Remediation Standards
(N.J.A.C. 7:26D)
Proposal for the Vapor Intrusion Pathway

External Stakeholder Meeting
June 10, 2014

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Purpose

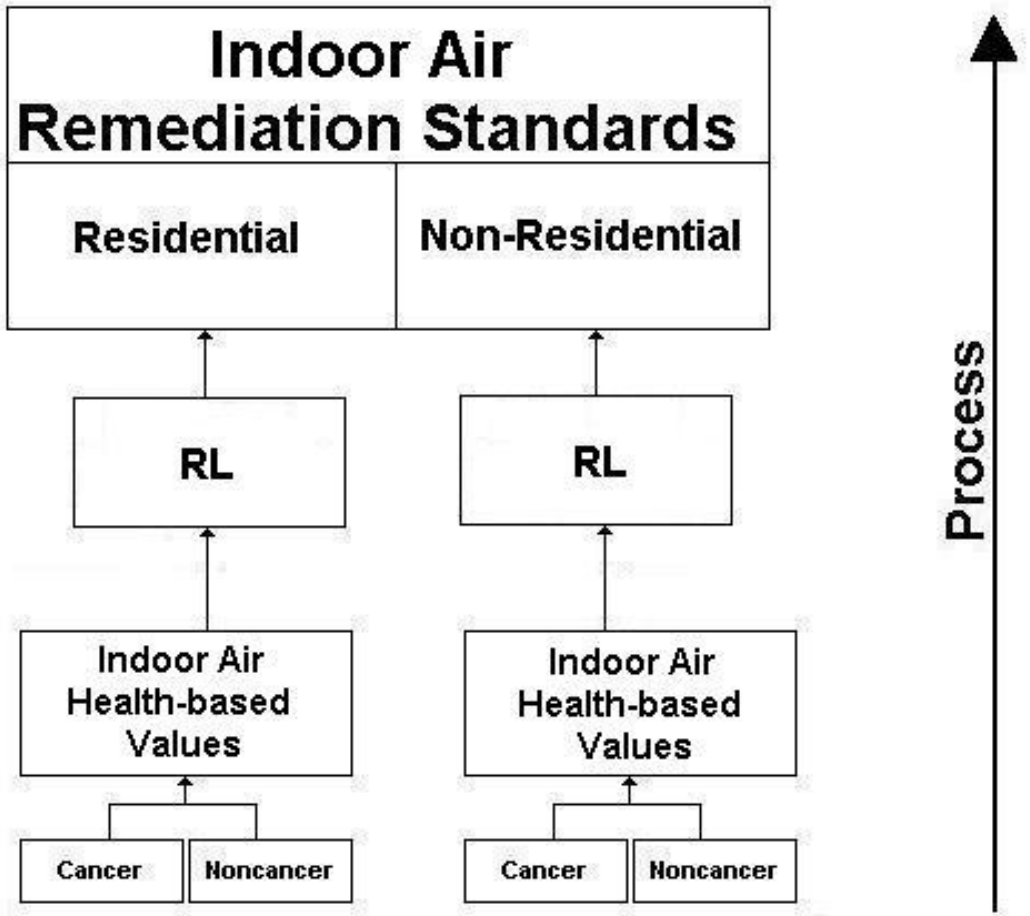
Develop Indoor Air Remediation Standards (IARS) for the vapor intrusion (VI) pathway as part of the Remediation Standards (N.J.A.C. 7:26D)

- The indoor air rapid action levels (RAL), ground water screening levels (GWSL), and soil gas screening levels (SGSL) will remain screening levels

Agenda

- Detail the process and principles proposed for developing the IARS
- List future steps required

IARS Development Process



Principles To Be Applied to IARS

- Contaminant List Determination
  - TCL/Method TO-15 parameters
  - Availability of toxicity factors
  - Contaminant is/is not of concern

- Follow USEPA Risk Assessment Guidance for Superfund (RAGS) Part F
  - http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/equations.htm

- Use updated toxicity information
  - following established hierarchy
  - restricted use of route-to-route extrapolation based data without Physiologically Based Pharmacokinetic (PBPK) Modeling

Principles To Be Applied to IARS

- Continue to include mutagenic mode of action determination as part of the cancer risk calculation (under evaluation)
- Implement Group C carcinogen policy from N.J.A.C. 7:26D 2008, where applicable
- Use updated analytical reporting limits (RL)
- Alternative and Interim remediation standards can be developed

Residential Equation-Cancer

$$IARS_{res-ca} = \frac{TR \times AT_r \times LT}{EF_r \times ED_r \times ET_r \times \frac{1}{24}\frac{day}{hours} \times IUR}$$

$IARS_{res-ca}$ = Residential Health-based Cancer Indoor Air Remediation Standard	chemical-specific	µg/m^3
TR = Target Risk Level	1.00E-06	
AT_r = Residential Averaging Time	365	days/year
LT = Lifetime	70	years
EF_r = Residential Exposure Frequency	350	days/year
ED_r = Residential Exposure Duration	30	years
ET_r = Residential Exposure Time	24	hours/day
IUR = Inhalation Unit Risk	chemical-specific	(µg/m^3)$^{-1}$

Residential Equation-Noncancer

$$IARS_{res-nc} = \frac{THQ \times AT_r \times ED_r \times \frac{1000\,\mu g}{mg}}{EF_r \times ED_r \times ET_r \times \frac{1}{24}\frac{day}{hours} \times \frac{1}{RfC}}$$

$IARS_{res-nc}$ = Residential Health-based Noncancer Indoor Air Remediation Standard	chemical-specific	µg/m^3
THQ = Target Hazard Quotient	1	
AT_r = Residential Averaging Time	365	days/year
ED_r = Residential Exposure Duration	30	years
EF_r = Residential Exposure Frequency	350	days/year
ET_r = Residential Exposure Time	24	hours/day
RfC = Inhalation Reference Concentration	chemical-specific	mg/m^3

