ILLINOIS POLLUTION CONTROL BOARD
April 19, 2012

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

Proposed Rule. First Notice.

OPINION AND ORDER OF THE BOARD (by T.E. Johnson):

The Board today proposes amendments to the Tiered Approach to Corrective Action Objectives (TACO) rules (35 Ill. Adm. Code 742). The amendments are proposed for first-notice publication in the *Illinois Register* pursuant to the Administrative Procedure Act (APA) (5 ILCS 100/5-40 (2010)). Publication will begin a 45-day public comment period. Since 1997, the TACO rules have provided procedures for developing remediation objectives based upon risks posed to human health by environmental conditions at a variety of sites. The first-notice 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 underlying volatile chemicals in soil or groundwater, a process commonly known as "vapor intrusion" or "VI."

The Board also proposes adding 13 chemicals to the TACO tables based upon the Board's pending rulemaking on groundwater quality standards, Proposed Amendments to Groundwater Quality Standards (35 Ill. Adm. Code 620) (Groundwater Quality), R08-18.[1] Further, the first-notice 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.

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 considering the entire record, including public comments and IEPA *errata* sheets, the Board is adopting for first notice the amendments proposed or agreed to by IEPA, with minor clarifying changes. In addition, the Board requires that IEPA be notified if an indoor inhalation building control technology at a school is rendered inoperable. The amendments will become effective on a date certain 60 days after their final adoption.

This opinion is divided into six main parts. First, the Board sets forth the procedural history of this rulemaking and a brief description of the predecessor rulemaking, Proposed

[1] In R08-18, the Board has proceeded to first notice under the APA (5 ILCS 100/5-40 (2010)). *See* Groundwater Quality, R08-18 (Oct. 20, 2011).

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. 2-5). Second, the Board addresses several procedural matters (pp. 5-8). Third, the Board provides background on the current TACO rules (pp. 8-9). Fourth, the Board gives an overview of the indoor inhalation exposure route (pp. 10-13). Fifth, the Board summarizes the first-notice proposal (pp. 13-24). Sixth and finally, the Board discusses the key issues raised at hearing and in public comment (pp. 24-57). The first-notice amendments themselves are set forth in the order following this opinion (pp. 59-220).

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 APA (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 the Johnson and Ettinger (1991) (J&E Model). *Id*. at 1.[2] The Illinois Environmental Regulatory Group (IERG) supported IEPA's motion for stay. *Id*. at 3. 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

[2] Board Member Thomas E. Johnson is not related to Paul C. Johnson, one of the developers of the J&E Model.

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.

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, 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).

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).

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including IERG, the Illinois Petroleum Council, the Illinois Petroleum Marketers Association, and the City of Chicago. Martin PFT2 at 1. IERG is a not-for-profit Illinois corporation affiliated with the Illinois Chamber of Commerce and is composed of member companies in the environmental regulated community.

The following participants filed public comments on the dates indicated: 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 (PC 5).

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. *See* 35 Ill. Adm. Code 101.306.

Because the following documents are not present in the R11-9 record but are relevant to the Board's decision-making today, the Board, "on its own initiative" (35 Ill. Adm. Code 101.306), incorporates into the R11-9 record these materials from the record of the 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);
- 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 incorporates the identifying initial page of each of these documents where it is not otherwise incorporated above. The Board directs the Clerk to make a copy of these materials from the R08-18 and R09-9 records. The Board further directs the Clerk to place the copy into the R11-9 record. *See* 35 Ill. Adm. Code 101.306. Finally, the Board directs the Clerk to create a single entry in the R11-9 docket for these incorporated materials, and to physically and electronically attach this portion of the Board's opinion to the front of the incorporated materials.

Motions to Correct Hearing Transcripts

On April 14, 2011, IEPA filed a motion to correct the first hearing's transcript, which the hearing officer granted on the record at the second hearing. Tr.2 at 7. On June 10, 2011, IEPA filed a motion to correct the second hearing's transcript, which is granted. Accordingly, the Board directs the Clerk's Office to do the following: (1) have the respective docket entries for the first and second hearing transcripts reflect the granting of IEPA's corresponding motion to correct; and (2) physically and electronically attach to the respective fronts of the first and second hearing transcripts both this portion of the Board's opinion and IEPA's corresponding motion to correct.

Filing Public Comments on the First-Notice Proposal

First-notice publication in the *Illinois Register* of these proposed rule changes will start a period of at least 45 days during which anyone may file a public comment with the Board, regardless of whether the person has already filed a public comment. The Board encourages persons to file public comments on the proposed amendments. The docket number for this rulemaking, R11-9, should be indicated on the public comment.

Public comments must be filed with the Clerk of the Board. Public comments may be filed at the following address:

Pollution Control Board
John Therriault, Assistant Clerk
JRTC
100 W. Randolph Street, Suite 11-500
Chicago, IL 60601

In addition, public comments may be filed electronically through the Clerk's Office On-Line (COOL) on the Board's Web site at www.ipcb.state.il.us. Any questions about electronic filing through COOL should be directed to the Clerk's Office at (312) 814-3629.[6]

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 COOL. Many other documents from this rulemaking are also available through COOL, including Board opinions and orders, hearing officer orders, pre-filed testimony, and public comments.

Abbreviations Used in this Opinion

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

[6] All filings with the Clerk must be served on the hearing officer and on those persons on the Service List for this rulemaking. The most recent version of the R11-9 Service List is available on COOL.

Act = Environmental Protection Act	OSWER = Office of Solid Waste and Emergency Response
APA = Administrative Procedure Act	RA = Remediation Applicant
ASTM = American Society for Testing and Materials	RBCA = Risk Based Corrective Action
BCT = building control technology	RCRA = Resource Conservation and Recovery Act
BTEX = benzene, toluene, ethylbenzene, and total xylenes	SMD = sub-membrane depressurization
COOL = Clerk's Office On-Line	SRAC = Site Remediation Advisory Committee
DCEO = Department of Commerce and Economic Opportunity	SRP = Site Remediation Program
ELUC = Environmental Land Use Control	SSD = sub-slab depressurization
IEPA or Agency = Illinois Environmental Protection Agency	SSL = Soil Screening Level
IERG = Illinois Environmental Regulatory Group	TACO = Tiered Approach to Corrective Action Objectives
J&E = Johnson and Ettinger	USEPA = United States Environmental Protection Agency
LVEJO = Little Village Environmental Justice Organization	UST = underground storage tank
NFR = No Further Remediation	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 notes, 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 an option for excluding pathways from further consideration and for 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. *Id*. Tier 1 involves comparing a site's contaminant concentrations with TACO tables of corresponding remediation objectives for residential or industrial/commercial properties. *See* 35 Ill. Adm. Code 742.115(b). Tier 2 involves developing remediation objectives by using risk-based equations from the Soil Screening Level (SSL) and Risk Based Corrective Action (RBCA) models listed in TACO. *See* 35 Ill. Adm. Code 742.115(c). 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(d). In addition, TACO provides for the use of "institutional controls" and "engineered barriers." *See* 35 Ill. Adm. Code 742.Subpart J, 742.Subpart K.[9]

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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.

[9] "Institutional Control" means "a legal mechanism for imposing a restriction on land use, as described in Subpart J [of Part 742]." 35 Ill. Adm. Code 742.200. "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." *Id*.

OVERVIEW OF THE INDOOR INHALATION EXPOSURE ROUTE

Addition of a New Pathway

The first-notice amendments address the potential for indoor air contamination resulting from subsurface volatile chemicals. The amendments 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 framework of three tiers, residential and industrial/commercial remediation objectives, and pathway exclusion. St. of Reas. at 2. The proposal allows 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

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 remediation objectives. 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* proposed 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 current 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 the SRP program. *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 this proposal is 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

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 proposal's 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. 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.

Instances of Vapor Intrusion Risk in Illinois

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 remediation objectives 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 the 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 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 the 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 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 of volatile chemicals 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 vapor barriers or other building control technologies, the exposure route would not need to be further evaluated. As such, the proposed rules allow for methods to make the pathway incomplete, such as vapor barriers. R09-9/Tr.1 at 77, 89. To this end, the proposal includes 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.

SUMMARY OF FIRST-NOTICE AMENDMENTS

In this portion of the opinion, the Board summarizes the proposed first-notice amendments to the TACO rules. Today's changes add an indoor inhalation exposure route to the existing risk-based methodology of TACO. The addition is made to protect building occupants "from volatile chemicals that have the potential to migrate from the soil and groundwater to indoor air." St. of Reas. at 3. The amendments contain new definitions, equations, parameters, default remediation objectives, and mechanisms for managing the indoor inhalation pathway. St. of Reas. at 6.

The amendments also add 13 new chemicals to the TACO tables based upon the proposed amendments to 35 Ill. Adm. Code 620 (Groundwater Quality, R08-18), updated physical and chemical parameters, and revised toxicity values consistent with USEPA's new hierarchy for selecting human health toxicity values. Updated values were used to calculate new remediation objectives for the new indoor inhalation exposure route and the existing outdoor inhalation exposure route. IEPA indicated that it would submit a new proposal at a later date to update the remediation objectives for other exposure routes. St. of Reas. at 7.

