance: User’s Guide”, EPA Publication No. EPA/540/R-96/018, PB 96-963505 (April 1996).

“Superfund Exposure Assessment Manual”, EPA Publication No. EPA/540/1-88/001 (April 1988).

“Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites”, OSWER Directive 9355.4-24 (December 2002).

“User’s Guide for Evaluating Subsurface Vapor Intrusion into Buildings”, EPA Publication No. EPA/68/W-02/33 (February 2004).

Polynuclear Aromatic Hydrocarbon Background Study, City of Chicago, Illinois, Tetra Tech Em Inc., 200 E. Randolph Drive, Suite 4700, Chicago~~,~~ IL 60601, February 24, 2003.

~~Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Soil in Illinois: Background PAHs, EPRI, Palo Alto, CA, We Energies, Milwaukee, WI, and IEPA, Springfield, IL: 2004. 1011376. EPRI, 3412 Hillview Avenue, Palo Alto, CA 94304, (800) 313-3774.~~

RCRA Facility Investigation Guidance, Interim Final, developed by USEPA (EPA 530/SW-89-031), 4 volumes (May 1989).

United States Environmental Protection Agency, Office of Environmental Information (2000). "Guidance for Data Quality Assessment, Practical Methods for Data Analysis," EPA QA/G-9, QAOO update. EPA Publication No. EPA/600/R-96-084. (Available ~~online~~ at www.epa.gov/oswer/riskassessment/pdf/ucl.pdf).

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United States Environmental Protection Agency, Compendium of Methods for Determination of Toxic Organic Compounds in Ambient Air, Second Edition, EPA Publication No. EPA/625/R-96/010b, January 1999, available at http://www.epa.gov/ttnamti1/files/ambient/airtox/tocomp99.pdf.

United States Environmental Protection Agency, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846 through Revision IVB (February 2007), available at http://www.epa.gov/sw-846/main.htm.

United States Environmental Protection Agency, CFR Promulgated Test Methods, Methods 3C and 16, Technology Transfer Network, Emission Measurement Center (2007), available at http://www.epa.gov/ttn/emc/promgate.html.

United States Environmental Protection Agency. "Guidelines for Carcinogen Risk Assessment (2005)". U. S. Environmental Protection Agency, Washington, DC, EPA Publication No. EPA/630/P-03/001F, 2005. (Available at http://cfpub.epa.gov/ncea/raf/recordisplay.cfm?deid=116283.)

“Vapor Intrusion Pathway: A Practical Guide”, Technical and Regulatory Guidance. Interstate Technology and Regulatory Council (January 2007).

b) CFR (Code of Federal Regulations). Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202)783-3238:

40 CFR 761 (1998).

c) This Section incorporates no later editions or amendments.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.220 Determination of Soil Saturation Limit

a) For any organic contaminant that has a melting point below 30^{o}C, the remediation objective for the outdoor inhalation exposure route developed under Tier 2 shall not exceed the soil saturation limit, as determined under subsection (c)~~ of this Section~~.

b) For any organic contaminant that has a melting point below 30^{o}C, the remediation objective under Tier 2 for the soil component of the groundwater ingestion exposure route shall not exceed the soil saturation limit, as determined under subsection (c)~~ of this Section~~.

c) The soil saturation limit shall be:

1) The value listed in Appendix A, Table A for that specific contaminant;

2) A value derived from Equation S29 in Appendix C, Table A; or

3) A value derived from another method approved by the Agency.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.222 Determination of Soil Vapor Saturation Limit

a) For any volatile chemical, the soil gas remediation objective for the indoor and outdoor inhalation exposure routes developed under Tier 2 shall not exceed the soil vapor saturation limit, as determined under subsection (b).

b) The soil vapor saturation limit shall be:

1) The value listed in Appendix A, Table K for that specific contaminant;

2) A value derived from Equation J&E5 in Appendix C, Table L; or

3) A value derived from another method approved by the Agency.

(Source: Added at 37 Ill. Reg. _____, effective ______)

Section 742.225 Demonstration of Compliance with Soil and Groundwater Remediation Objectives

Compliance with soil and groundwater remediation objectives is achieved if each sample result does not exceed that respective remediation objective unless a person elects to proceed under subsections (c), (d) and (e) ~~of this Section~~.

a) Compliance with groundwater remediation objectives developed under Subparts D through F and H through I shall be demonstrated by comparing the contaminant concentrations of discrete samples at each sample point to the applicable groundwater remediation objective. Sample points shall be determined by the program under which remediation is performed.

b) Unless the person elects to composite samples or average sampling results as provided in subsections (c) and (d) ~~of this Section~~, compliance with soil remediation objectives developed under Subparts D through G and I shall be demonstrated by comparing the contaminant concentrations of discrete samples to the applicable soil remediation objective.

1) Except as provided in subsections (c) and (d) ~~of this Section~~, compositing of samples is not allowed.

2) Except as provided in subsections (c) and (d) ~~of this Section~~, averaging of sample results is not allowed.

3) Notwithstanding subsections (c) and (d) ~~of this Section~~, compositing of samples and averaging of sample results is not allowed for the construction worker population.

4) The number of sampling points required to demonstrate compliance is determined by the requirements applicable to the program under which remediation is performed.

c) If a person chooses to composite soil samples or average soil sample results to demonstrate compliance relative to the soil component of the groundwater ingestion exposure route, the following requirements apply:

1) A minimum of two sampling locations for every 0.5 acre of contaminated area is required, with discrete samples at each sample location obtained at every two feet of depth, beginning at six inches below the ground surface for surface contamination and at the upper limit of contamination for subsurface contamination and continuing through the zone of contamination. Alternatively, a sampling method may be approved by the Agency based on an appropriately designed site-specific evaluation. Samples obtained at or below the water table shall not be used in compositing or averaging.

2) For contaminants of concern other than volatile chemicals ~~organic contaminants~~:

A) Discrete samples from the same boring may be composited; or

B) Discrete sample results from the same boring may be averaged.

3) For volatile chemicals ~~organic contaminants~~:

A) Compositing of samples is not allowed.

B) Discrete sample results from the same boring may be averaged.

4) Composite samples may not be averaged. An arithmetic average may be calculated for discrete samples collected at every two feet of depth through the zone of contamination as specified ~~above~~ in subsection (c)(1) ~~of this Section~~.

d) If a person chooses to composite soil samples or average soil sample results to demonstrate compliance relative to the outdoor inhalation exposure route or ingestion exposure ~~routes~~route, the following requirements apply:

1) A person shall submit a sampling plan for Agency approval, based upon a site-specific evaluation;

2) For volatile chemicals ~~organic contaminants~~, compositing of samples is not allowed; ~~and~~

3) All samples shall be collected within the contaminated area;~~.~~

4) Composite samples may not be averaged. Procedures specified in "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites", USEPA Office of Emergency and Remedial Response, OSWER 9285.6-10 (December 2002), as incorporated by reference in Section 742.210, or an alternative procedure approved by the Agency, shall be used to determine sample averages.

e) When averaging under this Section, if no more than 15% of sample results are reported as "non-detect", "no contamination", "below detection limits", or similar terms, such results shall be included in the averaging calculations as one-half the reported analytical detection limit for the contaminant. However, when performing a test for normal or lognormal distribution for the purpose of calculating a 95% Upper Confidence Limit of the mean for a contaminant, a person may substitute for each non-detect value a randomly generated value between, but not including, zero and the reported analytical detection limit. If more than 15% of sample results are "non-detect", procedures specified in "Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G-9, QA00 Update", EPA/600/R-96/084 (July 2000), as incorporated by reference in Section 742.210, or an alternative procedure approved by the Agency shall be used to address the non-detect values, or another statistically valid procedure approved by the Agency may be used to determine an average.

f) All soil samples collected after August 15, 2001~~,~~ shall be reported on a dry weight basis for the purpose of demonstrating compliance, with the exception of the TCLP and SPLP and the property pH.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.227 Demonstration of Compliance with Soil Gas Remediation Objectives for the Outdoor and Indoor Inhalation Exposure Routes

a) For purposes of the outdoor inhalation exposure route and the indoor inhalation exposure route, compliance with soil gas remediation objectives developed under any tier shall be demonstrated in accordance with this Section by comparing the contaminant concentrations of discrete samples at each sample point to the applicable soil gas remediation objective.

b) This Section applies to exterior soil gas samples for the outdoor inhalation exposure route, near-slab soil gas samples collected outside of an existing building for the indoor inhalation exposure route, and exterior soil gas samples collected at the footprint of a potential building for the indoor inhalation exposure route. Proposals to use sub-slab soil gas data for the indoor inhalation exposure route shall follow Section 742.935(c).

c) Sample points shall be determined by the program under which remediation is performed.

d) When collecting soil gas samples:

1) Use rigid-wall tubing made of nylon or Teflon® or other material approved by the Agency;

2) Use gas-tight, inert containers to hold the sample. For light sensitive or halogenated volatile chemicals, these containers shall be opaque or dark-colored;

3) Purge three volumes before obtaining each discrete soil gas sample;

4) Use a helium tracer or other leak apparatus detection system approved by the Agency; and

5) Limit the flow rate to 200 ml/min.

e) Soil gas samples shall be analyzed using a National Environmental Laboratory Accreditation Program (NELAP) certified laboratory.

f) Soil gas remediation objectives shall be compared to concentrations of soil gas collected at a depth at least 3 feet below ground surface and above the saturated zone.

(Source: Added at 37 Ill. Reg. _____, effective ______)

SUBPART C: EXPOSURE ROUTE EVALUATIONS

Section 742.305 Contaminant Source and Free Product Determination

No exposure route shall be excluded from consideration relative to a contaminant of concern unless the following requirements are met:

a) The sum of the concentrations of all organic contaminants of concern shall not exceed the attenuation capacity of the soil as determined under Section 742.215;

b) The concentrations of any organic contaminants of concern remaining in the soil shall not exceed the soil saturation limit as determined under Section 742.220;

c) Any soil which contains contaminants of concern shall not exhibit any of the characteristics of reactivity for hazardous waste as determined under 35 Ill. Adm. Code 721.123;

d) Any soil which contains contaminants of concern shall not exhibit a pH less than or equal to 2.0 or greater than or equal to 12.5, as determined by SW-846 Method 9040B: pH Electrometric for soils with 20% or greater aqueous (moisture) content or by SW-846 Method 9045C: Soil pH for soils with less than 20% aqueous (moisture) content as incorporated by reference in Section 742.210;

e) Any soil which contains contaminants of concern in the following list of inorganic chemicals or their salts shall not exhibit any of the characteristics of toxicity for hazardous waste as determined by 35 Ill. Adm. Code 721.124: arsenic, barium, cadmium, chromium, lead, mercury, selenium or silver; ~~and~~

f) If contaminants of concern include polychlorinated biphenyls (PCBs), the concentration of any PCBs in the soil shall not exceed 50 parts per million as determined by SW-846 Methods; and~~.~~

g) The concentration of any contaminant of concern in soil gas shall not exceed 10% of its Lower Explosive Limit (LEL) as measured by a hand held combustible gas indicator that has been calibrated to manufacturer specifications.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.310 Outdoor Inhalation Exposure Route

The outdoor inhalation exposure route may be excluded from consideration if:

a) The requirements in subsection (a)(1) or (a)(2) are met:

1) An approved engineered barrier is in place that meets the requirements of Subpart K; or

2) The only contaminants of concern are benzene, toluene, ethylbenzene, and total xylenes, and a demonstration of active biodegradation has been made for benzene, toluene, ethylbenzene, and total xylenes such that no outdoor inhalation exposure will occur. This demonstration shall be submitted to the Agency for review and approval;

b~~a~~) The requirements of Sections 742.300 and 742.305 are met;

~~b) An approved engineered barrier is in place that meets the requirements of Subpart K;~~

c) Safety precautions for the construction worker are taken if the Tier 1 construction worker remediation objectives are exceeded; and

d) An institutional control, in accordance with Subpart J, will be placed on the property.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.312 Indoor Inhalation Exposure Route

The indoor inhalation exposure route may be excluded from consideration if:

a) None of the contaminants of concern are listed on Appendix A, Table J and none of the contaminants of concern are volatile chemicals, as defined in Section 742.200; or

b) The requirements in subsections (b)(1)(A), (B) or (C) and (b)(2) and (b)(3) are met:

1) Exclusion options when the contaminants of concern are volatile chemicals:

A) No building or man-made pathway exists or will be placed above contaminated soil gas or groundwater exceeding Tier 1 remediation objectives for residential property (Appendix B, Table H), provided, however, that there is also no soil or groundwater contamination exceeding Tier 1 remediation objectives for residential property (Appendix B, Table A) or Class I groundwater (Appendix B, Table E) located 5 feet or less, horizontally, from any existing or potential building or man-made pathway; or

B) An approved building control technology is in place or will be placed that meets the requirements of Subpart L; or

C) If the contaminants of concern are benzene, toluene, ethylbenzene, and total xylenes only, a demonstration of active biodegradation has been made for benzene, toluene, ethylbenzene, and total xylenes such that no indoor inhalation exposure will occur. This demonstration shall be submitted to the Agency for review and approval;

2) The requirements of Sections 742.300 and 742.305 are met; and

3) An institutional control, in accordance with Subpart J, will be placed on the property.

(Source: Added at 37 Ill. Reg. _____, effective ______)

SUBPART D: DETERMINING AREA BACKGROUND

Section 742.405 Determination of Area Background for Soil

a) Soil sampling results shall be obtained for purposes of determining area background levels in accordance with the following procedures:

1) For volatile chemicals~~organic contaminants~~, sample results shall be based on discrete samples;

2) Unless an alternative method is approved by the Agency, for contaminants other than volatile chemicals~~organic contaminants~~, sample results shall be based on discrete samples or composite samples. If a person elects to use composite samples, each 0.5 acre of the area to be sampled shall be divided into quadrants and 5 aliquots of equal volume per quadrant shall be composited into 1 sample;

3) Samples shall be collected from similar depths and soil types, which shall be consistent with the depths and soil types in which maximum levels of contaminants are found in the areas of known or suspected releases; and

4) Samples shall be collected from areas of the site or adjacent to the site that are unaffected by known or suspected releases at or from the site. If the sample results show an impact from releases at or from the site, then the sample results shall not be included in determining area background levels under this Part.

b) Area background shall be determined according to one of the following approaches:

1) Statewide Area Background Approach:

A) The concentrations of inorganic chemicals in background soils listed in Appendix A, Table G may be used as the upper limit of the area background concentration for the site. The first column to the right of the chemical name presents inorganic chemicals in background soils for counties within Metropolitan Statistical Areas. Counties within Metropolitan Statistical Areas are identified in Appendix A, Table G, Footnote a. Sites located in counties outside Metropolitan Statistical Areas shall use the concentrations of inorganic chemicals in background soils shown in the second column to the right of the chemical name.

B) Soil area background concentrations determined according to this statewide area background approach shall be used as provided in Section 742.415(b) of this Part. For each parameter whose sampling results demonstrate concentrations above those in Appendix A, Table G, the person shall develop appropriate soil remediation objectives in accordance with this Part, or may determine area background in accordance with subsection (b)(2) ~~of this Section~~.

2) A statistically valid approach for determining area background concentrations appropriate for the characteristics of the data set, and approved by the Agency.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

SUBPART E: TIER 1 EVALUATION

Section 742.500 Tier 1 Evaluation Overview

a) A Tier 1 evaluation compares the concentration of each contaminant of concern detected at a site to the baseline remediation objectives provided in Appendix B, Tables A, B, C, D~~,~~ ~~and~~ E, G, H and I. Use of Tier 1 remediation objectives requires only limited site-specific information: concentrations of contaminants of concern, groundwater classification, land use classification, and, if appropriate, soil pH. (See Appendix B, Illustration A.)

b) Although Tier 1 allows for differentiation between residential and industrial/commercial property use of a site, an institutional control under Subpart J is required where remediation objectives are based on an industrial/commercial property use.

c) For the indoor inhalation exposure route:

1) Appendix B, Tables H and I apply only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls; and

2) Institutional controls under Subpart J are required to use remediation objectives in Appendix B, Table H or Table I.

d~~e~~) Any given exposure route is not a concern if the concentration of each contaminant of concern detected at the site is below the Tier 1 value of that given route. In such a case, no further evaluation of that route is necessary.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.505 Tier 1 Soil, Soil Gas and Groundwater Remediation Objectives

a) Soil

1) Outdoor Inhalation Exposure Route

A) The Tier 1 soil remediation objectives for this exposure route based upon residential property use are listed in Appendix B, Table A.

B) The Tier 1 soil remediation objectives for this exposure route based upon industrial/commercial property use are listed in Appendix B, Table B. Soil remediation objective determinations relying on this table require use of institutional controls in accordance with Subpart J.

C) For this exposure route, it is acceptable to determine compliance by meeting either the soil or soil gas remediation objectives.

2) Ingestion Exposure Route

A) The Tier 1 soil remediation objectives for this exposure route based upon residential property use are listed in Appendix B, Table A.

B) The Tier 1 soil remediation objectives for this exposure route based upon industrial/commercial property use are listed in Appendix B, Table B. Soil remediation objective determinations relying on this table require use of institutional controls in accordance with Subpart J.

3) Soil Component of the Groundwater Ingestion Route

A) The Tier 1 soil remediation objectives for this exposure route based upon residential property use are listed in Appendix B, Table A.

B) The Tier 1 soil remediation objectives for this exposure route based upon industrial/commercial property use are listed in Appendix B, Table B.

C) The pH-dependent Tier 1 soil remediation objectives for identified ionizable organics or inorganics for the soil component of the groundwater ingestion exposure route (based on the total amount of contaminants present in the soil sample results and groundwater classification) are provided in Appendix B, Tables C and D.

D) Values used to calculate the Tier 1 soil remediation objectives for this exposure route are listed in Appendix B, Table F.

4) Evaluation of the dermal contact with soil exposure route is not required under Tier 1.

b) Soil Gas

1) Outdoor Inhalation Exposure Route

A) The Tier 1 soil gas remediation objectives for this exposure route based upon residential property use are listed in Appendix B, Table G.

B) The Tier 1 soil gas remediation objectives for this exposure route based upon industrial/commercial property use, including the construction worker population, are listed in Appendix B, Table G. Soil gas remediation objective determinations relying on an industrial/commercial scenario require use of institutional controls in accordance with Subpart J.

C) For this exposure route, it is acceptable to determine compliance by meeting either the soil or soil gas remediation objectives.

2) Indoor Inhalation Exposure Route

A) The Tier 1 soil gas remediation objectives for this exposure route are listed in Appendix B, Tables H and I.

B) The Tier 1 soil gas remediation objectives for this exposure route are based on a default water-filled soil porosity value of 0.15 cm^3/cm^3 and the assumed presence of a building with a 10-cm thick, full concrete slab-on-grade.

C) Appendix B, Table H shall be used when any soil or groundwater contamination is located 5 feet or less, vertically or horizontally, from the existing or potential building or man-made pathway. In this scenario, the mode of contaminant transport is both diffusion and advection, which sets the Q_{soil} value at 83.33 cm^3/sec. Appendix B, Table H applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. Pursuant to Section 742.1000(a)(9), soil gas remediation objective determinations relying on Appendix B, Table H require the use of institutional controls in accordance with Subpart J.

D) Appendix B, Table I may be used only when all soil and groundwater contamination is located more than 5 feet, vertically and horizontally, from the existing or potential building or man-made pathway. In this scenario, the mode of contaminant transport is diffusion only, which sets the Q_{soil} value at 0.0 cm^3/sec. Appendix B, Table I applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. Pursuant to Section 742.1000(a)(7) and (a)(9), soil gas remediation objective determinations relying on Appendix B, Table I require the use of institutional controls in accordance with Subpart J. As an alternative to using Appendix B, Table I, it is permissible to use Appendix B, Table H.

E) To determine whether the Q_{soil} value can be set at 0.0 cm^3/sec, the site evaluator shall demonstrate that all soil and groundwater located 5 feet or less, vertically or horizontally, from the existing or potential building or man-made pathway meets the Tier 1 remediation objectives for residential property listed in Appendix B, Table A, and the Tier 1 remediation objectives for Class I groundwater listed in Appendix B, Table E, respectively.

~~b~~c) Groundwater

1) The Tier 1 groundwater remediation objectives for the groundwater component of the groundwater ingestion route are listed in Appendix B, Table E.

2) The Tier 1 groundwater remediation objectives for this exposure route are given for Class I and Class II groundwaters, respectively.

3) The evaluation of 35 Ill. Adm. Code 620.615 regarding mixtures of similar-acting chemicals shall be considered satisfied for Class I groundwater at the point of human exposure if:

A) No more than one similar-acting noncarcinogenic chemical as listed in Appendix A, Table E is detected in the groundwater at the site; and

B) No carcinogenic contaminant of concern as listed in Appendix A, Table I is detected in any groundwater sample associated with the site, using analytical procedures capable of achieving either the 1 in 1,000,000 cancer risk concentration or the ADL, whichever is greater.

4) If the conditions of subsection (c)(3)~~(b)(3)~~ of this Section are not met, the Class I groundwater remediation objectives set forth in Appendix B, Table E shall be corrected for the cumulative effect of mixtures of similar-acting chemicals using the following methodologies:

A) For noncarcinogenic chemicals, the methodologies set forth at Section 742.805(c) or Section 742.915(h) shall be used; and

B) For carcinogenic chemicals, the methodologies set forth at Section 742.805(d) or Section 742.915(h) shall be used.

5) For the groundwater component of the indoor inhalation exposure route, the Tier 1 groundwater remediation objectives are listed in Appendix B, Tables H and I.

A) The Tier 1 groundwater remediation objectives for this exposure route are based on a default water-filled soil porosity value of 0.15 cm^3/cm^3 and the assumed presence of a building with a 10-cm thick, full concrete slab-on-grade.

B) Appendix B, Table H shall be used when any soil or groundwater contamination is located 5 feet or less, vertically or horizontally, from the existing or potential building or man-made pathway. In this scenario, the mode of contaminant transport is both diffusion and advection, which sets the Q_{soil} value at 83.33 cm^3/sec. Appendix B, Table H applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. Pursuant to Section 742.1000(a)(9), groundwater remediation objective determinations relying on Appendix B, Table H require the use of institutional controls in accordance with Subpart J.

C) Appendix B, Table I may be used only when all soil and groundwater contamination is located more than 5 feet, vertically and horizontally, from the existing or potential building or man-made pathway. In this scenario, the mode of contaminant transport is diffusion only, which sets the Q_{soil} value at 0.0 cm^3/sec. Appendix B, Table I applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. Pursuant to Section 742.1000(a)(7) and (a)(9), groundwater remediation objective determinations relying on Appendix B, Table I require the use of institutional controls in accordance with Subpart J. As an alternative to using Appendix B, Table I, it is permissible to use Appendix B, Table H.

D) To determine whether the Q_{soil} value can be set at 0.0 cm^3/sec, the site evaluator shall demonstrate that all soil and groundwater located 5 feet or less, vertically or horizontally, from the existing or potential building or man-made pathway meets the Tier 1 remediation objectives for residential property listed in Appendix B, Table A, and the Tier 1 remediation objectives for Class I groundwater listed in Appendix B, Table E, respectively.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.510 Tier 1 Remediation Objectives Tables for the Ingestion, Outdoor

<u>Inhalation and Soil Component of the Groundwater Ingestion Exposure Routes</u>

a) Soil remediation objectives are listed in Appendix B, Tables A, B, C and D.

1) Appendix B, Table A is based upon residential property use.

A) The first column to the right of the chemical name lists soil remediation objectives for the soil ingestion exposure route.

B) The second column lists the soil remediation objectives for the <u>outdoor</u> inhalation exposure route.

C) The third and fourth columns list soil remediation objectives for the soil component of the groundwater ingestion exposure route for the respective classes of groundwater:

i) Class I groundwater; and

ii) Class II groundwater.

D) The final column lists the Acceptable Detection Limit (ADL), only <u>when</u>~~where~~ applicable.

2) Appendix B, Table B is based upon industrial/commercial property use.

A) The first and third columns to the right of the chemical name list the soil remediation objectives for the soil ingestion exposure route based on two receptor populations:

i) Industrial/commercial; and

ii) Construction worker.

B) The second and fourth columns to the right of the chemical name list the soil remediation objectives for the <u>outdoor</u> inhalation exposure route based on two receptor populations:

i) Industrial/commercial; and

ii) Construction worker.

C) The fifth and sixth columns to the right of the chemical name list the soil remediation objectives for the soil component of the groundwater ingestion exposure route for two classes of groundwater:

i) Class I groundwater; and

ii) Class II groundwater.

D) The final column lists the acceptable detection limit (ADL), only when applicable.

3) Appendix B, Tables C and D set forth pH specific soil remediation objectives for inorganic and ionizing organic chemicals for the soil component of the groundwater ingestion route.

A) Table C sets forth remediation objectives based on Class I groundwater and Table D sets forth remediation objectives based on Class II groundwater.

B) The first column in Tables C and D lists the chemical names.

C) The second through ninth columns to the right of the chemical names list the pH based soil remediation objectives.

4) For the inorganic chemicals listed in Appendix B, Tables A and B, the soil component of the groundwater ingestion exposure route shall be evaluated using TCLP (SW-846 Method 1311) or SPLP (SW-846 Method 1312), incorporated by reference at Section 742.210 unless a person chooses to evaluate the soil component on the basis of the total amount of contaminant in a soil sample result in accordance with subsection (a)(5) of this Section.

5) For those inorganic and ionizing organic chemicals listed in Appendix B, Tables C and D, if a person elects to evaluate the soil component of the groundwater ingestion exposure route based on the total amount of contaminant in a soil sample result (rather than TCLP or SPLP analysis), the person shall determine the soil pH at the site and then select the appropriate soil remediation objectives based on Class I and Class II groundwaters from Tables C and D, respectively. If the soil pH is less than 4.5 or greater than 9.0, then Tables C and D cannot be used.

6) Unless one or more exposure routes are excluded from consideration

under Subpart C, the most stringent soil remediation objective of the exposure routes (i.e., soil ingestion exposure route, outdoor inhalation exposure route, and soil component of the groundwater ingestion exposure route) shall be compared to the concentrations of soil contaminants of concern measured at the site. When using Appendix B, Table B to select soil remediation objectives for the ingestion exposure route and outdoor inhalation exposure routes ~~route~~, the remediation objective shall be the more stringent soil remediation objective of the industrial/commercial populations and construction worker populations.

7) Confirmation sample results may be averaged or soil samples may be composited in accordance with Section 742.225.

8) If a soil remediation objective for a chemical is less than the ADL, the ADL shall serve as the soil remediation objective.

b) Groundwater remediation objectives for the groundwater component of the groundwater ingestion exposure route are listed in Appendix B, Table E. However, Appendix B, Table E must be corrected for cumulative effect of mixtures of similar-acting noncarcinogenic chemicals as set forth in Section 742.505(c~~b~~)(3) and (c)(4).

1) The first column to the right of the chemical name lists groundwater remediation objectives for Class I groundwater, and the second column lists the groundwater remediation objectives for Class II groundwater.

2) To use Appendix B, Table E of this Part, the 35 Ill. Adm. Code 620 classification for groundwater at the site shall be determined. The concentrations of groundwater contaminants of concern at the site are compared to the applicable Tier 1 groundwater remediation objectives for the groundwater component of the groundwater ingestion exposure route in Appendix B, Table E.

c) Soil gas remediation objectives for the outdoor inhalation exposure route are listed in Appendix B, Table G.

1) The first column to the right of the chemical name lists the soil gas remediation objectives for residential populations.

2) The second and third columns to the right of the chemical names list the soil gas remediation objectives for the outdoor inhalation exposure route based on two receptor populations:

A) Industrial/commercial; and

B) Construction worker.

~~c~~d) For contaminants of concern not listed in Appendix B, Tables A, B ~~and~~ , E, and G, a person may request site-specific remediation objectives from the Agency or propose site-specific remediation objectives in accordance with 35 Ill. Adm. Code 620, Subpart I of this Part, or both.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.515 Tier 1 Remediation Objectives Tables for the Indoor Inhalation Exposure Route

a) For the indoor inhalation exposure route:

1) Appendix B, Tables H and I apply only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls; and

2) Institutional controls under Subpart J are required to use remediation objectives in Appendix B, Table H or Table I.

b) When the mode of contaminant transport is both diffusion and advection as described in Section 742.505 (i.e., any soil or groundwater contamination is located 5 feet or less, vertically or horizontally, from the existing or potential building or man-made pathway), the remediation objectives for soil gas or groundwater listed in Appendix B, Table H shall be used.

1) The first column to the right of the chemical name lists the soil gas remediation objectives for residential receptors.

2) The second column lists the soil gas remediation objectives for industrial/commercial receptors.

3) The third column lists the groundwater remediation objectives for residential receptors.

4) The fourth column lists the groundwater remediation objectives for industrial/commercial receptors.

c) Only when the mode of contaminant transport is diffusion only as described in Section 742.505 (i.e., all soil and groundwater contamination is located more than 5 feet, vertically and horizontally, from the existing or potential building or man-made pathway), the remediation objectives for soil gas and groundwater listed in Appendix B, Table I may be used.

1) The first column to the right of the chemical name lists the soil gas remediation objectives for residential receptors.

2) The second column lists the soil gas remediation objectives for industrial/commercial receptors.

3) The third column lists the groundwater remediation objectives for residential receptors.

4) The fourth column lists the groundwater remediation objectives for industrial/commercial receptors.

d) If using Appendix B, Table H, compliance is determined by meeting either the soil gas remediation objectives or the groundwater remediation objectives.

e) If using Appendix B, Table I, compliance is determined by meeting both the soil gas remediation objectives and the groundwater remediation objectives.

f) For volatile chemicals not listed in Appendix B, Table H or I, a person may request site-specific remediation objectives from the Agency or propose site-specific remediation objectives in accordance with Subpart I, or both.

g) As an alternative to using Appendix B, Table I pursuant to subsection (c), it is permissible to use Appendix B, Table H pursuant to subsection (b).

(Source: Added at 37 Ill. Reg. _____, effective ______)

SUBPART F: TIER 2 GENERAL EVALUATION

Section 742.600 Tier 2 Evaluation Overview

a) Tier 2 remediation objectives are developed through the use of equations which allow site-specific data to be used. (See Appendix C, Illustrations A and B.) The equations, identified in Appendix C, Tables A, ~~and~~ C, and L may be used to develop Tier 2 remediation objectives.

b) Tier 2 evaluation is only required for contaminants of concern and corresponding exposure routes (except where excluded from further consideration under Subpart C) exceeding the Tier 1 remediation objectives. When conducting Tier 2 evaluations, the values used in the calculations must have the appropriate units of measure as identified in Appendix C, Tables B, ~~and~~ D, and M.

c) Any development of remediation objectives using site-specific information or equations outside the Tier 2 framework shall be evaluated under Tier 3.

d) Any development of a remediation objective under Tier 2 shall not use a target hazard quotient greater than one at the point of human exposure or a target cancer risk greater than 1 in 1,000,000 at the point of human exposure.

e) In conducting a Tier 2 evaluation, the following conditions shall be met:

1) For each discrete sample, the total soil contaminant concentration of either a single contaminant or multiple contaminants of concern shall not exceed the attenuation capacity of the soil as provided in Section 742.215.

2) Remediation objectives for noncarcinogenic compounds which affect the same target organ, organ system or similar mode of action shall meet the requirements of Section 742.720.

3) The soil remediation objectives based on the outdoor inhalation exposure route ~~inhalation~~ and the soil component of the groundwater ingestion exposure routes shall not exceed the soil saturation limit as provided in Section 742.220.

