NJDEP "Hot Topic" Training

Impact to Ground Water Pathway

July 24, 2014, 3:00-6:00 pm
NJDEP Offices, Trenton NJ
1st Floor Hearing Room

Welcome

George Nicholas, Moderator
DEP/SRP Training Program, Co-Chair

"Housekeeping/Logistical" Items:

- Welcome: in-house and Webinar audience
- Refreshments: back of room (help yourselves)
- Please silence cell phones
- Hold questions until Q&A time; wait for mic
- DEP has applied to SRPLB for 3 Technical CECs for in-house participants; approval pending
  - Make sure to sign in before and after the session to obtain attendance Certificate.
  - Anyone arriving more than 45 minutes late for the session cannot be awarded an attendance Certificate for CECs

The Impact-to-Groundwater Pathway

June 24, 2014

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LSRP Continuing Education Requirements

36 Continuing Education Credits (CECs) over 3 year LSRP license renewal period

First LSRPs (July 2012) Need 36 CECs by 4/15

Minimum no. of CECs must be satisfied in these categories:

- 3 CECs Ethics
- 10 CECs Regulatory
- 14 CECs Technical

+9 CECs Discretionary

Board can require "CORE" courses

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Continuing Ed Credits (CECs)

- One CEC is equivalent to 1 hour of instruction from university, college, DEP, LSRPA & other professional organizations
- Conferences Conventions Workshops 1hr = ½CEC
  - Up to 8 CECs allowed within 3 year renewal cycle
  - Changes to this policy are up to discretion of LSRP Board
- Webinar and On-Line Courses: CEC is 1:1 but exam is required
- CECs available for presentations, publications but not 1:1 credit

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Dates & Events

- *Check LSRP Board's Current Course Listing for Course Offerings Approved for LSRP CECs-*
- Sep. 15 — UST Certification Course - NJWEA (5 Regulatory CECs)
- Sep.16 &17 — Groundwater Contamination & Remedial Principles & Practices (LSRPA/NWETC) 2 Days- 13 CECs
- Oct. 7 & 8 — Environmental Forensics (LSRPA/NWETC) 2 days- 13 CECs
- Oct 21 — Case Study Training for LSRPs by NJDEP- 7 Regulatory CECs

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NJ LSRP Board Activities

- Board Regulates LSRPs
  - Professional Conduct / Disciplinary Actions
  - Licensure
  - Continuing Education
  - Audits
- Board issued draft rules / Comment period closed on 6/9
- LSRPA provided comments to the LSRP Board on 6/9
- Board has issued 3 new approval applications for CECs:
  - Presentation - submit application within 90 days
  - Instruction - "
  - Publication of Paper - "

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Thank You

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Impact to Ground Water Pathway: New Guidance and Attainment

July 24, 2014

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Presenters

Barry Frasco, NJDEP
Michael Gonshor, Roux Associates Inc.
MaryAnne Kuserk, NJDEP
Stephen Posten, AMEC Environment & Infrastructure
Paul Sanders, NJDEP
Swati Toppin, NJDEP

IGW Framework

Default IGW Soil Screening Levels

Swati Toppin
NJDEP

Content of Presentations

- Will discuss highlights of new guidance documents
- Will discuss common errors in addressing IGW pathway
- Go over frequently asked questions

Framework for IGW Pathway

- IGW Default Soil Screening Levels found at http://www.nj.gov/dep/srp/guidance/rs/partition_equation.pdf
- ARS Options for Site Specific Remediation Standards found at http://www.nj.gov/dep/srp/guidance/rs/

Interaction Between the Various Options

- Use any option as described in guidance documents
- You may use the highest IGWSRS given by any option as the site specific IGWSRS

"Weight of Evidence"

Incomplete or wrongly implemented options may not be presented together as "weight of evidence" for no further action

For example:

- Only one sample for SPLP and immobile chemical option with no delineation
- Only one sample for SPLP and statement that contaminant is lab contaminant (not site related)