The first-notice amendments make minor clarifying changes to IEPA's original R11-9 proposal, as amended through three IEPA *errata* sheets. The Board also requires that IEPA be notified if an indoor inhalation building control technology at a school is rendered inoperable.

Subpart A ("Introduction") of Part 742

Under Subpart A 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 in 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* proposed Section 742.105(i). As proposed, TACO will provide remediation objectives not only for soil and groundwater, as it presently does, but also for soil gas. *See* proposed Sections 742.115(d) ("Environmental Media of Concern"), 742.225, 742.227.

Section 742.115(a) is amended to distinguish the new indoor inhalation exposure route from the existing outdoor inhalation exposure route. 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* proposed 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 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 proposed 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.

To develop remediation objectives for the indoor inhalation route, IEPA used a "modified" J&E Model. *See* proposed 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* proposed Sections 742.115(a)(4)(B), (a)(5)(A). Accordingly, provisions were added to allow the use of soil gas data when determining remediation objectives 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* proposed Section 742.115(a)(4); Tr.1 35-40.

Subpart B ("General") of Part 742

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"; "Q_{soil}"; "Saturated Zone"; "Soil Gas"; "Soil Vapor Saturation Limit"; "Unconfined Aquifer"; "Volatile Chemicals"; and "Water Table." *See* proposed 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* proposed 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 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 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; proposed 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]." Proposed Section 742.200.

The Board incorporates 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). *See* proposed Section 742.210. The Board notes that the latest edition of this document appears to be ASTM E2600-10, published in June 2010, and requests IEPA's comment on whether the more recent publication should be incorporated. 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* proposed Section 742.210.

Proposed 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* proposed Sections 742.200 and 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* proposed Section 742.222.

Proposed Section 742.227 provides the sampling requirements to demonstrate compliance with Tier 1 soil gas remediation objectives for the outdoor and indoor inhalation exposure routes. Exterior soil gas samples or near-slab samples collected outside a building are required. Any proposals to use sub-slab soil gas data for the indoor inhalation exposure route must be made under Tier 3. *See* proposed Section 742.227. Soil gas samples must be analyzed using a National Environmental Laboratory Accreditation Program (NELAP) certified laboratory. *See* proposed Section 742.227(c). Tier 1 soil gas remediation objectives 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* proposed 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 proposed to be 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* proposed 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. Proposed 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 none of the contaminants of concern are volatile chemicals. *See* proposed Section 742.312(a); *see also* R09-9/King PFT1 at 5-6.[10]

If volatile chemicals are present, the indoor inhalation exposure route cannot be excluded from consideration unless the "speed bump" provisions of current Sections 742.300 and 742.305 (35 Ill. Adm. Code 742.300, 742.305) are met. R09-9/King PFT1 at 5-6; *see also* proposed Section 742.312(b)(2). This ensures, 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 proposed for first notice 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* proposed Section 742.305(g); *see also* R09-9/King PFT1 at 6.

If volatile chemicals are present, one of the following must also be satisfied to exclude the indoor inhalation exposure route: (1) no building or man-made pathway exists or will be placed above the contaminated soil gas or groundwater; (2) a building control technology under Subpart L is used; or (3) when the contaminants of concern are benzene, toluene, ethylbenzene, and total xylenes (BTEX) only, a demonstration of active biodegradation has been made for BTEX such that no indoor inhalation exposure will occur. *See* proposed Section 742.312(b)(1); *see also* St. of Reas. at 9. Under any one of these three options, an institutional control under Subpart J must be placed on the property. *See* proposed 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.

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[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.

Tier 1 Tables G, H, and I are being added and are discussed below. *See* proposed Section 742.500(a). Tier 1 distinguishes between residential and industrial/commercial property uses of a site, but an institutional control under Subpart J is required where remediation objectives are based upon an industrial/commercial property use. *See* 35 Ill. Adm. Code 742.500(b).

Tier I 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* proposed 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* proposed Section 742.505(b)(1); *see also* proposed Section 742.510(c).

Tier I for the Indoor Inhalation Exposure Route

Section 742.505 also is modified to reflect the addition of the indoor inhalation exposure route. *See* proposed Sections 742.505(b)(2), (c)(5).

Tier 1 Soil Gas Remediation Objectives. The Tier 1 soil gas remediation objectives for the indoor inhalation pathway are listed in new Tables H and I of Appendix B. *See* proposed Section 742.505(b)(2). Table H must be used when soil or groundwater contamination is *within* 5 feet, vertically or horizontally, of an existing or potential building or man-made pathway. In this case, the mode of contaminant transport is both "diffusion and advection." *See* proposed Section 742.505(b)(2)(C). 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.[11] As explained in proposed Section 742.515(a), Table H provides soil gas remediation objectives for residential property use or industrial/commercial property use. *See* proposed 742.Appendix B, Table H; *see also* proposed Section 742.515(a).

Table I must be used when soil and groundwater contamination are *more than* 5 feet, vertically and horizontally, from an existing or potential building or man-made pathway. In this

[11] "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*.

case, the mode of contaminant transport is "diffusion only" and institutional controls are required. *See* proposed Section 742.505(b)(2)(D). [12] As explained in proposed Section 742.515(b), Table I provides soil gas remediation objectives for residential property use or industrial/commercial property use. *See* proposed 742.Appendix B, Table I; *see also* proposed Section 742.515(b). To apply Table I, however, the site evaluator must show that soil and groundwater within 5 feet, vertically and horizontally, of an existing or potential building or man-made pathway 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. *See* proposed Section 742.505(b)(2)(E).

Tier 1 Groundwater Remediation Objectives. For the groundwater component of the indoor inhalation pathway, the Tier 1 groundwater remediation objectives are also listed in new Tables H and I of Appendix B. *See* proposed Section 742.505(c)(5). Again, Table H must be used when soil or groundwater contamination is within 5 feet, vertically and horizontally, of an existing or potential building (*i.e.*, the contaminant transport mode is both diffusion and advection). *See* proposed Section 742.505(c)(5)(B). As explained in proposed Section 742.515(a), Table H provides groundwater remediation objectives for residential property use or industrial/commercial property use. *See* proposed 742.Appendix B, Table H; *see also* proposed Section 742.515(a).

Again, Table I must be used when soil and groundwater contamination are more than 5 feet, vertically and horizontally, from an existing or potential building (*i.e.*, the contaminant transport mode is diffusion only and institutional controls are required). *See* proposed Section 742.505(c)(5)(C). As explained in proposed Section 742.515(b), Table I provides groundwater remediation objectives for residential property use or industrial/commercial property use. *See* proposed 742.Appendix B, Table H; *see also* proposed Section 742.515(b). To apply Table I, however, the site evaluator must show that soil and groundwater within 5 feet, vertically and horizontally, of an existing or potential building or man-made pathway 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. *See* proposed Section 742.505(c)(5)(D).

Compliance. When using Table H (*i.e.*, contaminant transport mode is "diffusion and advection," soil or groundwater contamination is within 5 feet of an existing or potential building or man-made pathway), compliance is determined by meeting *either* the soil gas remediation objectives or the groundwater remediation objectives. *See* proposed Section 742.515(c). When using Table I (*i.e.*, contaminant transport mode is "diffusion only," soil and groundwater contamination are more than 5 feet from an existing or potential building or man-made pathway), compliance is determined by meeting *both* the soil gas remediation objectives and the groundwater remediation objectives. *See* proposed Section 742.515(d).

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[12] "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 F ("Tier 2 General Evaluation") of Part 742

Under Subpart F for Tier 2 in Section 742.600, IEPA conditioned compliance with the remediation objectives on the use of both soil gas and groundwater data when the "diffusion only" mode of contaminant transport is considered. Additionally, IEPA specified that if a contaminant has both carcinogenic and noncarcinogenic effects, the more stringent remediation objective calculated shall apply. St. of Reas. at 10.

Subpart G ("Tier 2 Soil and Soil Gas Evaluation") of Part 742

Under Subpart G for the Tier 2 soil and soil gas evaluation, IEPA added Section 742.712 to provide the SSL soil gas equation for the outdoor inhalation exposure route and Section 742.717 to require the use of the J&E Model for the indoor inhalation exposure route. St. of Reas. at 10.

Subpart H ("Tier 2 Groundwater Evaluation") of Part 742

Under Subpart H for the Tier 2 groundwater evaluation, IEPA added Section 742.805(e) and 742.812 to explain how to use the J&E equations for developing groundwater remediation objectives for the indoor inhalation exposure route. St. of Reas. at 11.