4) The soil gas remediation objectives based on the indoor and outdoor inhalation exposure routes shall not exceed the soil vapor saturation limit provided pursuant to Section 742.222.

f) Tier 2 remediation objectives for the indoor inhalation exposure route shall be calculated for either soil gas or groundwater if a Q_{soil} value of 83.33 cm^3/sec is used.

g) Tier 2 remediation objectives for the indoor inhalation exposure route shall be calculated for both soil gas and groundwater if a Q_{soil} value of 0.0 cm^3/sec is used.

~~f~~h) If the calculated Tier 2 soil remediation objective for an applicable exposure route is more stringent than the corresponding Tier 1 remediation objective, then the Tier 1 remediation objective applies.

~~g~~i) If the calculated Tier 2 soil remediation objective for an exposure route is more stringent than the Tier 1 soil remediation objectives ~~objective(s)~~ for the other exposure routes, then the Tier 2 calculated soil remediation objective applies and Tier 2 soil remediation objectives for the other exposure routes are not required.

~~h~~j) If the calculated Tier 2 soil remediation objective is less stringent than one or more of the soil remediation objectives for the remaining exposure routes, then the Tier 2 values are calculated for the remaining exposure routes ~~route(s)~~ and the most stringent Tier 2 calculated value applies.

k) If a contaminant has both carcinogenic and noncarcinogenic effects for any applicable exposure route or receptor, remediation objectives shall be calculated for each effect and the more stringent remediation objective shall apply. The toxicological-specific information is described in Section 742.705(d).

l) For the indoor inhalation exposure route:

1) Appendix C, Table L applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls; and

2) Institutional controls under Subpart J are required to develop remediation objectives pursuant to Appendix C, Table L.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.605 Land Use

a) Present and post-remediation land use is evaluated in a Tier 2 evaluation. Acceptable exposure factors for the Tier 2 evaluation for residential, industrial/commercial, and construction worker populations are provided in the far right column of Appendix C, Tables B, ~~and~~ D, and M. Use of exposure factors different from those in Appendix C, Tables B, ~~and~~ D, and M must be approved by the Agency as part of a Tier 3 evaluation.

b) If a Tier 2 evaluation is based on an industrial/commercial property use, then:

1) Construction worker populations shall also be evaluated, except for the indoor inhalation exposure route; and

2) Institutional controls are required in accordance with Subpart J.

c) For the indoor inhalation exposure route, institutional controls under Subpart J are required to develop remediation objectives pursuant to Appendix C, Table L.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.610 Chemical and Site Properties

a) Physical and Chemical Properties of Contaminants

Tier 2 evaluations require information on the physical and chemical properties of the contaminants of concern. The physical and chemical properties used in a Tier 2 evaluation are contained in Appendix C, Table E. If the site has contaminants not included in this table, a person may request the Agency to provide the applicable physical and chemical input values or may propose input values under Subpart I. If a person proposes to apply values other than those in Appendix C, Table E, or those provided by the Agency, the evaluation shall be considered under Tier 3.

b) Soil and Groundwater Parameters

1) A Tier 2 evaluation requires examination of soil and groundwater parameters. The parameters that may be varied, and the conditions under which these parameters are determined as part of Tier 2, are summarized in Appendix C, Tables B, ~~and~~ D, and M. If a person proposes to vary site-specific parameters outside of the framework of these tables, the evaluation shall be considered under Tier 3.

2) To determine site-specific physical soil parameters, a minimum of one boring per 0.5 acre of contamination shall be collected. This boring must be deep enough to allow the collection of the required field measurements. The site-specific physical soil parameters must be determined from the portion of the boring representing the stratigraphic units ~~unit(s)~~ being evaluated. For example, if evaluating the soil component of the groundwater ingestion exposure route, two samples from the boring will be required:

A) A sample of the predominant soil type for the vadose zone; and

B) A sample of the predominant soil type for the saturated zone.

3) A site-specific SSL dilution factor (used in developing soil remediation

objectives based upon the protection of groundwater) may be determined by substituting site information in Equation S22 in Appendix C, Table A. To make this demonstration, a minimum of three monitoring wells shall be used to determine the hydraulic gradient. As an alternative, the default dilution factor value listed in Appendix C, Table B may be used. If monitoring wells are used to determine the hydraulic gradient, the soil taken from the borings shall be visually inspected to ensure there are no significant differences in the stratigraphy. If there are similar soil types in the field, one boring shall be used to determine the site-specific physical soil parameters. If there are significant differences, all of the borings shall be evaluated before determining the site-specific physical soil parameters for the site.

4) Not all of the parameters identified in Appendix C, Tables B, ~~and~~ D, and M need to be determined on a site-specific basis. A person may choose to collect partial site-specific information and use default values as listed in Appendix C, Tables B, ~~and~~ D, and M for the rest of the parameters.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

SUBPART G: TIER 2 SOIL AND SOIL GAS EVALUATION

Section 742.700 Tier 2 Soil and Soil Gas Evaluation Overview

a) Tier 2 remediation objectives are developed through the use of models which allow site-specific data to be considered. Appendix C, Tables A, ~~and~~ C, and L list equations that shall be used under a Tier 2 evaluation to calculate soil remediation objectives prescribed by the SSL, ~~and~~ RBCA, and modified J&E models, respectively. (See also Appendix C, Illustration A.)

b) Appendix C, Table A lists equations that are used under the SSL model. (See also Appendix C, Illustration A.) The SSL model has equations to evaluate the following human exposure routes:

1) Soil ingestion exposure route;

2) Outdoor Inhalation exposure route ~~for:~~; and

~~A) Organic contaminants;~~

~~B) Fugitive dust; and~~

3) Soil component of the groundwater ingestion exposure route.

c) Evaluation of the dermal exposure route is not required under the SSL model.

d) Appendix C, Table C lists equations that are used under the RBCA model. (See also Appendix C, Illustration A.) The RBCA model has equations to evaluate human exposure based on the following:

1) The combined exposure routes of outdoor inhalation of vapors and particulates, soil ingestion and dermal contact with soil;

2) The ~~ambient vapor inhalation (outdoor)~~ outdoor inhalation exposure route from subsurface soils;

3) Soil component of the groundwater ingestion exposure route; and

4) Groundwater ingestion exposure route.

e) Appendix C, Table L lists equations that are used under the modified J&E model. The modified J&E model has equations to evaluate human exposure by the indoor inhalation exposure route. The modified model allows for the development of soil gas remediation objectives. For the indoor inhalation exposure route:

1) Appendix C, Table L applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls; and

2) Institutional controls under Subpart J are required to develop soil gas remediation objectives pursuant to Appendix C, Table L.

f~~e~~) The equations in either Appendix C, Table A~~, or~~ C, or L may be used to calculate remediation objectives for each contaminant of concern under Tier 2, if the following requirements are met:

1) The Tier 2 soil or soil gas remediation objectives for the ingestion and outdoor inhalation exposure routes shall use the applicable equations from the same approach (i.e., SSL equations in Appendix C, Table C). For the indoor inhalation exposure route, only the J&E equations can be used.

2) The equations used to calculate soil remediation objectives for the soil component of the groundwater ingestion exposure route are not dependent on the approach utilized to calculate soil remediation objectives for the

other exposure routes. For example, it is acceptable to use the SSL equations for calculating Tier 2 soil remediation objectives for the ingestion and outdoor inhalation exposure routes, and the RBCA equations for calculating Tier 2 soil remediation objectives for the soil component of the groundwater ingestion exposure route.

3) Combining equations from Appendix C, Tables A, ~~and~~ C, and L to form a new model is not allowed. In addition, Appendix C, Tables A, ~~and~~ C, and L must use their own applicable parameters identified in Appendix C, Tables B, ~~and~~ D, and M, respectively.

g~~f~~) In calculating soil or soil gas remediation objectives for industrial/commercial property use, applicable calculations shall be performed twice: once using industrial/commercial population default values and once using construction worker population default values. The more stringent soil or soil gas remediation objectives derived from these calculations must be used for further Tier 2 evaluations. The indoor inhalation exposure route does not apply to the construction worker population.

h~~g~~) Tier 2 data sheets provided by the Agency shall be used to present calculated Tier 2 remediation objectives, if required by the particular program for which remediation is being performed.

i~~h~~) The RBCA equations which rely on the parameter Soil Water Sorption Coefficient (k_s) can only be used for ionizing organics and inorganics by substituting values for k_s from Appendix C, Tables I and J, respectively. This will also require the determination of a site-specific value for soil pH.

j) For the outdoor inhalation exposure route, it is acceptable to use either Section 742.710 to develop a soil remediation objective or Section 742.712 to develop a soil gas remediation objective to determine compliance with the pathway.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.705 Parameters for Soil Remediation Objective Equations

a) Appendix C, Tables B, ~~and~~ D, and M list the input parameters for the SSL, ~~and~~ RBCA, and J&E equations, respectively. The first column lists each symbol as it is presented in the equation. The next column defines the parameters. The third column shows the units for the parameters. The fourth column identifies where information on the parameters can be obtained (i.e., field measurement, applicable equations~~equation(s)~~, reference source, or default value). The last column identifies how the parameters can be generated.

b) Default Values

Default values are numerical values specified for use in the Tier 2 equations. The fourth column of Appendix C, Tables B~~,~~ ~~and~~ D, and M denotes if the default values are from the SSL model, RBCA model, modified J&E model or some other source. The last column of Appendix C, Tables B~~,~~ ~~and~~ D, and M lists the numerical values for the default values used in the SSL~~,~~ ~~and~~ RBCA, and J&E equations, respectively.

c) Site-specific Information

Site-specific information is a parameter measured, obtained, or determined from the site to calculate Tier 2 remediation objectives. The fourth column of Appendix C, Tables B~~,~~ ~~and~~ D, and M identifies those site-specific parameters that may require direct field measurement. For some parameters, numerical default inputs have been provided in the last column of Appendix C, Tables B~~,~~ ~~and~~ D, and M to substitute for site-specific information. In some cases, information on the receptor or soil type is required to select the applicable numerical default inputs. Site-specific information includes:

1) Physical soil parameters identified in Appendix C, Table F. The second column identifies the location where the sample is to be collected. Acceptable methods for measuring or calculating these soil parameters are identified in the last column of Appendix C, Table F;

2) Institutional controls or engineered barriers, pursuant to Subparts J and K, describe applicable institutional controls and engineered barriers under a Tier 2 evaluation; and

3) Land use classification

d) Toxicological-specific Information

1) Toxicological-specific information is used to calculate Tier 2 remediation objectives for the following parameters, if applicable:

A) Oral Chronic Reference Dose (RfD_o, expressed in mg/kg-d);

B) Oral Subchronic Reference Dose (RfD_s, expressed in mg/kg-d, shall be used for construction worker remediation objective calculations);

C) Oral Slope Factor (SF_o, expressed in $(mg/kg\text{-}d)^{-1}$);

D) Inhalation Unit Risk Factor (URF expressed in $(\mu g/m^3)^{-1}$);

E) Inhalation Chronic Reference Concentration (RfC, expressed in mg/m^3);

F) Inhalation Subchronic Reference Concentration (RfC_s, expressed in mg/m^3, shall be used for construction worker remediation objective calculations);

G) Inhalation Chronic Reference Dose (RfD_i, expressed in mg/kg-d);

H) Inhalation Subchronic Reference Dose (RfD_{is}, expressed in mg/kg-d, shall be used for construction worker remediation objective calculations); and

I) Inhalation Slope Factor (SF_i, expressed in $(mg/kg\text{-}d)^{-1}$);

2) Toxicological information can be obtained ~~from IRIS~~ by following the guidelines in OSWER Directive 9285.7-53, as incorporated by reference in Section 742.210, or the program under which the remediation is being performed.

e) Chemical-specific Information
Chemical-specific information used to calculate Tier 2 remediation objectives is listed in Appendix C, Table E.

f) Calculations
Calculating numerical values for some parameters requires the use of equations listed in Appendix C, Tables~~Table~~ A, ~~or~~ C, and L. The parameters that are calculated are listed in Appendix C, Tables B, ~~and~~ D, and M.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.710 SSL Soil Equations

a) This Section sets forth the equations and parameters used to develop Tier 2 soil remediation objectives for the three exposure routes using the SSL approach.

b) Soil Ingestion Exposure Route

1) Equations S1 through S3 form the basis for calculating Tier 2 remediation objectives for the soil ingestion exposure route using the SSL approach. Equation S1 is used to calculate soil remediation objectives for noncarcinogenic contaminants. Equations S2 and S3 are used to calculate soil remediation objectives for carcinogenic contaminants for residential populations and industrial/commercial and construction worker populations, respectively.

2) For Equations S1 through S3, the SSL default values cannot be modified with site-specific information.

c) Outdoor Inhalation Exposure Route

1) Equations S4 through S16, S26 and S27 are used to calculate Tier 2 soil remediation objectives for the outdoor inhalation exposure route using the SSL approach. To address this exposure route, organic contaminants and mercury must be evaluated separately from fugitive dust using their own equations set forth in subsections (c)(2) and (c)(3)~~ of this Section~~, respectively.

2) Organic Contaminants

A) Equations S4 through S10 are used to calculate Tier 2 soil remediation objectives for organic contaminants and mercury based on the outdoor inhalation exposure route. Equation S4 is used to calculate soil remediation objectives for noncarcinogenic organic contaminants in soil for residential and industrial/commercial populations. Equation S5 is used to calculate soil remediation objectives for noncarcinogenic organic contaminants and mercury in soil for construction worker populations. Equation S6 is used to calculate soil remediation objectives for carcinogenic organic contaminants in soil for residential and industrial/commercial populations. Equation S7 is used to calculate soil remediation objectives for carcinogenic organic contaminants in soil for construction worker populations. Equations S8 through S10, S27 and S28 are used for calculating numerical values for some of the parameters in Equations S4 through S7.

B) For Equation S4, a numerical value for the Volatilization Factor

(VF) can be calculated in accordance with subsection (c)(2)(F)~~ of this Section~~. The remaining parameters in Equation S4 have either SSL default values listed in Appendix C, Table B or toxicological-specific information (i.e., RfC), which can be obtained ~~from IRIS~~ by following the guidelines in OSWER Directive 9285.7-53, as incorporated by reference in Section 742.210 or requested from the program under which the remediation is being performed.

C) For Equation S5, a numerical value for the Volatilization Factor adjusted for Agitation (VF') can be calculated in accordance with subsection (c)(2)(G)~~ of this Section~~. The remaining parameters in Equation S5 have either SSL default values listed in Appendix C, Table B or toxicological-specific information (i.e., RfC), which can be obtained ~~from IRIS~~ by following the guidelines in OSWER Directive 9285.7-53, as incorporated by reference in Section 742.210 or requested from the program under which the remediation is being performed.

D) For Equation S6, a numerical value for VF can be calculated in accordance with subsection (c)(2)(F)~~ of this Section~~. The remaining parameters in Equation S6 have either default values listed in Appendix C, Table B or toxicological-specific information (i.e., URF), which can be obtained ~~from IRIS~~ by following the guidelines in OSWER Directive 9285.7-53, as incorporated by reference in Section 742.210 or requested from the program under which the remediation is being performed.

E) For Equation S7, a numerical value for VF' can be calculated in accordance with subsection (c)(2)(G)~~ of this Section~~. The remaining parameters in Equation S7 have either default values listed in Appendix C, Table B or toxicological-specific information (i.e., URF), which can be obtained ~~from IRIS~~ by following the guidelines in OSWER Directive 9285.7-53, as incorporated by reference in Section 742.210 or requested from the program under which the remediation is being performed.

F) The VF can be calculated for residential and industrial/commercial populations using one of the following equations based on the information known about the contaminant source and receptor population:

i) Equation S8, in conjunction with Equation S10, is used to calculate VF assuming an infinite source of contamination; or

ii) If the area and depth of the contaminant source are known or can be estimated reliably, mass limit considerations may be used to calculate VF using Equation S26.

G) The VF' can be calculated for the construction worker populations using one of the following equations based on the information known about the contaminant source:

i) Equation S9 is used to calculate VF' assuming an infinite source of contamination; or

ii) If the area and depth of the contaminant source are known or can be estimated reliably, mass limit considerations may be used to calculate VF' using Equation S27.

3) Fugitive Dust

A) Equations S11 through S16 are used to calculate Tier 2 soil remediation objectives using the SSL fugitive dust model for the <u>outdoor</u> inhalation exposure route. Equation S11 is used to calculate soil remediation objectives for noncarcinogenic contaminants in fugitive dust for residential and industrial/commercial populations. Equation S12 is used to calculate soil remediation objectives for noncarcinogenic contaminants in fugitive dust for construction worker populations. Equation S13 is used to calculate soil remediation objectives for carcinogenic contaminants in fugitive dust for residential and industrial/commercial populations. Equation S14 is used to calculate soil remediation objectives for carcinogenic contaminants in fugitive dust for construction worker populations. Equations S15 and S16 are used for calculating numerical quantities for some of the parameters in Equations S11 through S14.

B) For Equation S11, a numerical value can be calculated for the Particulate Emission Factor (PEF) using Equation S15. This equation relies on various input parameters from a variety of sources. The remaining parameters in Equation S11 have either SSL default values listed in Appendix C, Table B or toxicological-specific information (i.e., RfC), which can be obtained ~~from IRIS~~

by following the guidelines in OSWER Directive 9285.7-53, as incorporated by reference in Section 742.210 or requested from the program under which the remediation is being performed.

C) For Equation S12, a numerical value for the Particulate Emission Factor for Construction Worker (PEF') can be calculated using Equation S16. The remaining parameters in Equation S12 have either SSL default values listed in Appendix C, Table B or toxicological-specific information (i.e., RfC), which can be obtained ~~from IRIS~~ by following the guidelines in OSWER Directive 9285.7-53, as incorporated by reference in Section 742.210 or requested from the program under which the remediation is being performed.

D) For Equation S13, a numerical value for PEF can be calculated using Equation S15. The remaining parameters in Equation S13 have either default values listed in Appendix C, Table B or toxicological-specific information (i.e., URF), which can be obtained ~~from IRIS~~ by following the guidelines in OSWER Directive 9285.7-53, as incorporated by reference in Section 742.210 or requested from the program under which the remediation is being performed.

E) For Equation S14, a numerical value for PEF' can be calculated using Equation S16. The remaining parameters in Equation S14 have either default values listed in Appendix C, Table B or toxicological-specific information (i.e., URF), which can be obtained ~~from IRIS~~ by following the guidelines in OSWER Directive 9285.7-53, as incorporated by reference in Section 742.210 or requested from the program under which the remediation is being performed.

d) Soil Component of the Groundwater Ingestion Exposure Route

The Tier 2 remediation objective for the soil component of the groundwater ingestion exposure route can be calculated using one of the following equations based on the information known about the contaminant source and receptor population:

1) Equation S17 is used to calculate the remediation objective assuming an infinite source of contamination.

A) The numerical quantities for four parameters in Equation S17, the Target Soil Leachate Concentration (C_w), Soil-Water Partition Coefficient (K_d) for non-ionizing organics, Water-Filled Soil Porosity Theta w (θ_w) and Air-Filled Soil Porosity Theta a (θ_a), are calculated using Equations S18, S19, S20 and S21, respectively. Equations S22, S23, S24 and S25 are also needed to calculate numerical values for Equations S18 and S21. The pH-dependent K_d values for ionizing organics can be calculated using Equation S19 and the pH-dependent Koc values in Appendix C, Table I.

B) The remaining parameters in Equation S17 are Henry's Law Constant (H'), a chemical specific value listed in Appendix C, Table E and Dry Soil Bulk Density (ρ_b), a site-specific based value listed in Appendix C, Table B.

C) The default value for GW_{obj} is the Tier 1 groundwater objective. For chemicals for which there is no Tier 1 groundwater remediation objective, the value for GW_{obj} shall be the concentration determined according to the procedures specified in 35 Ill. Adm. Code 620, Subpart F. As an alternative to using Tier 1 groundwater remediation objectives or concentrations determined according to the procedures specified in 35 Ill. Adm. Code 620, Subpart F~~.~~, GW_{obj} may be developed using Equations R25 and R26, if approved institutional controls are in place as required in Subpart J.

2) If the area and depth of the contaminant source are known or can be estimated reliably, mass limit considerations may be used to calculate the remediation objective for this exposure route using Equation S28. The parameters in Equation S28 have default values listed in Appendix C, Table B.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.712 SSL Soil Gas Equation for the Outdoor Inhalation Exposure Route

a) This Section sets forth the equation and parameters used to develop Tier 2 soil gas remediation objectives for the outdoor inhalation exposure route using the SSL approach.

b) Equation S30 is used to calculate Tier 2 soil gas remediation objectives for the outdoor inhalation exposure route for residential, industrial/commercial, and construction worker populations.

c) Equations S4 through S16, S26 and S27, which calculate Tier 2 soil remediation objectives as described in Section 742.710(c), form the basis for developing the Tier 2 soil gas remediation objectives for the outdoor inhalation exposure route using the SSL model.

d) The remaining parameters used to calculate Equation S30 are listed in Appendix C, Table B, except for Dimensionless Henry's Law Constant (25°C), a chemical specific value listed in Appendix C, Table E.

(Source: Added at 37 Ill. Reg. _____, effective ______)

Section 742.715 RBCA Soil Equations

a) This Section presents the RBCA model and describes the equations and parameters used to develop Tier 2 soil remediation objectives.

b) Ingestion, Outdoor Inhalation, and Dermal Contact

1) The two sets of equations in subsections (b)(2) and (b)(3) ~~of this Section~~ shall be used to generate Tier 2 soil remediation objectives for the combined ingestion, outdoor inhalation, and dermal contact with soil exposure routes.

2) Combined Exposure Routes of Soil Ingestion, Outdoor Inhalation of Vapors and Particulates, and Dermal Contact with Soil

A) Equations R1 and R2 form the basis for deriving Tier 2 remediation objectives for the set of equations that evaluates the combined exposure routes of soil ingestion, outdoor inhalation of vapors and particulates, and dermal contact with soil using the RBCA approach. Equation R1 is used to calculate soil remediation objectives for carcinogenic contaminants. Equation R2 is used to calculate soil remediation objectives for noncarcinogenic contaminants. Soil remediation objectives for the ~~ambient vapor inhalation (outdoor)~~ outdoor inhalation exposure route from subsurface soils must also be calculated in accordance with the procedures outlined in subsection (b)(3) of this Section and compared to the values generated from Equations R1 or R2. The smaller value (i.e., R1 and R2 compared to R7 and R8, respectively) from these calculations is the Tier 2 soil remediation objective for the combined exposure routes of soil ingestion, outdoor inhalation, and dermal contact with soil.

B) In Equation R1, numerical values are calculated for two parameters:

i) The volatilization factor for surficial soils (VF_{ss}) using Equations R3 and R4; and

ii) The volatilization factor for ~~subsurface~~ surficial soils regarding particulates (VF_p) using Equation R5.

C) VF_{ss} uses Equations R3 and R4 to derive a numerical value. Equation R3 requires the use of Equation R6. Both equations must be used to calculate the VF_{ss}. The lowest calculated value from these equations must be substituted into Equation R1.

D) The remaining parameters in Equation R1 have either default values listed in Appendix C, Table D or toxicological-specific information (i.e., SF_o, SF_i), which can be obtained ~~from IRIS~~ by following the guidelines in OSWER Directive 9285.7-53, as incorporated by reference in Section 742.210 or requested from the program under which the remediation is being performed.

E) For Equation R2, the parameters VF_{ss} and VF_p are calculated. The remaining parameters in Equation R2 have either default values listed in Appendix C, Table D or toxicological-specific information (i.e., RfD_o, RfD_i), which can be obtained ~~from IRIS~~ by following the guidelines in OSWER Directive 9285.7-53, as incorporated by reference in Section 742.210 or requested from the program under which the remediation is being performed.

F) For chemicals other than inorganics which do not have default values for the dermal absorption factor (RAF_d) in Appendix C, Table D~~,~~ a dermal absorption factor of 0.5 shall be used for Equations R1 and R2. For inorganics, dermal absorption may be disregarded (i.e., $RAF_d = 0$).

3) ~~Ambient Vapor Inhalation (outdoor) route~~Outdoor Inhalation Exposure Route from Subsurface Soils (soil below one meter)

A) Equations R7 and R8 form the basis for deriving Tier 2 remediation objectives for the ~~ambient vapor inhalation (outdoor)~~ outdoor inhalation exposure route from subsurface soils using the RBCA approach. Equation R7 is used to calculate soil remediation objectives for carcinogenic contaminants. Equation R8 is used to calculate soil remediation objectives for noncarcinogenic contaminants.

B) For Equation R7, the carcinogenic risk-based screening level for air ($RBSL_{air}$) and the volatilization factor for soils below one meter to ambient air (VF_{samb}) have numerical values that are calculated using Equations R9 and R11, respectively. Both equations rely on input parameters from a variety of sources.

C) The noncarcinogenic risk-based screening level for air ($RBSL_{air}$) and the volatilization factor for soils below one meter to ambient air (VF_{samb}) in Equation R8 have numerical values that can be calculated using Equations R10 and R11, respectively.

c) Soil Component of the Groundwater Ingestion Exposure Route

1) Equation R12 forms the basis for deriving Tier 2 remediation objectives for the soil component of the groundwater ingestion exposure route using the RBCA approach. The parameters, groundwater at the source (GW_{source}) and Leaching Factor (LF_{sw}), have numerical values that are calculated using Equations R13 and R14, respectively.

2) Equation R13 requires numerical values that are calculated using Equation R15.

3) Equation R14 requires numerical values that are calculated using Equations R21, R22, and R24. For non-ionizing organics, the Soil Water Sorption Coefficient (k_s) shall be calculated using Equation R20. For ionizing organics and inorganics, the values for ~~(~~k_s~~)~~ are listed in Appendix C, Tables I and J, respectively. The pH-dependent k_s values for ionizing organics can be calculated using Equation R20 and the pH-dependent K_{oc} values in Appendix C, Table I. The remaining parameters in Equation R14 are field measurements or default values listed in Appendix C, Table D.

d) The default value for GW_{comp} is the Tier 1 groundwater remediation objective. For chemicals for which there is no Tier 1 groundwater remediation objective, the value for GW_{comp} shall be the concentration determined according to the procedures specified in 35 Ill. Adm. Code 620, Subpart F. As an alternative to using the above concentrations, GW_{comp} may be developed using Equations R25 and R26, if approved institutional controls are in place as may be required in Subpart J.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.717 J&E Soil Gas Equations for the Indoor Inhalation Exposure Route

a) This Section sets forth the equations and parameters to be used to develop Tier 2 soil gas remediation objectives for the indoor inhalation exposure route using the modified J&E model.

b) Equations J&E1 and J&E2 calculate, for carcinogens and noncarcinogens, respectively, an acceptable concentration of the contaminant of concern in indoor air that adequately protects humans who inhale this air. Equation J&E3 converts indoor air concentrations from parts per million volume to milligrams per cubic meter.

c) Equation J&E4 calculates an acceptable concentration of the contaminant of concern in the soil gas at the source of contamination. This calculation is made using:

   1) an attenuation factor developed in accordance with Equations J&E7 through 18; and

   2) the acceptable concentration of the contaminant of concern in indoor air calculated in accordance with Equation J&E1 (for carcinogens) or J&E2 (for noncarcinogens).

d) The attenuation factor (Equation J&E7 or J&E8) accounts for the following processes:

   1) Migration of contaminants from the source upwards through the vadose zone;

   2) Migration of contaminants through the earthen filled cracks in the building's full concrete slab-on-grade or full concrete basement floor and walls; and

   3) Mixing of the contaminants with air inside the building.

e) Equation J&E7 must be used when the mode of contaminant transport is both diffusion and advection. In this scenario, the Q_{soil} value equals 83.33 cm^3/sec as described in Section 742.505.

f) Equation J&E8 may be used only when the mode of contaminant transport is diffusion only. In this scenario, the Q_{soil} value equals 0.0 cm^3/sec as described in Section 742.505. As an alternative to using Equation J&E8 pursuant to this subsection, it is permissible to use Equation J&E7, in which case the Q_{soil} value equals 83.33 cm^3/sec as described in Section 742.505.

g) Equations J&E9a through J&E18 calculate input parameters for either Equation J&E7 or J&E8 (the equations used to calculate an attenuation factor). These equations assume there are "n" different soil layers between the source of the contamination and the floor of the building. Equations J&E11, 16, 17 and 18 shall be used to calculate the needed parameters for each of the n layers (the general soil layer is referred to as soil layer "i" and i = 1, 2, . . . n). Equations J&E16, 17, and 18 shall also be used to calculate needed parameters for the soil in the cracks of the building's full concrete slab-on-grade or full concrete basement floor and walls (it is through these cracks that contaminated soil gas is assumed to flow from the subsurface into the building). As reflected in Equation J&E14, the only crack assumed to be present is the floor-wall seam gap. To calculate the surface area of the enclosed space at or below grade, Equation J&E12a shall be used for a building with a full concrete slab-on-grade and Equation J&E12b shall be used for a building with a full concrete basement floor and walls.

h) The default representative subsurface temperature for Henry's Law Constant is 13°C. This value shall be used, as appropriate, in all calculations needed to represent the system by which contaminants migrate through the subsurface.

i) The calculated soil gas remediation objective shall be compared with the soil vapor saturation limit (C_v^{sat}, Equation J&E5) for each volatile chemical. The calculated C_v^{sat} shall use the default representative subsurface temperature specified in subsection (h). If the calculated soil gas remediation objective is greater than C_v^{sat}, then C_v^{sat} is used as the soil gas remediation objective.

j) The calculated soil gas remediation objective shall be compared to concentrations of soil gas collected at a depth at least 3 feet below ground surface and above the saturated zone. If a valid sample cannot be collected, a soil gas sampling plan shall be approved by the Agency under Tier 3.

(Source: Added at 37 Ill. Reg. _____, effective ______)

SUBPART H: TIER 2 GROUNDWATER EVALUATION

Section 742.805 Tier 2 Groundwater Remediation Objectives

a) To develop a groundwater remediation objective under this Section that exceeds the applicable Tier 1 groundwater remediation objective, or for which there is no Tier I groundwater remediation objective, a person may request approval from the Agency if the person has performed the following:

1) Identified the horizontal and vertical extent of groundwater for which the Tier 2 groundwater remediation objective is sought;

2) Taken corrective action, to the maximum extent practicable to remove any free product;

3) Using Equation R26 in accordance with Section 742.810, demonstrated that the concentration of any contaminant of concern in groundwater will meet:

A) The applicable Tier 1 groundwater remediation objective at the point of human exposure; or

B) For any contaminant of concern for which there is no Tier 1 groundwater remediation objective, the concentration determined according to the procedures specified in 35 Ill. Adm. Code 620 at the point of human exposure. A person may request the Agency to provide these concentrations or may propose these concentrations under Subpart I;

4) Using Equation R26 in accordance with Section 742.810, demonstrated that the concentration of any contaminant of concern in groundwater within the minimum or designated maximum setback zone of an existing potable water supply well will meet the applicable Tier 1 groundwater remediation objective or, if there is no Tier 1 groundwater remediation objective, the concentration determined according to the procedures specified in 35 Ill. Adm. Code 620. A person may request the Agency to provide these concentrations or may propose these concentrations under Subpart I;

5) Using Equation R26 in accordance with Section 742.810, demonstrated that the concentration of any contaminant of concern in groundwater

discharging into a surface water will meet the applicable water quality standard under 35 Ill. Adm. Code 302;

6) Demonstrated that the source of the release is not located within the minimum or designated maximum setback zone or within a regulated recharge area of an existing potable water supply well; and

7) If the selected corrective action includes an engineered barrier as set forth in Subpart K to minimize migration of contaminants of concern from the soil to the groundwater, demonstrated that the engineered barrier will remain in place for post-remediation land use through an institutional control as set forth in Subpart J.

b) A groundwater remediation objective that exceeds the water solubility of that chemical (refer to Appendix C, Table E for solubility values) is not allowed.

c) The contaminants of concern for which a Tier 1 remediation objective has been developed shall be included in any mixture of similar-acting chemicals under consideration in Tier 2. The evaluation of 35 Ill. Adm. Code 620.615 regarding mixtures of similar-acting chemicals shall be considered satisfied for Class I groundwater at the point of human exposure if either of the following requirements are achieved:

1) Calculate the weighted average using the following equations:

$$W_{ave} = \frac{x_1}{CUOx_1} + \frac{x_2}{CUOx_2} + \frac{x_3}{CUOx_3} + \ldots + \frac{x_a}{CUOx_a}$$

where:

W_{ave} = Weighted Average

x_1 through x_a = Concentration of each individual contaminant at the location of concern. Note that, depending on the target organ, the actual number of contaminants will range from 2 to 33.