IGW Default Soil Screening Level (IGWSSL)

- Based on Soil Water Partition Equation
- Useful where no site specific data is available (Protective of ground water for cases with little or no site specific information
- Protective against potential future contamination

Soil Water Partition Equations

- Organic contaminants equation

$$IGWSRS = GWQC\left\{K_{oc}f_{oc} + \frac{\theta_w + \theta_a H'}{\rho_b}\right\}DAF$$

- Inorganic contaminants equation

$$IGWSRS = GWQC\left\{K_d + \frac{\theta_w + \theta_a H'}{\rho_b}\right\}DAF$$

Common Misconceptions

1. The IGWSRS has not been exceeded, therefore no ground water investigation is necessary. This is not correct. For guidance on when to conduct a GW investigation, see Technical Requirements and GW Guidance documents.

2. The ground water is clean therefore no IGW pathway investigation is needed. This is not correct.

3. If site specific conditions lead to a different conclusion, use professional judgment &/or contact the Department.

New Dilution-Attenuation Factor Guidance

Hot Topics Training
Impact to Groundwater Updates
July 24, 2014

Paul Sanders
Site Remediation Program

Dilution-Attenuation Factor

When infiltrating soil water reaches the water table, it mixes with GW and contaminants are diluted. The resulting concentration in GW is therefore lower than that in the infiltrating water. A DAF factor is used to account for this process.

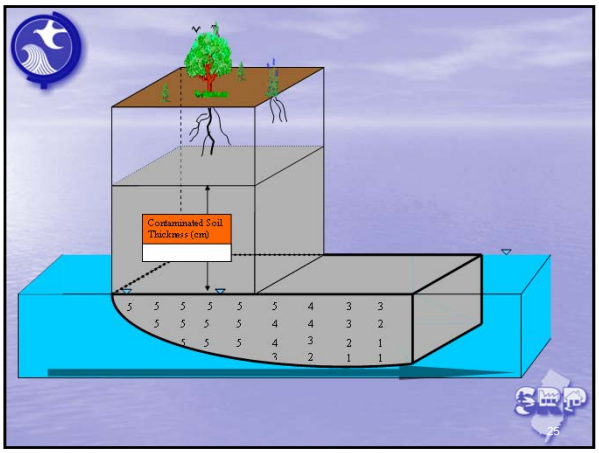
$$DAF = 1 + \frac{Kid}{IL}$$

i = gradient
d = mixing zone depth
I = infiltration rate
L = length of AOC parallel to GW flow
K = hydraulic conductivity

Dilution-Attenuation Factor: Mixing Zone Depth

$$d = (0.0112L^2)^{0.5} + d_a\{1 - \exp[(-LI)/(Kid_a)]\}$$

- Mixing zone depth is dependent on the same parameters and also the aquifer thickness, d_a



Dilution-Attenuation Factor

If plume does not reach the bottom of the aquifer as it flows under the contaminated zone, the DAF is unaffected by d and L

DAF as a function of the size of the area of concern (mg/kg)			
	Length of Site Parallel to GW flow (m)		
	15.2	30.5	152
Aquifer thickness = 3.5 m	20	20	5
Aquifer thickness = 15.2 m	20	20	18

Historical Perspective: Dilution-Attenuation Factor (DAF) USEPA Soil Screening Level Guidance

- May 1996 Soil Screening Guidance published 2 sets of numbers using DAF of 1 and DAF of 20
- EPA used two studies and a "weight of evidence" approach to determine default DAF of 20:

1. A Monte Carlo approach not appropriate for New Jersey policy. The Monte Carlo approach does not use the DAF equation.
2. Calculated DAFs from two databases of hydrogeological site investigations. As part of NJDEP assessment, these databases were inspected for DAF values reported for hydrologic regions appropriate for New Jersey

Dilution-Attenuation Factor (DAF): USEPA Mid-Atlantic Regional Screening Level Tables

- Regional Screening Level table uses only a DAF of 1

(http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/docs/master_sl_table_run_NOV2013.pdf)