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

Under Subpart I for the Tier 3 evaluation, IEPA added Section 742.935 to provide for other situations where the indoor inhalation exposure route may be excluded, to describe the use of alternative building control technologies for excluding the exposure route, and to describe the use of calculations and modeling involving soil gas data to develop remediation objectives. St. of Reas. at 11. IEPA also specifically proposed under 742.900(c)(3) that "results of indoor air sampling" could 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

Under Subpart J for institutional controls, IEPA added Sections 742.1000(a)(7) and (8) to require the use of institutional controls whenever the indoor inhalation remediation objectives are based upon the "diffusion only" part of the J&E Model and whenever remediation objectives are based upon a building control technology. St. of Reas. at 11-12. IEPA indicated institutional controls would be needed for a land use restriction prohibiting a building or man-made pathway above the contaminated soil or groundwater and for the operation and maintenance requirements for approved building control technologies. R09-9/King PFT1 at 5-6. IEPA added references to "indoor inhalation building control technologies" in Section 742.1010 on Environmental Land Use Controls (ELUCs). The Board adds a reference to "soil gas" in the ELUC provision as well. IEPA also added Section 742.1015(j) to prohibit 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

Under Subpart K, IEPA proposed to clarify that the engineered barrier requirements under 742.1105(c)(3) apply to the "outdoor" inhalation exposure route.

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

Under Subpart L, building control technologies (BCTs) are addressed as an acceptable final remedial action when coupled with institutional controls under Subpart J. A no further remediation determination can be conditioned upon an approved BCT being in place and operational before human occupancy. R09-9/King PFT1 at 21. Subpart L describes the requirements of four types of systems: sub-slab depressurization (SSD); sub-membrane depressurization (SMD); membrane barrier; and vented raised floors. St. of Reas. at 12; King PFT1 at 23-26. IEPA found all four to be economically reasonable and technically feasible. Tr.1 at 104. IEPA described SSD as 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 proposed under Section 742.1210(c). However, other alternatives would have to be reviewed and approved under Tier 3. Tr.1 at 102-03. Finally, IEPA must be notified if a BCT at a school is rendered inoperable. *See* proposed Section 742.1200(e)(3).

Appendices

To accommodate the addition of the indoor inhalation exposure route and reconcile the TACO amendments with those proposed in docket R08-18 on groundwater quality standards, the Board proposes new tables along with revisions to some existing tables. IEPA proposed revisions to the Appendices reflecting: (1) updated physical and chemical parameters 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 proposed groundwater quality standards (35 Ill. Adm. Code 620, R08-18), (4) new SSL and J&E equations, and (5) Tier 1 remediation objectives for the indoor and outdoor inhalation exposure route. PFT1 Hurley at 1-2, St. of Reas. at 12-14. The amendments do not update remediation objectives for the existing exposure routes, however, IEPA indicated that it will submit a new proposal at a later date to update remediation objectives for the existing exposure routes based upon updated toxicity, chemical and physical parameter values. St. of Reas. at 7. The Board also amends the Appendix F model for ELUCs to reflect the new indoor inhalation exposure route.

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"); Table F ("Similar-Acting Carcinogenic Chemicals"). In Appendix A, Table A, IEPA proposed adding a column

for the Soil Saturation Concentration (C_{sat}) for the soil component of the groundwater ingestion exposure route. PFT1 Hurley at 6. Tables A, E and F reflect the addition of the new chemicals proposed for addition in the groundwater quality standards as applicable (35 Ill. Adm. Code 620, R08-18). PFT1 Hurley at 7. The 13 new chemicals added to the proposed groundwater quality standards, and now this TACO proposal, were based upon a review of chemicals detected in Illinois groundwater that had sufficient toxicity values to support the development of a groundwater standard. R08-18/Cobb PFT1 at 11-17; R08-18/Hornshaw PFT1 at 5-7; R08-18/IEPA PFT2 at 10.

Of the new chemicals proposed for the R08-18 groundwater quality standards, perchlorate was not included in the current rulemaking because it is not a volatile chemical and molybdenum 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.

Finally, the Board requests that IEPA's public comment address whether TACO provisions on "similar-acting chemicals" would apply with respect to remediation objectives for the indoor inhalation exposure route and, if so, how they would apply.[13]

Table J ("List of TACO Volatile Chemicals for the Indoor Inhalation Exposure Route"). Table J is being added to Appendix A to identify the volatile chemicals that must be considered for the indoor inhalation route. Hurley PFT1 at 7. IEPA's proposed Table J lists 59 volatile chemicals to be evaluated for the indoor inhalation exposure route. IEPA noted that the definition for "volatile chemicals" replaces "volatile organic compounds" in TACO in order to include other volatile contaminants subject to evaluation under the new indoor inhalation exposure route that are not organic, such as mercury. R09-9/King PFT1 at 2-3. IEPA explained that the proposed definition for volatile chemical differs from USEPA's definition in its 2002 draft guidance.[14] Ms. Hurley explained that USEPA's definition includes many polynuclear aromatic hydrocarbons that do not volatilize in a significant amount. R09-9/Hurley PFT1 at 7. Ms. Hurley indicated the table does not include any of the PNAs that would not volatilize. R09-9/Tr.1 at 58-59.

IEPA chose naphthalene as a "cutoff point" in determining whether a chemical meets the definition of "volatile chemical" or not because it is included in both SW846 Method 8260

[13] "'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.

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

(volatiles) and 8270 (semi-volatiles). R09-9/Tr.1 at 59. Dr. Salhotra added that because the water solubility of those chemicals is small, very little is expected to be present in the groundwater. *Id*. at 60. Mr. King added that there may be other chemicals of concern present at a site that would meet the proposed definition of "volatile chemicals" that do 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." *Id*. at 67-68.

Table K ("Soil Vapor Saturation Limits (C_v^{sat}) for Volatile Chemicals"). Table K is being added, listing the Soil Vapor Saturation Concentration (C_v^{sat}) values for the volatile chemicals, calculated from the equation J&E5. Hurley PFT1 at 8.

Appendix B ("Tier 1 Illustrations and Tables")

In Appendix B, Table G is being added to provide the "Tier 1 Soil Gas Remediation Objectives for the Outdoor Inhalation Exposure Route." Remediation objectives were calculated using the new SSL equation S30 added to Appendix C, Table A. IEPA also proposed 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") for the Tier 1 soil gas and groundwater remediation objectives for the indoor inhalation exposure route. Table H remediation objectives were calculated using both diffusion and advection contaminant transport mechanisms of the J&E Model, while Table I is based upon diffusion only.[15] Hurley PFT1 at 9-10; Tr.1 at 18.

As discussed above, Table H is to be used when soil or groundwater contamination is within 5 feet, vertically or horizontally, of an existing or potential building or man-made pathway. Table I is to be used when soil and groundwater contamination is more than 5 feet away. IEPA indicated that if groundwater is not encountered, Table H or Tier 3 should be used. Tr.1 at 76.

Where the calculated groundwater remediation objective exceeded the solubility of the chemical in water or where no oral toxicity values were available, IEPA proposed the solubility limit as the remediation objective. Hurley PFT1 at 10. For chloroform, IEPA proposed the groundwater quality standard as the remediation objective because the calculated remediation objective was less stringent than the groundwater quality standard. *Id*.

In a conservative approach, Tier 1 remediation objectives were developed for a slab-on-grade building with building-specific default values. IEPA explained that the slab-on-grade scenario is more conservative than a basement scenario, which would assume mixing of the volatile contaminants with the basement air before reaching the first above-grade floor. IEPA noted that the same building-specific default values must be used when performing Tier 2 calculations. Otherwise, restrictions would be required on the size of any building that might be

[15] *See* footnotes 11 and 12.

constructed over the contaminated area in the future, which would limit the transferability of the property. King PFT1 at 10-11; R09-9/Tr.2 AM at 33, 48. The Board requests that IEPA's public comment explain whether IEPA's use of the slab-on-grade scenario is protective of basement occupants.

Under IEPA's proposal, Tier 2 remediation objectives would be developed using the J&E equations along with default and site-specific parameters provided in proposed 742.Appendix C, Tables E, L, and M. King PFT1 at 15. IEPA indicated that if a Tier 2 soil gas remediation objective were calculated to be more stringent that the Tier 1 objective, the Tier 1 remediation objective would apply. *Id*. at 20.

Appendix C ("Tier 2 Illustrations and Tables")

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

In Table B ("SSL Parameters"), IEPA proposed to revise the source of the toxicity values in light of USEPA's latest hierarchy for determining human health toxicity values under 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, IEPA proposed to refer to IEPA's website.[16] 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 clarified that although toxicity values are updated quarterly, the web 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 Board updates the default physical and chemical parameters and added the 13 new chemicals from the proposed R08-18 groundwater quality standards. The updated physical and chemical parameters 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 were added to the methods for determining physical soil parameters. Hurley PFT1 at 12.

[16] 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.

In Table L ("J&E Equations") and Table M ("J&E Parameters"), the Board provides the J&E equations, parameters, and default values. IEPA noted 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.

Appendix F ("Environmental Land Use Control")

For this institutional control, the Board adds references to "soil gas and "indoor inhalation building control technologies" in the model ELUC at Appendix F.