$CUOx_a$ = A Tier 1 or Tier 2 remediation objective must be developed for each x_a.

A) If the value of the weighted average calculated in accordance with the equations above is less than or equal to 1.0, then the remediation objectives are met for those chemicals.

B) If the value of the weighted average calculated in accordance with the equations above is greater than 1.0, then additional remediation must be carried out until the level of contaminants remaining in the remediated area has a weighted average calculated in accordance with the equation above less than or equal to one; or

2) Divide each individual chemical's remediation objective by the number of chemicals in that specific target organ group that were detected at the site. Each of the contaminant concentrations at the site is then compared to the remediation objectives that have been adjusted to account for this potential additivity.

d) The evaluation of 35 Ill. Adm. Code 620.615 regarding mixtures of similar-acting chemicals is ~~are~~ considered satisfied if the cumulative risk from any contaminants~~contaminant(s)~~ of concern listed in Appendix A, Table I, plus any other contaminants~~contaminant(s)~~ of concern detected in groundwater and listed in Appendix A, Table F as affecting the same target organ/organ system as the contaminants~~contaminant(s)~~ of concern detected from Appendix A, Table I, does not exceed 1 in 10,000.

e) Groundwater remediation objectives for the indoor inhalation exposure route shall be developed in accordance with Section 742.812. For the indoor inhalation exposure route:

1) Appendix C, Table L applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls; and

2) Institutional controls under Subpart J are required to develop groundwater remediation objectives pursuant to Appendix C, Table L.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.810 RBCA Calculations to Predict Impacts from Remaining Groundwater Contamination

a) Equation R26 predicts the contaminant concentration along the centerline of a groundwater plume emanating from a vertical planar source in the aquifer (dimensions S_w wide and S_d deep). This model accounts for both three-dimensional dispersion (x is the direction of groundwater flow, y is the other horizontal direction, and z is the vertical direction) and biodegradation.

1) The parameters in this equation are:

X = distance from the planar source to the location of concern, along the centerline of the groundwater plume (i.e., y=0, z=0)

C_x = the concentration of the contaminant at a distance X from the source, along the centerline of the plume

C_{source} = the greatest potential concentration of the contaminant of concern in the groundwater at the source of the contamination, based on the concentrations of contaminants in groundwater due to the release and the projected concentration of the contaminant migrating from the soil to the groundwater. As indicated above, the model assumes a planar source discharging groundwater at a concentration equal to C_{source}.

α_x = dispersivity in the x direction (i.e., Equation R16)

α_y = dispersivity in the y direction (i.e., Equation R17)

α_z = dispersivity in the z direction (i.e., Equation R18)

U = specific discharge (i.e., actual groundwater flow velocity through a porous medium; takes into account the fact that the groundwater actually flows only through the pores of the subsurface materials) where the aquifer hydraulic conductivity (K), the hydraulic gradient (I) and the total soil porosity θ_T must be known (i.e., Equation R19)

λ= first order degradation constant obtained from Appendix C, Table E or from measured groundwater data

S_w = width of planar groundwater source in the y direction

S_d = depth of planar groundwater source in the z direction

2) The following parameters are determined through field measurements: U, K, I, θ_T, S_w, S_d.

A) The determination of values for U, K, I and θ_T can be obtained through the appropriate laboratory and field techniques;

B) From the immediate down-gradient edge of the source of the groundwater contamination values for S_w and S_d shall be determined. S_w is defined as the width of groundwater at the source which exceeds the Tier 1 groundwater remediation objective. S_d is defined as the depth of groundwater at the source which exceeds the Tier 1 groundwater remediation objective; and

C) Total soil porosity can also be calculated using Equation R23.

b) Once values are obtained for all the input parameters identified in subsection (a) of this Section, the contaminant concentration C_x along the centerline of the plume at a distance X from the source shall be calculated so that X is the distance from the down-gradient edge of the source of the contamination at the site to the point where the contaminant concentration is equal to the Tier 1 groundwater remediation objective or concentration determined according to the procedures specified in 35 Ill. Adm. Code 620, Subpart F.

1) If there are any potable water supply wells located within the calculated distance X, then the Tier 1 groundwater remediation objective or concentration shall be met at the edge of the minimum or designated maximum setback zone of the nearest potable water supply down-gradient of the source. To demonstrate that a minimum or maximum setback zone of a potable water supply well will not be impacted above the applicable Tier 1 groundwater remediation objective or concentration determined according to the procedures specified in 35 Ill. Adm. Code 620, Subpart F, X shall be the distance from the C_{source} location to the edge of the setback zone.

2) To demonstrate that no surface water is adversely impacted, X shall be the distance from the down-gradient edge of the source of the contamination site to the nearest surface water body. This calculation must show that the contaminant in the groundwater at this location (C_x) does not exceed the applicable water quality standard.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.812 J&E Groundwater Equations for the Indoor Inhalation Exposure Route

Groundwater remediation objectives for the indoor inhalation exposure route are calculated using the modified J&E model as described in Section 742.717, except as follows:

a) In Equation J&E9a, the total number of layers of soil that contaminants migrate through from the source to the building shall include a capillary fringe layer.

b) The thickness of the capillary fringe layer is 37.5 cm.

c) The volumetric water content of the capillary fringe shall be 90 % of the total porosity of the soil that comprises the capillary fringe.

d) Equations J&E7 and J&E8 calculate an acceptable groundwater remediation objective.

   1) This calculation is made using:

      A) the soil gas remediation objective calculated in accordance with Equation J&E4; and

      B) the assumption that this gas is in equilibrium with any contamination in the groundwater.

   2) Equation J&E7 must be used when the mode of contaminant transport is both diffusion and advection. In this scenario, the Q_{soil} value equals 83.33 cm^3/sec as described in Section 742.505.

   3) Equation J&E8 may be used only when the mode of contaminant transport is diffusion only. In this scenario, the Q_{soil} value equals 0.0 cm^3/sec as described in Section 742.505. As an alternative to using Equation J&E8 pursuant to this subsection, it is permissible to use Equation J&E7, in which case the Q_{soil} value equals 83.33 cm^3/sec as described in Section 742.505.

e) A groundwater remediation objective that exceeds the water solubility of that chemical (refer to Appendix C, Table E for solubility values) is not allowed. If the calculated groundwater remediation objective is greater than the water solubility of that chemical, then the solubility is used as the groundwater remediation objective.

(Source: Added at 37 Ill. Reg. _____, effective ______)

SUBPART I: TIER 3 EVALUATION

Section 742.900 Tier 3 Evaluation Overview

a) Tier 3 sets forth a flexible framework to develop remediation objectives outside of the requirements of Tiers 1 and 2. Although Tier 1 and Tier 2 evaluations are not prerequisites to conduct Tier 3 evaluations, data from Tier 1 and Tier 2 can assist in developing remediation objectives under a Tier 3 evaluation.

b) The level of detail required to adequately characterize a site depends on the particular use of Tier 3. Tier 3 can require additional investigative efforts beyond those described in Tier 2 to characterize the physical setting of the site. However, in situations where remedial efforts have simply reached a physical obstruction additional investigation may not be necessary for a Tier 3 submittal.

c) Situations that can be considered for a Tier 3 evaluation include, but are not limited to:

1) Modification of parameters not allowed under Tier 2;

2) Use of models different from those used in Tier 2;

3) Use of additional site data, such as results of indoor air sampling, to improve or confirm predictions of exposed receptors to contaminants of concern;

4) Analysis of site-specific risks using formal risk assessment, probabilistic data analysis, and sophisticated fate and transport models (e.g., requesting a target hazard quotient greater than 1 or a target cancer risk greater than 1 in 1,000,000);

5) Requests for site-specific remediation objectives because an assessment indicates further remediation is not practical;

6) Incomplete human exposure pathways~~pathway(s)~~ not excluded under Subpart C;

7) Use of toxicological-specific information not available from the sources listed in Tier 2;

8) Land uses which are substantially different from the assumed residential or industrial/commercial property uses of a site (e.g., a site will be used for recreation in the future and cannot be evaluated in Tier 1 or 2); ~~and~~

9) Requests for site-specific remediation objectives that exceed Tier 1 groundwater remediation objectives so long as the following is demonstrated:

A) *To the extent practical, the exceedance of the groundwater quality standard has been minimized and beneficial use appropriate to the groundwater that was impacted has been returned; and*

B) *Any threat to human health or the environment has been minimized*~~.~~ [415 ILCS 5/58.5(d)(4)(A)]; and

10) Use of building control technologies, other than those described in Subpart L, to prevent completion of the indoor inhalation exposure route.

d) For requests of a target cancer risk ranging between 1 in 1,000,000 and 1 in 10,000 at the point of human exposure or a target hazard quotient greater than 1 at the point of human exposure, the requirements of Section 742.915 shall be followed. Requests for a target cancer risk exceeding 1 in 10,000 at the point of human exposure are not allowed.

e) Requests for approval of a Tier 3 evaluation must be submitted to the Agency for review under the specific program under which remediation is performed. When reviewing a submittal under Tier 3, the Agency shall consider *whether the interpretations and conclusions reached are supported by the information gathered*~~.~~ [415 ILCS 58.7(e)(1)]. The Agency shall approve a Tier 3 evaluation if the person submits the information required under this Part and establishes through such information that public health is protected and that specified risks to human health and the environment have been minimized.

f) If contaminants of concern include polychlorinated biphenyls (PCBs), requests for approval of a Tier 3 evaluation must additionally address the applicability of 40 CFR 761.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.920 Impractical Remediation

Any request for site-specific remediation objectives due to impracticality of remediation shall be submitted to the Agency for review and approval. Any request for site-specific remediation objectives due to impracticality of remediation that involves the indoor inhalation exposure route shall follow Section 742.935 in lieu of this Section. A submittal under this Section shall include the following information:

a) The reasons~~reason(s)~~ why the remediation is impractical;

b) The current extent and modeled migration of contamination;

c) Geology, including soil types and parameters;

d) The potential impact to groundwater;

e) Results and locations of sampling events;

f) Map of the area, including all utilities and structures; and

g) Present and post-remediation uses of the area of contamination, including human receptors at risk.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.925 Exposure Routes

Technical information may demonstrate that there is no actual or potential impact of contaminants of concern to receptors from a particular exposure route. In these instances, a demonstration excluding an exposure route shall be submitted to the Agency for review and approval. A demonstration that involves the indoor inhalation exposure route shall follow Section 742.935 in lieu of this Section. A submittal under this Section shall include the following information:

a) A description of the route evaluated;

b) A description of the site and physical site characteristics;

c) A discussion of the result and possibility of the route becoming active in the future; and

d) Technical support that may include, but is not limited to, the following:

1) a discussion of the natural or man-made barriers to that exposure route;

2) calculations and modeling;

3) physical and chemical properties of contaminants of concern; and

4) contaminant migration properties.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.935 Indoor Inhalation Exposure Route

a) Exclusion of Exposure Route

Site information may demonstrate that there is no actual or potential impact of contaminants of concern to receptors from the indoor inhalation exposure route. In these instances, a demonstration excluding the exposure route shall be submitted to the Agency for review and approval. A submittal under this Section shall include the following information:

1) A description of the site, physical site characteristics, existing and planned buildings, and existing and planned man-made pathways; and

2) A discussion of the possibility of the route becoming active in the future.

b) Exclusion of Exposure Route Using Building Control Technologies

Any proposals to use building control technologies as a means to prevent or mitigate human exposures under the indoor inhalation exposure route that differ from the requirements of Subpart L shall be submitted to the Agency for review and approval. A submittal under this Section shall include the following information:

1) A description of the site and physical site characteristics;

2) The current extent and modeled migration of contamination;

3) Geology, including soil types and parameters;

4) Results and locations of sampling events;

5) Scaled map of the area, including all buildings and man-made pathways;

6) A description of building characteristics and methods of construction, including a description of man-made pathways;

7) Present and post-remediation uses of the land that are at issue due to the

area of contamination, including human receptors at risk;

8) A description of any building control technologies currently in place or proposed for installation that can reduce or eliminate the potential for completion of the exposure route, including design and construction specifications;

9) Information regarding the effectiveness of any building control technologies currently in place or proposed for installation and a schedule for performance testing to show the effectiveness of the control technology. For buildings not yet constructed, an approved building control technology shall be in place and operational prior to human occupancy;

10) Identification of documents reviewed and the criteria used in the documents for determining whether building control technologies are effective and how those criteria compare to existing or potential buildings or man-made pathways at the site; and

11) A description as to how the effectiveness of the building control technologies will be operated and maintained for the life of the buildings and man-made pathways, or until soil gas and groundwater contaminant concentrations have reached remediation objectives that are approved by the Agency. This includes provisions for potential extended system inoperability due to power failure or other disruption.

c) Calculations and Modeling Used to Establish Soil Gas Remediation Objectives

The calculations and modeling shall account for contaminant transport through the mechanisms of diffusion and advection. Proposals to use soil gas data, including sub-slab samples, to establish remediation objectives for the indoor inhalation exposure route that differ from the requirements of Section 742.227 shall be submitted to the Agency for review and approval. A submittal under this Section shall include the following information:

1) Scaled map of the area, showing all buildings and man-made pathways (current and planned);

2) The current extent and modeled migration of contamination;

3) Geology, including soil types and parameters;

4) Depth to groundwater (including seasonal variation) and flow direction;

5) Location of soil gas sampling points;

6) A discussion of soil gas sampling procedures that, at a minimum, addresses the following:

A) sampling equipment;

B) soil gas collection protocol, including field tests and weather conditions; and

C) laboratory analytical methods.

d) Calculations and Modeling Used to Establish Soil Remediation Objectives

The calculations and modeling shall account for contaminant transport through the mechanisms of diffusion and advection. Any proposals to use soil data in lieu of soil gas data to establish remediation objectives for the indoor inhalation exposure route shall be submitted to the Agency for review and approval. A submittal under this Section shall include the following information:

1) Scaled map of the area, showing all buildings and man-made pathways (current and planned);

2) The current extent and modeled migration of contamination;

3) Geology, including soil types and parameters;

4) Location of soil sampling points;

5) A discussion of soil sampling procedures that, at a minimum, addresses the following:

A) sampling equipment;

B) soil collection protocol, including field tests and weather conditions; and

C) laboratory analytical methods;

6) Mathematical and technical justification for the model proposed; and

7) Demonstration that the model was correctly applied.

e) Calculations and Modeling Used to Establish Groundwater Remediation Objectives

The calculations and modeling shall account for contaminant transport through the mechanisms of diffusion and advection. Proposals to use groundwater data to establish remediation objectives for the indoor inhalation exposure route that differ from the requirements of Sections 742.805 and 742.812 shall be submitted to the Agency for review and approval. A submittal under this Section shall include the following information:

1) Scaled map of the area, showing all buildings and man-made pathways (current and planned);

2) The current extent and modeled migration of contamination;

3) Geology, including soil types and parameters and the thickness of the capillary fringe;

4) Depth to groundwater (including seasonal variation) and flow direction;

5) Results and locations of groundwater sampling events;

6) Mathematical and technical justification for the model proposed; and

7) Demonstration that the model was correctly applied.

(Source: Added at 37 Ill. Reg. _____, effective ______)

SUBPART J: INSTITUTIONAL CONTROLS

Section 742.1000 Institutional Controls

a) Institutional controls in accordance with this Subpart must be placed on the property when remediation objectives are based on any of the following assumptions:

1) Industrial/Commercial property use;

2) Target cancer risk greater than 1 in 1,000,000;

3) Target hazard quotient greater than 1;

4) Engineered barriers;

5) The point of human exposure is located at a place other than at the source;

6) Exclusion of exposure routes; ~~or~~

7) A diffusion only mode of contaminant transport for the indoor inhalation exposure route;

8) Use of an indoor inhalation building control technology;

9) For the indoor inhalation exposure route, the presence of a building with a full concrete slab-on-grade or a full concrete basement floor and walls; or

10~~7~~) Any combination of the above.

b) The Agency shall not approve any remediation objective under this Part that is based on the use of institutional controls unless the person has proposed institutional controls meeting the requirements of this Subpart and the requirements of the specific program under which the institutional control is proposed. A proposal for approval of institutional controls shall provide identification of the selected institutional controls from among the types recognized in this Subpart.

c) The following instruments may be institutional controls subject to the requirements of this Subpart J and the requirements of the specific program under which the institutional control is proposed:

1) No Further Remediation Letters;

2) Environmental Land Use Controls;

3) Land Use Control Memoranda of Agreement;

4) Ordinances adopted and administered by a unit of local government;

5) Agreements between a property owner (or, in the case of a petroleum leaking underground storage tank, the owner or operator of the tank) and a highway authority with respect to any contamination remaining under

highways; and

6) Agreements between a highway authority that is also the property owner (or, in the case of a petroleum leaking underground storage tank, the owner or operator of the tank) and the Agency with respect to any contamination remaining under the highways.

d) No Further Remediation Letters and Environmental Land Use Controls that meet the requirements of this Subpart and the recording requirements of the program under which remediation is being performed are transferred with the property.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.1010 Environmental Land Use Controls

a) An Environmental Land Use Control (ELUC) is an institutional control that may be used under this Part to impose land use limitations or requirements related to environmental contamination. ELUCs are only effective when approved by the Agency in accordance with this Part. Activities or uses that may be limited or required include, but are not limited to, prohibition of use of groundwater for potable purposes, restriction to industrial/commercial uses, operation or maintenance of engineered barriers, <u>indoor inhalation building control technologies,</u> or worker safety plans. ELUCs may be used in the following circumstances:

1) When No Further Remediation Letters are not available, including but not limited to when contamination has migrated off-site or outside the remediation site; or

2) When No Further Remediation Letters are not issued under the program for which a person is undergoing remediation.

b) Recording requirements:

1) An ELUC approved by the Agency pursuant to this Section must be recorded in the Office of the Recorder or Registrar of Titles for the county in which the property that is the subject of the ELUC is located. A copy of the ELUC demonstrating that it has been recorded must be submitted to the Agency before the Agency will issue a no further remediation determination.

2) An ELUC approved under this Section will not become effective until

officially recorded in the chain of title for the property that is the subject of the ELUC in accordance with subsection (b)(1) of this Section.

3) Reference to the recorded ELUC must be made in the instrument memorializing the Agency's no further remediation determination. Recording of the no further remediation determination and confirmation of recording must be in accordance with the requirements of the program under which the determination was issued.

4) The requirements of this Section do not apply to Federally Owned Property for which the Federal Landholding Entity does not have the authority under federal law to record land use limitations on the chain of title.

5) The requirements of this Section apply only to those sites for which a request for a no further remediation determination has not yet been made to the Agency by January 6, 2001.

c) Duration:

1) Except as provided in this subsection (c), an ELUC shall remain in effect in perpetuity.

2) *At no time shall any site for which an ELUC has been imposed as a result of remediation activities under this Part be used in a manner inconsistent with the land use limitation unless attainment of objectives appropriate for the new land use is achieved and a new* no further remediation determination has been *obtained and recorded in accordance with* the program under which the ELUC was first imposed or the Site Remediation Program (35 Ill. Adm. Code 740)~~.~~ [415 ILCS 58.8(c)]. In addition, the appropriate release or modification of the ELUC must be prepared by the Agency and filed on the chain of title for the property that is the subject of the ELUC.

A) For a Leaking Underground Storage Tank (LUST) site under 35 Ill. Adm. Code 731 or ~~732~~ 734 or a Site Remediation Program site under 35 Ill. Adm. Code 740, an ELUC may be released or modified only if the NFR Letter is also modified under the Site Remediation Program to reflect the change;

B) For a RCRA site under 35 Ill. Adm. Code 721-730, an ELUC may be released or modified only if there is also an amended certification of closure or a permit modification.

3) In addition to any other remedies that may be available, a failure to comply with the limitations or requirements of an ELUC may result in voidance of an Agency no further remediation determination in accordance with the program under which the determination was made. The failure to comply with the limitations or requirements of an ELUC may also be grounds for an enforcement action pursuant to Title VIII of the Act.

d) An ELUC submitted to the Agency must match the form and contain the same substance, except for variable elements (e.g., name of property owner), as the model in Appendix F and must contain the following elements:

1) Name of property owners and declaration of property ownership;

2) Identification of the property to which the ELUC applies by common address, legal description, and Real Estate Tax Index/Parcel Index Number;

3) A reference to the Bureau of Land LPC numbers or 10-digit identification numbers under which the remediation was conducted;

4) A statement of the reason for the land use limitation or requirement relative to protecting human health and the surrounding environment from soil, groundwater, and/or other environmental contamination;

5) The language instituting such land use limitations or requirements;

6) A statement that the limitations or requirements apply to the current owners, occupants, and all heirs, successors, assigns, and lessees;

7) A statement that the limitations or requirements apply in perpetuity or until:

A) The Agency determines that there is no longer a need for the ELUC;

B) The Agency, upon written request, issues to the site that received the no further remediation determination that relies on the ELUC a new no further remediation determination approving modification or removal of the limitations or requirements;

C) The new no further remediation determination is filed on the chain of title of the site subject to the no further remediation determination; and

D) A release or modification of the land use limitation is filed on the chain of title for the property that is the subject of the ELUC;

8) Scaled site maps showing:

A) The legal boundary of the property to which the ELUC applies;

B) The horizontal and vertical extent of contaminants of concern above applicable remediation objectives for soil<u>,</u> ~~and~~ groundwater<u>, and soil gas</u> to which the ELUC applies;

C) Any physical features to which an ELUC applies (e.g., engineered barriers, monitoring wells, caps<u>, indoor inhalation building control technologies</u>); and

D) The nature, location of the source, and direction of movement of the contaminants of concern;

9) A statement that any information regarding the remediation performed on the property for which the ELUC is necessary may be obtained from the Agency through a request under the Freedom of Information Act [5 ILCS 140] and rules promulgated thereunder; and

10) The dated, notarized signatures of the property owners or authorized agent.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.1015 Ordinances

a) An ordinance adopted by a unit of local government that effectively prohibits the installation of potable water supply wells (and the use of such wells) may be used as an institutional control to meet the requirements of Section 742.320(d) or 742.805(a)(3) if the requirements of this Section are met. A model ordinance is found in Appendix G. Ordinances prohibiting the installation of potable water supply wells (and the use of such wells) that do not expressly prohibit the installation of potable water supply wells (and the use of such wells) by units of local government may be acceptable as institutional controls if the requirements of this Section are met and a Memorandum of Understanding (MOU) is entered into under subsection (i) of this Section. For purposes of this Section, a unit of local government is considered to be expressly prohibited from installing and using potable water supply wells only if the unit of local government is included in the prohibition provision by name. The prohibition required by this Section shall satisfy the following requirements at a minimum:

1) The prohibition shall not allow exceptions for potable water well installation and use other than for the adopting unit of local government;

2) The prohibition shall apply at all depths and shall not be limited to particular aquifers or other geologic formations;

3) If the prohibition does not apply everywhere within the boundaries of the unit of local government, the limited area to which the prohibition applies shall be easily identifiable and clearly defined by the ordinance (e.g., narrative descriptions accompanied by maps with legends or labels showing prohibition boundaries, or narrative descriptions using fixed, common reference points such as street names). Boundaries of prohibitions limited by area shall be fixed by the terms of the ordinance and shall not be subject to change without amending the ordinance in which the prohibition has been adopted (e.g., no boundaries defined with reference to zoning districts or the availability of the public water supply); and

4) The prohibition shall not in any way restrict or limit the Agency's approval of the use of the ordinance as an institutional control pursuant to this Part (e.g., no restrictions based on remediation program participation, no restrictions on persons performing remediation within the prohibition area who may use the ordinance).

b) A request for approval of a local ordinance as an institutional control shall provide the following:

1) A copy of the ordinance restricting groundwater use certified by an official of the unit of local government in which the site is located that it is a true and accurate copy of the ordinance, unless the Agency and the unit of local government have entered an agreement under subsection (i) of this Section, in which case the request may alternatively reference the MOU. The ordinance must demonstrate that potable use of groundwater from potable water supply wells is prohibited;

2) A scaled map or maps~~map(s)~~ delineating the area and extent of groundwater contamination modeled above the applicable remediation objectives including any measured data showing concentrations of contaminants of concern in which the applicable remediation objectives are exceeded;

3) A scaled map delineating the boundaries of all properties under which groundwater is located that~~which~~ exceeds the applicable groundwater remediation objectives;

4) Information identifying the current owners~~owner(s)~~ of each property identified in subsection (b)(3) ~~of this Section~~; and

5) A copy of the proposed written notification to the unit of local government that adopted the ordinance and to the current owners identified in subsection (b)(4) ~~of this Section~~ that includes the following information:

   A) The name and address of the unit of local government that adopted the ordinance;

   B) The ordinance's citation;

   C) A description of the property being sent notice by adequate legal description, reference to a plat showing the boundaries of the property, or accurate street address;

   D) Identification of the party requesting to use the groundwater ordinance as an institutional control, and a statement that the party has requested approval from the Agency to use the ordinance as an institutional control;

   E) A statement that use of the ordinance as an institutional control allows contamination above groundwater ingestion remediation objectives to remain in groundwater beneath the affected properties, and that the ordinance strictly prohibits human and domestic consumption of the groundwater;

   F) A statement as to the nature of the release and response action with the site name, site address, and Agency site number or Illinois inventory identification number; and

G) A statement that more information about the remediation site may be obtained by contacting the party requesting the use of the groundwater ordinance as an institutional control or by submitting a FOIA request to the Agency.

c) Written notification proposed pursuant to subsection (b)(5) ~~of this Section~~ must be sent to the unit of local government that adopted the ordinance, as well as to all current property owners identified in subsection (b)(4). Written proof that the notification was sent to the unit of local government and the property owners shall be submitted to the Agency within 45 days from the date the Agency's no further remediation determination is recorded. Such proof may consist of the return card from certified mail, return receipt requested, a notarized certificate of service, or a notarized affidavit.

d) Unless the Agency and the unit of local government have entered into a MOU under subsection (i) ~~of this Section~~, the current owner or successors in interest of a site who have received approval of use of an ordinance as an institutional control under this Section shall:

1) Monitor activities of the unit of local government relative to variance requests or changes in the ordinance relative to the use of potable groundwater at properties identified in subsection (b)(3) ~~of this Section~~; and

2) Notify the Agency of any approved variance requests or ordinance changes within 30 days after the date such action has been approved.

e) The information required in subsections (b)(1) through (b)(5) ~~of this Section~~ and the Agency letter approving the groundwater remediation objective shall be submitted to the unit of local government. Proof that the information has been filed with the unit of local government shall be provided to the Agency.

f) Any ordinance or MOU used as an institutional control pursuant to this Section shall be recorded in the Office of the Recorder or Registrar of Titles of the county in which the site is located together with the instrument memorializing the Agency's no further remediation determination pursuant to the specific program within 45 days after receipt of the Agency's no further remediation determination.

g) An institutional control approved under this Section shall not become effective until officially recorded in accordance with subsection (f) ~~of this Section~~. The person receiving the approval shall obtain and submit to the Agency within 30 days after recording a copy of the institutional control demonstrating that it has been recorded.

h) The following shall be grounds for voidance of the ordinance as an institutional control and the instrument memorializing the Agency's no further remediation determination:

1) Modification of the ordinance by the unit of local government to allow potable use of groundwater;

2) Approval of a site-specific request, such as a variance, to allow potable use of groundwater at a site identified in subsection (b)(3)~~ of this Section~~;

3) Violation of the terms of an institutional control recorded under Section 742.1005 or Section 742.1010; or

4) Failure to provide notification and proof of such notification pursuant to subsection (c)~~ of this Section~~.

i) The Agency and a unit of local government may enter into a MOU under this Section if the unit of local government has adopted an ordinance satisfying subsection (a) ~~of this Section~~ and if the requirements of this subsection are met. The MOU submitted to the Agency must match the form and contain the same substance as the model in Appendix H and shall include the following:

1) Identification of the authority of the unit of local government to enter the MOU;

2) Identification of the legal boundaries, or equivalent, under which the ordinance is applicable;

3) A certified copy of the ordinance;

4) A commitment by the unit of local government to notify the Agency of any variance requests or proposed ordinance changes at least 30 days prior to the date the local government is scheduled to take action on the request or proposed change;

5) A commitment by the unit of local government to maintain a registry of all sites within the unit of local government that have received no further remediation determinations pursuant to specific programs; and

6) If the ordinance does not expressly prohibit the installation of potable

water supply wells (and the use of such wells) by units of local government, a commitment by the unit of local government:

A) To review the registry of sites established under subsection (i)(5) ~~of this Section~~ prior to siting potable water supply wells within the area covered by the ordinance;

B) To determine whether the potential source of potable water may be or has been affected by contamination left in place at those sites; and

C) To take whatever steps are necessary to ensure that the potential source of potable water is protected from the contamination or treated before it is used as a potable water supply.

j) A groundwater ordinance may not be used to exclude the indoor inhalation exposure route.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

SUBPART K: ENGINEERED BARRIERS

Section 742.1105 Engineered Barrier Requirements

a) Natural attenuation, access controls, and point of use treatment shall not be considered engineered barriers. Engineered barriers may not be used to prevent direct human exposure to groundwater without the use of institutional controls.

b) For purposes of determining remediation objectives under Tier 1, engineered barriers are not recognized.

c) The following engineered barriers are recognized for purposes of calculating remediation objectives that exceed residential remediation objectives:

1) For the soil component of the groundwater ingestion exposure route, the following engineered barriers are recognized if they prevent completion of the exposure pathway:

A) Caps or walls constructed of compacted clay, asphalt, concrete or other material approved by the Agency; and

B) Permanent structures such as buildings and highways.

2) For the soil ingestion exposure route, the following engineered barriers are recognized if they prevent completion of the exposure pathway:

A) Caps or walls constructed of compacted clay, asphalt, concrete, or other material approved by the Agency;

B) Permanent structures such as buildings and highways; and

C) Soil, sand, gravel, or other geologic materials that:

i) Cover the contaminated media;

ii) Meet the soil remediation objectives under Subpart E for residential property for contaminants of concern; and

iii) Are a minimum of three feet in depth.