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OLD (2008) NJDEP Dilution-Attenuation Factor (DAF)

- New Jersey conducted it's own assessment of DAFs based on data from the New Jersey Kirkwood-Cohansey aquifer
- Hydraulic conductivity GIS grid file of Kirkwood-Cohansey from NJDEP research project
- Two different methods were used to develop GIS grid files of the hydraulic gradient for the Kirkwood-Cohansey
- The GIS was used to multiply conductivities and gradients together at each point in the grid to get point-by-point aquifer flow rates
- Best estimate of DAF from this approach was 13

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New NJDEP DAF – Hydraulic Gradient (i)

A representative gradient was determined from 235 actual measurements of gradient on water table elevation maps for the Kirkwood-Cohansey aquifer.

Median i=0.003

New NJDEP DAF – Hydraulic Conductivity (K)

- Results of 67 independent aquifer stress tests from NJGS and USGS were compiled for the Kirkwood-Cohansey aquifer.
- 33 NJGS (Canace and Sugarman, 2009)
- 13 USGS (Martin, 1990)
- 21 Basin Tests from the aquifer elevation maps (1992-2004)

Median K=142 ft/day

DAF – Recharge Rate (I)

- Unchanged from 2008, explained in Inhalation Basis and Background document
- Calculated from New Jersey Geological Survey groundwater recharge calculator for widespread soil types (e.g. Sassafras, Downer, Boonton, Rockaway) in municipalities where they occur
- Looked at landscaped open space, vegetated and general agricultural land uses

Table 2: Summary of infiltration rates of New Jersey Soils

	Average infiltration rates (in./yr)			
Soil Texture	*Landscaped*	*Unvegetated*	*Agriculture*	*Overall*
Sandy loam	12.8	8.4	11.3	10.9
Sand	16	13.6	15.2	15
Loamy sand	13.1	9	11.6	11.2
Loam	13.8	6.7	11.6	10.7
Silt loam	12.3	5.4	10.2	9.3
All soils	13.5	8.5	11.8	11.3

- 11"/year is a representative recharge rate for most soil textures

Kirkwood - Cohansey DAF Default Input Parameters

$$DAF = 1 + \frac{Kid}{IL}$$

- Length of AOC Parallel to GW Flow (L) = 100 ft
- Mixing zone depth, d = 3.4 m
- K = 142 ft/day
- i = 0.003
- I= 0.28 m/yr

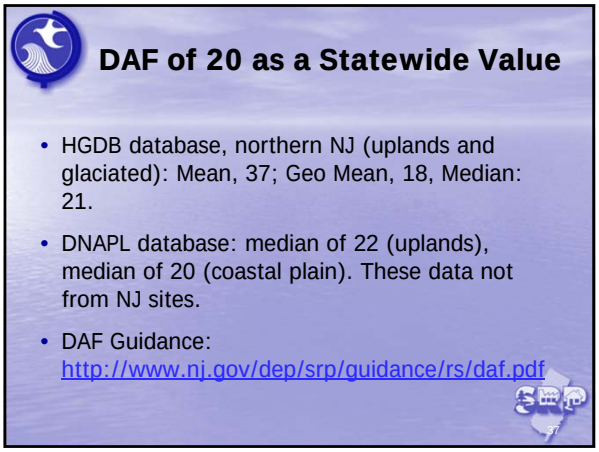
DAF = 20

DAF of 20 as a Statewide Value

- Inner coastal plain aquifers judged to be similar to outer coastal plain (Kirkwood-Cohansey), at least in terms of the surface aquifers and the product of K and i.
- For the rest of the state, two USEPA DAF databases presented in the 1996 USEPA Soil Screening Guidance were used to evaluate DAF values for 0.5 acre site size.