DISCUSSION

IEPA's R11-9 proposal was generally supported by most participants who testified or provided public comment. *See* Exh. 10 (SRAC); PC2 (LVEJO); PC5 (City of Champaign); *see also* Tr.1 at 22-23 (USEPA). In this part of the opinion, the Board discusses the key issues raised at hearing and in public comment. These matters are addressed in the following sequence:

- USEPA feedback on proposal development (pp. 24-28);
- Scope of indoor inhalation exposure route (pp. 28-29);
- Use of the J&E Model (pp. 29-30);
- J&E Model assumptions (pp. 30-33);
- Biodegradation (pp. 33-34);
- Indoor air sampling (pp. 34-37);
- NFR letters and the new indoor inhalation exposure route (pp. 37-41);
- Definition of "building" (p. 42);
- Multi-building sites (pp. 42-43);
- Building control technologies (BCTs) (pp. 43-44);
- BCT maintenance requirements (pp. 44-48);
- Off-site impacts (pp. 48-49);
- "Reopening" NFR letters (pp. 49-50);
- School sites with NFR letters not addressing the indoor inhalation pathway (pp. 50-52);
- "Right-to-know" requirements (p. 52);
- Additional chemical constituents proposed (p. 53); and
- Technical feasibility and economic reasonableness (pp. 53-57).

The Board concludes its discussion by describing some minor revisions made by the Board to IEPA's proposal (pp. 57-58).

USEPA Feedback on Proposal Development

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 also 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 to the existing *outdoor* inhalation exposure route. St. of Reas. at 5. The first change responded to USEPA's concerns with the using the J&E Model to calculate remediation objectives 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 remediation objectives. 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 dis 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 indicated that it is in the process of revising its 2002 draft vapor intrusion guidance,[17] 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 explained 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

[17] 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)

own statewide database of vapor intrusion attenuation factors, at great time and expense. *Id*. 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.

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.[18] 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 the use of 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. When this guidance becomes available, it is suggested that IL EPA 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

[18] 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.

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).[19] 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.

Following up on USEPA's reference to its final vapor intrusion guidance anticipated by November 30, 2012, the 2009 OIG evaluation report, and a 2010 OSWER report entitled "Review of the Draft 2002 Subsurface Vapor Intrusion Guidance,"[20] 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 the R11-9 proposal differs 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 requests that IEPA evaluate the final USEPA vapor intrusion guidance when it becomes available and timely file any proposed TACO amendments based upon that evaluation. At this

[19] "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.

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

time, the Board finds that the IEPA's proposed use of the J&E Model, default parameters, and Tier 1 Tables H and I is appropriate for sites in Illinois.

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:

> 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. Exh. 8.

At the first hearing, Board staff questioned whether the second sentence of this provision might be inconsistent with the development of remediation objectives 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.

The Board finds, however, 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, the Board has 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 is "designed to address indoor inhalation of vapors coming only from either soil gas or groundwater" and that the amendments accordingly would not apply where the contamination is not "coming from the subsurface." Tr.2 at 47. The Board has 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 adds 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, as proposed for first notice, proposed Section 742.105(i) reads as follows:

> 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* proposed Section 742.105(i).

J&E Model Use

Mr. Reott, an environmental lawyer and active participant in the original TACO rulemaking,[21] 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.[22] Mr. Reott indicated that in preparing the final guidance, USEPA has been studying actual homes and comparing that data to the subsurface data. 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." PC4 at 3. 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." *Id*.

On her own behalf, Bhooma Sundar of USEPA presented verbal public comment during the second hearing about USEPA OSWER's anticipated final vapor intrusion guidance. Tr.2 at 25-27, 57. Ms. Sundar is a toxicologist, professor of human health risk, and project manager on vapor intrusion issues. Ms. Sundar cited her recent experience in remediating 120 homes in Hammond, Indiana for vapor intrusion issues. Tr.2 at 57. Ms. Sundar explained how distance affects petroleum contaminants, which are expected to biodegrade, and other recalcitrant contaminants like chlorinated chemicals, which do not. Tr.2 at 59-61. Ms. Sundar stated:

> [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.

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

[22] 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).

> There is a huge potential for the vapor to move horizontally and vertically into the building. Tr.2 at 61.

Ms. Sundar indicated that she anticipates the 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. Second, she expected the final guidance to rely upon the generic attenuation 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 remediation objectives under IEPA's proposal with what she anticipates will be in USEPA's final guidance. Ms. Sundar indicated that generally, IEPA's approach for calculating remediation objectives 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 USEPA's approach is to provide guidance at a national level, so 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 IEPA's proposal, IEPA would consider that under Tier 3. Tr.2 at 75.

Based upon this record, the Board finds that using the modified J&E Model is appropriate as folded into the existing TACO scheme and tailored for Illinois-specific geology. IEPA has provided the Board with 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. The Board 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 soil gas "right-to-know" provisions discussed below. The Board recognizes the updated federal vapor intrusion guidance is planned for issuance by November 30, 2012. As stated above, the Board requests that IEPA evaluate the final USEPA guidance upon its issuance and timely propose resulting TACO amendments, if any.

J&E Model Assumptions

Mr. Reott asserted that IEPA used very conservative assumptions regarding crawlspaces and basements and in determining a default value for the square footage of residential and commercial buildings. PC4 at 6. IEPA's proposal called for a default residential building size of

1,000 x 1,000 cm and a default industrial/commercial building size of 2,000 x 2,000 cm.[23] *See* proposed 742.Appendix C, Table M. 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 11% of houses under 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 proposed rules be amended to include a table for houses with basements and a "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 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

[23] The Board notes that 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.

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.

The Board understands that IEPA's proposal to use the default building sizes under Tier 1 and 2 is a conservative approach, especially where larger buildings and buildings with crawlspaces and basements are evaluated.[24] As IEPA explained, for Tiers 1 and 2, the approach avoids placing minimum-size restrictions upon any building that might be constructed over the contaminated area in the future. The Board agrees with IEPA's default parameters. Particularly as the indoor inhalation exposure route has never before been implemented through Board regulation, the Board finds that it would be inappropriate to provide for alternate building-size restrictions under the widely-used Tier 1 or Tier 2 provisions at this time. If, however, a given property owner is willing to place such restrictions on a future structure within the NFR determination, 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 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).[25] R09-9/PC6 at 1. IEPA believes that overall, its proposal based upon the

[24] The Board requested that IEPA comment on whether its approach is protective of persons who occupy basements.

[25] 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

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 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.

Biodegradation

Mr. Reott pointed out that USEPA's 2004 guidance[26] indicates that the J&E Model should not be used for UST sites with petroleum contamination. PC4 at 3. 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 explained 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*.[27]

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)). 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

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http://www.epa.gov/oswer/riskassessment/ragsf/pdf/partf_200901_final.pdflast visited 12-20-2011.

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

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

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 can be changed under such circumstances. R09-9/Tr.2 AM at 29-30.

The Board agrees with IEPA's approach to provide a mechanism for excluding the indoor inhalation pathway based upon a demonstration of active biodegradation for BTEX contaminants. The Board finds that because the J&E Model does not account for biodegradation, the approach taken at first notice adequately addresses 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 American Petroleum Institute's 2009 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.

Indoor Air Sampling

During the Predecessor Rulemaking, R09-9, Harvey Pokorny of Versar suggested that the proposed rules should include 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 remediation objectives 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 remediation objectives 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.

IEPA considered but early on rejected using indoor air data as a general method to demonstrate compliance with remediation objectives under Tier 1 or 2. IEPA's proposal does 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 are "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.[28] 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 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.

[28] 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.

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.

The Board recognizes, 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. As IEPA explained, 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 finds that Mr. Pokorny's suggestion to develop Tier 1 indoor air remediation objectives in order to establish a pathway exclusion would not be appropriate. The Board notes that IEPA modified its original proposal (under Tier 3 Section 742.900(c)(3)) to specifically reference indoor air sample results as site data that may be accepted for evaluation. Nifong PFT2 at 4; Exh. 8 at 3. The Board agrees with IEPA's proposal regarding indoor air sampling and finds that Tier 3 is the appropriate means to evaluate indoor air sample results.

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.[29] 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 agrees 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. However, to place this general statement in context, certain differences in the underlying regulatory programs must be emphasized. IEPA's testimony on the contrasting ways that off-site contamination might be handled under the Leaking UST Program and SRP suggests some of these 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, Subparts B and C; *see also generally* 35 Ill. Adm. Code 732. 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;*

[29] 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.

> 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) defines the "remediation site"[30] and the "recognized environmental conditions"[31] 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:

> *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

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[30] "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.

[31] "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.

> 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)).

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 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"). 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.

The Board finds 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. SRAC and IEPA agree 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 agrees.