3) For the <u>outdoor</u> inhalation exposure route, the following engineered barriers are recognized if they prevent completion of the exposure pathway:

A) Caps or walls constructed of compacted clay, asphalt, concrete, or other material approved by the Agency;

B) Permanent structures such as buildings and highways; and

C) Soil, sand, gravel, or other geologic materials that:

i) Cover the contaminated media;

ii) Meet the soil remediation objectives under Subpart E for residential property for contaminants of concern; and

iii) Are a minimum of ten feet in depth and not within ten feet of any manmade pathway.

4) For the ingestion of groundwater exposure route, the following engineered barriers are recognized if they prevent completion of the exposure pathway:

A) Slurry walls; and

B) Hydraulic control of groundwater.

d) Unless otherwise prohibited under Section 742.1100, any other type of engineered barrier may be proposed if it will be as effective as the options listed in subsection (c)~~ of this Section~~.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

SUBPART L: BUILDING CONTROL TECHNOLOGIES

Section 742.1200 Building Control Technologies

a) Any person who develops remediation objectives under this Part based on building control technologies shall meet the requirements of this Subpart and the requirements of Subpart J relative to institutional controls.

b) The Agency shall not approve any remediation objective under this Part that is based on the use of building control technologies unless the person has proposed building control technologies meeting the requirements of the following:

1) This Subpart L or Subpart I; and

2) Subpart J relative to institutional controls.

c) The use of building control technologies can be recognized in determining remediation objectives only if the building control technologies are intended for use as part of the final corrective action.

d) An approved building control technology shall be in place and operational prior to human occupancy.

e) Any no further remediation determination based upon the use of building control technologies shall require effective maintenance of the building control technology. The maintenance requirements shall be included in an institutional control under Subpart J. This institutional control shall address provisions for inoperability by requiring the following if the building control technology is rendered inoperable:

1) The site owner/operator shall notify building occupants and workers in advance of intrusive activities. The notification shall enumerate the contaminant of concern known to be present;

2) The site owner/operator shall require building occupants and workers to implement protective measures consistent with good industrial hygiene practice; and

3) For a school, the school administrator shall notify the Agency, the school board, and every parent or legal guardian for all enrolled students when a building control technology is rendered inoperable for a period of five consecutive calendar days during the school year when school is in session. For purposes of the preceding sentence, any occurrence of inoperability, regardless of its duration, results in the date of the occurrence constituting a day of inoperability. For purposes of this subsection (e)(3), the term "school" means any public educational facility in Illinois, including grounds and/or campus, consisting of students, comprising one or more grade groups or other identifiable groups, organized as one unit with one or more teachers to give instruction of a defined type. Public educational facility includes, but is not limited to, primary and secondary (kindergarten-12th grade), charter, vocational, alternative, and special education schools. Public educational facility does not include junior colleges, colleges, or universities. For purposes of this subsection (e)(3), the term "school administrator" means the school's principal, or similar administrator responsible for the school's operations, or his or her designee.

f) Failure to install or maintain a building control technology in accordance with a no further remediation determination shall be grounds for voidance of the determination and the instrument memorializing the Agency's no further remediation determination.

(Source: Added at 37 Ill. Reg. _____, effective ______)

Section 742.1205 Building Control Technology Proposals

A proposal to use a building control technology under this Subpart shall include the following information:

a) A description of the site and physical site characteristics;

b) The current extent and modeled migration of contamination;

c) Geology, including soil types and parameters;

d) Results and locations of sampling events;

e) Scaled map of the area, including all buildings and man-made pathways;

f) A description of building characteristics and methods of construction, including a description of man-made pathways; and

g) Present and post-remediation uses of the land that are at issue due to the area of contamination, including human receptors at risk.

(Source: Added at 37 Ill. Reg. _____, effective ______)

Section 742.1210 Building Control Technology Requirements

a) Natural attenuation, access controls, and point of use treatment shall not be considered building control technologies.

b) For purposes of determining compliance with remediation objectives under Tier 1, building control technologies are not recognized.

c) The following building control technologies are recognized for purposes of pathway exclusion under Section 742.312.

1) Sub-slab depressurization (SSD) systems meeting the following requirements:

A) A suction pit is installed that is at least two cubic feet and extends at least 6 inches below the slab (larger suction pits may be excavated as needed to achieve the performance criteria in subsection (c)(1)(B));

B) A PVC pipe of at least 3 inches in diameter extends from the suction pit to the intake side of an in-line fan capable of achieving a static vacuum of at least 0.25 inches water column (wc) at the suction point and measureable vacuum at the farthest edges of the area served by the suction pit under worst case conditions (all exhaust fans and heating systems running, during cold weather) as determined by a differential pressure reading of at least -0.003 inches wc below the slab or visible downward flow of air at test holes using chemical or smoke sticks;

C) All visible cracks and joints in the slab (including the place where the pipe exits the slab) and foundation walls are sealed;

D) The pipe exhausts outside the building at least 10 feet above ground and at least 10 feet from any door or window; and

E) Additional suction pits meeting the requirements of subsection (c)(1)(A) shall be installed as necessary to achieve measureable vacuum below the slab in all areas, including in any area where subsurface or foundation conditions (e.g., a sub-slab grade beam) prevent adequate suction field extension.

2) Sub-membrane depressurization (SMD) systems meeting the following requirements:

A) A non-woven geotextile is installed on the exposed earthen material;

B) A cross-laminated polyethylene membrane liner at least 0.10 mm (or 4 mil) thick is placed over the geotextile and sealed to foundation walls using a low volatile adhesive that is recommended by the liner manufacturer (e.g., acrylic latex adhesive);

C) A 3 inch diameter PVC pipe extends from a hole cut in the liner to the intake side of an in-line fan capable of achieving a static vacuum of at least 0.25 inches water column (wc) at the riser pipe and measureable vacuum at the farthest edges of the liner under worst case conditions (all exhaust fans running during cold weather) as determined by a differential pressure reading of at least -0.003 inches wc below the liner or visible downward flow of air in test holes using chemical or smoke sticks;

D) The pipe is sealed to the liner;

E) The pipe exhausts outside the building at least 10 feet above ground and at least 10 feet from any door or window; and

F) No leaks based on smoke stick tests along the entire perimeter of the liner (i.e., at all sealed edges) with the fan running. Where leaks are identified, appropriate repairs are undertaken and smoke stick testing repeated until no leaks are detected.

3) Membrane barrier systems when placed below concrete slabs meeting the following requirements:

A) The membrane is impermeable to volatile chemicals and is not less than 1.5 mm (or 60 mil) thick;

B) The membrane is sealed to foundation walls and any penetrating pipes according to membrane manufacturer/installer recommendations;

C) The membrane is installed in accordance with the manufacturer's requirements and by an applicator trained and approved by the manufacturer;

D) A smoke test of the membrane system (where smoke is injected below the installed liner prior to slab installation), in accordance with the manufacturer's requirements, is performed to ensure no leaks exist. Where leaks are identified, appropriate repairs are undertaken and smoke testing repeated until no leaks are detected;

E) The membrane is puncture resistant to slab installation construction activities and protected by sand layers or geotextiles as recommended by the manufacturer; and

F) Construction activities following membrane installation do not damage, puncture or tear the membrane or otherwise compromise its ability to prevent the migration of volatile chemicals.

4) Vented raised floors meeting the following requirements:

A) An interconnected void system below the slab sufficient to allow free movement of air and communication of negative pressures to all points below the slab;

B) Sealing of all construction joints, open cracks, and penetrations through the slab (e.g., for utilities and riser pipes) with a low volatile caulk; and

C) At least one 3 inch diameter riser pipe venting to the atmosphere above the roof line (at least 10 feet from any doors or windows) for each 5000 square feet of membrane area, with the capability of converting passively vented floor systems to actively vented or SSD systems meeting the performance requirements of subsection (c)(1).

(Source: Added at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX A: General

Section 742.TABLE A: Soil Saturation Limits (C_{sat}) for Chemicals Whose Melting Point is Less Than~~than~~ 30° C

~~CAS No.~~	~~Chemical Name~~	~~C_{sat} (mg/kg)~~
~~67-64-1~~	~~Acetone~~	~~100,000~~
~~71-43-2~~	~~Benzene~~	~~870~~
~~111-44-4~~	~~Bis(2-chloroethyl)ether~~	~~3,300~~
~~117-81-7~~	~~Bis(2-ethylhexyl)phthalate~~	~~31,000~~
~~75-27-4~~	~~Bromodichloromethane (Dichlorobromomethane)~~	~~3,000~~
~~75-25-2~~	~~Bromoform~~	~~1,900~~
~~71-36-3~~	~~Butanol~~	~~10,000~~
~~85-68-7~~	~~Butyl benzyl phthalate~~	~~930~~
~~75-15-0~~	~~Carbon disulfide~~	~~720~~
~~56-23-5~~	~~Carbon tetrachloride~~	~~1,100~~
~~108-90-7~~	~~Chlorobenzene (Monochlorobenzene)~~	~~680~~
~~124-48-1~~	~~Chlorodibromomethane (Dibromochloromethane)~~	~~1,300~~
~~67-66-3~~	~~Chloroform~~	~~2,900~~
~~96-12-8~~	~~1,2-Dibromo-3-chloropropane~~	~~1,400~~
~~106-93-4~~	~~1,2-Dibromoethane (Ethylene dibromide)~~	~~2,800~~
~~84-74-2~~	~~Di-*n*-butyl phthalate~~	~~2,300~~
~~95-50-1~~	~~1,2-Dichlorobenzene (o-Dichlorobenzene)~~	~~560~~
~~75-34-3~~	~~1,1-Dichloroethane~~	~~1,700~~
~~107-06-2~~	~~1,2-Dichloroethane (Ethylene dichloride)~~	~~1,800~~
~~75-35-4~~	~~1,1-Dichloroethylene~~	~~1,500~~
~~156-59-2~~	~~*cis*-1,2-Dichloroethylene~~	~~1,200~~
~~156-60-5~~	~~*trans*-1,2-Dichloroethylene~~	~~3,100~~
~~78-87-5~~	~~1,2-Dichloropropane~~	~~1,100~~
~~542-75-6~~	~~1,3-Dichloropropene (1,3-Dichloropropylene, *cis* +~~	~~1,400~~

	~~*trans*)~~	
~~84-66-2~~	~~Diethyl phthalate~~	~~2,000~~
~~117-84-0~~	~~Di-*n*-octyl phthalate~~	~~10,000~~
~~100-41-4~~	~~Ethylbenzene~~	~~400~~
~~77-47-4~~	~~Hexachlorocyclopentadiene~~	~~2,200~~
~~78-59-1~~	~~Isophorone~~	~~4,600~~
~~74-83-9~~	~~Methyl bromide (Bromomethane)~~	~~3,200~~
~~1634-04-4~~	~~Methyl tertiary-butyl ether~~	~~8,800~~
~~75-09-2~~	~~Methylene chloride (Dichloromethane)~~	~~2,400~~
~~98-95-3~~	~~Nitrobenzene~~	~~1,000~~
~~100-42-5~~	~~Styrene~~	~~1,500~~
~~127-18-4~~	~~Tetrachloroethylene (Perchloroethylene)~~	~~240~~
~~108-88-3~~	~~Toluene~~	~~650~~
~~120-82-1~~	~~1,2,4-Trichlorobenzene~~	~~3,200~~
~~71-55-6~~	~~1,1,1-Trichloroethane~~	~~1,200~~
~~79-00-5~~	~~1,1,2-Trichloroethane~~	~~1,800~~
~~79-01-6~~	~~Trichloroethylene~~	~~1,300~~
~~108-05-4~~	~~Vinyl acetate~~	~~2,700~~
~~75-01-4~~	~~Vinyl chloride~~	~~1,200~~
~~108-38-3~~	~~m-Xylene~~	~~420~~
~~95-47-6~~	~~o-Xylene~~	~~410~~
~~106-42-3~~	~~p-Xylene~~	~~460~~
~~1330-20-7~~	~~Xylenes (total)~~	~~320~~
	~~**Ionizable Organics**~~	
~~95-57-8~~	~~2-Chlorophenol~~	~~53,000~~

CAS No.	Chemical Name	For the Outdoor Inhalation Exposure Route[a] C_{sat} (mg/kg)	For the Soil Component of the Groundwater Ingestion Exposure Route[b] C_{sat} (mg/kg)
67-64-1	Acetone	1.00E+05	2.00E+05
71-43-2	Benzene	8.00E+02	5.80E+02
111-44-4	Bis(2-chloroethyl)ether	3.00E+03	3.90E+03
117-81-7	Bis(2-ethylhexyl)phthalate	2.00E+02	6.80E+01
75-27-4	Bromodichloromethane (Dichlorobromomethane)	2.80E+03	2.00E+03
75-25-2	Bromoform	2.00E+03	1.20E+03
71-36-3	Butanol	1.00E+04	1.60E+04
78-93-3	2-Butanone (MEK)	2.50E+04	4.50E+04
85-68-7	Butyl benzyl phthalate	1.00E+03	3.40E+02
75-15-0	Carbon disulfide	8.50E+02	5.20E+02
56-23-5	Carbon tetrachloride	1.20E+03	5.60E+02
108-90-7	Chlorobenzene (Monochlorobenzene)	6.20E+02	2.90E+02
124-48-1	Chlorodibromomethane (Dibromochloromethane)	1.40E+03	8.90E+02
67-66-3	Chloroform	3.40E+03	2.50E+03
95-57-8	2-Chlorophenol [c] (ionizable organic)	1.00E+04	7.10E+03
75-99-0	Dalapon	1.20E+05	1.90E+05
96-12-8	1,2-Dibromo-3-chloropropane	6.90E+02	4.30E+02
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	1.60E+03	1.20E+03
84-74-2	Di-*n*-butyl phthalate	2.60E+03	8.80E+02
95-50-1	1,2-Dichlorobenzene (o-Dichlorobenzene)	5.60E+02	2.10E+02

CAS No.	Chemical Name	For the Outdoor Inhalation Exposure Route[a] C_{sat} (mg/kg)	For the Soil Component of the Groundwater Ingestion Exposure Route[b] C_{sat} (mg/kg)
75-71-8	Dichlorodifluoromethane	8.70E+02	4.30E+02
75-34-3	1,1-Dichloroethane	1.70E+03	1.40E+03
107-06-2	1,2-Dichloroethane (Ethylene dichloride)	1.90E+03	2.10E+03
75-35-4	1,1-Dichloroethylene	1.40E+03	9.10E+02
156-59-2	*cis*-1,2-Dichloroethylene	1.30E+03	1.00E+03
156-60-5	*trans*-1,2-Dichloroethylene	3.00E+03	2.10E+03
78-87-5	1,2-Dichloropropane	1.20E+03	8.70E+02
542-75-6	1,3-Dichloropropene (1,3-Dichloropropylene, *cis* + *trans*)	1.00E+03	8.50E+02
84-66-2	Diethyl phthalate	2.20E+03	9.20E+02
105-67-9	2,4-Dimethylphenol	1.00E+04	4.70E+03
117-84-0	Di-*n*-octyl phthalate	1.60E+01	5.20E+00
123-91-1	p-Dioxane	1.00E+05	2.00E+05
100-41-4	Ethylbenzene	3.50E+02	1.50E+02
77-47-4	Hexachlorocyclopentadiene	1.30E+02	4.40E+01
78-59-1	Isophorone	3.00E+03	3.00E+03
98-82-8	Isopropylbenzene (Cumene)	9.40E+02	4.00E+02
7439-97-6	Mercury (elemental)	3.10E+00	N/A
74-83-9	Methyl bromide (Bromomethane)	3.10E+03	3.60E+03
1634-04-4	Methyl tertiary-butyl ether	8.40E+03	1.10E+04
75-09-2	Methylene chloride (Dichloromethane)	2.50E+03	3.00E+03
98-95-3	Nitrobenzene	7.10E+02	5.90E+02
621-64-7	n-Nitrosodi-n-propylamine	1.90E+03	2.30E+03

CAS No.	Chemical Name	For the Outdoor Inhalation Exposure Route[a] C_{sat} (mg/kg)	For the Soil Component of the Groundwater Ingestion Exposure Route[b] C_{sat} (mg/kg)
100-42-5	Styrene	6.30E+02	2.60E+02
127-18-4	Tetrachloroethylene (Perchloroethylene)	8.00E+02	3.10E+02
108-88-3	Toluene	5.80E+02	2.90E+02
120-82-1	1,2,4-Trichlorobenzene	3.40E+02	1.20E+02
71-55-6	1,1,1-Trichloroethane	1.30E+03	6.70E+02
79-00-5	1,1,2-Trichloroethane	1.80E+03	1.30E+03
79-01-6	Trichloroethylene	1.20E+03	6.50E+02
75-69-4	Trichlorofluoromethane	1.80E+03	8.90E+02
108-05-4	Vinyl acetate	2.60E+03	4.20E+03
75-01-4	Vinyl chloride	2.60E+03	2.90E+03
108-38-3	m-Xylene	4.10E+02	1.60E+02
95-47-6	o-Xylene	3.70E+02	1.50E+02
106-42-3	p-Xylene	3.30E+02	1.40E+02
1330-20-7	Xylenes (total)	2.80E+02	1.10E+02

[a] Soil Saturation Limits calculated using an f_{oc} of 0.006 g/g and a system temperature of 25°C.

[b] Soil Saturation Limits calculated using an f_{oc} of 0.002 g/g and a system temperature of 25°C.

[c] C_{sat} for pH of 6.8. If soil pH is other than 6.8, a site-specific C_{sat} should be calculated using equations S19 and S29 and the pH-specific K_{oc} values in Appendix C Table I.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX A General

Section 742.TABLE E Similar-Acting Noncarcinogenic Chemicals

~~Adrenal Gland~~
~~Nitrobenzene~~
~~1,2,4-Trichlorobenzene (Ingestion only)~~

~~Kidney~~
~~Acetone (Ingestion only)~~
~~Cadmium (Ingestion only)~~
~~Chlorobenzene~~
~~Dalapon~~
~~1,1-Dichloroethane~~
~~Di-n-octyl phthalate (Ingestion only)~~
~~Endosulfan~~
~~Ethylbenzene~~
~~Fluoranthene~~
~~Methyl tertiary-butyl ether (Inhalation only)~~
~~Nitrobenzene~~
~~Pyrene~~
~~Toluene (Ingestion only)~~
~~2,4,5-Trichlorophenol~~
~~Vinyl acetate (Ingestion only)~~

~~Liver~~
~~Acenaphthene~~
~~Acetone (Ingestion only)~~
~~Butylbenzyl phthalate (Ingestion only)~~
~~Chlorobenzene (Ingestion only)~~
~~1,1-Dichloroethylene (Ingestion only)~~
~~Di-n-octyl phthalate (Ingestion only)~~
~~Endrin~~
~~Ethylbenzene~~
~~Fluoranthene~~
~~Methyl tertiary-butyl ether (Inhalation only)~~
~~Nitrobenzene~~
~~Picloram~~
~~Styrene (Ingestion only)~~
~~2,4,5-TP (Silvex)~~
~~Toluene (Ingestion only)~~
~~1,2,4-Trichlorobenzene (Inhalation only)~~
~~2,4,5-Trichlorophenol~~

~~Central Nervous System~~
~~Butanol (Ingestion only)~~
~~Cyanide (amenable)~~
~~2,4-Dimethylphenol~~
~~Endrin~~
~~Manganese~~
~~2-Methylphenol~~
~~Mercury (Inhalation only)~~
~~Styrene (Inhalation only)~~
~~Toluene (Inhalation only)~~
~~Xylenes (Ingestion only)~~

~~Circulatory System~~
~~Antimony~~
~~Barium (Ingestion only)~~
~~2,4-D~~
~~cis-1,2-Dichloroethylene (Ingestion only)~~
~~Nitrobenzene~~
~~trans-1,2-Dichloroethylene (Ingestion only)~~
~~2,4-Dimethylphenol~~
~~Fluoranthene~~
~~Fluorene~~
~~Styrene (Ingestion only)~~
~~Zinc~~

~~Gastrointestinal System~~
~~Beryllium (Ingestion only)~~
~~Endothall~~
~~Hexachlorocyclopentadiene (Ingestion only)~~
~~Methyl bromide (Ingestion only)~~
~~Methyl tertiary -butyl ether (Ingestion only)~~

~~Immune System~~
~~2,4-Dichlorophenol~~
~~p-Chloroaniline~~
~~Mercury (Ingestion only)~~

~~Reproductive System~~
~~Barium (Inhalation only)~~
~~Boron (Ingestion only)~~
~~Carbon disulfide~~
~~2-Chlorophenol (Ingestion only)~~
~~1,2 Dibromo-3-Chloropropane (Inhalation only)~~
~~Dinoseb~~
~~Ethylbenzene (Inhalation only)~~
~~Methoxychlor~~
~~Phenol~~

~~Respiratory System~~
~~1,2-Dichloropropane (Inhalation only)~~
~~1,3-Dichloropropylene (Inhalation only)~~
~~Hexachlorocyclopentadiene (Inhalation only)~~
~~Methyl bromide (Inhalation only)~~
~~Naphthalene (Inhalation only)~~
~~Toluene (Inhalation only)~~
~~Vinyl acetate (Inhalation only)~~

~~Cholinesterase Inhibition~~
~~Aldicarb~~
~~Carbofuran~~
~~Decreased Body Weight Gains~~

~~and Circulatory System Effects~~
~~Atrazine~~
~~Simazine~~

Adrenal Gland
Isopropylbenzene

Cholinesterase Inhibition
Aldicarb
Carbofuran

Circulatory System
Alachlor
Antimony (ingestion only)

<u>Benzene</u>
<u>Cobalt (ingestion only)</u>
<u>2,4-D</u>
<u>*cis*-1,2-Dichloroethylene (ingestion only)</u>
<u>2,4-Dimethylphenol</u>
<u>2,4-Dinitrotoluene</u>
<u>2,6-Dinitrotoluene</u>
<u>Ensosulfan</u>
<u>Fluoranthene</u>
<u>Fluorene</u>
<u>Methylene Chloride (inhalation only)</u>
<u>Nickel (Res. & I/C only) (inhalation only)</u>
<u>Nitrate as N</u>
<u>Nitrobenzene (ingestion only)</u>
<u>Selenium</u>
<u>Simazine</u>
<u>Styrene (ingestion only)</u>
<u>1,3,5-Trinitrobenzene</u>
<u>Zinc</u>

<u>**Decreased Body Weight Gain**</u>
<u>Atrazine</u>
<u>Bis(2-chloroethyl)ether</u>
<u>Cyanide</u>
<u>1,2-Dichlorobenzene (inhalation only)</u>
<u>Diethyl phthalate (ingestion only)</u>
<u>Ensosulfan</u>
<u>2-Methylphenol (o-cresol)</u>
<u>Naphthalene (ingestion only)</u>
<u>Nickel (ingestion only)</u>
<u>n-Nitrosodiphenylamine</u>
<u>Phenol (ingestion only)</u>
<u>Simazine</u>
<u>Tetrachloroethylene (ingestion only)</u>
<u>1,1,1-Trichloroethane (ingestion only)</u>
<u>Vinyl acetate (ingestion only)</u>
<u>Xylenes (Res. & I/C only) (ingestion only)</u>

<u>**Endocrine System**</u>
<u>Cyanide</u>
<u>1,2-Dibromoethane (ingestion only)</u>
<u>Di-n-octyl phthalate (ingestion only)</u>
<u>Nitrobenzene</u>
<u>1,2,4-Trichlorobenzene (ingestion only)</u>

Eye
2,4-Dinitrophenol
n-Nitrosodiphenylamine
Polychlorinated biphenyls (PCBs)
Trichloroethylene

Gastrointestinal System
Beryllium (ingestion only)
Copper
1,3-Dichloropropene (*cis* + *trans*) (ingestion only)
Endothall
Fluoride
Hexachlorocyclopentadiene (ingestion only)
Iron
Methyl bromide (ingestion only)
Methyl tertiary-butyl ether (ingestion only)

Immune System
4-Chloroaniline
2,4-Dichlorophenol
Mercury (ingestion only)
Polychlorinated biphenyls (PCBs)

Kidney
Acetone (ingestion only)
Aldrin (CW only)
Barium
Bromodichloromethane (ingestion only)
Cadmium
2,4-D
Dalapon
1,1-Dichloroethane
1,2-Dichloroethane (CW only) (ingestion only)
Ensosulfan
Ethylbenzene (ingestion only)
Fluoranthene
gamma-HCH (gamma-BHC)
Hexachloroethane (ingestion only)
Isopropylbenzene
Mecoprop (MCPP)
Methyl tertiary-butyl ether (inhalation only)
Pentachlorophenol
Pyrene

Toluene (ingestion only)
2,4,5-Trichlorophenol
Vinyl acetate (ingestion only)

Liver
Acenapthene
Aldrin (Res. & I/C only)
Bis(2-ethylhexyl)phthalate (Res. & I/C only) (ingestion only)
Bromoform
Butyl Benzyl Phtalate (ingestion only)
Carbon Tetrachloride
Chlordane
Chlorobenzene (ingestion only)
Chlorodibromomethane (ingestion only)
Chloroform
2,4-D
DDT
1,2-Dibromoethane (ingestion only)
1,2-Dichlorobenezene (CW only) (ingestion only)
1,4-Dichlorobenzene
Dichlorodifluoromethane
1,2-Dichloroethane (inhalation only)
1,1-Dichloroethylene
trans-1,2-Dichloroethylene
1,2-Dichloropropane (ingestion only)
Dieldrin (Res. & I/C only)
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Di-n-octyl phthalate (ingestion only)
p-Dioxane
Endrin
Ethylbenzene (ingestion only)
Fluoranthene
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
alpha-HCH (alpha-BHC
gamma-HCH (gamma-BHC)
High Melting Explosive, Octogen (HMX)
Isophorone (inhalation only)
Methyl tertiary-butyl ether
Methylene Chloride (ingestion only)
Pentachlorophenol
Phenol (inhalation only)

Picloram
Styrene (ingestion only)
Tetrachloroethylene (ingestion only)
Toxaphene (CW only)
2,4,5-TP (Silvex)
1,2,4-Trichlorobenzene (inhalation only)
1,1,1-Trichloroethane (inhalation only)
1,1,2-Trichloroethane (ingestion only)
2,4,5-Trichlorophenol
2,4,6-Trinitrotoluene (TNT)
Vinyl Chloride

Mortality
Di-n-butyl phthalate (ingestion only)
Xylenes (Res. & I/C only) (ingestion only)

Nervous System
Butanol (ingestion only)
Carbon disulfide (inhalation only)
Cyanide
Dieldrin (CW only)
2,4-Dimethylphenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Endrin
Hexachloroethane (inhalation only) (CW only)
Manganese
Mercury (inhalation only)
2-Methylphenol (o-cresol)
Phenol (inhalation only)
Selenium
Styrene (inhalation only)
Tetrachloroethylene (inhalation only)
Toluene (inhalation only)
Trichloroethylene
Xylenes (CW only) (ingestion only)
Xylenes (inhalation only)

Reproductive System
Arsenic (inhalation only)
Bis(2-ethylhexyl)phthalate (CW only) (ingestion only)
Boron
2-Butanone
Carbofuran

Carbon disulfide (ingestion only)
2-Chlorophenol
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane (ingestion only)
Dicamba
Dinoseb
Ethylbenzene (inhalation only)
Isophorone (inhalation only)
Methoxychlor
Royal Demolition Explosive , Cyclonite (RDX)
2,4,6-Trichlorophenol

Respiratory System
Antimony (inhalation only)
Benzoic Acid (inhalation only)
Berryllium (inhalation only)
Cadmium (inhalation only)
Chromium (hex) (inhalation only)
Cobalt (inhalation only)
1,2-Dibromoethane (inhalation only)
trans-1,2-Dichloroethylene (inhalation only)
1,2-Dichloropropane (inhalation only)
1,3-Dichloropropene (*cis* + *trans*) (inhalation only)
Hexachlorocyclopentadiene (inhalation only)
Methyl bromide (inhalation only)
Naphtalene (inhalation only)
Nickel (inhalation only)
Nitrobenezene (inhalation only)
Vinyl acetate (inhalation only)

Skin
Arsenic (ingestion only)
Polychlorinated biphenyls (PCBs)
Selenium
Silver

Spleen
1,3-Dinotrobenzene
1,3,5-Trinitrobenzene

Notes:
Res. = Residential receptor
I/C = Industrial/Commercial receptor
CW = Construction Worker receptor

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX A: General

Section 742.TABLE F: Similar-Acting Carcinogenic Chemicals

~~Kidney~~
~~Bromodichloromethane (Ingestion only)~~
~~Chloroform (Ingestion only)~~
~~1,2-Dibromo-3-chloropropane (Ingestion only)~~
~~2,4-Dinitrotoluene~~
~~2,6-Dinitrotoluene~~
~~Hexachlorobenzene~~

~~Liver~~
~~Aldrin~~
~~Bis(2-chloroethyl)ether~~
~~Bis(2-ethylhexyl)phthalate (Ingestion only)~~
~~Carbazole~~
~~Carbon tetrachloride~~
~~Chlordane~~
~~Chloroform (Inhalation only)~~
~~DDD~~
~~DDE~~
~~DDT~~
~~1,2-Dibromo-3-chloropropane (Ingestion only)~~
~~1,2-Dibromoethane(Ingestion only)~~
~~3,3'-Dichlorobenzidine~~
~~1,2-Dichloroethane~~
~~1,2-Dichloropropane (Ingestion only)~~
~~1,3-Dichloropropylene (Ingestion only)~~
~~Dieldrin~~
~~2,4-Dinitrotoluene~~
~~2,6-Dinitrotoluene~~
~~Heptachlor~~
~~Heptachlor epoxide~~
~~Hexachlorobenzene~~
~~alpha-HCH~~
~~gamma-HCH (Lindane)~~
~~Methylene chloride~~
~~N-Nitrosodiphenylamine~~
~~N-Nitrosodi-n-propylamine~~
~~Pentachlorophenol~~
~~Tetrachloroethylene~~
~~Trichloroethylene~~
~~2,4,6-Trichlorophenol~~
~~Toxaphene~~

~~Vinyl chloride~~

~~Circulatory System~~
~~Benzene~~
~~2,4,6-Trichlorophenol~~

~~Gastrointestinal System~~
~~Benzo(a)anthracene~~
~~Benzo(b)fluoranthene~~
~~Benzo(k)fluoranthene~~
~~Benzo(a)pyrene~~
~~Chrysene~~
~~Dibenzo(a,h)anthracene~~
~~Indeno(1,2,3-c,d)pyrene~~
~~Bromodichloromethane (Ingestion only)~~
~~Bromoform~~
~~1,2-Dibromo-3-chloropropane (Ingestion only)~~
~~1,2-Dibromoethane (Ingestion only)~~
~~1,3-Dichloropropylene (Ingestion only)~~

~~Lung~~
~~Arsenic (Inhalation only)~~
~~Beryllium (Inhalation only)~~
~~Cadmium (Inhalation only)~~
~~Chromium, hexavalent (Inhalation only)~~
~~1,3-Dichloropropylene (Inhalation only)~~
~~Methylene chloride (Inhalation only)~~
~~N-Nitrosodi-n-propylamine~~
~~Nickel (Inhalation only)~~
~~Vinyl chloride~~

~~Nasal Cavity~~
~~1,2-Dibromo-3-chloropropane (Inhalation only)~~
~~1,2-Dibromoethane (Inhalation only)~~
~~N-Nitrosodi-n-propylamine~~

~~Bladder~~
~~3,3~~
~~-Dichlorobenzidine~~
~~1,3-Dichloropropylene (Ingestion only)~~
~~N-Nitrosodiphenylamine~~

Bladder
1,3-Dichloropropene (*cis* + *trans*) (ingestion only)
n-Nitrosodiphenylamine

Liver (continued)
Chlordane
Chloroform

Circulatory System
Benzene
1,2-Dibromoethane
1,2-Dichloroethane
Pentachlorophenol
2,4,6-Trichlorophenol

Gall Bladder
p-Dioxane (inhalation only)

Gastrointestinal System
Benzo(a)anthracene (ingestion only)
Benzo(b)fluoranthene (ingestion only)
Benzo(k)flouranthene (ingestion only)
Benzo(a)pyrene (ingestion only)
Bromoform
Chrysene (ingestion only)
Dibenzo(a,h)anthracene (ingestion only)
1,2-Dibromoethane (ingestion only)
Indeno(1,2,3-cd)pyrene (ingestion only)

Kidney
Bromodichloromethane (ingestion only)
Chloroform (ingestion only)
1,2-Dibromo-3-chloropropane (ingestion only)
Nitrobenzene

Liver
Aldrin
Bis(2-chloroethyl)ether
Bis(2-ethylhexyl)phthalate
Carbazole
Carbon Tetrachloride
DDD
DDE
DDT
1,2-Dichloropropane
Dieldrin
2,4-Dinitrotoluene
2,6-Dinitrotoluene
p-Dioxane
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
alpha-HCH (alpha-BHC)
gamma-HCH (gamma-BHC)
Methylene Chloride
Nitrobenzene
n-Nitrosodiphenylamine (inhalation only)
n-Nitrosodi-n-propylamine
Pentachlorophenol
Polychlorinated biphenyls (PCBs)
Tetrachloroethylene
Toxaphene
Trichloroethylene
Vinyl Chloride (I/C & CW)
Vinyl Chloride (Res.)