DAF of 20 as a Statewide Value

- HGDB database, northern NJ (uplands and glaciated): Mean, 37; Geo Mean, 18, Median: 21.
- DNAPL database: median of 22 (uplands), median of 20 (coastal plain). These data not from NJ sites.
- DAF Guidance: http://www.nj.gov/dep/srp/guidance/rs/daf.pdf


NJDEP Impact to Ground Water Dilution-Attenuation Factor Calculator - V2.1, November 2013

Site Name: Date:

Additional Description: Evaluated by:

$$DAF = 1 + \frac{Kid}{IL} \qquad d = (0.112L^2)^{0.5} + d_a[1 - \exp\{(-LI)/(Kid_a)\}], d \le d_a$$

Parameter	Definition	Value units	Converted to metric: Value units
L	Length of Area of Concern Parallel to Ground Water Flow	100 ft	30.5 m
d_a	Aquifer Thickness	11.5 ft	3.5 m
I	Infiltration Rate	11 in/yr	0.28 m/yr
K	Aquifer Hydraulic Conductivity	51865 ft/yr	15808 m/yr
i	Gradient	0.003 dimensionless	0.003 dimensionless
d	Mixing Zone Depth		3.4 m
DAF	Dilution-Attenuation Factor		20 dimensionless

NOTES: (click outside box when finished)

http://www.nj.gov/dep/srp/guidance/rs/

Site-Specific DAF Determination

- Use actual length of area of concern
- Aquifer thickness should be measured if plume extends to bottom of aquifer
- K and i are determined as described in the Department's Ground Water SI/RI/RA Technical Guidance:

http://www.nj.gov/dep/srp/guidance/srra/gw_inv_si_ri_ra.pdf

New Capping Guidance for the IGW Pathway

Swati Toppin
NJDEP

Capping Guidance

- http://www.nj.gov/dep/srp/guidance/rs/igw_capping.pdf
- Contaminants allowed for capping

-Inorganics and semivolatiles
(listed in Table 1 of the capping document)

- Capping for volatile contaminants is under consideration

IGW Pathway: Conditions for Capping

-Impermeable cap

-Area large enough to prevent infiltration of water around edges of cap

-No free or residual product (Tech Rules)

-if GW is clean, 2' clean buffer between water table and contaminants

-If GW contaminated, periodic monitoring of GW

-Deed Notice and approved Remedial Action Permit for Soil (ARRCS)

Interactions with Other Guidance

- Generally speaking, all guidance should be reviewed relative to other guidance documents to identify conflicts.
- For Example: Where both VOs and Inorganics are present, capping may not be used for inorganics if the new SESOIL/AT123D guidance is to be used for addressing the volatiles.

Questions

New Synthetic Precipitation Leaching Procedure (SPLP) Guidance

Paul Sanders, Michael Gonshor & Swati Toppin

SPLP Guidance, Primary Change: Addition of Volatiles

- NJ Science Advisory Board recommended volatiles be added to NJDEP SPLP guidance
- USEPA Method 1312 does provide for leach testing of volatiles using zero headspace extractor
- Problem with volatiles is during sample collection and sample preparation

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USEPA Method 1312

- Describes the laboratory procedures to conduct the leaching test
- Does not discuss sample collection and preparation
- The method says to "Compare the analyte concentrations in the 1312 extract with the levels identified in the appropriate regulations"

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NJDEP SPLP Guidance

- Uses Method 1312 to conduct the leaching test
- Uses Method 1312 results to calculate the Leachate Concentration that would be observed under field (environmental) conditions
- This leachate concentration is compared to the Leachate Criteria (LC) and is correlated with the corresponding total contaminant concentration in soil
- May be used to determine acceptable total contaminant concentration (alternative remediation standard) if some of the contaminated soil yields leachate concentrations above the leachate criteria

http://www.nj.gov/dep/srp/guidance/rs/

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Leachate Criterion (LC)

- Leachate from soil is diluted when it mixes with the groundwater
- The amount of dilution is the DAF (default of 20 for NJ)
- Ground Water Quality Criteria (GWQC) should not be exceeded when leachate mixes with the ground water. Therefore: LC is 20 times the GWQC