The Board finds, however, that the voluntary nature of SRP raises a question of whether a delayed effective date is necessary for remediation completion submittals in that program. As discussed above in the context of SRP, the RA defines the site conditions for which it seeks an NFR letter. If the indoor inhalation pathway was not included in the RA's remedial action plan, then the pathway would be beyond the scope of the requested NFR letter. SRP does not "require" the RA to address all environmental conditions. *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 seeks public comment from IEPA and others on whether these TACO amendments taking effect would

preclude the subsequent issuance of a limited NFR letter in SRP, such as one explicitly providing that the indoor inhalation exposure route was not addressed.

Even with this potential caveat, the Board finds 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 notes 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*. Providing an extra 60 days after final adoption before the amendments take effect should further ease sites near closure through this transitional period.

The Board finds 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." Tiered Approach to Corrective Action Objectives (TACO): 35 Ill. Adm. Code 742, 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 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 will make 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.").

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*.

Definition of "Building"

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

> "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.

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

> "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. *See* proposed Section 742.200.

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 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 concurs 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 an existing or potential building or man-made pathway), while another building on the same site is addressed under Appendix B, Table I (because soil and groundwater contamination are more than 5 feet from an existing or potential building or man-made pathway). Tr.1 at 67-68.

Building Control Technologies

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 proposed 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 found 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 stated is more conventional. Additionally, CETCO/Geokinetics found 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 decreases 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 proposed Section 742.1210(c)(2)(B). The Board requests that IEPA provide information in its public comment to support the decrease in thickness. The Board further requests that IEPA's comment respond to CETCO/Geokinetics' advocacy of a minimum 60-mil thick membrane.

BCT Maintenance Requirements

NFR Letter Conditions

IEPA provided a list of the maintenance requirements for BCTs, as outlined in proposed Section 742.1210, which would be specified in an NFR determination. The maintenance requirements would appear in the NFR letter as part of the section on "Conditions and Terms of Approval" within the subsection "Preventive, Engineering, and Institutional Controls" under the title "Institutional." 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:

> **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 proposed 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. The Board solicits public comment on whether these terms should be defined in the proposed rules.

Voidance "Safe Harbor"

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 finds that BCTs, like engineered barriers, require effective maintenance. The BCT maintenance conditions for NFR letters will 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 finds 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 notes that the failure to install a BCT as required by an NFR letter is also grounds for voidance. *See* proposed Section 742.1220(f). Notice is further discussed below.

Notice to IEPA of BCT Inoperability

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 determination. Tr.2 at 40.

The Board finds 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 observes that Part 740 requirements, however, would not apply to school sites in the Leaking UST Program, which are generally subject to Part 732 or Part 734 (35 Ill. Adm. Code 732, 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).

Mr. King's testimony on SRP's school-specific provisions does highlight 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 requests that IEPA's public comment address whether there are any disadvantages to requiring that IEPA be notified of BCT inoperability at school sites. The Board appreciates IEPA's concerns about resource preservation and creating a mere "paperwork exercise." The 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, having issued the NFR letter, IEPA is aware of site conditions at each post-NFR school site, which should help inform IEPA about how to respond to a notice.

Additionally, the Board requests public comment from IEPA and others addressing proposed Section 742.1200(e)(3), which the Board adds at first notice. The first sentence of the new provision states: "<u>For a school, the site owner/operator shall notify the Agency upon any building control technology being rendered inoperable.</u>" The Board requests 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 asks that IEPA's public comment include revised BCT maintenance conditions for such school-site NFR letters, reflecting the additional notice requirement.

Finally, for purposes of this new notice requirement only, the Board adds, at proposed Section 742.1200(e)(3), 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 solicits public comment on the proposed use of this SRP language. *See* proposed Section 742.1200(e)(3).

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

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 includes an amended Appendix F in this first-notice proposal. The amendments add 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.

"Reopening" NFR Letters

IEPA mentioned that the States of New York and New Jersey are reopening "a huge number of closed sites to relook at the indoor inhalation component." R09-9/Tr.1 at 66. In the Predecessor Rulemaking, 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 agrees 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. 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 voidance of NFR letters and enforcement actions.

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 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.

LVEJO identified 45 schools that are or were enrolled in SRP. Most of the schools identified were in Chicago while others were located in Cicero, East St. Louis, Joliet, Lake Forest, LeRoy, New Lenox, Orland Park, and Woodstock. PC2 at 2-3. 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. PC2 at 3. 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. PC2 at 4. 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. *Id*. 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 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 proposes screening and, if necessary, mitigation for Illinois school sites that relied upon institutional controls or engineered barriers. 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 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.

The Board 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. IEPA maintains records on each of these sites for which NFR letters have issued or which are subject to an ELUC, under SRP or the Leaking UST Program. The Board finds 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 requests that IEPA describe in its public comment how IEPA will go about providing this notice. The Board further requests 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 ELUC, indicating which of those sites, if any, have already directly addressed the indoor inhalation exposure route.

In responding to the Board's request, IEPA should 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.[32] In addition, to the extent IEPA has the information reasonably available, the Board asks 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)).

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 notes that necessarily, some

[32] SRP's definition of "school" is set forth above at page 48.

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 in the discussion of economic reasonableness below.

"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 notes 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 notes 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, the "soil gas" notice language of the Act itself will be implemented by IEPA based upon the final TACO Tier 1 indoor inhalation remediation objectives. *Id*.

Additional Chemical Constituents Proposed

IEPA proposed adding 13 chemical constituents to the TACO rules based upon the same chemicals being added to the proposal in Groundwater Quality, R08-18.[33] The premise for adding these chemicals to the groundwater quality standards is based upon a review of chemical constituents that have 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.

Of the new chemicals that are being added in the pending R08-18 groundwater quality rulemaking but that are not already in TACO, IEPA is not proposing 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 at first notice 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). The Board finds 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

[33] The Board proceeded to first notice on October 20, 2011. *See* Groundwater Quality, R08-18 (Oct. 20, 2011).

reasons below, the Board finds that the amendments proposed today 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 first-notice proposal is technically infeasible. Several participants voiced concern over the J&E Model. The Board found, however, that the modified J&E Model, as a component of the existing TACO framework, is appropriate for Illinois sites. The Board agreed with the IEPA's default parameters and IEPA's provision for BTEX biodegradation demonstrations. Further, the Board requested that IEPA evaluate the final USEPA vapor intrusion guidance upon its issuance.

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. Citing information presented by CETCO/Geokinetics during the Predecessor Rulemaking, R09-9, the Board requested that IEPA comment on the issue of minimum membrane thickness under proposed Section 742.1210(c)(2)(B). In response to suggestions from SRAC and IEPA, the Board will include the 60-day delay in rule effectiveness. To assist the regulated community in implementing the new indoor inhalation exposure route, the Board notes that IEPA plans to prepare issue-specific "fact sheets" as they are needed. Tr.1 at 49.

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

Economic Reasonableness

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. Several participants, however, presented pertinent economic information during the course of this rulemaking and the Predecessor Rulemaking, R09-9.

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 of 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 proposed to be 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 observes 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.

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. 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 finds that the amendments proposed for first notice are economically reasonable and will not have an adverse economic impact on the People of Illinois.

Minor Revisions to IEPA Proposal

Names for Chemicals

At the Board's request, IEPA provided the common names for the explosive chemicals being 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 includes the common names in the proposed amendments to Part 742 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)

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 proposed 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). The Board revises the symbols for porosity to use the Greek lower case letter Theta "θ" throughout Table M.

References to Part 734 Leaking UST Regulations

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 adds 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).

CONCLUSION

The Board proposes Part 742 TACO amendments for first notice. Among today's more significant modifications is the addition of the indoor inhalation exposure route and corresponding Tier 1 soil gas and groundwater remediation objectives. Substantively, the Board is adopting the IEPA's proposed amendments with minor clarifying changes. The Board also requires that notification be provided to IEPA if an indoor inhalation building control technology at a school is rendered inoperable.

The Board will make the amendments take effect on a date certain 60 days after their final adoption. Publication in the *Illinois Register* of these first-notice amendments will start a period of at least 45 days during which anyone may file public comments with the Clerk of the Board at the address set forth at the outset of this opinion. Additionally, as noted, public comments may be filed electronically through COOL at www.ipcb.state.il.us.

ORDER

The Board directs the Clerk to cause first-notice publication of the following proposed TACO amendments in the *Illinois Register*. Proposed additions to Part 742 are underlined; proposed deletions appear stricken.