Mammary Gland
3,3'-Dichlorobenzidine
2,4-Dinitrotoluene
2,6-Dinitrotoluene

Respiratory System
Arsenic (inhalation only)
Benzo(a)anthracene (inhalation only)
Benzo(b)fluoranthene (inhalation only)

Respiratory System (continued)
Benzo(k)flouranthene (inhalation only)
Benzo(a)pyrene (inhalation only)
Beryllium
Cadmium
Chromium (hexavalent ion)
Chrysene (inhalation only)
Cobalt
Dibenzo(a,h)anthracene (inhalation only)
1,2-Dibromo-3-chloropropane (inhalation only)
1,2-Dibromoethane (inhalation only)
1,3-Dichloropropene (*cis* + *trans*) (inhalation only)
p-Dioxane (inhalation only)
Trichloroethylene

Notes:
Res. = Residential receptor
I/C = Industrial/Commercial receptor
CW = Construction Worker receptor

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX A: General

Section 742.Table J: List of TACO Volatile Chemicals for the Indoor Inhalation Exposure Route

CAS No.	**Chemical**
67-64-1	Acetone
71-43-2	Benzene
111-44-4	Bis(2-chloroethyl)ether
75-27-4	Bromodichloromethane
75-25-2	Bromoform
71-36-3	Butanol
78-93-3	2-Butanone (MEK)
75-15-0	Carbon disulfide
56-23-5	Carbon tetrachloride
108-90-7	Chlorobenzene
124-48-1	Chlorodibromomethane
67-66-3	Chloroform
95-57-8	2-Chlorophenol
75-99-0	Dalapon
96-12-8	1,2-dibromo-3-chloropropane
106-93-4	1,2-Dibromoethane
95-50-1	1,2-Dichlorobenzene
106-46-7	1,4-Dichlorobenzene
75-71-8	Dichlorodifluoromethane
75-34-3	1,1-Dichloroethane
107-06-2	1,2-Dichloroethane
75-35-4	1,1-Dichloroethylene
156-59-2	*cis*-1,2-Dichloroethylene
156-60-5	*trans*-1,2-Dichloroethylene
78-87-5	1,2-Dichloropropane
542-75-6	1,3-Dichloropropylene (*cis* + *trans*)
123-91-1	p-Dioxane
100-41-4	Ethylbenzene
76-44-8	Heptachlor
118-74-1	Hexachlorobenzene
77-47-4	Hexachlorocyclopentadiene
67-72-1	Hexachloroethane
78-59-1	Isophorone
98-82-8	Isopropylbenzene (Cumene)
7439-97-6	Mercury

CAS No.	Chemical
74-83-9	Methyl bromide
1634-04-4	Methyl tertiary-butyl ether
75-09-2	Methylene chloride
93-65-2	2-Methylnaphthalene
95-48-7	2-Methylphenol (o-cresol)
91-20-3	Naphthalene
98-95-3	Nitrobenzene
621-64-7	n-Nitrosodi-n-propylamine
108-95-2	Phenol
1336-36-3	Polychlorinated biphenyls (PCBs)
100-42-5	Styrene
127-18-4	Tetrachloroethylene
108-88-3	Toluene
120-82-1	1,2,4-Trichlorobenzene
71-55-6	1,1,1-Trichloroethane
79-00-5	1,1,2-Trichloroethane
79-01-6	Trichloroethylene
75-69-4	Trichlorofluoromethane
108-05-4	Vinyl acetate
75-01-4	Vinyl chloride
108-38-3	m-Xylene
95-47-6	o-Xylene
106-42-3	p-Xylene
1330-20-7	Xylenes (total)

(Source: Added at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX A: General

Section 742.TABLE K: Soil Vapor Saturation Limits (C_v^{sat}) for Volatile Chemicals

CAS No.	Chemical Name	C_v^{sat} (mg/m^3)
67-64-1	Acetone	7.50E+05
71-43-2	Benzene	4.20E+05
111-44-4	Bis(2-chloroethyl)ether	1.20E+04
75-27-4	Bromodichloromethane	4.50E+05
75-25-2	Bromoform	7.80E+04
71-36-3	Butanol	2.90E+04
78-93-3	2-Butanone (MEK)	3.80E+05
75-15-0	Carbon disulfide	1.50E+06
56-23-5	Carbon tetrachloride	1.00E+06
108-90-7	Chlorobenzene	7.40E+04
124-48-1	Chlorodibromomethane	5.70E+04
67-66-3	Chloroform	1.30E+06
95-57-8	2-Chlorophenol (ionizable organic)	1.70E+04
75-99-0	Dalapon	1.50E+03
96-12-8	1,2-Dibromo-3-chloropropane	7.80E+03
106-93-4	1,2-Dibromoethane	1.40E+05
95-50-1	1,2-Dichlorobenzene	1.10E+04
106-46-7	1,4-Dichlorobenzene	8.40E+03
75-71-8	Dichlorodifluoromethane	3.30E+07
75-34-3	1,1-Dichloroethane	1.30E+06
107-06-2	1,2-Dichloroethane	4.40E+05
75-35-4	1,1-Dichloroethylene	3.30E+06
156-59-2	*cis*-1,2-Dichloroethylene	1.10E+06

CAS No.	Chemical Name	C_v^{sat} (mg/m^3)
156-60-5	*trans*-1,2-Dichloroethylene	1.80E+06
78-87-5	1,2-Dichloropropane	3.20E+05
542-75-6	1,3-Dichloropropylene (*cis* + *trans*)	2.10E+05
123-91-1	p-Dioxane	1.90E+05
100-41-4	Ethylbenzene	5.90E+04
76-44-8	Heptachlor	8.30E+00
118-74-1	Hexachlorobenzene	2.80E-01
77-47-4	Hexachlorocyclopentadiene	9.10E+02
67-72-1	Hexachloroethane	2.80E+03
78-59-1	Isophorone	3.40E+03
98-82-8	Isopropylbenzene (Cumene)	3.00E+04
7439-97-6	Mercury (elemental)	2.20E+01
74-83-9	Methyl bromide	8.60E+06
1634-04-4	Methyl tertiary-butyl ether	1.20E+06
75-09-2	Methylene chloride	2.00E+06
93-65-2	2-Methylnaphthalene	5.30E+02
1634-04-4	2-Methylphenol (o-cresol)	1.80E+03
91-20-3	Naphthalene	6.20E+02
98-95-3	Nitrobenzene	1.70E+03
621-64-7	n-Nitrosodi-n-propylamine	9.50E+02
108-95-2	Phenol	1.50E+03
1336-36-3	Polychlorinated biphenyls (PCBs)	9.00E+00
100-42-5	Styrene	3.40E+04
127-18-4	Tetrachloroethylene	1.80E+05
108-88-3	Toluene	1.40E+05

CAS No.	Chemical Name	C_v^{sat} (mg/m^3)
120-82-1	1,2,4-Trichlorobenzene	4.30E+03
71-55-6	1,1,1-Trichloroethane	8.70E+05
79-00-5	1,1,2-Trichloroethane	1.70E+05
79-01-6	Trichloroethylene	5.30E+05
75-69-4	Trichlorofluoromethane	6.30E+06
108-05-4	Vinyl acetate	4.30E+05
75-01-4	Vinyl chloride	1.10E+07
108-38-3	m-Xylene	5.20E+04
95-47-6	o-Xylene	4.10E+04
106-42-3	p-Xylene	5.50E+04
1330-20-7	Xylenes (total)	4.90E+04

(Source: Added at 37 Ill. Reg. ______, effective ______)

Section 742.APPENDIX B: Tier 1 Illustrations and Tables

Section 742.TABLE G: Tier 1 Soil Gas Remediation Objectives for the Outdoor Inhalation Exposure Route[a]

CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Construction Worker (mg/m^3)
67-64-1	Acetone	750,000[e]	750,000[e]	750,000[e]
71-43-2	Benzene	420[c]	800[c]	1,100[c]
111-44-4	Bis(2-chloroethyl)ether	1.3[c]	2.4[c]	3.4[c]
75-27-4	Bromodichloromethane	450,000[e]	450,000[e]	450,000[e]
75-25-2	Bromoform	1,800[c]	3,500[c]	4,900[c]
71-36-3	Butanol	29,000[e]	29,000[e]	29,000[e]
78-93-3	2-Butanone (MEK)	380,000[e]	380,000[e]	15,000[b]
75-15-0	Carbon disulfide	1,500,000[e]	1,500,000[e]	48,000[b]
56-23-5	Carbon tetrachloride	290[c]	550[c]	770[c]
108-90-7	Chlorobenzene	36,000[b]	57,000[b]	3,700[b]
124-48-1	Chlorodibromomethane	57,000[e]	57,000[e]	150[b]
67-66-3	Chloroform	110[c]	200[c]	290[c]
95-57-8	2-Chlorophenol	17,000[e]	17,000[e]	17,000[e]
75-99-0	Dalapon	1,500[e]	1,500[e]	1,500[e]
96-12-8	1,2-Dibromo-3-chloropropane	0.14[c]	0.27[c]	0.38[c]
106-93-4	1,2-Dibromoethane	2.9[c]	5.6[c]	7.9[c]
95-50-1	1,2-Dichlorobenzene	11,000[e]	11,000[e]	6,700[b]
106-46-7	1,4-Dichlorobenzene	8,400[e]	8,400[e]	6,400[b]
75-71-8	Dichlorodifluoromethane	890,000[b]	1,400,000[b]	92,000[b]
75-34-3	1,1-Dichloroethane	870,000[b]	1,300,000[e]	90,000[b]
107-06-2	1,2-Dichloroethane	67[c]	130[c]	180[c]

75-35-4	1,1-Dichloroethylene	520,000[b]	820,000[b]	5,300[b]
156-59-2	*cis*-1,2-Dichloroethylene	1,100,000[e]	1,100,000[e]	1,100,000[e]
156-60-5	*trans*-1,2-Dichloroethylene	120,000[b]	190,000[b]	12,000[b]
78-87-5	1,2-Dichloropropane	240[c]	470[c]	110[c]
542-75-6	1,3-Dichloropropylene (*cis* + *trans*)	1,900[c]	3,700[c]	1,400[c]
123-91-1	p-Dioxane	16[c]	30[c]	42[c]
100-41-4	Ethylbenzene	59,000[e]	59,000[e]	8,500[b]
76-44-8	Heptachlor	0.40[c]	0.76[c]	1.1[c]
118-74-1	Hexachlorobenzene	0.26[c]	0.28[e]	0.28[e]
77-47-4	Hexachlorocyclopentadiene	85[b]	140[b]	440[b]
67-72-1	Hexachloroethane	2,800[e]	2,800[e]	2,800[e]
78-59-1	Isophorone	3,400[e]	3,400[e]	1,500[b]
98-82-8	Isopropylbenzene (Cumene)	30,000[e]	30,000[e]	30,000[e]
7439-97-6	Mercury[f]	22[e]	22[e]	0.62[b]
74-83-9	Methyl bromide	12,000[b]	19,000[b]	2,400[b]
1634-04-4	Methyl tertiary-butyl ether	1,200,000[e]	1,200,000[e]	23,000[b]
75-09-2	Methylene chloride	6,100[c]	12,000[c]	5,100[b]
91-57-6	2-Methylnaphthalene	530[e]	530[e]	530[e]
95-48-7	2-Methylphenol (o-cresol)	1,800[e]	1,800[e]	410[b]
91-20-3	Naphthalene	560[b]	620[e]	5.8[b]
98-95-3	Nitrobenzene	6.5[c]	12[c]	10[b]
621-64-7	n-Nitrosodi-n-propylamine	0.056[c]	0.11[c]	0.15[c]
108-95-2	Phenol	1,500[e]	1,500[e]	79[b]
1336-36-3	Polychlorinated biphenyls (PCBs)	---[d]	---[d]	---[d]
100-42-5	Styrene	34,000[e]	34,000[e]	16,000[b]
127-18-4	Tetrachloroethylene	360[c]	690[c]	970[c]

108-88-3	Toluene	140,000[e]	140,000[e]	50,000[b]
120-82-1	1,2,4-Trichlorobenzene	1,000[b]	1,600[b]	110[b]
71-55-6	1,1,1-Trichloroethane	870,000[e]	870,000[e]	89,000[b]
79-00-5	1,1,2-Trichloroethane	170,000[e]	170,000[e]	170,000[e]
79-01-6	Trichloroethylene	1,700[c]	3,300[c]	1,500[b]
75-69-4	Trichlorofluoromethane	2,100,000[b]	3,400,000[b]	220,000[b]
108-05-4	Vinyl acetate	160,000[b]	250,000[b]	1,600[b]
75-01-4	Vinyl chloride	780[c]	3,000[c]	3,000[b]
108-38-3	m-Xylene	52,000[e]	52,000[e]	3,100[b]
95-47-6	o-Xylene	41,000[e]	41,000[e]	2,600[b]
106-42-3	p-Xylene	55,000[e]	55,000[e]	3,300[b]
1330-20-7	Xylenes (total)	49,000[e]	49,000[e]	2,900[b]

Chemical Name and Remediation Objective Notations

[a] For the outdoor inhalation exposure route, it is acceptable to determine compliance by meeting either the soil or soil gas remediation objectives. The soil remediation objectives for the outdoor inhalation route are located in Appendix B, Tables A and B.

[b] Calculated values correspond to a target hazard quotient of 1.

[c] Calculated values correspond to a cancer risk level of 1 in 1,000,000.

[d] PCBs are a mixture of different congeners. The appropriate values to use for the physical/chemical and toxicity parameters depend on the congeners present at the site. Persons remediating sites should consult with IEPA Bureau of Land (BOL) if calculation of Tier 2 or 3 remediation objectives is desired.

[e] The value shown is the C_v^{sat} value of the chemical in soil gas. The C_v^{sat} of the chemical becomes the remediation objective if the calculated value exceeds the C_v^{sat} value or if there are no toxicity criteria available for the inhalation route of exposure.

[f] Value for the inhalation exposure route is based on Reference Concentration for elemental Mercury (CAS No. 7439-97-6). Inhalation remediation objectives only apply at sites where elemental Mercury is a contaminant of concern.

(Source: Added at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX B: Tier 1 Illustrations and Tables

Section 742.TABLE H: Tier 1 Soil Gas and Groundwater Remediation Objectives for the Indoor Inhalation Exposure Route – Diffusion and Advection[j]

Q_{soil} equals 83.33 cm^3/sec[a]

		Soil Gas		Groundwater	
CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Residential (mg/L)	Industrial/Commercial (mg/L)
67-64-1	Acetone	750,000[f]	750,000[f]	1,000,000[g]	1,000,000[g]
71-43-2	Benzene	0.37[c]	2.8[c]	0.11[c]	0.41[c]
111-44-4	Bis(2-chloroethyl)ether	0.014[c]	0.087[c]	0.083[c]	0.43[c]
75-27-4	Bromodichloromethane	450,000[f]	450,000[f]	6,700[g]	6,700[g]
75-25-2	Bromoform	11[c]	52[c]	3.1[c]	12[c]
71-36-3	Butanol	29,000[f]	29,000[f]	74,000[g]	74,000[g]
78-93-3	2-Butanone (MEK)	6,400[b]	40,000[b]	10,000[b]	48,000[b]
75-15-0	Carbon disulfide	780[b]	5,300[b]	67[b]	210[b]
56-23-5	Carbon tetrachloride	0.21[c]	1.5[c]	0.020[c]	0.076[c]
108-90-7	Chlorobenzene	69[b]	420[b]	26[b]	82[b]
124-48-1	Chlorodibromomethane	57,000[f]	57,000[f]	2,600[g]	2,600[g]
67-66-3	Chloroform	0.11[c]	0.92[c]	0.07[i]	0.15[c]
95-57-8	2-Chlorophenol	17,000[f]	17,000[f]	22,000[g]	22,000[g]
75-99-0	Dalapon[e]	1,500[f]	1,500[f]	900,000[g]	900,000[g]
96-12-8	1,2-Dibromo-3-chloropropane[e]	0.0012[c]	0.0062[c]	0.00065[c]	0.0027[c]
106-93-4	1,2-Dibromoethane	0.0078[c]	0.048[c]	0.0035[c]	0.014[c]
95-50-1	1,2-Dichlorobenzene	290[b]	1,700[b]	140[b]	160[g]
106-46-7	1,4-Dichlorobenzene	1,200[b]	6,800[b]	79[g]	79[g]

		Soil Gas		Groundwater	
CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Residential (mg/L)	Industrial/Commercial (mg/L)
75-71-8	Dichlorodifluoromethane	270[b]	1,700[b]	3.0[b]	9.2[b]
75-34-3	1,1-Dichloroethane	690[b]	4,200[b]	180[b]	580[b]
107-06-2	1,2-Dichloroethane	0.099[c]	0.81[c]	0.054[c]	0.22[c]
75-35-4	1,1-Dichloroethylene	240[b]	1,600[b]	24[b]	74[b]
156-59-2	*cis*-1,2-Dichloroethylene	1,100,000[f]	1,100,000[f]	3,500[g]	3,500[g]
156-60-5	*trans*-1,2-Dichloroethylene	85[b]	510[b]	16[b]	51[b]
78-87-5	1,2-Dichloropropane	0.31[c]	2.3[c]	0.12[c]	0.48[c]
542-75-6	1,3-Dichloropropylene (*cis* + *trans*)	0.90[c]	6.2[c]	0.14[c]	0.52[c]
123-91-1	p-Dioxane	0.22[c]	2.3[c]	2.9[c]	25[c]
100-41-4	Ethylbenzene	1,3[c]	9.3[c]	0.37[c]	1.4[c]
76-44-8	Heptachlor	0.0063[c]	0.032[c]	0.0025[c]	0.0096[c]
118-74-1	Hexachlorobenzene	0.0087[c]	0.057[c]	0.0059[c]	0.0062[g]
77-47-4	Hexachlorocyclopentadiene	0.58[b]	2.6[b]	0.084[b]	0.26[b]
67-72-1	Hexachloroethane	2,800[f]	2,800[f]	50[g]	50[g]
78-59-1	Isophorone	2,900[b]	3,400[f]	12,000[g]	12,000[g]
98-82-8	Isopropylbenzene (Cumene)	600[b]	3,500[b]	2.7[b]	8.4[b]
7439-97-6	Mercury[h]	0.42[b]	2.5[b]	0.053[b]	0.060[g]
74-83-9	Methyl bromide	6.9[b]	42[b]	1.5[b]	4.8[b]
1634-04-4	Methyl tertiary-butyl ether	3,700[b]	24,000[b]	1,900[b]	6,800[b]
75-09-2	Methylene chloride	5.6[c]	45[c]	2.1[c]	8.2[c]
91-57-6	2-Methylnaphthalene	530[f]	530[f]	25[g]	25[g]
95-48-7	2-Methylphenol (o-cresol)	600[b]	1,800[f]	26,000[g]	26,000[g]
91-20-3	Naphthalene	0.11[c]	0.75[c]	0.075[c]	0.32[c]

		Soil Gas		Groundwater	
CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Residential (mg/L)	Industrial/Commercial (mg/L)
98-95-3	Nitrobenzene	0.077[c]	0.57[c]	0.34[c]	2.0[c]
621-64-7	n-Nitrosodi-n-propylamine	0.0016[c]	0.012[c]	0.044[c]	0.27[c]
108-95-2	Phenol	140[b]	1,300[b]	28,000[b]	83,000[g]
1336-36-3	Polychlorinated biphenyls (PCBs)	---[d]	---[d]	---[d]	---[d]
100-42-5	Styrene	1,400[b]	8,500[b]	310[g]	310[g]
127-18-4	Tetrachloroethylene	0.55[c]	4.0[c]	0.091[c]	0.34[c]
108-88-3	Toluene	6,200[b]	40,000[b]	530[g]	530[g]
120-82-1	1,2,4-Trichlorobenzene	5.4[b]	25[b]	1.8[b]	5.9[b]
71-55-6	1,1,1-Trichloroethane	6,600[b]	41,000[b]	1,000[b]	1,300[g]
79-00-5	1,1,2-Trichloroethane	170,000[f]	170,000[f]	4,400[g]	4,400[g]
79-01-6	Trichloroethylene	1.5[c]	12[c]	0.34[c]	1.3[c]
75-69-4	Trichlorofluoromethane	860[b]	5,600[b]	26[b]	82[b]
108-05-4	Vinyl acetate	250[b]	1,600[b]	160[b]	550[b]
75-01-4	Vinyl chloride	0.29[c]	4.8[c]	0.028[c]	0.21[c]
108-38-3	m-Xylene	140[b]	850[b]	43[b]	130[b]
95-47-6	o-Xylene	120[b]	790[b]	40[b]	130[b]
106-42-3	p-Xylene	130[b]	820[b]	38[b]	120[b]
1330-20-7	Xylenes (total)[e]	140[b]	840[b]	30[b]	93[b]

Chemical Name and Remediation Objective Notations

a Compliance is determined by meeting either the soil gas remediation objectives or the groundwater remediation objectives. See Sections 742.505 and 742.515.

b Calculated values correspond to a target hazard quotient of 1.

[c] Calculated values correspond to a cancer risk level of 1 in 1,000,000.

[d] PCBs are a mixture of different congeners. The appropriate values to use for the physical/chemical and toxicity parameters depend on the congeners present at the site. Persons remediating sites should consult with BOL if calculation of Tier 2 or 3 remediation objectives is desired.

[e] Groundwater remediation objective calculated at 25°C. For Dalapon and 1,2-Dibromo-3-chloropropane, the critical temperature (T_c) and enthalpy of vaporization at the normal boiling point ($H_{v,b}$) are not available. For Xylenes (total), the enthalpy of vaporization at the normal boiling point ($H_{v,b}$) is not available.

[f] The value shown is the C_v^{sat} value of the chemical in soil gas. The C_v^{sat} of the chemical becomes the remediation objective if the calculated value exceeds the C_v^{sat} value or if there are no toxicity criteria available for the inhalation route of exposure.

[g] The value shown is the solubility of the chemical in water. The solubility of the chemical becomes the remediation objective if the calculated value exceeds the solubility or if there are no toxicity criteria available for the ingestion route of exposure.

[h] Value for the inhalation exposure route is based on Reference Concentration for elemental Mercury (CAS No. 7439-97-6). Inhalation remediation objectives only apply at sites where elemental Mercury is a contaminant of concern.

[i] The value shown is the Groundwater Remediation Objective listed in Appendix B, Table E.

[j] Calculated values for the remediation objectives in this table are based on the assumption that the existing or potential building has a full concrete slab-on-grade, though the remediation objectives in this table are also considered protective of occupants of buildings with full concrete basement floors and walls. This table applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. Institutional controls under Subpart J are required to use remediation objectives in this table. This table does not apply when the existing or potential building has neither a full concrete slab-on-grade nor a full concrete basement floor and walls, such as a building with an earthen crawl space, an earthen floor, a stone foundation, a

partial concrete floor, or a sump. In such cases, site evaluators have the option of excluding the indoor inhalation exposure route under Section 742.312, meeting the building control technology requirements under Subpart L, or proposing an alternative approach under Tier 3.

(Source: Added at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX B: Tier 1 Illustrations and Tables

Section 742.TABLE I: Tier 1 Soil Gas and Groundwater Remediation Objectives for the Indoor Inhalation Exposure Route – Diffusion Only[j]

Q_{soil} equals 0.0 cm^3/sec[a,b]

		Soil Gas		Groundwater	
CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Residential (mg/L)	Industrial/Commercial (mg/L)
67-64-1	Acetone	750,000[g]	750,000[g]	1,000,000[h]	1,000,000[h]
71-43-2	Benzene	41[d]	300[d]	0.41[d]	2.6[d]
111-44-4	Bis(2-chloroethyl)ether	1.9[d]	14[d]	6.6[d]	48[d]
75-27-4	Bromodichloromethane	450,000[g]	450,000[g]	6,700[h]	6,700[h]
75-25-2	Bromoform	1,800[d]	13,000[d]	170[d]	1,300[d]
71-36-3	Butanol	29,000[g]	29,000[g]	74,000[h]	74,000[h]
78-93-3	2-Butanone (MEK)	380,000[g]	380,000[g]	220,000[h]	220,000[h]
75-15-0	Carbon disulfide	81,000[c]	500,000[c]	170[c]	820[c]
56-23-5	Carbon tetrachloride	24[d]	180[d]	0.052[d]	0.31[d]
108-90-7	Chlorobenzene	8,300[c]	51,000[c]	130[c]	470[h]
124-48-1	Chlorodibromomethane	57,000[g]	57,000[g]	2,600[h]	2,600[h]
67-66-3	Chloroform	12[d]	87[d]	0.17[d]	1.1[d]
95-57-8	2-Chlorophenol	17,000[g]	17,000[g]	22,000[h]	22,000[h]
75-99-0	Dalapon[f]	1,500[g]	1,500[g]	900,000[h]	900,000[h]
96-12-8	1,2-Dibromo-3-chloropropane[f]	0.17[d]	1.3[d]	0.029[d]	0.21[d]
106-93-4	1,2-Dibromoethane	1.1[d]	7.9[d]	0.073[d]	0.52[d]
95-50-1	1,2-Dichlorobenzene	11,000[g]	11,000[g]	160[h]	160[h]
106-46-7	1,4-Dichlorobenzene	8,400[g]	8,400[g]	79[h]	79[h]

CAS No.	Chemical Name	Soil Gas Residential (mg/m^3)	Soil Gas Industrial/Commercial (mg/m^3)	Groundwater Residential (mg/L)	Groundwater Industrial/Commercial (mg/L)
75-71-8	Dichlorodifluoromethane	32,000[c]	200,000[c]	6.8[c]	33[c]
75-34-3	1,1-Dichloroethane	81,000[c]	500,000[c]	750[c]	4,100[c]
107-06-2	1,2-Dichloroethane	10[d]	76[d]	0.50[d]	3.5[d]
75-35-4	1,1-Dichloroethylene	27,000[c]	160,000[c]	61[c]	300[c]
156-59-2	*cis*-1,2-Dichloroethylene	1,100,000[g]	1,100,000[g]	3,500[h]	3,500[h]
156-60-5	*trans*-1,2-Dichloroethylene	10,000[c]	63,000[c]	58[c]	310[c]
78-87-5	1,2-Dichloropropane	36[d]	260[d]	0.67[d]	4.5[d]
542-75-6	1,3-Dichloropropylene (*cis* + *trans*)	110[d]	830[d]	0.42[d]	2.6[d]
123-91-1	p-Dioxane	15[d]	110[d]	140[d]	1,000[d]
100-41-4	Ethylbenzene	150[d]	1,100[d]	1.3[d]	8.1[d]
76-44-8	Heptachlor	0.97[d]	7.1[d]	0.058[d]	0.18[h]
118-74-1	Hexachlorobenzene	0.28[g]	0.28[g]	0.0062[h]	0.0062[h]
77-47-4	Hexachlorocyclopentadiene	86[c]	530[c]	0.29[c]	1.5[c]
67-72-1	Hexachloroethane	2,800[g]	2,800[g]	50[h]	50[h]
78-59-1	Isophorone	3,400[g]	3,400[g]	12,000[h]	12,000[h]
98-82-8	Isopropylbenzene (Cumene)	30,000[g]	30,000[g]	6.2[c]	30[c]
7439-97-6	Mercury[i]	22[g]	22[g]	0.060[h]	0.060[h]
74-83-9	Methyl bromide	830[c]	5,100[c]	6.1[c]	33[c]
1634-04-4	Methyl tertiary-butyl ether	420,000[c]	1,200,000[g]	30,000[c]	51,000[h]
75-09-2	Methylene chloride	590[d]	4,400[d]	12[d]	84[d]
91-57-6	2-Methylnaphthalene	530[g]	530[g]	25[h]	25[h]
95-48-7	2-Methylphenol (o-cresol)	1,800[g]	1,800[g]	26,000[h]	26,000[h]
91-20-3	Naphthalene	14[d]	100[d]	1.8[d]	13[d]

		Soil Gas		Groundwater	
CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Residential (mg/L)	Industrial/Commercial (mg/L)
98-95-3	Nitrobenzene	9.0[d]	66[d]	23[d]	170[d]
621-64-7	n-Nitrosodi-n-propylamine	0.18[d]	1.3[d]	3.3[d]	24[d]
108-95-2	Phenol	1,500[g]	1,500[g]	83,000[h]	83,000[h]
1336-36-3	Polychlorinated biphenyls (PCBs)	---[e]	---[e]	---[e]	---[e]
100-42-5	Styrene	34,000[g]	34,000[g]	310[h]	310[h]
127-18-4	Tetrachloroethylene	66[d]	490[d]	0.26[d]	1.6[d]
108-88-3	Toluene	140,000[g]	140,000[g]	530[h]	530[h]
120-82-1	1,2,4-Trichlorobenzene	800[c]	4,300[g]	35[h]	35[h]
71-55-6	1,1,1-Trichloroethane	770,000[c]	870,000[g]	1,300[h]	1,300[h]
79-00-5	1,1,2-Trichloroethane	170,000[g]	170,000[g]	4,400[h]	4,400[h]
79-01-6	Trichloroethylene	180[d]	1,300[d]	1.1[d]	6.7[d]
75-69-4	Trichlorofluoromethane	97,000[c]	600,000[c]	62[c]	300[c]
108-05-4	Vinyl acetate	28,000[c]	170,000[c]	2,500[c]	15,000[c]
75-01-4	Vinyl chloride	30[d]	440[d]	0.065[d]	0.75[d]
108-38-3	m-Xylene	17,000[d]	52,000[c]	160[c]	160[h]
95-47-6	o-Xylene	14,000[d]	41,000[c]	170[c]	180[h]
106-42-3	p-Xylene	16,000[d]	55,000[c]	140[c]	160[h]
1330-20-7	Xylenes (total)[f]	17,000[d]	49,000[c]	96[c]	110[h]

Chemical Name and Remediation Objective Notations

[a] Compliance is determined by meeting both the soil gas remediation objectives and the groundwater remediation objectives. See Sections 742.505 and 742.515.