Non-Residential Equations-Cancer

$$IARS_{nr-ca} = \frac{TR \times AT_{nr} \times LT}{EF_{nr} \times ED_{nr} \times ET_{nr} \times \frac{1}{24}\frac{day}{hours} \times IUR}$$

$IARS_{nr-ca}$ = Non-residential Health-based Cancer Indoor Air Remediation Standard	chemical-specific	µg/m^3
TR = Target Risk Level	1.00E-06	
AT_{nr} = Nonresidential Averaging Time	365	days/year
LT = Lifetime	70	years
EF_{nr} = Nonresidential Exposure Frequency	250	days/year
ED_{nr} = Nonresidential Exposure Duration	25	years
ET_{nr} = Nonresidential Exposure Time	8	hours/day
IUR = Inhalation Unit Risk	chemical-specific	(µg/m^3)$^{-1}$

Non-Residential Equations- Noncancer

$$IARS_{nr-nc} = \frac{THQ \times AT_{nr} \times ED_{nr} \times \frac{1000\,\mu g}{mg}}{EF_{nr} \times ED_{nr} \times ET_{nr} \times \frac{1}{24}\frac{day}{hours} \times \frac{1}{RfC}}$$

$IARS_{nr-nc}$ = Non-residential Health-based Noncancer Indoor Air Remediation Standard	chemical-specific	µg/m^3
THQ = Target Hazard Quotient	1	
AT_{nr} = Nonresidential Averaging Time	365	days/year
ED_{nr} = Nonresidential Exposure Duration	25	years
EF_{nr} = Nonresidential Exposure Frequency	250	days/year
ET_{nr} = Nonresidential Exposure Time	8	hours/day
RfC = Inhalation Reference Concentration	chemical-specific	mg/m^3

Residential Equations-Mutagenic

$$IARS_{res-mu} = \frac{TR * AT_r * LT}{EF_r * ET_r * \frac{1day}{24hours} * \left[\left(ED_{0-2} * IUR * 10\right) + \left(ED_{2-6} * IUR * 3\right) + \left(ED_{6-16} * IUR * 3\right) + \left(ED_{16-30} * IUR * 1\right)\right]}$$

$IARS_{res-mu}$ = Residential Health-based Mutagenic Indoor Air Remediation Standard	chemical-specific	µg/m^3
TR = Target Risk Level	1.00E-06	
AT_r = Residential Averaging Time	365	days/year
LT = Lifetime	70	years
EF_r = Residential Exposure Frequency	350	days/year
ET_r = Residential Exposure Time	24	hours/day
IUR = Inhalation Unit Risk	chemical-specific	(µg/m^3)$^{-1}$

ED_{0-2}=2 year exposure duration
ED_{2-6}=4 year exposure duration
ED_{6-16}=10 year exposure duration
ED_{16-30}=14 year exposure duration

Vapor Intrusion Pathway

Equations and Exposure Parameters consistent with USEPA

- Include updated Superfund Program exposure factors in the IARS
- Residential Equations and Default Values (Cancer and Non-cancer Endpoints) are the same except for change in the exposure duration slightly impacting cancer values
- Non-Residential Equations and Default Values are the same

VI Pathway-IARS
Toxicity Value Breakdown

Tier	Toxicity Source	IUR	RfC
I	IRIS	9	28
II	PPRTV	0	4
	CalEPA	3	0
	HEAST	0	2
	ATSDR	0	1

Abbreviations and URLs

ATSDR - Agency for Toxic Substances and Disease Registry. 2013. Minimal Risk Levels for Hazardous Substances.
http://www.atsdr.cdc.gov/mrls/mrllist.asp

CalEPA -California Environmental Protection Agency. Office of Environmental Health Hazard Assessment (OEHHA). OEHHA Toxicity Criteria Database.
http://www.oehha.ca.gov/risk/chemicalDB/index.asp

EPA RSL – United States Environmental Protection Agency Regions 3, 6, 9. November 2013. Regional Screening Levels for Chemical Contaminants at Superfund Sites.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

HEAST - Health Effects Assessment Summary : Annual Update FY 1997. United States Environmental Protection Agency, Office of Research and Development, Office of Emergency and Remedial Response, Washington, DC. NTIS PB97-921199.
http://epa-heast.ornl.gov/index.html

IRIS – Integrated Risk Information System, United States Environmental Protection Agency (EPA).
http://www.epa.gov/IRIS/

PPRTV - Provisional Peer Reviewed Toxicity Values for Superfund, United States Environmental Protection agency (EPA).
http://hhpprtv.ornl.gov/index.html

Analytical Reporting Limits

Propose use of updated analytical RL in the development of the IARS

- Most contaminant RL would be 0.2 ppbv rather than 0.5 ppbv
- Therefore, those RL based standards would be lower due to the lower analytical limits

Alternative and Interim Remediation Standards

- **Alternative Remediation Standards**
  - New toxicity data
  - Alternative exposure scenarios (limited exposure frequency/time)

- **Interim Remediation Standard**
  - Developed on a chemical-specific basis

Future Steps

- Use Updated USEPA Superfund Exposure Parameters
- Generate IARS

Vapor Intrusion Pathway Summary

- Vapor Intrusion IARS are proposed with RAL, GWSL and SGSL continued as screening levels
- Proposed IARS continue to be based on USEPA equations and exposure parameters
- IARS differ from the existing indoor air screening levels
  - Contaminant list
  - Toxicity factor updates (restricted route-to-route extrapolation)
  - Updated reporting limits
  - Updated exposure factors
- Alternative and Interim remediation standards can be developed

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