TITLE 35: ENVIRONMENTAL PROTECTION
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

Section
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
742.200 Definitions
742.205 Severability
742.210 Incorporations by Reference
742.215 Determination of Soil Attenuation Capacity
742.220 Determination of Soil Saturation Limit
742.222 Determination of Soil Vapor Saturation Limit
742.225 Demonstration of Compliance with Soil and Groundwater Remediation Objectives
742.227 Demonstration of Compliance with Soil Gas Remediation Objectives for the Outdoor and Indoor Inhalation Exposure Routes
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

Section
742.400 Area Background
742.405 Determination of Area Background for Soil
742.410 Determination of Area Background for Groundwater
742.415 Use of Area Background Concentrations

SUBPART E: TIER 1 EVALUATION

Section
742.500 Tier 1 Evaluation Overview
742.505 Tier 1 Soil, Soil Gas and Groundwater Remediation Objectives
742.510 Tier 1 Remediation Objectives Tables for the Ingestion, Outdoor Inhalation, and Soil Component of the Groundwater Ingestion Exposure Routes
742.515 Tier 1 Remediation Objectives Tables for the Indoor Inhalation Exposure Route

SUBPART F: TIER 2 GENERAL EVALUATION

Section
742.600 Tier 2 Evaluation Overview
742.605 Land Use
742.610 Chemical and Site Properties

SUBPART G: TIER 2 SOIL AND SOIL GAS EVALUATION

Section
742.700 Tier 2 Soil Evaluation Overview
742.705 Parameters for Soil Remediation Objective Equations
742.710 SSL Soil Equations
742.712 SSL Soil Gas Equation for the Outdoor Inhalation Exposure Route
742.715 RBCA Soil Equations
742.717 J&E Soil Gas Equations for the Indoor Inhalation Exposure Route
742.720 Chemicals with Cumulative Noncarcinogenic Effects

SUBPART H: TIER 2 GROUNDWATER EVALUATION

Section
742.800 Tier 2 Groundwater Evaluation Overview
742.805 Tier 2 Groundwater Remediation Objectives
742.810 RBCA Calculations to Predict Impacts from Remaining Groundwater Contamination

742.812 J&E Groundwater Equations for the Indoor Inhalation Exposure Route

SUBPART I: TIER 3 EVALUATION

Section
742.900 Tier 3 Evaluation Overview
742.905 Modifications of Parameters
742.910 Alternative Models
742.915 Formal Risk Assessments
742.920 Impractical Remediation
742.925 Exposure Routes
742.930 Derivation of Toxicological Data
742.935 Indoor Inhalation Exposure Route

SUBPART J: INSTITUTIONAL CONTROLS

Section
742.1000 Institutional Controls
742.1005 No Further Remediation Letters
742.1010 Environmental Land Use Controls
742.1012 Federally Owned Property: Land Use Control Memoranda of Agreement
742.1015 Ordinances
742.1020 Highway Authority Agreements and Highway Authority Agreement Memoranda of Agreement

SUBPART K: ENGINEERED BARRIERS

Section
742.1100 Engineered Barriers
742.1105 Engineered Barrier Requirements

SUBPART L: BUILDING CONTROL TECHNOLOGIES

Section
742.1200 Building Control Technologies
742.1205 Building Control Technology Proposals
742.1210 Building Control Technology Requirements

742.APPENDIX A General
ILLUSTRATION A Developing Soil Remediation Objectives Under the Tiered Approach
ILLUSTRATION B Developing Groundwater Remediation Objectives Under the Tiered Approach
TABLE A Soil Saturation Limits (C_{sat}) for Chemicals Whose Melting Point is Less than 30°C

TABLE B Tolerance Factor (K)
TABLE C Coefficients $\{A_{N-I+1}\}$ for W Test of Normality, for N=2(1)50
TABLE D Percentage Points of the W Test for n=3(1)50
TABLE E Similar-Acting Noncarcinogenic Chemicals
TABLE F Similar-Acting Carcinogenic Chemicals
TABLE G Concentrations of Inorganic Chemicals in Background Soils
TABLE H Concentrations of Polynuclear Aromatic Hydrocarbon Chemicals in Background Soils
TABLE I Chemicals Whose Tier 1 Class I Groundwater Remediation Objective Exceeds the 1 in 1,000,000 Cancer Risk Concentration
TABLE J List of TACO Volatile Chemicals for the Indoor Inhalation Exposure Route
TABLE K Soil Vapor Saturation Limits (C_v^{sat}) for Volatile Chemicals

742.APPENDIX B Tier 1 Illustrations and Tables
ILLUSTRATION A Tier 1 Evaluation
TABLE A Tier 1 Soil Remediation Objectives for Residential Properties
TABLE B Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties
TABLE C pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics for the Soil Component of the Groundwater Ingestion Route (Class I Groundwater)
TABLE D pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics for the Soil Component of the Groundwater Ingestion Route (Class II Groundwater)
TABLE E Tier 1 Groundwater Remediation Objectives for the Groundwater Component of the Groundwater Ingestion Route
TABLE F Values Used to Calculate the Tier 1 Soil Remediation Objectives for the Soil Component of the Groundwater Ingestion Route
TABLE G Soil Gas Remediation Objectives for the Outdoor Inhalation Exposure Route
TABLE H Tier 1 Soil Gas and Groundwater Remediation Objectives for the Indoor Inhalation Exposure Route – Diffusion and Advection
TABLE I Tier 1 Soil Gas and Groundwater Remediation Objectives for the Indoor Inhalation Exposure Route – Diffusion Only

742.APPENDIX C Tier 2 Illustrations and Tables
ILLUSTRATION A Tier 2 Evaluation for Soil
ILLUSTRATION B Tier 2 Evaluation for Groundwater
ILLUSTRATION C US Department of Agriculture Soil Texture Classification
TABLE A SSL Equations
TABLE B SSL Parameters
TABLE C RBCA Equations
TABLE D RBCA Parameters
TABLE E Default Physical and Chemical Parameters

TABLE F Methods for Determining Physical Soil Parameters
TABLE G Error Function (erf)
TABLE H Q/C Values By Source Area
TABLE I K_{oc} Values for Ionizing Organics as a Function of pH (cm^3/g or L/kg or cm^3_{water}/g_{soil})
TABLE J Values to be Substituted for kd or ks when Evaluating Inorganics as a Function of pH (cm^3/g or L/kg or cm^3_{water}/g_{soil})
TABLE K Parameter Estimates for Calculating Water-Filled Soil Porosity θ_w)
TABLE L J&E Equations
TABLE M J&E Parameters

742.APPENDIX D Highway Authority Agreement
742.APPENDIX E Highway Authority Agreement Memorandum of Agreement
742.APPENDIX F Environmental Land Use Control
742.APPENDIX G Model Ordinance
742.APPENDIX H Memorandum of Understanding

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 at 36 Ill. Reg. _____, effective _____.

NOTE: Italics indicates statutory language.

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 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 36 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 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.

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.

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 36 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;

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 36 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 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* or as "carcinogenic to humans" or "likely to be carcinogenic to humans" *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.

"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 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)), 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]

"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 soil pore air and pore water are saturated with the chemical and the adsorptive limits of the soil particles have been reached~~. 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 which are liquid at ambient soil temperatures) do not apply, and alternative modeling approaches are required.

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

"Total Petroleum Hydrocarbon (TPH)" means the additive total of all petroleum hydrocarbons found in an analytical sample.

"Township 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 1.9×10^{-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 36 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. ~~American Society for Testing and Materials~~ International, 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 2600-08, Standard Practice for Assessment for Vapor Intrusion into Structures on Property Involved in Real Estate Transactions, approved March 1, 2008.

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).

"Users Guide for Evaluating Subsurface Vapor Intrusion into Buildings," EPA. EPA/68/W-02/33, (February 2004).

Polynuclear Aromatic Hydrocarbon Background Study City of Chicago, 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).

United States Environmental Protection Agency, Office of Solid Waste and Emergency Response (2003). "Human Health Toxicity Values in Superfund Risk Assessments," OSWER Directive 9285.7-53. (Available online at http://www.epa.gov/oswer/riskassessment/pdf/hhmemo.pdf).

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 (2005). "Guidelines for Carcinogen Risk Assessment (2005)". U. S. Environmental Protection Agency, Washington, DC, EPA Publication No. EPA/630/P-03/001F, 2005. (Available online 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 36 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 36 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) of this Section.

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 36 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 ~~organic contaminants~~ chemicals:

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 ~~organic contaminants~~ chemicals:

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 Section 742.225(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 route~~s~~, the following requirements apply:

1) A person shall submit a sampling plan for Agency approval, based upon a site-specific evaluation;

2) For volatile ~~organic compounds~~ chemicals, 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 36 Ill. Reg. _____, effective _____)

Section 742.227 Demonstration of Compliance with Soil Gas Remediation Objectives for the Outdoor and Indoor Inhalation Exposure Routes

Compliance shall be demonstrated by comparing the contaminant concentrations of discrete samples at each sample point to the applicable soil gas remediation objective. As specified in Section 742.510(c), the soil gas remediation objectives for the outdoor inhalation exposure route are contained in Appendix B, Table G. As specified in Section 742.515, the soil gas remediation objectives for the indoor inhalation exposure route are contained in Appendix B, Tables H and I. Section 742.227 applies to exterior soil gas samples or near-slab samples collected outside a building. Proposals to use sub-slab soil gas data for the indoor inhalation exposure route shall follow Section 742.935(c).

a) Sample points shall be determined by the program under which remediation is performed.

b) 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.

c) Soil gas samples shall be analyzed using a National Environmental Laboratory Accreditation Program (NELAP) certified laboratory.

d) 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 36 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 36 Ill. Reg. _____, effective _____)

Section 742.310 Outdoor Inhalation Exposure Route

The outdoor inhalation exposure route may be excluded from consideration if:

a) The following requirements in subsections (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 worker precautions for the construction worker are taken if the Tier 1 construction remediation objectives are exceeded; and

d) An institutional control, in accordance with Subpart J, will be placed on the property.