[b] Remediation objectives relying on this table require use of institutional controls in accordance with Subpart J.

[c] Calculated values correspond to a target hazard quotient of 1.

[d] Calculated values correspond to a cancer risk level of 1 in 1,000,000.

[e] PCBs are a mixture of different congeners. The appropriate values to use for the physical/chemical and toxicity parameters depend on the congeners present at the site. Persons remediating sites should consult with BOL if calculation of Tier 2 or 3 remediation objectives is desired

[f] Groundwater remediation objective calculated at 25°C. For Dalapon and 1,2-Dibromo-3-chloropropane, the critical temperature (T_c) and enthalpy of vaporization at the normal boiling point ($H_{v,b}$) are not available. For Xylenes (total), the enthalpy of vaporization at the normal boiling point ($H_{v,b}$) is not available.

[g] The value shown is the C_v^{sat} value of the chemical in soil gas. The C_v^{sat} of the chemical becomes the remediation objective if the calculated value exceeds the C_v^{sat} value or if there are no toxicity criteria available for the inhalation route of exposure.

[h] The value shown is the solubility of the chemical in water. The solubility of the chemical becomes the remediation objective if the calculated value exceeds the solubility or if there are no toxicity criteria available for the inhalation route of exposure.

[i] Value for the inhalation exposure route is based on Reference Concentration for elemental Mercury (CAS No. 7439-97-6). Inhalation remediation objectives only apply at sites where elemental Mercury is a contaminant of concern.

[j] Calculated values for the remediation objectives in this table are based on the assumption that the existing or potential building has a full concrete slab-on-grade, though the remediation objectives in this table are also considered protective of occupants of buildings with full concrete basement floors and walls. This table applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. Institutional controls under Subpart J are required to use remediation objectives in this table. This table does not apply when the existing or potential building has neither a full concrete slab-on-grade nor a full concrete basement floor and walls, such as a building with an earthen crawl space, an earthen floor, a stone foundation, a

partial concrete floor, or a sump. In such cases, site evaluators have the option of excluding the indoor inhalation exposure route under Section 742.312, meeting the building control technology requirements under Subpart L, or proposing an alternative approach under Tier 3.

(Source: Added at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX C: Tier 2 Illustrations and Tables

Section 742.Table A: SSL Equations

Equations for Soil Ingestion Exposure Route	Remediation Objectives for Noncarcinogenic Contaminants (mg/kg)	$$\frac{THQ \bullet BW \bullet AT \bullet 365 \frac{d}{yr}}{\frac{1}{RfD_O} \bullet 10^{-6} \frac{kg}{mg} \bullet EF \bullet ED \bullet IR_{soil}}$$	**S1**
	Remediation Objectives for Carcinogenic Contaminants - Residential (mg/kg)	$$\frac{TR \bullet AT_c \bullet 365 \frac{d}{yr}}{SF_o \bullet 10^{-6} \frac{kg}{mg} \bullet EF \bullet IF_{soil-adj}}$$	**S2**
	Remediation Objectives for Carcinogenic Contaminants - Industrial/ Commercial, Construction Worker (mg/kg)	$$\frac{TR \bullet BW \bullet AT_c \bullet 365 \frac{d}{yr}}{SF_o \bullet 10^{-6} \frac{kg}{mg} \bullet EF \bullet ED \bullet IR_{soil}}$$	**S3**

Equations for Inhalation Exposure Route (Organic Contaminants and Mercury)	Remediation Objectives for Noncarcinogenic Contaminants - Residential, Industrial/ Commercial (mg/kg)	$$\frac{THQ \bullet AT \bullet 365\frac{d}{yr}}{EF \bullet ED \bullet \left(\frac{1}{RfC} \bullet \frac{1}{VF}\right)}$$	**S4**
	Remediation Objectives for Noncarcinogenic Contaminants - Construction Worker (mg/kg)	$$\frac{THQ \bullet AT \bullet 365\frac{d}{yr}}{EF \bullet ED \bullet \left(\frac{1}{RfC} \bullet \frac{1}{VF'}\right)}$$	**S5**
	Remediation Objectives for Carcinogenic Contaminants - Residential, Industrial/ Commercial (mg/kg)	$$\frac{TR \bullet AT_c \bullet 365\frac{d}{yr}}{URF \bullet 1{,}000\frac{ug}{mg} \bullet EF \bullet ED \bullet \frac{1}{VF}}$$	**S6**
	Remediation Objectives for Carcinogenic Contaminants - Construction Worker (mg/kg)	$$\frac{TR \bullet AT_c \bullet 365\frac{d}{yr}}{URF \bullet 1{,}000\frac{ug}{mg} \bullet EF \bullet ED \bullet \frac{1}{VF'}}$$	**S7**

	Equation for Derivation of the Volatilization Factor - Residential, Industrial/ Commercial, VF (m^3/kg)	$$VF = \frac{Q}{C} \bullet \frac{\left(3.14 \bullet D_A \bullet T\right)^{1/2}}{\left(2 \bullet \rho_b \bullet D_A\right)} \bullet 10^{-4}\ \frac{m^2}{cm^2}$$	**S8**
	Equation for Derivation of the Volatilization Factor - Construction Worker, VF′ (m^3/kg)	$$VF' = \frac{VF}{10}$$	**S9**
	Equation for Derivation of Apparent Diffusivity, D_A (cm^2/s)	$$D_A = \frac{\left(\theta_a^{3.33} \bullet D_i \bullet H'\right) + \left(\theta_w^{3.33} \bullet D_w\right)}{\eta^2} \bullet \frac{1}{\left(\rho_b \bullet K_d\right) + \theta_w + \left(\theta_a \bullet H'\right)}$$	**S10**
Equations for Inhalation Exposure Route (Fugitive Dusts)	Remediation Objectives for Noncarcinogenic Contaminants - Residential, Industrial/Commercial (mg/kg)	$$\frac{THQ \bullet AT \bullet 365 \frac{d}{yr}}{EF \bullet ED \bullet \left(\frac{1}{RfC} \bullet \frac{1}{PEF}\right)}$$	**S11**

	Remediation Objectives for Noncarcinogenic Contaminants - Construction Worker (mg/kg)	$$\frac{THQ \bullet AT \bullet 365\frac{d}{yr}}{EF \bullet ED \bullet \left(\frac{1}{RfC} \bullet \frac{1}{PEF'}\right)}$$	**S12**
	Remediation Objectives for Carcinogenic Contaminants - Residential, Industrial/ Commercial (mg/kg)	$$\frac{TR \bullet AT_c \bullet 365\frac{d}{yr}}{URF \bullet 1{,}000\frac{ug}{mg} \bullet EF \bullet ED \bullet \frac{1}{PEF}}$$	**S13**
	Remediation Objectives for Carcinogenic Contaminants - Construction Worker (mg/kg)	$$\frac{TR \bullet AT_c \bullet 365\frac{d}{yr}}{URF \bullet 1{,}000\frac{ug}{mg} \bullet EF \bullet ED \bullet \frac{1}{PEF'}}$$	**S14**
	Equation for Derivation of Particulate Emission Factor, PEF (m^3/kg)	$$PEF = \frac{Q}{C} \bullet \frac{3{,}600\frac{s}{hr}}{0.036 \bullet (1-V) \bullet \left(\frac{U_m}{U_t}\right)^3 \bullet F(x)}$$	**S15**

	Equation for Derivation of Particulate Emission Factor, PEF′ - Construction Worker (m^3/kg)	$$PEF' = \frac{PEF}{10}$$ NOTE: PEF must be the industrial/commercial value	**S16**
Equations for the Soil Component of the Groundwater Ingestion Exposure Route	Remediation Objective (mg/kg)	$$C_w \bullet \left[K_d + \frac{(\theta_w + \theta_a \bullet H')}{\rho_b} \right]$$ NOTE: This equation can only be used to model contaminant migration not in the water bearing unit.	**S17**
	Target Soil Leachate Concentration, C_w (mg/L)	$$C_w = DF \bullet GW_{obj}$$	**S18**
	Soil-Water Partition Coefficient, K_d (cm^3/g)	$$K_d = K_{oc} \bullet f_{oc}$$	**S19**
	Water-Filled Soil Porosity, $\underline{\theta}_w$ (L_{water}/L_{soil})	$$\theta_w = \eta \bullet \left(\frac{I}{K_s} \right)^{1/(2b+3)}$$	**S20**

	Air-Filled Soil Porosity, $\underline{\theta}_a$ (L_{air}/L_{soil})	$\theta_a = \eta - \theta_w$	**S21**
	Dilution Factor, DF (unitless)	$DF = 1 + \frac{K \bullet i \bullet d}{I \bullet L}$	**S22**
	Groundwater Remediation Objective for Carcinogenic Contaminants, GW_{obj} (mg/L)	$\frac{TR \bullet BW \bullet AT_c \bullet 365 \frac{d}{yr}}{SF_o \bullet IR_w \bullet EF \bullet ED}$	**S23**
	Total Soil Porosity, η (L_{pore}/L_{soil})	$\eta = 1 - \frac{\rho_b}{\rho_s}$	**S24**
	Equation for Estimation of Mixing Zone Depth, d (m)	$d = \left(0.0112 \bullet L^2\right)^{0.5} + d_a\left[1 - \exp\frac{(-L \bullet I)}{\left(K \bullet i \bullet d_a\right)}\right]$	**S25**

Mass-Limit Equations for Inhalation Exposure Route and Soil Component of the Groundwater Ingestion Exposure Route	Mass-Limit Volatilization Factor for the Inhalation Exposure Route - Residential, Industrial/ Commercial, VF (m^3/kg)	$VF_{M-L} = \frac{Q}{C} \bullet \frac{\left[T_{M-L} \bullet \left(3.15 \bullet 10^7 \frac{s}{yr}\right)\right]}{\rho_b \bullet d_s \bullet 10^6 \frac{cm^3}{m^3}}$ NOTE: This equation may be used when vertical thickness of contamination is known or can be estimated reliably.	**S26**
	Mass-Limit Volatilization Factor for Inhalation Exposure Route - Construction Worker, VF′ - (m^3/kg)	$VF'_{M-L} = \frac{VF_{M-L}}{10}$	**S27**
	Mass-Limit Remediation Objective for Soil Component of the Groundwater Ingestion Exposure Route (mg/kg)	$\frac{\left(C_w \bullet I_{M-L} \bullet ED_{M-L}\right)}{\rho_b \bullet d_s}$ NOTE: This equation may be used when vertical thickness is known or can be estimated reliably.	**S28**

Equation for Derivation of the Soil Saturation Limit, C_{sat}	$$C_{sat} = \frac{S}{\rho_b} \bullet \left[\left(K_d \bullet \rho_b \right) + \theta_w + \left(H' \bullet \theta_a \right) \right]$$	**S29**
Equation for the soil gas component of the Outdoor Inhalation Exposure Route	$$RO_{soil\ gas} = \frac{RO_{soil} \times H \times \rho_b \times 1000}{H' \times \theta_a + \theta_w + K_a \times \rho_b}$$	**S30**

(Source: Amended at 37 Ill. Reg. ______, effective _______)

Section 742.APPENDIX C: Tier 2 Illustrations and Tables

Section 742.Table B: SSL Parameters

Symbol	Parameter	Units	Source	Parameter Value(s)
AT	Averaging Time for Noncarcinogens in Ingestion Equation	yr		Residential = 6 Industrial/Commercial = 25 Construction Worker = 0.115
AT	Averaging Time for Noncarcinogens in Inhalation Equation	yr		Residential = 30 Industrial/Commercial = 25 Construction Worker = 0.115
AT_c	Averaging Time for Carcinogens	yr	SSL	70
BW	Body Weight	kg		Residential = 15, noncarcinogens 70, carcinogens Industrial/Commercial = 70 Construction Worker = 70
C_{sat}	Soil Saturation Concentration	mg/kg	Appendix A, Table A or Equation S29 in Appendix C, Table A	Chemical-Specific or Calculated Value

Symbol	Parameter	Units	Source	Parameter Value(s)
C_w	Target Soil Leachate Concentration	mg/L	Equation S18 in Appendix C, Table A	Groundwater Standard, Health Advisory concentration, or Calculated Value
d	Mixing Zone Depth	m	SSL or Equation S25 in Appendix C, Table A	2 m or Calculated Value
d_a	Aquifer Thickness	m	Field Measurement	Site-Specific
d_s	Depth of Source (Vertical thickness of contamination)	m	Field Measurement or Estimation	Site-Specific
D_A	Apparent Diffusivity	cm^2/s	Equation S10 in Appendix C, Table A	Calculated Value
D_i	Diffusivity in Air	cm^2/s	Appendix C, Table E	Chemical-Specific
D_w	Diffusivity in Water	cm^2/s	Appendix C, Table E	Chemical-Specific
DF	Dilution Factor	unitless	Equation S22 in Appendix C, Table A	20 or Calculated Value
ED	Exposure Duration for Ingestion of Carcinogens	yr		Industrial/Commercial = 25 Construction Worker = 1

Symbol	Parameter	Units	Source	Parameter Value(s)
ED	Exposure Duration for Inhalation of Carcinogens	yr		Residential = 30 Industrial/Commercial = 25 Construction Worker = 1
ED	Exposure Duration for Ingestion of Noncarcinogens	yr		Residential = 6 Industrial/Commercial = 25 Construction Worker = 1
ED	Exposure Duration for Inhalation of Noncarcinogens	yr		Residential = 30 Industrial/Commercial = 25 Construction Worker = 1
ED	Exposure Duration for the Direct Ingestion of Groundwater	yr		Residential = 30 Industrial/Commercial = 25 Construction Worker = 1
ED_{M-L}	Exposure Duration for Migration to Groundwater Mass-Limit Equation S28	yr	SSL	70
EF	Exposure Frequency	d/yr		Residential = 350 Industrial/Commercial = 250 Construction Worker = 30

Symbol	Parameter	Units	Source	Parameter Value(s)
F(x)	Function dependent on U_m/U_t	unitless	SSL	0.194
f_{oc}	Organic Carbon Content of Soil	g/g	SSL or Field Measurement (See Appendix C, Table F)	Surface Soil = 0.006 Subsurface soil = 0.002, or Site-Specific
GW_{obj}	Groundwater Remediation Remediation Objective	mg/L	Appendix B, Table E, 35 IAC 620.Subpart F, or Equation S23 in Appendix C, Table A	Chemical-Specific or Calculated
H'	Henry's Law Constant	unitless	Appendix C, Table E	Chemical-Specific
i	Hydraulic Gradient	m/m	Field Measurement (See Appendix C, Table F)	Site-Specific
I	Infiltration Rate	m/yr	SSL	0.3
I_{M-L}	Infiltration Rate for Migration to Groundwater Mass-Limit Equation S28	m/yr	SSL	0.18

Symbol	Parameter	Units	Source	Parameter Value(s)
$IF_{soil\text{-}adj}$ (residential)	Age Adjusted Soil Ingestion Factor for Carcinogens	(mg-yr)/(kg-d)	SSL	114
IR_{soil}	Soil Ingestion Rate	mg/d		Residential = 200 Industrial/Commercial = 50 Construction Worker = 480
IR_W	Daily Water Ingestion Rate	L/d		Residential = 2 Industrial/Commercial = 1
K	Aquifer Hydraulic Conductivity	m/yr	Field Measurement (See Appendix C, Table F)	Site-Specific
K_d (Non-ionizing organics)	Soil-Water Partition Coefficient	cm^3/g or L/kg	Equation S19 in Appendix C, Table A	Calculated Value
K_d (Ionizing organics)	Soil-Water Partition Coefficient	cm3/g or L/kg	Equation S19 in Appendix C, Table A	Chemical and pH-Specific (see Appendix C, Table I)
K_d (Inorganics)	Soil-Water Partition Coefficient	cm3/g or L/kg	Appendix C, Table J	Chemical and pH-Specific
K_{oc}	Organic Carbon Partition Coefficient	cm^3/g or L/kg	Appendix C, Table E or Appendix C, Table I	Chemical-Specific

Symbol	Parameter	Units	Source	Parameter Value(s)
K_s	Saturated Hydraulic Conductivity	m/yr	Appendix C, Table K Appendix C, Illustration C	Site-Specific
L	Source Length Parallel to Groundwater Flow	m	Field Measurement	Site-Specific
PEF	Particulate Emission Factor	m^3/kg	SSL or Equation S15 in Appendix C, Table A	Residential = $1.32 \bullet 10^9$ or Site-Specific Industrial/Commercial = $1.24 \bullet 10^9$ or Site-Specific
PEF′	Particulate Emission Factor adjusted for Agitation (construction worker)	m^3/kg	Equation S16 in Appendix C, Table A using PEF (industrial/commercial)	$1.24 \bullet 10^8$ or Site-Specific
Q/C (used in VF equations)	Inverse of the mean concentration at the center of a square source	$(g/m^2\text{-}s)/(kg/m^3)$	Appendix C, Table H	Residential = 68.81 Industrial/Commercial = 85.81 Construction Worker = 85.81
Q/C (used in PEF equations)	Inverse of the mean concentration at the center of a square source	$(g/m^2\text{-}s)/(kg/m^3)$	SSL or Appendix C, Table H	Residential = 90.80 Industrial/Commercial = 85.81 Construction Worker = 85.81

Symbol	Parameter	Units	Source	Parameter Value(s)
RfC	Inhalation Reference Concentration	mg/m^3	~~IEPA (IRIS/HEAST[a])~~ Illinois EPA: http://www.epa.state.il.us/land/taco/toxicity-values.xls	Toxicological-Specific (Note: for Construction Workers use subchronic reference concentrations)
RfD_o	Oral Reference Dose	mg/(kg-d)	~~IEPA (IRIS/HEAST[a])~~ Illinois EPA: http://www.epa.state.il.us/land/taco/toxicity-values.xls	Toxicological-Specific (Note: for Construction Worker use subchronic reference doses)
RO_{soil}	Soil remediation objective	mg/kg	Equation S30 in Appendix C, Table A	Calculated value
$RO_{soil\ gas}$	Soil gas remediation objective	mg/m^3	Equation S30 in Appendix C, Table A	Calculated value
S	Solubility in Water	mg/L	Appendix C, Table E	Chemical-Specific
SF_o	Oral Slope Factor	$(mg/kg\text{-}d)^{-1}$	~~IEPA (IRIS/HEAST[a])~~ Illinois EPA: http://www.epa.state.il.us/land/taco/toxicity-values.xls	Toxicological-Specific
T	Exposure Interval	s		Residential = $9.5 \bullet 10^8$ Industrial/Commercial = $7.9 \bullet 10^8$ Construction Worker = $3.6 \bullet 10^6$

Symbol	Parameter	Units	Source	Parameter Value(s)
T_{M-L}	Exposure Interval for Mass-Limit Volatilization Factor Equation S26	yr	SSL	30
THQ	Target Hazard Quotient	unitless	SSL	1
TR	Target Cancer Risk	unitless		Residential = 10^{-6} at the point of human exposure Industrial/Commercial = 10^{-6} at the point of human exposure Construction Worker = 10^{-6} at the point of human exposure
U_m	Mean Annual Windspeed	m/s	SSL	4.69
URF	Inhalation Unit Risk Factor	$(ug/m^3)^{-1}$	~~IEPA (IRIS/HEAST[a])~~ Illinois EPA: http://www.epa.state.il.us/land/taco/toxicity-values.xls	Toxicological-Specific
U_t	Equivalent Threshold Value of Windspeed at 7 m	m/s	SSL	11.32

Symbol	Parameter	Units	Source	Parameter Value(s)
V	Fraction of Vegetative Cover	unitless	SSL or Field Measurement	0.5 or Site-Specific
VF	Volatilization Factor	m^3/kg	Equation S8 in Appendix C, Table A	Calculated Value
VF′	Volatilization Factor adjusted for Agitation	m^3/kg	Equation S9 in Appendix C, Table A	Calculated Value
VF_{M-L}	Mass-Limit Volatilization Factor	m^3/kg	Equation S26 in Appendix C, Table A	Calculated Value
VF'_{M-L}	Mass-Limit Volatilization Factor adjusted for Agitation	m^3/kg	Equation S27 in Appendix C, Table A	Calculated Value
η	Total Soil Porosity	L_{pore}/L_{soil}	SSL or Equation S24 in Appendix C, Table A	0.43, or Gravel = 0.25 Sand = 0.32 Silt = 0.40 Clay = 0.36, or Calculated Value

Symbol	Parameter	Units	Source	Parameter Value(s)
θ_a	Air-Filled Soil Porosity	L_{air}/L_{soil}	SSL or Equation S21 in Appendix C, Table A	Surface Soil (top 1 meter) = 0.28 Subsurface Soil (below 1 meter) = 0.13, or Gravel = 0.05 Sand = 0.14 Silt - 0.24 Clay = 0.19, or Calculated Value
θ_w	Water-Filled Soil Porosity	L_{water}/L_{soil}	SSL or Equation S20 in Appendix C, Table A	Surface Soil (top 1 meter) = 0.15 Subsurface Soil (below 1 meter) = 0.30, or Gravel = 0.20 Sand = 0.18 Silt = 0.16 Clay = 0.17, or Calculated Value
ρ_b	Dry Soil Bulk Density	kg/L or g/cm^3	SSL or Field Measurement (See Appendix C, Table F)	1.5, or Gravel = 2.0 Sand = 1.8 Silt = 1.6 Clay = 1.7, or Site-Specific

Symbol	Parameter	Units	Source	Parameter Value(s)
ρ_s	Soil Particle Density	g/cm^3	SSL or Field Measurement (See Appendix C, Table F)	2.65, or Site-Specific
ρ_w	Water Density	g/cm^3	SSL	1
1/(2b+3)	Exponential in Equation S20	unitless	Appendix C, Table K Appendix C, Illustration C	Site-Specific

~~[a] HEAST = Health Effects Assessment Summary Tables. USEPA, Office of Solid Waste and Emergency Response. EPA/SQO/R-95/036. Updated Quarterly.~~

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX C: Tier 2 Illustrations and Tables

Section 742.Table E: Default Physical and Chemical Parameters[e]

~~CAS No.~~	~~Chemical~~	~~Solubility in Water (S) (mg/L)~~	~~Diffusivity in Air (Di) (cm^2/s)~~	~~Diffusivity in Water (D_w) (cm^2/s)~~	~~Dimensionless Henry's Law Constant (H') (25°C)~~	~~Organic Carbon Partition Coefficient (K_{oc}) (L/kg)~~	~~First Order Degradation Constant (λ) (d^{-1})~~
~~Neutral Organics~~							
~~83-32-9~~	~~Acenaphthene~~	~~4.24~~	~~0.0421~~	~~7.69E-6~~	~~0.00636~~	~~7,080~~	~~0.0034~~
~~67-64-1~~	~~Acetone~~	~~1,000,000~~	~~0.124~~	~~1.14E-5~~	~~0.00159~~	~~0.575~~	~~0.0495~~
~~15972-60-8~~	~~Alachlor~~	~~242~~	~~0.0198~~	~~5.69E-6~~	~~0.00000132~~	~~394~~	~~No Data~~
~~116-06-3~~	~~Aldicarb~~	~~6,000~~	~~0.0305~~	~~7.19E-6~~	~~0.0000000574~~	~~12~~	~~0.00109~~
~~309-00-2~~	~~Aldrin~~	~~0.18~~	~~0.0132~~	~~4.86E-6~~	~~0.00697~~	~~2,450,000~~	~~0.00059~~
~~120-12-7~~	~~Anthracene~~	~~0.0434~~	~~0.0324~~	~~7.74E-6~~	~~0.00267~~	~~29,500~~	~~0.00075~~
~~1912-24-9~~	~~Atrazine~~	~~70~~	~~0.0258~~	~~6.69E-6~~	~~0.00000005~~	~~451~~	~~No Data~~
~~71-43-2~~	~~Benzene~~	~~1,750~~	~~0.088~~	~~9.80E-6~~	~~0.228~~	~~58.9~~	~~0.0009~~

~~CAS No.~~	~~Chemical~~	~~Solubility in Water (S) (mg/L)~~	~~Diffusivity in Air (Di) (cm^2/s)~~	~~Diffusivity in Water (D_w) (cm^2/s)~~	~~Dimensionless Henry's Law Constant (H') (25^oC)~~	~~Organic Carbon Partition Coefficient (K_{oc}) (L/kg)~~	~~First Order Degradation Constant (λ) (d^{-1})~~
~~56-55-3~~	~~Benzo(a)anthracene~~	~~0.0094~~	~~0.0510~~	~~9.00E-6~~	~~0.000137~~	~~398,000~~	~~0.00051~~
~~205-99-2~~	~~Benzo(b)fluoranthene~~	~~0.0015~~	~~0.0226~~	~~5.56E-6~~	~~0.00455~~	~~1,230,000~~	~~0.00057~~
~~207-08-9~~	~~Benzo(k)fluoranthene~~	~~0.0008~~	~~0.0226~~	~~5.56E-6~~	~~0.000034~~	~~1,230,000~~	~~0.00016~~
~~65-85-0~~	~~Benzoic Acid~~	~~3,500~~	~~0.0536~~	~~7.97E-6~~	~~0.0000631~~	~~0.600~~	~~No Data~~
~~50-32-8~~	~~Benzo(a)pyrene~~	~~0.00162~~	~~0.043~~	~~9.00E-6~~	~~0.0000463~~	~~1,020,000~~	~~0.00065~~
~~111-44-4~~	~~Bis(2-chloroethyl)ether~~	~~17,200~~	~~0.0692~~	~~7.53E-6~~	~~0.000738~~	~~15.5~~	~~0.0019~~
~~117-81-7~~	~~Bis(2-ethylhexyl)phthalate~~	~~0.34~~	~~0.0351~~	~~3.66E-6~~	~~0.00000418~~	~~15,100,000~~	~~0.0018~~
~~75-27-4~~	~~Bromodichloromethane~~	~~6,740~~	~~0.0298~~	~~1.06E-5~~	~~0.0656~~	~~55.0~~	~~No Data~~
~~75-25-2~~	~~Bromoform~~	~~3,100~~	~~0.0149~~	~~1.03E-5~~	~~0.0219~~	~~87.1~~	~~0.0019~~
~~71-36-3~~	~~Butanol~~	~~74,000~~	~~0.0800~~	~~9.30E-6~~	~~0.000361~~	~~6.92~~	~~0.01283~~
~~85-68-7~~	~~Butyl Benzyl Phthalate~~	~~2.69~~	~~0.0174~~	~~4.83E-6~~	~~0.0000517~~	~~57,500~~	~~0.00385~~
~~86-74-8~~	~~Carbazole~~	~~7.48~~	~~0.0390~~	~~7.03E-6~~	~~0.000000626~~	~~3,390~~	~~No Data~~

~~CAS No.~~	~~Chemical~~	~~Solubility in Water (S) (mg/L)~~	~~Diffusivity in Air (Di) (cm^2/s)~~	~~Diffusivity in Water (D_w) (cm^2/s)~~	~~Dimensionless Henry's Law Constant (H') (25°C)~~	~~Organic Carbon Partition Coefficient (K_{oc}) (L/kg)~~	~~First Order Degradation Constant (λ) (d^{-1})~~
~~1563-66-2~~	~~Carbofuran~~	~~320~~	~~0.0249~~	~~6.63E-6~~	~~.00377~~	~~37~~	~~No Data~~
~~75-15-0~~	~~Carbon Disulfide~~	~~1,190~~	~~0.104~~	~~1.00E-5~~	~~1.24~~	~~45.7~~	~~No Data~~
~~56-23-5~~	~~Carbon Tetrachloride~~	~~793~~	~~0.0780~~	~~8.80E-6~~	~~1.25~~	~~174~~	~~0.0019~~
~~57-74-9~~	~~Chlordane~~	~~0.056~~	~~0.0118~~	~~4.37E-6~~	~~0.00199~~	~~120,000~~	~~0.00025~~
~~106-47-8~~	~~p-Chloroaniline~~	~~5,300~~	~~0.0483~~	~~1.01E-5~~	~~0.0000136~~	~~66.1~~	~~No Data~~
~~108-90-7~~	~~Chlorobenzene~~	~~472~~	~~0.0730~~	~~8.70E-6~~	~~0.152~~	~~219~~	~~0.0023~~
~~124-48-1~~	~~Chlorodibromomethane~~	~~2,600~~	~~0.0196~~	~~1.05E-5~~	~~0.0321~~	~~63.1~~	~~0.00385~~
~~67-66-3~~	~~Chloroform~~	~~7,920~~	~~0.104~~	~~1.00E-5~~	~~0.15~~	~~39.8~~	~~0.00039~~
~~95-57-8~~	~~2-Chlorophenol~~	~~22,000~~	~~0.0501~~	~~9.46E-6~~	~~0.016~~	~~388~~	~~No Data~~
~~218-01-9~~	~~Chrysene~~	~~0.0016~~	~~0.0248~~	~~6.21E-6~~	~~0.00388~~	~~398,000~~	~~0.00035~~
~~94-75-7~~	~~2,4-D~~	~~680~~	~~0.0231~~	~~7.31E-6~~	~~0.00000041~~	~~451~~	~~0.00385~~
~~72-54-8~~	~~4,4'-DDD~~	~~0.09~~	~~0.0169~~	~~4.76E-6~~	~~0.000164~~	~~1,000,000~~	~~0.000062~~

~~CAS No.~~	~~Chemical~~	~~Solubility in Water (S) (mg/L)~~	~~Diffusivity in Air (Di) (cm^2/s)~~	~~Diffusivity in Water (D_w) (cm^2/s)~~	~~Dimensionless Henry's Law Constant (H') (25°C)~~	~~Organic Carbon Partition Coefficient (K_{oc}) (L/kg)~~	~~First Order Degradation Constant (λ) (d^{-1})~~
~~72-55-9~~	~~4,4'-DDE~~	~~0.12~~	~~0.0144~~	~~5.87E-6~~	~~0.000861~~	~~4,470,000~~	~~0.000062~~
~~50-29-3~~	~~4,4'-DDT~~	~~0.025~~	~~0.0137~~	~~4.95E-6~~	~~0.000332~~	~~2,630,000~~	~~0.000062~~
~~75-99-0~~	~~Dalapon~~	~~900,000~~	~~0.0414~~	~~9.46E-6~~	~~0.00000264~~	~~5.8~~	~~0.005775~~
~~53-70-3~~	~~Dibenzo(a,h)anthracene~~	~~0.00249~~	~~0.0202~~	~~5.18E-6~~	~~0.000000603~~	~~3,800,000~~	~~0.00037~~
~~96-12-8~~	~~1,2-Dibromo-3-chloropropane~~	~~1,200~~	~~0.0212~~	~~7.02E-6~~	~~0.00615~~	~~182~~	~~0.001925~~
~~106-93-4~~	~~1,2-Dibromoethane~~	~~4,200~~	~~0.0287~~	~~8.06E-6~~	~~0.0303~~	~~93~~	~~0.005775~~
~~84-74-2~~	~~Di-n-butyl Phthalate~~	~~11.2~~	~~0.0438~~	~~7.86E-6~~	~~0.0000000385~~	~~33,900~~	~~0.03013~~
~~95-50-1~~	~~1,2-Dichlorobenzene~~	~~156~~	~~0.0690~~	~~7.90E-6~~	~~0.0779~~	~~617~~	~~0.0019~~
~~106-46-7~~	~~1,4-Dichlorobenzene~~	~~73.8~~	~~0.0690~~	~~7.90E-6~~	~~0.0996~~	~~617~~	~~0.0019~~
~~91-94-1~~	~~3,3-Dichlorobenzidine~~	~~3.11~~	~~0.0194~~	~~6.74E-6~~	~~0.000000164~~	~~724~~	~~0.0019~~

~~CAS No.~~	~~Chemical~~	~~Solubility in Water (S) (mg/L)~~	~~Diffusivity in Air (Di) (cm^2/s)~~	~~Diffusivity in Water (D_w) (cm^2/s)~~	~~Dimensionless Henry's Law Constant (H') (25°C)~~	~~Organic Carbon Partition Coefficient (K_{oc}) (L/kg)~~	~~First Order Degradation Constant (λ) (d^{-1})~~
~~75-34-3~~	~~1,1-Dichloroethane~~	~~5,060~~	~~0.0742~~	~~1.05E-5~~	~~0.23~~	~~31.6~~	~~0.0019~~
~~107-06-2~~	~~1,2-Dichloroethane~~	~~8,520~~	~~0.104~~	~~9.90E-6~~	~~0.0401~~	~~17.4~~	~~0.0019~~
~~75-35-4~~	~~1,1-Dichloroethylene~~	~~2,250~~	~~0.0900~~	~~1.04E-5~~	~~1.07~~	~~58.9~~	~~0.0053~~
~~156-59-2~~	~~Cis-1,2-Dichloroethylene~~	~~3,500~~	~~0.0736~~	~~1.13E-5~~	~~0.167~~	~~35.5~~	~~0.00024~~
~~156-60-5~~	~~Trans-1,2-Dichloroethylene~~	~~6,300~~	~~0.0707~~	~~1.19E-5~~	~~0.385~~	~~52.5~~	~~0.00024~~
~~120-83-2~~	~~2,4-Dichlorophenol~~	~~4,500~~	~~0.0346~~	~~8.77E-6~~	~~0.00013~~	~~147~~	~~0.00027~~
~~78-87-5~~	~~1,2-Dichloropropane~~	~~2,800~~	~~0.0782~~	~~8.73E-6~~	~~0.115~~	~~43.7~~	~~0.00027~~
~~542-75-6~~	~~1,3-Dichloropropylene (cis + trans)~~	~~2,800~~	~~0.0626~~	~~1.00E-5~~	~~0.726~~	~~45.7~~	~~0.061~~
~~60-57-1~~	~~Dieldrin~~	~~0.195~~	~~0.0125~~	~~4.74E-6~~	~~0.000619~~	~~21,400~~	~~0.00032~~
~~84-66-2~~	~~Diethyl Phthalate~~	~~1,080~~	~~0.0256~~	~~6.35E-6~~	~~0.0000185~~	~~288~~	~~0.00619~~
~~105-67-9~~	~~2,4-Dimethylphenol~~	~~7,870~~	~~0.0584~~	~~8.69E-6~~	~~0.000082~~	~~209~~	~~0.0495~~
~~51-28-5~~	~~2,4-Dinitrophenol~~	~~2,790~~	~~0.0273~~	~~9.06E-6~~	~~0.0000182~~	~~0.01~~	~~0.00132~~

~~CAS No.~~	~~Chemical~~	~~Solubility in Water (S) (mg/L)~~	~~Diffusivity in Air (Di) (cm^2/s)~~	~~Diffusivity in Water (D_w) (cm^2/s)~~	~~Dimensionless Henry's Law Constant (H') (25^oC)~~	~~Organic Carbon Partition Coefficient (K_{oc}) (L/kg)~~	~~First Order Degradation Constant (λ) (d^{-1})~~
~~121-14-2~~	~~2,4-Dinitrotoluene~~	~~270~~	~~0.203~~	~~7.06E-6~~	~~0.0000038~~	~~95.5~~	~~0.00192~~
~~606-20-2~~	~~2,6-Dinitrotoluene~~	~~182~~	~~0.0327~~	~~7.26E-6~~	~~0.0000306~~	~~69.2~~	~~0.00192~~
~~88-85-7~~	~~Dinoseb~~	~~52~~	~~0.0215~~	~~6.62E-6~~	~~0.0000189~~	~~1,120~~	~~0.002817~~
~~117-84-0~~	~~Di-n-octyl Phthalate~~	~~0.02~~	~~0.0151~~	~~3.58E-6~~	~~0.00274~~	~~83,200,000~~	~~0.0019~~
~~115-29-7~~	~~Endosulfan~~	~~0.51~~	~~0.0115~~	~~4.55E-6~~	~~0.000459~~	~~2,140~~	~~0.07629~~
~~145-73-3~~	~~Endothall~~	~~21,000~~	~~0.0291~~	~~8.07E-6~~	~~0.0000000107~~	~~0.29~~	~~No Data~~
~~72-20-8~~	~~Endrin~~	~~0.25~~	~~0.0125~~	~~4.74E-6~~	~~0.000308~~	~~12,300~~	~~0.00032~~
~~100-41-4~~	~~Ethylbenzene~~	~~169~~	~~0.0750~~	~~7.80E-6~~	~~0.323~~	~~363~~	~~0.003~~
~~206-44-0~~	~~Fluoranthene~~	~~0.206~~	~~0.0302~~	~~6.35E-6~~	~~0.00066~~	~~107,000~~	~~0.00019~~
~~86-73-7~~	~~Fluorene~~	~~1.98~~	~~0.0363~~	~~7.88E-6~~	~~0.00261~~	~~13,800~~	~~0.000691~~
~~76-44-8~~	~~Heptachlor~~	~~0.18~~	~~0.0112~~	~~5.69E-6~~	~~60.7~~	~~1,410,000~~	~~0.13~~
~~1024-~~	~~Heptachlor epoxide~~	~~0.2~~	~~0.0132~~	~~4.23E-6~~	~~0.00039~~	~~83,200~~	~~0.00063~~

~~57-3~~							
~~CAS No.~~	~~Chemical~~	~~Solubility in Water (S) (mg/L)~~	~~Diffusivity in Air (Di) (cm^2/s)~~	~~Diffusivity in Water (D_w) (cm^2/s)~~	~~Dimensionless Henry's Law Constant (H') (25^oC)~~	~~Organic Carbon Partition Coefficient (K_{oc}) (L/kg)~~	~~First Order Degradation Constant (λ) (d^{-1})~~
~~118-74-1~~	~~Hexachlorobenzene~~	~~6.2~~	~~0.0542~~	~~5.91E-6~~	~~0.0541~~	~~55,000~~	~~0.00017~~
~~319-84-6~~	~~Alpha-HCH (alpha-BHC)~~	~~2.0~~	~~0.0142~~	~~7.34E-6~~	~~0.000435~~	~~1,230~~	~~0.0025~~
~~58-89-9~~	~~Gamma-HCH (Lindane)~~	~~6.8~~	~~0.0142~~	~~7.34E-6~~	~~0.000574~~	~~1,070~~	~~0.0029~~
~~77-47-4~~	~~Hexachlorocyclo-Pentadiene~~	~~1.8~~	~~0.0161~~	~~7.21E-6~~	~~1.11~~	~~200,000~~	~~0.012~~
~~67-72-1~~	~~Hexachloroethane~~	~~50~~	~~0.0025~~	~~6.80E-6~~	~~0.159~~	~~1,780~~	~~0.00192~~
~~193-39-5~~	~~Indeno(1,2,3-c,d)pyrene~~	~~0.000022~~	~~0.0190~~	~~5.66E-6~~	~~0.0000656~~	~~3,470,000~~	~~0.00047~~
~~78-59-1~~	~~Isophorone~~	~~12,000~~	~~0.0623~~	~~6.76E-6~~	~~0.000272~~	~~46.8~~	~~0.01238~~
~~7439-97-6~~	~~Mercury~~	~~—~~	~~0.0307~~	~~6.30E-6~~	~~0.467~~	~~—~~	~~No Data~~
~~72-43-5~~	~~Methoxychlor~~	~~0.045~~	~~0.0156~~	~~4.46E-6~~	~~0.000648~~	~~97,700~~	~~0.0019~~
~~74-83-9~~	~~Methyl Bromide~~	~~15,200~~	~~0.0728~~	~~1.21E-5~~	~~0.256~~	~~10.5~~	~~0.01824~~
~~1634-04-4~~	~~Methyl tertiary-butyl ether~~	~~51,000~~	~~0.102~~	~~1.10E-5~~	~~0.0241~~	~~11.5~~	~~No Data~~
~~75-09-2~~	~~Methylene Chloride~~	~~13,000~~	~~0.101~~	~~1.17E-5~~	~~0.0898~~	~~11.7~~	~~0.012~~

~~CAS No.~~	~~Chemical~~	~~Solubility in Water (S) (mg/L)~~	~~Diffusivity in Air (Di) (cm^2/s)~~	~~Diffusivity in Water (D_w) (cm^2/s)~~	~~Dimensionless Henry's Law Constant (H') (25°C)~~	~~Organic Carbon Partition Coefficient (K_{oc}) (L/kg)~~	~~First Order Degradation Constant (λ) (d^{-1})~~
~~95-48-7~~	~~2-Methylphenol (o-cresol)~~	~~26,000~~	~~0.0740~~	~~8.30E-6~~	~~0.0000492~~	~~91.2~~	~~0.0495~~
~~91-20-3~~	~~Naphthalene~~	~~31.0~~	~~0.0590~~	~~7.50E-6~~	~~0.0198~~	~~2,000~~	~~0.0027~~
~~98-95-3~~	~~Nitrobenzene~~	~~2,090~~	~~0.0760~~	~~8.60E-6~~	~~0.000984~~	~~64.6~~	~~0.00176~~
~~86-30-6~~	~~N-Nitrosodiphenylamine~~	~~35.1~~	~~0.0312~~	~~6.35E-6~~	~~0.000205~~	~~1,290~~	~~0.01~~
~~621-64-7~~	~~N-Nitrosodi-n-propylamine~~	~~9,890~~	~~0.0545~~	~~8.17E-6~~	~~0.0000923~~	~~24.0~~	~~0.0019~~
~~87-86-5~~	~~Pentachlorophenol~~	~~1,950~~	~~0.0560~~	~~6.10E-6~~	~~0.000001~~	~~592~~	~~0.00045~~
~~108-95-2~~	~~Phenol~~	~~82,800~~	~~0.0820~~	~~9.10E-6~~	~~0.0000163~~	~~28.8~~	~~0.099~~
~~1918-02-1~~	~~Picloram~~	~~430~~	~~0.0255~~	~~5.28E-6~~	~~0.00000000166~~	~~1.98~~	~~No Data~~
~~1336-36-3~~	~~Polychlorinated biphenyls (PCBs)~~	~~0.7~~	~~------~~[a]	~~------~~[a]	~~------~~[a]	~~309,000~~	~~No Data~~
~~129-00-0~~	~~Pyrene~~	~~0.135~~	~~0.0272~~	~~7.24E-6~~	~~0.000451~~	~~105,000~~	~~0.00018~~
~~122-34-9~~	~~Simazine~~	~~5~~	~~0.027~~	~~7.36E-6~~	~~0.0000000133~~	~~133~~	~~No Data~~
~~100-42-5~~	~~Styrene~~	~~310~~	~~0.0710~~	~~8.00E-6~~	~~0.113~~	~~776~~	~~0.0033~~

~~CAS No.~~	~~Chemical~~	~~Solubility in Water (S) (mg/L)~~	~~Diffusivity in Air (Di) (cm^2/s)~~	~~Diffusivity in Water (D_w) (cm^2/s)~~	~~Dimensionless Henry's Law Constant (H') (25°C)~~	~~Organic Carbon Partition Coefficient (K_{oc}) (L/kg)~~	~~First Order Degradation Constant (λ) (d^{-1})~~
~~93-72-1~~	~~2,4,5-TP (Silvex)~~	~~31~~	~~0.0194~~	~~5.83E-6~~	~~0.0000000032~~	~~5,440~~	~~No Data~~
~~127-18-4~~	~~Tetrachloroethylene~~	~~200~~	~~0.0720~~	~~8.20E-6~~	~~0.754~~	~~155~~	~~0.00096~~
~~108-88-3~~	~~Toluene~~	~~526~~	~~0.0870~~	~~8.60E-6~~	~~0.272~~	~~182~~	~~0.011~~
~~8001-35-2~~	~~Toxaphene~~	~~0.74~~	~~0.0116~~	~~4.34E-6~~	~~0.000246~~	~~257,000~~	~~No Data~~
~~120-82-1~~	~~1,2,4-Trichlorobenzene~~	~~300~~	~~0.0300~~	~~8.23E-6~~	~~0.0582~~	~~1,780~~	~~0.0019~~
~~71-55-6~~	~~1,1,1-Trichloroethane~~	~~1,330~~	~~0.0780~~	~~8.80E-6~~	~~0.705~~	~~110~~	~~0.0013~~
~~79-00-5~~	~~1,1,2-Trichloroethane~~	~~4,420~~	~~0.0780~~	~~8.80E-6~~	~~0.0374~~	~~50.1~~	~~0.00095~~
~~79-01-6~~	~~Trichloroethylene~~	~~1,100~~	~~0.0790~~	~~9.10E-6~~	~~0.422~~	~~166~~	~~0.00042~~
~~95-95-4~~	~~2,4,5-Trichlorophenol~~	~~1,200~~	~~0.0291~~	~~7.03E-6~~	~~0.000178~~	~~1,600~~	~~0.00038~~
~~88-06-2~~	~~2,4,6-Trichlorophenol~~	~~800~~	~~0.0318~~	~~6.25E-6~~	~~0.000319~~	~~381~~	~~0.00038~~
~~108-05-4~~	~~Vinyl Acetate~~	~~20,000~~	~~0.0850~~	~~9.20E-6~~	~~0.021~~	~~5.25~~	~~No Data~~
~~57-01-4~~	~~Vinyl Chloride~~	~~2,760~~	~~0.106~~	~~1.23E-6~~	~~1.11~~	~~18.6~~	~~0.00024~~
~~108-38-3~~	~~m-Xylene~~	~~161~~	~~0.070~~	~~7.80E-6~~	~~0.301~~	~~407~~	~~0.0019~~

~~CAS No.~~	~~Chemical~~	~~Solubility in Water (S) (mg/L)~~	~~Diffusivity in Air (Di) (cm^2/s)~~	~~Diffusivity in Water (D_w) (cm^2/s)~~	~~Dimensionless Henry's Law Constant (H') (25°C)~~	~~Organic Carbon Partition Coefficient (K_{oc}) (L/kg)~~	~~First Order Degradation Constant (λ) (d^{-1})~~
~~95-47-6~~	~~o-Xylene~~	~~178~~	~~0.087~~	~~1.00E-5~~	~~0.213~~	~~363~~	~~0.0019~~
~~106-42-3~~	~~p-Xylene~~	~~185~~	~~0.0769~~	~~8.44E-6~~	~~0.314~~	~~389~~	~~0.0019~~
~~1330-20-7~~	~~Xylenes (total)~~	~~186~~	~~0.0720~~	~~9.34E-6~~	~~0.25~~	~~260~~	~~0.0019~~

~~Chemical Abstracts Service (CAS) registry number. This number in the format xxx-xx-x, is unique for each chemical and allows efficient searching on computerized data bases.~~

~~[a] Soil Remediation objectives are determined pursuant to 40 CFR 761, as incorporated by reference at Section 732.104 (the USEPA "PCB Spill Cleanup Policy"), for most sites;~~
~~persons remediating sites should consult with BOL if calculation of Tier 2 soil remediation objectives is desired.~~

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (D_i) (cm^2/s)	Diffusivity in Water (D_w) (cm^2/s)	Dimensionless Henry's Law Constant (H') (25^oC)	Dimensionless Henry's Law Constant (H') (13^oC) For the indoor inhalation exposure route	Organic Carbon Partition Coefficient (K_{oc}) (L/kg)	First Order Degradation Constant (λ) (d^{-1})	Vapor Pressure (mm/Hg)
Neutral Organics									
83-32-9	Acenaphthene	3.60E+00	4.76E-02	7.69E-06	6.60E-03	-------[b]	6.30E+03	3.40E-03	2.50E-03
67-64-1	Acetone	1.00E+06	1.24E-01	1.14E-05	1.60E-03	9.73E-04	7.80E-01	4.95E-02	2.30E+02
15972-60-8	Alachlor	2.40E+02	2.13E-02	5.28E-06	3.40E-06	-------[b]	3.20E+03	No Data	2.20E-05
116-06-3	Aldicarb	6.03E+03	3.18E-02	7.24E-06	5.90E-08	-------[b]	1.29E+01	1.09E-03	3.47E-05
309-00-2	Aldrin	1.70E-02	1.96E-02	4.86E-06	7.00E-03	-------[b]	2.50E+05	5.90E-04	6.00E-06
120-12-7	Anthracene	4.30E-02	3.85E-02	7.74E-06	2.70E-03	-------[b]	2.50E+04	7.50E-04	2.70E-06
1912-24-9	Atrazine	7.00E+01	2.59E-02	6.67E-06	9.68E-08	-------[b]	3.63E+02	No Data	2.70E-07
71-43-2	Benzene	1.80E+03	8.80E-02	1.02E-05	2.30E-01	1.34E-01	5.00E+01	9.00E-04	9.50E+01
56-55-3	Benzo(a) anthracene	9.40E-03	5.10E-02	9.00E-06	1.39E-04	-------[b]	4.00E+05	5.10E-04	1.10E-07
205-99-2	Benzo(b) fluoranthene	1.50E-03	2.23E-02	5.56E-06	4.55E-03	-------[b]	1.05E+06	5.70E-04	5.00E-07
207-08-9	Benzo(k) fluoranthene	8.00E-04	2.23E-02	5.56E-06	3.40E-05	-------[b]	1.00E+06	1.60E-04	2.00E-09
65-85-0	Benzoic Acid	3.40E+03	7.02E-02	7.97E-06	1.56E-06	-------[b]	1.21E+00[d]	No Data	7.00E-04
50-32-8	Benzo(a)pyrene	1.60E-03	4.30E-02	9.49E-06	4.50E-05	-------[b]	7.90E+05	6.50E-04	5.50E-09

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (D_i) (cm^2/s)	Diffusivity in Water (D_w) (cm^2/s)	Dimensionless Henry's Law Constant (H') (25°C)	Dimensionless Henry's Law Constant (H') (13°C) For the indoor inhalation exposure route	Organic Carbon Partition Coefficient (K_{oc}) (L/kg)	First Order Degradation Constant (λ) (d^{-1})	Vapor Pressure (mm/Hg)
111-44-4	Bis(2-chloroethyl)ether	1.72E+04	4.13E-02	7.53E-06	7.40E-04	2.94E-04	1.26E+01	1.90E-03	1.55E+00
117-81-7	Bis(2-ethylhexyl) phthalate	3.40E-01	3.51E-02	3.66E-06	4.10E-06	-------[b]	1.00E+05	1.80E-03	6.80E-08
75-27-4	Bromodichloro-methane	6.70E+03	5.61E-02	1.06E-05	6.60E-02	3.71E-02	5.00E+01	No Data	5.00E+01
75-25-2	Bromoform	3.10E+03	1.49E-02	1.03E-05	2.19E-02	1.06E-02	9.12E+01	1.90E-03	5.51E+00
71-36-3	Butanol	7.40E+04	8.00E-02	9.30E-06	3.61E-04	1.55E-04	6.00E+00	1.28E-02	7.00E+00
78-93-3	2-Butanone (MEK)	2.20E+05	8.08E-02	9.8E-06	2.30E-03	1.32E-03	2.00E+00	4.95E-02	9.50E+01
85-68-7	Butyl Benzyl Phthalate	2.70E+00	1.99E-02	4.89E-06	5.30E-05	-------[b]	6.30E+04	3.85E-03	8.30E-06
86-74-8	Carbazole	1.20E+00	4.17E-02	7.45E-06	3.60E-06	-------[b]	4.00E+03	No Data	7.00E-04
1563-66-2	Carbofuran	3.20E+02	2.37E-02	5.95E-06	1.27E-07	-------[b]	1.91E+02	No Data	4.85E-06
75-15-0	Carbon Disulfide	1.20E+03	1.04E-01	1.00E-05	1.23E+00	8.06E-01	6.30E+01	No Data	3.60E+02
56-23-5	Carbon Tetrachloride	7.90E+02	7.80E-02	8.80E-06	1.23E+00	7.48E-01	2.00E+02	1.90E-03	1.20E+02
57-74-9	Chlordane	5.60E-02	1.79E-02	4.37E-06	2.00E-03	-------[b]	2.50E+05	2.50E-04	9.80E-06
106-47-8	p-Chloroaniline	5.30E+03	6.99E-02	1.01E-05	4.76E-05	-------[b]	6.31E+01	No Data	1.23E-02

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108-90-7	Chlorobenzene	4.70E+02	7.30E-02	8.70E-06	1.50E-01	7.93E-02	2.00E+02	2.30E-03	1.20E+01
124-48-1	Chlorodibromo-methane	2.60E+03	3.66E-02	1.05E-05	3.20E-02	2.07E-02	6.92E+01	3.85E-03	4.90E+00
67-66-3	Chloroform	7.90E+03	1.04E-01	1.00E-05	1.50E-01	9.18E-02	5.00E+01	3.90E-04	2.00E+02
95-57-8	2-Chlorophenol	2.20E+04	6.61E-02	9.46E-06	1.60E-02	7.28E-03	5.93E+01[d]	No Data	2.34E+00
218-01-9	Chrysene	6.30E-03	2.44E-02	6.21E-06	3.90E-03	-------[b]	4.00E+05	3.50E-04	6.20E-09
94-75-7	2,4-D	6.77E+02	5.88E-02	6.49E-06	4.18E-07	-------[b]	5.75E+02	3.85E-03	6.00E-07
72-54-8	4,4'-DDD	9.00E-02	2.27E-02	5.79E-06	1.60E-04	-------[b]	7.90E+05	6.20E-05	6.70E-07
72-55-9	4,4'-DDE	1.20E-01	2.38E-02	5.87E-06	8.60E-04	-------[b]	4.00E+05	6.20E-05	6.00E-06
50-29-3	4,4'-DDT	2.50E-02	1.99E-02	4.95E-06	3.30E-04	-------[b]	2.00E+06	6.20E-05	1.60E-07
75-99-0	Dalapon	9.00E+05	6.08E-02	9.45E-06	2.64E-06	NA	4.80E+00	5.78E-03	1.90E-01
53-70-3	Dibenzo(a,h) anthracene	2.50E-03	2.11E-02	5.24E-06	6.10E-07	-------[b]	2.50E+06	3.70E-04	1.00E-10
96-12-8	1,2-Dibromo-3-chloropropane	1.20E+03	2.68E-02	7.02E-06	6.20E-03[c]	NA	7.90E+01	1.93E-03	5.80E-01
106-93-4	1,2-Dibromoethane	4.00E+03	4.37E-02	8.44E-06	3.00E-02	1.54E-02	5.00E+01	5.78E-03	1.30E+01
84-74-2	Di-n-butyl Phthalate	1.10E+01	4.38E-02	7.86E-06	7.40E-05	-------[a]	4.00E+04	3.01E-02	7.30E-05

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1918-00-9	Dicamba	4.50E+03	2.37E-02	5.95E-06	2.18E-09	-------[a]	2.95E+00	No Data	3.38E-05
95-50-1	1,2-Dichlorobenzene	1.56E+02	6.90E-02	7.90E-06	7.79E-02	3.56E-02	5.75E+02	1.90E-03	1.36E+00
106-46-7	1,4-Dichlorobenzene	7.90E+01	6.90E-02	7.90E-06	9.80E-02	4.69E-02	7.90E+02	1.90E-03	1.00E+00
91-94-1	3,3-Dichloro-benzidine	3.10E+00	2.59E-02	6.74E-06	1.60E-07	-------[a]	2.82E+03	1.90E-03	3.71E-08
75-71-8	Dichlorodifluoro-methane	2.80E+02	7.60E-02	1.08E-05	1.41E+01	8.14E+00	6.17E+01	1.92E-03	4.85E+03
75-34-3	1,1-Dichloroethane	5.10E+03	7.42E-02	1.05E-05	2.30E-01	1.42E-01	3.20E+01	1.90E-03	2.30E+02
107-06-2	1,2-Dichloroethane	8.50E+03	1.04E-02	9.90E-06	4.00E-02	2.29E-02	2.00E+01	1.90E-03	7.90E+01
75-35-4	1,1-Dichloroethylene	2.30E+03	9.00E-02	1.04E-05	1.10E+00	7.10E-01	5.00E+01	5.30E-03	6.00E+02
156-59-2	*cis*-1,2-Dichloroethylene	3.50E+03	8.86E-02	1.13E-05	1.70E-01	1.00E-01	4.00E+01	2.40E-04	2.00E+02
156-60-5	*trans*-1,2-Dichloroethylene	6.30E+03	7.03E-02	1.19E-05	3.90E-01	2.43E-01	5.00E+01	2.40E-04	3.30E+02
120-83-2	2,4-Dichlorophenol	4.50E+03	4.89E-02	8.77E-06	1.30E-04	-------[a]	7.32E+02[d]	2.70E-04	6.70E-02
78-87-5	1,2-Dichloropropane	2.80E+03	7.82E-02	8.73E-06	1.10E-01	6.52E-02	5.00E+01	2.70E-04	5.20E+01

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542-75-6	1,3-Dichloro-propylene (*cis* + *trans*)	2.80E+03	6.26E-02	1.00E-05	7.40E-01	3.98E-01	2.00E+01	6.10E-02	3.40E+01
60-57-1	Dieldrin	2.00E-01	1.92E-02	4.74E-06	6.2E-04	-------[a]	2.50E+04	3.20E-04	5.9E-06
84-66-2	Diethyl Phthalate	1.10E+03	2.49E-02	6.35E-06	1.80E-05	-------[a]	3.20E+02	6.19E-03	1.60E-03
105-67-9	2,4-Dimethylphenol	7.90E+03	6.43E-02	8.69E-06	8.20E-05	-------[a]	2.00E+02	4.95E-02	9.80E-02
75-71-8	1,3-Dinitrobenzene	8.60E+02	4.55E-02	8.46E-06	2.30E-07	-------[a]	3.20E+01	1.92E-03	9.00E-04
51-28-5	2,4-Dinitrophenol	2.79E+03	2.73E-02	9.06E-06	1.82E-05	-------[a]	3.24E+01	1.32E-03	5.10E-03
121-14-2	2,4-Dinitrotoluene	2.70E+02	2.03E-01	7.06E-06	3.80E-06	-------[a]	8.90E+01	1.92E-03	1.47E-04
606-20-2	2,6-Dinitrotoluene	1.82E+02	3.70E-02	7.76E-06	3.06E-05	-------[a]	4.90E+01	1.92E-03	5.67E-04
88-85-7	Dinoseb	5.20E+01	2.45E-02	6.25E-06	1.87E-05	-------[a]	9.17E+01[d]	2.82E-03	7.50E-05
117-84-0	Di-n-octyl Phthalate	2.00E-02	1.73E-02	4.17E-06	2.74E-03	-------[a]	1.30E+05	1.90E-03	2.60E-06
123-91-1	p-Dioxane	1.00E+06	2.29E-01	1.02E-05	1.97E-04	1.07E-04	7.20E-01	1.92E-03	3.81E+01
115-29-7	Endosulfan	5.10E-01	1.85E-02	4.55E-06	4.51E-04	-------[a]	5.00E+03	7.63E-02	1.00E-05
145-73-3	Endothall	2.10E+04	2.91E-02	8.07E-06	1.58E-14	-------[a]	7.59E+01	No Data	1.57E-10

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72-20-8	Endrin	2.50E-01	1.92E-02	4.74E-6	3.08E-04	-------[a]	3.20E+04	3.20E-04	3.00E-06
100-41-4	Ethylbenzene	1.70E+02	7.50E-02	7.80E-06	3.24E-01	1.64E-01	3.20E+02	3.00E-03	9.60E+00
206-44-0	Fluoranthene	2.06E-01	2.51E-02	6.35E-06	6.60E-04	-------[a]	7.40E+04	1.90E-04	1.23E-08
86-73-7	Fluorene	2.00E+00	4.40E-02	7.88E-06	2.62E-03	-------[a]	1.30E+04	6.91E-04	6.30E-04
76-44-8	Heptachlor	1.80E-01	2.23E-02	5.69E-06	6.07E-02	1.73E-02	3.00E+03	1.30E-01	4.00E-04
1024-57-3	Heptachlor epoxide	2.00E-01	2.19E-02	5.57E-06	3.90E-04	-------[a]	2.00E+05	6.30E-04	1.90E-05
118-74-1	Hexachloro-benzene	6.20E-03	5.42E-02	5.91E-06	5.33E-02	1.35E-02	2.00E+04	1.70E-04	1.80E-05
319-84-6	Alpha-HCH (alpha-BHC)	2.00E+00	2.04E-02	5.04E-06	4.51E-04	-------[a]	5.00E+03	2.50E-03	4.50E-05
58-89-9	Gamma-HCH (Lindane)	7.30E+00	2.75E-02	7.34E-06	5.74E-04	-------[a]	3.00E+03	2.90E-03	4.10E-04
2691-41-0	High Melting Explosive, Octogen (HMX)	5.00E+00	2.69E-02	7.15E-06	8.67E-10	3.55E-08	1.40E+00	No Data	3.30E-14
77-47-4	Hexachlorocyclo-Pentadiene	1.80E+00	2.79E-02	7.21E-06	1.11E+00	4.22E-01	1.20E+04	1.20E-02	5.96E-02
67-72-1	Hexachloroethane	5.00E+01	2.50E-03	6.80E-06	1.59E-01	7.26E-02	1.50E+03	1.92E-03	2.10E-01
193-39-5	Indeno(1,2,3-c,d)pyrene	2.20E-05	2.25E-02	5.66E-06	6.56E-05	-------[a]	3.10E+06	4.70E-04	1.00E-10

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78-59-1	Isophorone	1.20E+04	6.23E-02	6.76E-06	2.72E-04	1.12E-04	2.50E+01	1.24E-02	4.38E-01
98-82-8	Isopropylbenzene (Cumene)	6.10E+01	6.50E-02	7.10E-06	4.92E+01	2.10E+01	1.02E+03	4.33E-02	4.50E+00
93-65-2	Mecoprop (MCPP)	8.95E+02	2.40E-02	6.05E-06	7.70E-09	-------[a]	1.84E+01[d]	3.85E-03	2.44E-05
7439-97-6	Mercury	6.00E-02	7.14E-02	3.01E-05	4.51E-01	1.59E-01	8.70E+03	No Data	2.00E-03
72-43-5	Methoxychlor	4.50E-02	1.84E-02	4.46E-06	6.56E-04	-------[a]	5.00E+04	1.90E-03	6.00E-07
74-83-9	Methyl Bromide	1.50E+04	7.28E-02	1.21E-05	2.56E-01	1.79E-01	1.00E+01	1.82E-02	1.62E+03
1634-04-4	Methyl tertiary-butyl ether	5.10E+04	8.59E-02	1.10E-05	2.42E-02	1.50E-02	1.00E+01	No Data	2.50E+02
75-09-2	Methylene Chloride	1.30E+04	1.01E-01	1.17E-05	9.02E-02	5.70E-02	1.30E+01	1.20E-02	4.30E+02
93-65-2	2-Methyl-naphthalene	2.50E+01	5.22E-02	7.75E-06	2.10E-02	6.95E-03	1.60E+03	No Data	6.80E-02
95-48-7	2-Methylphenol (o-cresol)	2.60E+04	7.40E-02	8.30E-06	4.92E-05	2.00E-05	4.20E+01	4.95E-02	2.99E-01
91-20-3	Naphthalene	3.10E+01	5.90E-02	7.50E-06	1.97E-02	8.29E-03	5.00E+02	2.70E-03	8.50E-02
98-95-3	Nitrobenzene	2.09E+03	7.60E-02	8.60E-06	9.84E-04	3.99E-04	4.00E+01	1.76E-03	2.40E-01
86-30-6	N-Nitrosodiphenyl-amine	3.50E+01	2.83E-02	7.19E-06	2.10E-04	-------[a]	1.00E+03	1.00E-02	6.70E-04