(Source: Amended at 36 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 following requirements in subsections (b)(1)(A) or (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 the contaminated soil gas or groundwater; 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 concerns 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 36 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 ~~organic contaminants~~ chemicals, sample results shall be based on discrete samples;

2) Unless an alternative method is approved by the Agency, for contaminants other than volatile ~~organic contaminants~~ chemicals, 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 36 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) 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 36 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.

C) Appendix B, Table H shall be used when soil or groundwater contamination is within 5 feet, vertically or horizontally, of an 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.

D) Appendix B, Table I shall be used when soil and groundwater contamination are more than 5 feet, vertically and horizontally, from an 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. Soil gas remediation objective determinations relying on this table require use of institutional controls in accordance with Subpart J.

E) To determine whether the Q_{soil} value can be set at 0.0 cm^3/sec, the site evaluator shall demonstrate that soil and groundwater within 5 feet, vertically and horizontally, of an existing or potential building or man-made pathway 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

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.

   B) Appendix B, Table H shall be used when soil or groundwater contamination is within 5 feet, vertically and horizontally, of an 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.

C) Appendix B, Table I shall be used when soil and groundwater contamination are more than 5 feet, vertically and horizontally, from an 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. Groundwater remediation objective determinations relying on this table require use of institutional controls in accordance with Subpart J.

D) To determine whether the Q_{soil} value can be set at 0.0 cm^3/sec, the site evaluator shall demonstrate that soil and groundwater within 5 feet, vertically and horizontally, of an existing or potential building or man-made pathway 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.

(Source: Amended at 36 Ill. Reg. _____, effective _____)

Section 742.510 Tier 1 Remediation Objectives Tables for the Ingestion, Outdoor Inhalation and Soil Component of the Groundwater Ingestion Exposure Routes

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 outdoor 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 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 outdoor 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 where 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, 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~~ Sections 742.505(c)(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 36 Ill. Reg. _____, effective _____)

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

a) When the mode of contaminant transport is both diffusion and advection as described in Section 742.505 (i.e., soil or groundwater contamination is within 5 feet of an existing or potential building or man-made pathway), the remediation objectives for soil gas and 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.

b) When the mode of contaminant transport is diffusion only as described in Section 742.505 (i.e., soil and groundwater contamination are more than 5 feet from an existing or potential building or man-made pathway), the remediation objectives for soil gas and groundwater listed in Appendix B, Table I shall be used. Remediation objectives relying on this table require use of institutional controls in accordance with Subpart J.

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) If using Appendix B, Table H, compliance is determined by meeting either the soil gas remediation objectives or the groundwater remediation objectives.

d) If using Appendix B, Table I, compliance is determined by meeting both the soil gas remediation objectives and the groundwater remediation objectives.

e) 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 of this Part, or both.

(Source: Added at 36 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 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 as provided in 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 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 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).

(Source: Amended at 36 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.

(Source: Amended at 36 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 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 36 Ill. Reg. _____, effective _____)

SUBPART G: TIER 2 SOIL AND SOIL GAS EVALUATION

Section 742.700 Tier 2 Soil 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 SSL, ~~and~~ RBCA, and the 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;

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.

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 742.710 to develop a soil remediation objective or 742.712 to develop a soil gas remediation objective to determine compliance with the pathway.

(Source: Amended at 36 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 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, the 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 $(mg/kg-d)^{-1}$);

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, 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 36 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 742.210or 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 outdoor 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 36 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 36 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)~~ 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 36 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 slab-on-grade or basement floor and walls; and

3) Mixing of the contaminants with air inside the building.

e) Equation J&E7 is used where 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 is used where 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.

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 (it is through these cracks that contaminants flow from the subsurface and into the building).

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 saturated vapor concentration (C_v^{sat}, Equation J&E6b) for each volatile chemical. The calculated C_v^{sat} shall use the default representative subsurface temperature specified in 742.717(g). 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 36 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 are considered satisfied if the cumulative risk from any contaminant(s) of concern listed in Appendix A, Table I, plus any other contaminant(s) of concern detected in groundwater and listed in Appendix A, Table F as affecting the same target organ/organ system as the 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.

(Source: Amended at 36 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, θT, Sw, Sd.

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 Sw and Sd shall be determined. Sw is defined as the width of groundwater at the source which exceeds the Tier 1 groundwater remediation objective. Sd 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 Cx 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 Csource 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 (Cx) does not exceed the applicable water quality standard.

(Source: Amended at 36 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. This calculation is made using: (1) the soil gas remediation objective calculated in accordance with Equation J&E4, and (2) the assumption that this gas is in equilibrium with any contamination in the groundwater.

1) Equation J&E7 is used where 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.

2) Equation J&E8 is used where 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.

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.

(Source: Added at 36 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 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 36 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 reason(s) why the remediation is impractical;

b) The extent of contamination;

c) Geology, including soil types;

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 36 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 36 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 such 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 manmade 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 of contamination;

3) Geology, including soil 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 above 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 subslab 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 of contamination;

3) Geology, including soil parameters;

4) Depth to groundwater (including seasonal variation) and flow direction;

5) Location of soil gas sampling points; and

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 of contamination;

3) Geology, including soil parameters;

4) Location of soil sampling points; and

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 Section 742.805 and Section 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 of contamination;

3) Geology, including soil 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 36 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) Use of remediation objectives based on a diffusion only mode of contaminant transport for the indoor inhalation exposure route;

8) Use of an indoor inhalation building control technology; or

9) ~~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, which 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 36 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, indoor inhalation building control technologies, 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, or 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, ~~and~~ groundwater, and soil gas to which the ELUC applies;

   C) Any physical features to which an ELUC applies (e.g., engineered barriers, monitoring wells, caps, indoor inhalation building control technologies); 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 36 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, 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(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 which exceeds the applicable groundwater remediation objectives;

4) Information identifying the current 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 by 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 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 36 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 outdoor 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 36 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 this Subpart or Subpart I and 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. Such 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 site owner/operator shall notify the Agency upon any building control technology being rendered inoperable. For the 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.

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 36 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;

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 above the area of contamination, including human receptors at risk.

(Source: Added at 36 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 Section 742.1210(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 furthest 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 Section 742.1210(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 furthest 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 Section 742.1210(c)(1).

(Source: Added at 36 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 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* + *trans*)	1,400
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
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

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)
75-35-4	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
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

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)
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 foc of 0.006 g/g and a system temperature of 25°C.
[b] Soil Saturation Limits calculated using an foc 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 Koc values in Appendix C Table I.

(Source: Amended at 36 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)
Benzene
Cobalt (ingestion only)
2,4-D
cis-1,2-Dichloroethylene (ingestion only)
2,4-Dimethylphenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Ensosulfan
Fluoranthene
Fluorene
Methylene Chloride (inhalation only)
Nickel (Res. & I/C only) (inhalation only)
Nitrate as N
Nitrobenzene (ingestion only)
Selenium
Simazine
Styrene (ingestion only)
1,3,5-Trinitrobenzene
Zinc

Decreased Body Weight Gain
Atrazine
Bis(2-chloroethyl)ether
Cyanide
1,2-Dichlorobenzene (inhalation only)
Diethyl phthalate (ingestion only)

Immune System
4-Chloroaniline
2,4-Dichlorophenol
Mercury (ingestion only)
Polychlorinated biphenyls (PCBs)

Decreased Body Weight Gain (continued)
Ensosulfan
2-Methylphenol (o-cresol)
Naphthalene (ingestion only)
Nickel (ingestion only)
n-Nitrosodiphenylamine
Phenol (ingestion only)
Simazine
Tetrachloroethylene (ingestion only)
1,1,1-Trichloroethane (ingestion only)
Vinyl acetate (ingestion only)
Xylenes (Res. & I/C only) (ingestion only)

Endocrine System
Cyanide
1,2-Dibromoethane (ingestion only)
Di-n-octyl phthalate (ingestion only)
Nitrobenzene
1,2,4-Trichlorobenzene (ingestion only)

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)

Liver (continued)
Chlorobenzene (ingestion only)
Chlorodibromomethane (ingestion only)
Chloroform
2,4-D
DDT

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
Acenaphthene
Aldrin (Res. & I/C only)
Bis(2-ethylhexyl)phthalate (Res.& I/C only) (ingestion only)
Bromoform
Butyl Benzyl Phthalate (ingestion only)
Carbon Tetrachloride
Chlordane

Liver (continued)
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)
1,2-Dibromoethane (ingestion only)
1,2-Dichlorobenzene (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 Exlosive, 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)

Reproductive System (continued)
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)