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621-64-7	N-Nitrosodi-n-propylamine	9.89E+03	5.87E-02	8.17E-06	9.20E-05	5.48E-05	1.45E+01	1.90E-03	1.30E-01
87-86-5	Pentachloro-phenol	2.00E+03	5.60E-02	6.10E-06	9.84E-07	-------[a]	2.77E+03[d]	4.50E-04	3.20E-05
108-95-2	Phenol	8.30E+04	8.20E-02	9.10E-06	1.64E-05	6.67E-06	2.00E+01	9.90E-02	2.80E-01
1918-02-1	Picloram	4.30E+02	2.26E-02	5.64E-06	2.19E-12	-------[a]	2.00E+00	No Data	7.21E-11
1336-36-3	Polychlorinated biphenyls (PCBs)	-------[a]	-------[a]	-------[a]	-------[a]	-------[a]	-------[a]	-------[a]	-------[a]
129-00-0	Pyrene	1.40E+00	2.77E-02	7.24E-06	4.51E-04	-------[a]	6.31E+04	1.80E-04	4.60E-06
121-82-4	Royal Demolition Explosive, Cyclonite (RDX)	5.97E+01	3.11E-02	8.49E-06	2.01E-11	-------[a]	7.20E+00	No Data	4.10E-09
122-34-9	Simazine	6.20E+00	2.48E-02	6.28E-06	3.80E-08	-------[a]	1.32E+02	No Data	2.21E-08
100-42-5	Styrene	3.10E+02	7.10E-02	8.00E-06	1.11E-01	5.48E-03	3.16E+02	3.30E-03	6.10E+00
93-72-1	2,4,5-TP (Silvex)	7.10E+01	2.30E-02	5.83E-06	3.71E-07	-------[a]	5.50E+03	No Data	9.97E-06
127-18-4	Tetrachloro-ethylene	2.00E+02	7.20E-02	8.20E-06	7.38E-01	4.00E-01	6.31E+02	9.60E-04	1.90E+01
108-88-3	Toluene	5.30E+02	8.70E-02	8.60E-06	2.71E-01	1.49E-01	1.58E+02	1.10E-02	2.80E+01
8001-35-2	Toxaphene	7.40E-01	2.16E-02	5.51E-06	2.46E-04	-------[a]	5.01E+04	No Data	9.80E-07

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (D_i) (cm^2/s)	Diffusivity in Water (D_w) (cm^2/s)	Dimensionless Henry's Law Constant (H') (25°C)	Dimensionless Henry's Law Constant (H') (13°C) For the indoor inhalation exposure route	Organic Carbon Partition Coefficient (K_{oc}) (L/kg)	First Order Degradation Constant (λ) (d^{-1})	Vapor Pressure (mm/Hg)
120-82-1	1,2,4-Trichlorobenzene	3.50E+01	3.00E-02	8.23E-06	5.74E-02	2.38E-02	1.58E+03	1.90E-03	4.30E-01
71-55-6	1,1,1-Trichloroethane	1.30E+03	7.80E-02	8.80E-06	6.97E-01	4.21E-01	1.26E+02	1.30E-03	1.20E+02
79-00-5	1,1,2-Trichloroethane	4.40E+03	7.80E-02	8.80E-06	3.73E-02	1.98E-02	5.01E+01	9.50E-04	2.30E+01
79-01-6	Trichloroethylene	1.50E+03	7.90E-02	9.10E-06	4.10E-01	2.41E-01	1.00E+02	4.20E-04	7.30E+01
75-69-4	Trichlorofluoro-methane	1.10E+03	8.70E-02	9.70E-06	3.98E+00	2.69E+00	1.30E+02	9.63E-04	8.00E+02
95-95-4	2,4,5-Trichlorophenol	1.20E+03	2.91E-02	7.03E-06	1.78E-04	-------[a]	2.68E+03[d]	3.80E-04	2.40E-02
88-06-2	2,4,6-Trichlorophenol	8.00E+02	2.61E-02	6.36E-06	3.53E-04	-------[a]	8.78E+02 [d]	3.80E-04	2.00E-02
108-05-4	Vinyl Acetate	2.00E+04	8.50E-02	9.20E-06	2.09E-02	1.18E-02	4.57E+00	No Data	9.00E+01
99-35-4	1,3,5-Trinitrobenzene	2.80E+02	2.41E-02	6.08E-06	3.30E-10	-------[a]	1.60E+01	No Data	6.40E-06
118-96-7	2,4,6-Trinitrotoluene (TNT)	1.24E+02	2.94E-02	7.90E-06	4.87E-09	-------[a]	3.72E+01	1.92E-03	2.02E-06
57-01-4	Vinyl Chloride	8.80E+03	1.06E-01	1.23E-06	1.11E+00	8.14E-01	1.58E+01	2.40E-04	3.00E+03
108-38-3	m-Xylene	1.60E+02	7.00E-02	7.80E-06	2.99E-01	1.52E-01	3.98E+02	1.90E-03	8.50E+00
95-47-6	o-Xylene	1.80E+02	8.70E-02	1.00E-05	2.13E-01	1.07E-01	3.16E+02	1.90E-03	6.60E+00

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (D_i) (cm^2/s)	Diffusivity in Water (D_w) (cm^2/s)	Dimensionless Henry's Law Constant (H') (25°C)	Dimensionless Henry's Law Constant (H') (13°C) For the indoor inhalation exposure route	Organic Carbon Partition Coefficient (K_{oc}) (L/kg)	First Order Degradation Constant (λ) (d^{-1})	Vapor Pressure (mm/Hg)
106-42-3	p-Xylene	1.60E+02	7.69E-02	8.44E-06	3.16E-01	1.59E-01	3.16E+02	1.90E-03	8.90E+00
1330-20-7	Xylenes (total)	1.10E+02	7.35E-02	9.23E-06	2.71E-01	NA	3.98E+02	1.90E-03	8.00E+00

Chemical Abstracts Service (CAS) registry number. This number in the format xxx-xx-x, is unique for each chemical and allows efficient searching on computerized data bases.

[a] Soil remediation objectives are determined pursuant to 40 CFR 761, as incorporated by reference at Section 742.210(b) (the USEPA "PCB Spill Cleanup Policy"), for most sites; persons remediating sites should consult with BOL if calculation of Tier 2 or 3 remediation objectives is desired. PCBs are a mixture of different congeners. The appropriate values to use for the physical/chemical parameters depend on congeners present at the site.

[b] Dimensionless Henry's Law Constant at 13°C is not calculated because the chemical is not volatile and does not require evaluation under the indoor inhalation exposure route.

[c] Dimensionless Henry's Law Constant = 20°C

[d] These chemicals are ionizing and its K_{oc} value will change with pH. The K_{oc} values listed in this table is the effective K_{oc} at pH of 6.8. If the site-specific pH is values other than 6.8, the K_{oc} value listed in Section 742, Appendix C, Table I should be used.

[e] The values in this table were taken from the following sources (in order of preference): SCDMS online database (http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm); CHEMFATE online database (http://www.srcinc.com/what-we-do/databaseforms.aspx?id=381); PhysProp online database (http://www.srcinc.com/what-we-do/databaseforms.aspx?id-386); Water9 (http://www.epa.gov/ttn/chief/software/water/) for diffusivity values; and Handbook of Environmental Degradation Rates by P.H. Howard (1991) for first order degradation constant values.

(Source: Amended at 37 Ill. Reg. ______, effective ______)

Section 742.APPENDIX C: Tier 2 Illustrations and Tables

Section 742.Table F: Methods for Determining Physical Soil Parameters

Methods for Determining Physical Soil Parameters		
Parameter	Sampling Location[a]	Method
ρ_b (soil bulk density)	Surface	ASTM - D 1556-90 Sand Cone Method[b]
		ASTM - D 2167-94 Rubber Balloon Method[b]
		ASTM - D 2922-91 Nuclear Method[b]
	Subsurface	ASTM - D 2937-94 Drive Cylinder Method[b]
ρ_s (soil particle density)	Surface or Subsurface	ASTM - D 854-92 Specific Gravity of Soil[b]
w (moisture content)	Surface or Subsurface	ASTM - D 4959-89 (Reapproved 1994) Standard[b]
		ASTM - D 4643-93 Microwave Oven[b]
		ASTM - D2216-92 Laboratory Determination[b]
		ASTM - D3017-88 (Reapproved 1993) Nuclear Method[b]
		Equivalent USEPA Method (e.g., sample preparation procedures described in methods 3541 or 3550)
f_{oc} (fraction organic carbon content)	Surface or Subsurface	ASTM - D 2974-00 Moisture, Ash, and Organic Matter~~[b]~~ appropriately adjusted to estimate the fraction of organic carbon as stated in Nelson and Sommers (1982)[b]

Methods for Determining Physical Soil Parameters		
Parameter	Sampling Location[a]	Method
η or θ_T (total soil porosity)	Surface or Subsurface (calculated)	Equation S24 in Appendix C, Table A for SSL Model, or Equation R23 in Appendix C, Table C for RBCA Model, or Equation J&E 16 in Appendix C, Table L for J&E Model
θ_a or θ_{as} (air-filled soil porosity)	Surface or Subsurface (calculated)	Equation S21 in Appendix C, Table A for SSL Model, or Equation R21 in Appendix C, Table C for RBCA Model, or Equation J&E 18 in Appendix C, Table L for J&E Model
θ_w or θ_{ws} (water-filled soil porosity)	Surface or Subsurface (calculated)	Equation S20 in Appendix C, Table A for SSL Model, or Equation R22 in Appendix C, Table C for RBCA Model, or Equation J&E 17 in Appendix C, Table L for J&E Model
K (hydraulic conductivity)	Surface or Subsurface	ASTM - D 5084-90 Flexible Wall Permeameter[b]
		Pump Test
		Slug Test
i (hydraulic gradient)	Surface or Subsurface	Field Measurement

[a] This is the location where the sample is collected

[b] As incorporated by reference in Section 742.120.

(Source: Amended at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX C: Tier 2 Tables

Section 742.Table L: J&E Equations[a]

Indoor air remediation objectives (mg/m^3)	For carcinogenic contaminants	$$RO_{indoor\ air} = \frac{TR \times AT_c \times 365\,\frac{days}{yr}}{ED \times EF \times URF \times 1000\,\frac{\mu g}{mg}}$$	**J&E1**
	For noncarcinogenic contaminants	$$RO_{indoor\ air} = \frac{THQ \times AT_{nc} \times 365\,\frac{days}{yr} \times RfC}{ED \times EF}$$	**J&E2**
To convert mg/m^3 from parts per million volume		$$mg/m^3 = \frac{ppmv \times MW}{24.45}$$ Note: 24.45 equals the molar volume of air in liters at normal temperature (25°C) and pressure (760 mm Hg).	**J&E3**

Soil gas remediation objective (mg/m³)		$$RO_{soil\ gas} = \frac{RO_{indoor\ air}}{\alpha}$$	**J&E4**
Soil Vapor Saturation Limit (mg/m³-air)		$$C_v^{sat} = \frac{P \times MW}{R \times T} \times 10^6$$	**J&E5**
Groundwater remediation objectives		$$RO_{gw} = \frac{RO_{soil\ gas}}{H'_{TS} \times 1000 \frac{L}{m^3}}$$	**J&E6**
Attenuation factor	Attenuation factor when the mode of contaminant transport is both diffusion and advection Q_{soil} = 83.33 cm³/sec	$$\alpha = \frac{\left[\left(\frac{D_T^{eff} \times A_B}{Q_{bldg} \times L_T}\right) \times \exp\left(\frac{Q_{soil} \times L_{crack}}{D_{crack}^{eff} \times A_{crack}}\right)\right]}{\left[\exp\left(\frac{Q_{soil} \times L_{crack}}{D_{crack}^{eff} \times A_{crack}}\right) + \left(\frac{D_T^{eff} \times A_B}{Q_{bldg} \times L_T}\right) + \left(\frac{D_T^{eff} \times A_B}{Q_{soil} \times L_T}\right)\left[\exp\left(\frac{Q_{soil} \times L_{crack}}{D_{crack}^{eff} \times A_{crack}}\right) - 1\right]\right]}$$	**J&E7**

	Attenuation factor when the mode of contaminant transport is diffusion only Q_{soil}= 0 cm^3/sec	$$\alpha = \frac{\left(\frac{D_T^{eff} \times A_B}{Q_{bldg} \times L_T}\right)}{\left[1 + \left(\frac{D_T^{eff} \times A_B}{Q_{bldg} \times L_T}\right) + \left(\frac{D_T^{eff} \times A_B \times L_{crack}}{L_T \times D_{crack}^{eff} \times A_{crack}}\right)\right]}$$	**J&E8**
Total overall effective diffusion coefficient for vapor transport in porous media for multiple soil layers (cm^2/s)		$$D_T^{eff} = \frac{L_T}{\sum_{i=1}^{n} L_i / D_i^{eff}}$$	**J&E9a**
	In Equation J&E9a, the following condition must be satisfied:	$$\sum_{i=1}^{n} L_i = L_T$$	**J&E9b**
Source to building separation (cm)		$$L_T = D_{source} - L_F$$	**J&E10**
Effective diffusion coefficient for each soil layer (cm^2/s)		$$D_i^{eff} = D_i\left(\frac{\theta_{a,i}^{3.33}}{\theta_{T,i}^2}\right) + \left(\frac{D_w}{H_{TS}^{'}}\right)\left(\frac{\theta_{w,i}^{3.33}}{\theta_{T,i}^2}\right)$$	**J&E11**

Surface area of enclosed space at or below grade (cm^2)	For a building with a full concrete slab-on-grade	$$A_B = \left(L_B \times W_B\right)$$	**J&E12a**
Surface area of enclosed space at or below grade (cm^2)	For a building with a full concrete basement floor and walls	$$A_B = (L_B \times W_B) + (2 \times L_F \times L_B) + (2 \times L_F \times W_B)$$	**J&E12b**
Building ventilation rate (cm^3/s)		$$Q_{bldg} = \left(\frac{L_B \times W_B \times H_B \times ER}{3600\,\frac{sec}{hr}}\right)$$	**J&E13**
Area of total cracks (cm^2)		$$A_{crack} = 2 \times \left(L_B + W_B\right) \times w$$	**J&E14**
Effective diffusion coefficient through the cracks (cm^2/s)		$$D_{crack}^{eff} = D_i\left(\frac{\theta_{a,crack}^{3.33}}{\theta_{T,crack}^{2}}\right) + \left(\frac{D_w}{H'_{TS}}\right)\left(\frac{\theta_{w,crack}^{3.33}}{\theta_{T,crack}^{2}}\right)$$	**J&E15**

Total porosity		$\theta_{T\,i} = 1 - \frac{\rho_{bi}}{\rho_s}$	**J&E16**
Water-filled soil porosity		$\theta_w = (W)\left(\frac{\rho_b}{\rho_w}\right)$	**J&E17**
Air-filled soil porosity		$\theta_a = \theta_T - \theta_w$	**J&E18**

[a] This table contains equations based on the assumption that the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. This table applies only when the existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls. Institutional controls under Subpart J are required to develop remediation objectives pursuant to this table. This table does not apply when the existing or potential building has neither a full concrete slab-on-grade nor a full concrete basement floor and walls, such as a building with an earthen crawl space, an earthen floor, a stone foundation, a partial concrete floor, or a sump. In such cases, site evaluators have the option of excluding the indoor inhalation exposure route under Section 742.312, meeting the building control technology requirements under Subpart L, or proposing an alternative approach under Tier 3.

(Source: Added at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX C: Tier 2 Tables

Section 742.Table M: J&E Parameters

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
A_B	Surface area of enclosed space at or below grade	cm^2	Equation J&E 12a or 12b, Appendix C, Table L	Residential = 1×10^6 Industrial/Commercial = 4.0×10^6
A_{crack}	Area of total cracks	cm^2	Equation J&E 14, Appendix C, Table L	Calculated Value
AT_c	Averaging time for carcinogens	year	SSL, May 1996	70
AT_{nc}	Averaging time for noncarcinogens	year	AT_{nc}= ED	Residential = 30 Industrial/Commercial = 25
C_v^{sat}	Soil vapor saturation limit	mg/m^3-air	Equation J&E 5, Appendix C, Table L	Chemical-Specific or Calculated Value
D_{crack}^{eff}	Effective diffusion coefficient through the cracks	cm^2/s	Equation J&E 15, Appendix C, Table L	Calculated Value
D_i	Diffusivity in air	cm^2/s	Appendix C, Table E	Chemical-Specific

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
D_i^{eff}	Effective diffusion coefficient for each soil layer	cm^2/s	Equation J&E 11, Appendix C, Table L	Calculated Value
D_{source}	Distance from ground surface to top of contamination	cm	Field Measurement	Soil Gas Contamination = 152.4 Groundwater Contamination = 304.8 Site-Specific
D_T^{eff}	Total overall effective diffusion coefficient	cm^2/s	Equation J&E 9a, Appendix C, Table L	Calculated Value
D_w	Diffusivity in water	cm^2/s	Appendix C, Table E	Chemical-Specific
ED	Exposure duration	year	Residential: SSL, May 1996 Industrial/Commercial: SSL 2002	Residential = 30 Industrial/Commercial = 25
EF	Exposure frequency	day/year	Residential: SSL, May 1996 Industrial/Commercial: SSL 2002	Residential = 350 Industrial/Commercial = 250

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
ER	Air exchange rate	exchanges per hour	Illinois EPA	Residential = 0.53 Industrial/Commercial = 0.93
f_{oc}	Fraction organic carbon content	g/g	SSL, May 1996, or Field Measurement Appendix C, Table F	0.002 or Site-Specific
H_B	Height of building	cm	Illinois EPA	Slab on Grade Residential = 244 Industrial/Commercial = 305 or Site-Specific in Tier 3 Basement Residential = 427 Industrial/Commercial = 488 or Site-Specific in Tier 3
H'_{TS}	Dimensionless Henry's law constant at the system (soil) temperature 13˚C	unitless	Appendix C, Table E	Chemical-Specific

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
L_B	Length of building	cm	Illinois EPA	Residential = 1000 Industrial/Commercial = 2000 or Site-Specific in Tier 3
L_{crack}	Slab thickness	cm	US EPA, Users Guide 2004	10
L_F	Distance from ground surface to bottom of slab	cm	US EPA, Users Guide 2004	10 (slab on grade) 200 (basement)
L_i	Thickness of soil layer i	cm	Field Measurement For capillary fringe, USEPA, 2004	Site-Specific For capillary fringe, 37.5 cm
L_T	Distance from bottom of slab to top of contamination	cm	Field Measurement or Equation J&E 10, Appendix C, Table L	142.4 or Site-Specific
MW	Molecular weight	g/mole	Illinois EPA	Chemical-Specific

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
n	Total number of layers of different types of soil vapors migrate through from source to building (if source is groundwater, include a capillary fringe layer of 37.5 cm as one of the layers)	unitless	Field measurement	Site-Specific
P	Vapor Pressure	atm	Appendix C, Table E	Chemical-Specific
Q_{bldg}	Building ventilation rate	cm^3/s	Equation J&E 13, Appendix C, Table L	Slab on Grade Residential = 3.59×10^4 Industrial/Commercial = 3.15×10^5 or Site-Specific in Tier 3 Basement Residential = 6.28×10^4 Industrial/Commercial = 5.04×10^5 or Site-Specific in Tier 3

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
Q_{soil}	Volumetric flow rate of soil gas into the enclosed space	cm^3/s	US EPA, Users Guide for Evaluating Subsurface Vapor Intrusion into Buildings 2004	If L_T is less than 5 feet (152 cm), Q_{soil} equals 83.33 If L_T is 5 feet (152 cm) or greater, Q_{soil} equals zero An input value of zero requires an institutional control. See Section 742.505(b) and (c).
R	Ideal gas constant	atm-L/mol-K	US EPA, Users Guide 2004	0.08206
RfC	Reference concentration	ug/m^3	Illinois EPA: http://www.epa.state.il.us /land/taco/toxicity-values.xls	Toxicological-Specific
RO_{gw}	Groundwater remediation objective	mg/L	Appendix B, Table E, or Equation J&E 6, Appendix C, Table L	Chemical-Specific or Calculated Value
$RO_{indoor\ air}$	Indoor air remediation objective	mg/m^3	Equations J&E 1 and 2, Appendix C, Table L	Calculated Value

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
$RO_{soil\ gas}$	Soil gas remediation objective	mg/m^3	Equation J&E 4, Appendix C, Table L	Calculated Value
S	Solubility in water	mg/L	Appendix C, Table E	Chemical-Specific
T	Temperature	K	US EPA, Users Guide 2004	286 (converted from $13^{o}C$)
THQ	Target hazard quotient for a chemical	unitless	SSL, May 1996	1
TR	Target risk or the increased chance of developing cancer over a lifetime due to exposure to a chemical	unitless	SSL, May 1996	Residential = 10^{-6} at the point of human exposure Industrial/Commercial = 10^{-6} at the point of human exposure
URF	Unit risk factor	$(ug/m^3)^{-1}$	Illinois EPA: http://www.epa.state.il.us/land/taco/toxicity-values.xls	Toxicological- Specific

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
w	Floor-wall seam gap	cm	US EPA, Users Guide 2004	0.1
W	Moisture content	g of water/g of soil	Field Measurement, Appendix C, Table F	Site-Specific
W_B	Width of building	cm	Illinois EPA	Residential = 1000 Industrial/Commercial = 2000 or Site-Specific in Tier 3
α	Attenuation factor	unitless	Equations J&E 7 or 8, Appendix C, Table L	Site-Specific
θ_a	Air-filled soil porosity	cm^3/cm^3	SSL, May 1996 or Equation J&E 18, Appendix C, Table L	0.28 or Calculated Value
$\theta_{a,crack}$	Air-filled porosity for soil in cracks	cm^3/cm^3	SSL, May 1996 or Equation J&E 18, Appendix C, Table L	0.13
$\theta_{a,i}$	Air-filled porosity of soil layer i	cm^3/cm^3	SSL, May 1996 or Equation J&E 18, Appendix C, Table L	0.13 or Calculated Value For capillary fringe, $\theta_{a,i} = 0.1\ \theta_{T,i}$

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
$\theta_{T,crack}$	Total porosity for soil in cracks	cm^3/cm^3	SSL, May 1996 or Equation J&E 16, Appendix C, Table L	0.43
$\theta_{T,i}$	Total porosity of soil layer i	cm^3/cm^3	SSL, May 1996 or Equation J&E 16, Appendix C, Table L	0.43 or Calculated Value
θ_w	Water-filled soil porosity	cm^3/cm^3	SSL, May 1996 or Equation J&E 17, Appendix C, Table L	0.15 or Calculated Value
$\theta_{w,crack}$	Water-filled porosity for soil in cracks	cm^3/cm^3	SSL, May 1996 or Equation J&E 17, Appendix C, Table L	0.15
$\theta_{w,i}$	Water-filled porosity of soil layer i	cm^3/cm^3	SSL, May 1996 or Equation J&E 17, Appendix C, Table L For capillary fringe, US EPA, Users Guide 2004	0.15 or Calculated Value For capillary fringe = 0.375 or 0.9 $\theta_{T,i}$

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
$\cancel{\theta}\rho_{b}$	Dry soil bulk density	g/cm^3	SSL, May 1996 or Field Measurement, Appendix C, Table F	1.5 or Calculated Value
$\cancel{\theta}\rho_{s,i}$	Soil particle density	g/cm^3	SSL, May 1996 or Field Measurement, Appendix C, Table F	2.65 or Calculated Value
$\cancel{\theta}\rho_{w}$	Density of water	g/cm^3	Illinois EPA	1

(Source: Added at 37 Ill. Reg. _____, effective ______)

Section 742.APPENDIX F: Environmental Land Use Control

PREPARED BY:

Name: ____________________
____
Address: ___________________

RETURN TO:

Name: ____________________
____
Address: ___________________

THE ABOVE SPACE FOR RECORDER'S OFFICE

Model Environmental Land Use Control

THIS ENVIRONMENTAL LAND USE CONTROL ("ELUC"), is made this ________ day of ______________, 20__, by __________________________, ("Property Owner") of the real property located at the common address_______________________________________("Property").

WHEREAS, 415 ILCS 5/58.17 and 35 Ill. Adm. Code 742 provide for the use of an ELUC as an institutional control in order to impose land use limitations or requirements related to environmental contamination so that persons conducting remediation can obtain a No Further Remediation determination from the Illinois Environmental Protection Agency ("IEPA"). The reason for an ELUC is to ensure protection of human health and the environment. The limitations and requirements contained herein are necessary in order to protect against exposure to contaminated soil, ~~or~~ groundwater, or soil gas ~~both,~~ that may be present on the property as a result of [**VARIABLE**] activities. Under 35 Ill. Adm. Code 742, the use of risk-based, site-specific remediation objectives may require the use of an ELUC on real property, and the ELUC may apply to certain physical features (e.g., engineered barriers, indoor inhalation building control technologies, monitoring wells, caps, etc.).

WHEREAS, ___________________ [**the party performing remediation**] intends to request risk-based, site specific soil, ~~and~~ groundwater, or soil gas remediation objectives from IEPA under 35 Ill. Adm. Code 742 to obtain risk-based closure of the site, identified by Bureau of Land [**10-digit LPC or Identification number**] __________________ , utilizing an ELUC.

NOW, THEREFORE, the recitals set forth above are incorporated by reference as if fully

set forth herein, and the Property Owner agrees as follows:
Date: __________________________________By:_______________________________________

Director

Section One. Property Owner does hereby establish an ELUC on the real estate, situated in the County of ___________, State of Illinois and further described in Exhibit A attached hereto and incorporated herein by reference (the "Property").

Attached as Exhibit B are site maps that show the legal boundary of the Property, any physical features to which the ELUC applies, the horizontal and vertical extent of the contaminants of concern above the applicable remediation objectives for soil, ~~or~~ groundwater, or soil gas ~~both~~, and the nature, location of the source, and direction of movement of the contaminants of concern, as required under 35 Ill. Adm. Code 742.

Section Two. Property Owner represents and warrants **he/she** is the current owner of the Property and has the authority to record this ELUC on the chain of title for the Property with the Office of the Recorder or Registrar of Titles in ___________ County, Illinois.

Section Three. The Property Owner hereby agrees, for **himself/herself**, and **his/her** heirs, grantees, successors, assigns, transferees and any other owner, occupant, lessee, possessor or user of the Property or the holder of any portion thereof or interest therein, that [**INSERT RESTRICTION (e.g. the groundwater under the Property shall not be used as a potable supply of water, and any contaminated groundwater or soil that is removed, excavated, or disturbed from the Property described in Exhibit A herein must be handled in accordance with all applicable laws and regulations**)].

Section Four. This ELUC is binding on the Property Owner, **his/her** heirs, grantees, successors, assigns, transferees and any other owner, occupant, lessee, possessor or user of the Property or the holder of any portion thereof or interest therein. This ELUC shall apply in perpetuity against the Property and shall not be released until the IEPA determines there is no longer a need for this ELUC as an institutional control; until the IEPA, upon written request, issues to the site that received the no further remediation determination a new no further remediation determination approving modification or removal of the limitation(s) or requirement(s); the new no further remediation determination is filed on the chain of title of the site subject to the no further remediation determination; and until a release or modification of the land use limitation or requirement is filed on the chain of title for the Property.

Section Five. Information regarding the remediation performed on the Property may be obtained from the IEPA through a request under the Freedom of Information Act (5 ILCS 140) and rules promulgated thereunder by providing the IEPA with the [10-digit LPC or identification number] listed above.

Section Six. The effective date of this ELUC shall be the date that it is officially recorded in the chain of title for the Property to which the ELUC applies.

WITNESS the following signatures:

Property Owner(s)

By:____

Its: ____

Date: ____

STATE OF ILLINOIS)
) SS:
COUNTY OF)

I, ___________________________the undersigned, a Notary Public for said County and State, DO HEREBY CERTIFY, that __________________ and __________________, personally known to me to be the Property Owner(s) of _________________________, and personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person and severally acknowledged that in said capacities they signed and delivered the said instrument as their free and voluntary act for the uses and purposes therein set forth.

Given under my hand and official seal, this _____ day of ___________________, 20__.

Notary Public

STATE OF _________)
) S.S.
COUNTY OF ________)

I, _______________, a notary public, do hereby certify that before me this day in person appeared ___________________________, personally known to me to be the Property Owner(s), of ________________________, each severally acknowledged that they signed and delivered the foregoing instrument as the Property Owner(s) herein set forth, and as their own free and voluntary act, for the uses and purposes herein set forth.

Given under my hand and seal this ________ day of _______________, 20__.

Notary Public

PIN NO. XX-XX-XXX-XXX-XXXX
(Parcel Index Number)

Exhibit A

The subject property is located in the City of **_____________**, **___________** County, State of Illinois, commonly known as **_________________________________**, **__________**, Illinois and more particularly described as:

LIST THE COMMON ADDRESS;
LEGAL DESCRIPTION; AND
REAL ESTATE TAX INDEX OR PARCEL #
(PURSUANT TO SECTION 742. 1010(d~~D~~)(2))

PIN NO. XX-XX-XXX-XXX-XXXX

Exhibit B

IN ACCORDANCE WITH SECTION 742.1010(d)~~(D)~~(8)(A) through -(D), PROVIDE ALL THE FOLLOWING ELEMENTS. ATTACH SEPARATE SHEETS, LABELED AS EXHIBIT B, WHERE NECESSARY.

(A) A scaled map showing the legal boundary of the property to which the ELUC applies.

(B) Scaled maps showing the horizontal and vertical extent of contaminants of concern above the applicable remediation objectives for soil, ~~and~~ groundwater, and soil gas to which the ELUC applies.

(C) Scaled maps showing the physical features to which an ELUC applies (e.g., engineered barriers, indoor inhalation building control technologies, monitoring wells, caps, etc.).

(D) Scaled maps showing the nature, location of the source, and direction of movement of the contaminants of concern.

(Source: Amended at 37 Ill. Reg.______, effective __________)

IT IS SO ORDERED.

Member J.A. Burke abstained.

Section 41(a) of the Environmental Protection Act provides that final Board orders may be appealed directly to the Illinois Appellate Court within 35 days after the Board serves the order. 415 ILCS 5/41(a) (2010); *see also* 35 Ill. Adm. Code 101.300(d)(2), 101.906, 102.706. Illinois Supreme Court Rule 335 establishes filing requirements that apply when the Illinois Appellate Court, by statute, directly reviews administrative orders. 172 Ill. 2d R. 335. The Board's procedural rules provide that motions for the Board to reconsider or modify its final orders may be filed with the Board within 35 days after the order is received. 35 Ill. Adm. Code 101.520; *see also* 35 Ill. Adm. Code 101.902, 102.700, 102.702.

I, John T. Therriault, Assistant Clerk of the Illinois Pollution Control Board, certify that the Board adopted the above opinion and order on May 16, 2013, by a vote of 4-0.

John T. Therriault, Assistant Clerk
Illinois Pollution Control Board