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

Spleen
1,3-Dinotrobenzene
1,3,5-Trinitrobenzene

Reproductive System (continued)
Methoxychlor
Royal Demolition Explosive, Cyclonite (RDX)
2,4,6-Trichlorophenol

Respiratory System
Antimony (inhalation only)
Benzoic Acid (inhalation only)
Beryllium (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)
Naphthalene (inhalation only)
Nickel (inhalation only)
Nitrobenezene (inhalation only)
Vinyl acetate (inhalation only)

Skin
Arsenic (ingestion only)

Polychlorinated biphenyls (PCBs)
Selenium
Silver

Notes:
Res. = Residential receptor
I/C = Industrial Commercial receptor
CW = Construction Worker receptor

(Source: Amended at 36 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~~
~~3,30-Dichlorobenzidine~~
~~1,3-Dichloropropylene (Ingestion only)~~
~~N-Nitrosodiphenylamine~~

Bladder
1,3-Dichloropropene (cis + trans) (ingestion only)
n-Nitrosodiphenylamine

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

Liver (continued)
Chlordane
Chloroform
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 36 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
74-83-9	Methyl bromide
1634-04-4	Methyl tertiary-butyl ether
75-09-2	Methylene chloride

CAS No.	Chemical
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 36 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

CAS No.	Chemical Name	C_v^{sat} (mg/m^3)
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
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

CAS No.	Chemical Name	C_v^{sat} (mg/m^3)
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
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 36 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]

CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Construction Worker (mg/m^3)
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	---[d]	---[d]	---[d]

CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Construction Worker (mg/m^3)
	(PCBs)			
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 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 36 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

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]
75-71-8	Dichlorodifluoromethane	270[b]	1,700[b]	3.0[b]	9.2[b]

		Soil Gas		Groundwater	
CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Residential (mg/L)	Industrial/Commercial (mg/L)
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]
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]

		Soil Gas		Groundwater	
CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Residential (mg/L)	Industrial/Commercial (mg/L)
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	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 (Tc) and enthalpy of vaporization at the normal boiling point (Hv,b) are not available. For Xylenes (total), the enthalpy of vaporization at the normal boiling point (Hv,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.

(Source: Added at 36 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

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]
75-71-8	Dichlorodifluoromethane	32,000[c]	200,000[c]	6.8[c]	33[c]

		Soil Gas		Groundwater	
CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Residential (mg/L)	Industrial/Commercial (mg/L)
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]
98-95-3	Nitrobenzene	9.0[d]	66[d]	23[d]	170[d]

		Soil Gas		Groundwater	
CAS No.	Chemical Name	Residential (mg/m^3)	Industrial/Commercial (mg/m^3)	Residential (mg/L)	Industrial/Commercial (mg/L)
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 (Tc) and enthalpy of vaporization at the normal boiling point (Hv,b) are not available. For Xylenes (total), the enthalpy of vaporization at the normal boiling point (Hv,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.

(Source: Added at 36 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)	$C_w \bullet \left[K_d + \frac{\left(\theta_w + \theta_a \bullet H'\right)}{\rho_b} \right]$ 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, θ_w (L_{water}/L_{soil})	$\theta_w = \eta \bullet \left(\frac{I}{K_s} \right)^{1/(2b+3)}$	**S20**
	Air-Filled Soil Porosity, θ_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)	$$VF_{M-L} = \frac{Q}{C} \bullet \frac{\left[T_{M-L} \bullet \left(3.15 \bullet 10^7 \frac{s}{yr}\right)\right]}{\rho_b \bullet d_s \bullet 10^6 \frac{\text{cm}^3}{\text{m}^3}}$$ 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		$RO_{soil\,gas} = \frac{RO_{soil} \times H \times \rho_b \times 1000}{H' \times \theta_a + \theta_w + K_d \times \rho_b}$	**S30**

(Source: Amended at 36 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
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

Symbol	Parameter	Units	Source	Parameter Value(s)
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
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
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	mg/L	Appendix B, Table E,	Chemical-Specific or Calculated

Symbol	Parameter	Units	Source	Parameter Value(s)
	Remediation Objective		35 IAC 620.Subpart F, or Equation S23 in Appendix C, Table A	
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
$IF_{soil-adj}$ (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
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

Symbol	Parameter	Units	Source	Parameter Value(s)
T	Exposure Interval	s		Residential = $9.5 \bullet 10^8$ Industrial/Commercial = $7.9 \bullet 10^8$ Construction Worker = $3.6 \bullet 10^6$
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
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

Symbol	Parameter	Units	Source	Parameter Value(s)
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
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 36 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^oC)	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°C)	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 (D_i) (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°C)	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
1024-57-3	Heptachlor epoxide	0.2	0.0132	4.23E-6	0.00039	83,200	0.00063

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})
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

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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

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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

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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 (Di) (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
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

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75-27-4	Bromodichloromethane	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
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	Chlorodibromomethane	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

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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
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-Dichlorobenzidine	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	Dichlorodifluoromethane	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

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)	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)
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
542-75-6	1,3-Dichloropropylene (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

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)	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)
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
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	Hexachlorobenzene	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

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)	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)
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
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-Methylnaphthalene	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-Nitrosodiphenylamine	3.50E+01	2.83E-02	7.19E-06	2.10E-04	-------[a]	1.00E+03	1.00E-02	6.70E-04
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

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)	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)
87-86-5	Pentachlorophenol	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	Tetrachloroethylene	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
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

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)	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)
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	Trichlorofluoromethane	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
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 36 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]
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

Methods for Determining Physical Soil Parameters		
Parameter	Sampling Location[a]	Method
		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 36 Ill. Reg. _____, effective _____)

Section 742.APPENDIX C: Tier 2 Tables

Section 742.Table L: J&E Equations

Indoor air remediation objectives (mg/m^3)	For carcinogenic contaminants	$$RO_{indoor\text{-}air} = \frac{TR \times AT_c \times 365 \frac{\text{days}}{\text{yr}}}{ED \times EF \times URF \times 1000 \frac{\mu g}{mg}}$$	**J&E1**
	For noncarcinogenic contaminants	$$RO_{indoor\text{-}air} = \frac{THQ \times AT_{nc} \times 365 \frac{\text{days}}{\text{yr}} \times RfC}{ED \times EF}$$	**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/m^3)		$$RO_{soil\ gas} = \frac{RO_{indoor\text{-}air}}{\alpha}$$	**J&E4**
Soil Vapor Saturation Limit (mg/m^3-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 cm^3/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 slab-on-grade building	$A_B = (L_B \times W_B)$	**J&E12a**
Surface are of enclosed space at or below grade (cm^2)	For a building with a basement	$A_B = (L_B \times W_B) + (2 \times L_F \times L_B) + (2 \times L_F \times W_B)$	**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)		$A_{crack} = 2 \times (L_B + W_B) \times w$	**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**

(Source: Added at 36 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
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 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

Symbol	Parameter	Units	Source	Tier 1 or 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
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
L_B	Length of building	cm	Illinois EPA	Residential = 1000 Industrial/Commercial = 2000 or Site-Specific in Tier 3

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
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
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
$RO_{indoor\text{-}air}$	Indoor air remediation objective	mg/m^3	Equations J&E 1 and 2, Appendix C, Table L	Calculated Value
$RO_{soilgas}$	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^oC)

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
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
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

Symbol	Parameter	Units	Source	Tier 1 or Calculated Value
$\theta_{a,i}$	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, $\Theta_{a,i} = 0.1\ \Theta_{T,i}$
$\theta_{T,crack}$	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 $0.9\ \Theta_{T,i}$
θ_{b}	Dry soil bulk density	g/cm^3	SSL, May 1996 or Field Measurement, Appendix C, Table F	1.5 or Calculated Value
$\theta_{s,i}$	Soil particle density	g/cm^3	SSL, May 1996 or Field Measurement, Appendix C, Table F	2.65 or Calculated Value
θ_{w}	Density of water	g/cm^3	Illinois EPA	1

(Source: Added at 36 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)(2))

PIN NO. XX-XX-XXX-XXX-XXXX

Exhibit B

IN ACCORDANCE WITH SECTION 742.1010(d)~~(D)~~(8)(A)-(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.).

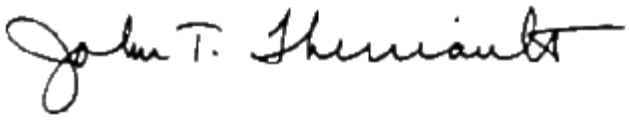
(D) Scaled maps showing the nature, location of the source, and direction of movement of the contaminants of concern.

(Source: Amended at 36 Ill. Reg._____, effective _____)

IT IS SO ORDERED.

Board Member J.A. Burke abstained.

I, John T. Therriault, Assistant Clerk of the Illinois Pollution Control Board, certify that the Board adopted the above opinion and order on April 19, 2012, by a vote of 4-0.



John T. Therriault, Assistant Clerk
Illinois Pollution Control Board