Addition of Volatiles to SPLP Guidance

- NJDEP SPLP guidance needs matched samples to correlate total contaminant concentration in soil with field leachate concentrations
- With metals and semivolatiles, one sample can be well-mixed and split for total analysis and Method 1312 testing
- With volatiles, mixing and splitting one sample would cause volatile loss. Must collect separate matched samples for total analysis and leach testing. Uncertainty in whether total concentrations match for both samples

Addition of Volatiles to SPLP Guidance

- Generic procedures for collection of volatiles should be followed.
- Samples for total analysis and leach testing should be taken from immediately adjacent locations. An Encore® or equivalent sampler must be used for the sample for SPLP testing
- Recommend samples be taken from intact soil cores with plastic liners immediately upon cutting open the liner
- Sampling sidewalls after excavation is problematic, because of volatile loss. Recommend use of a hand coring device to sample a few inches in from the sidewall surface

Adjustment of SPLP Aqueous Extract Concentration to the Field Leachate Concentration (Env. Chemistry 101)

- USEPA Method 1312 is a batch equilibrium test.
- Batch equilibrium tests measure the ratio of concentrations in the sorbed and aqueous phases under equilibrium conditions.
- This equilibrium ratio is the Kd constant, or soil-water adsorption-desorption constant. It is best measured under high water/soil ratios. A 20:1 ratio is used in Method 1312

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Adjustment of SPLP Aqueous Extract Concentration to the Field Leachate Concentration (Environmental Chemistry 101)

$$K_d = \frac{C_s}{C_w}$$

C_s is the concentration of the chemical in the soil sorbed phase, C_w is the concentration of the chemical in the aqueous phase, and K_d is the soil-water partition coefficient.

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Adjustment of SPLP Aqueous Extract Concentration to the Field Leachate Concentration (Env. Chemistry 101)

- Kd is assumed to be constant over a range of concentrations and soil-to-water ratios.
- Therefore, concentrations in the sorbed and solution phases must vary as the soil/water ratio changes in order to maintain the constant ratio (Kd)
- For highly adsorbed contaminants, the variation in aqueous concentration as the soil/water ratio changes is small.
- However, for MOBILE contaminants (low Kd values) the dependence of the aqueous concentration on the soil/water ratio is LARGE.

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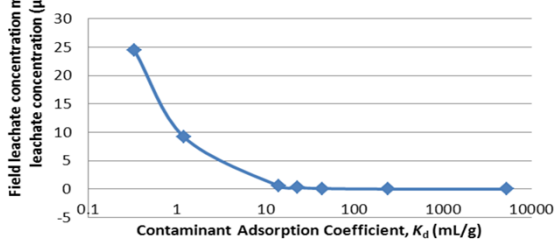
Method 1312 Extract Concentration Versus Field Leachate Concentration

- The aqueous concentration of contaminant in the Method 1312 extract (the SPLP leachate concentration) is NOT the same as the field (environmental) leachate concentration
- Method 1312 extract concentration is the equilibrium concentration of contaminant in aqueous solution at a 20:1 ratio of solution to soil
- We want the equilibrium concentration in soil moisture under field conditions (0.23:1.5 ratio of solution to soil).
  - 0.23 ml water and 1.5 gm soil in a ml of soil

Figure 1
Difference between SPLP leachate concentration and field leachate concentration as a function of contaminant K_d



Representative contaminant	K_d *Soil adsorption coefficient with default fraction organic carbon content of 0.002 (mL/g)*	*Conditions*	$C_{leachate}$ *Equilibrium leachate concentration after SPLP experiment (µg/mL)*
TCE	0.33	Field	27.77
		SPLP	0.66
1,4 Dichlorobenzene	1.2	Field	9.87
		SPLP	0.63
2-Methylnaphthalene	14	Field	0.94
		SPLP	0.39
Cadmium	23	Field	0.58
		SPLP	0.31
Dieldrin	43	Field	0.31
		SPLP	0.21
Chlordane	240	Field	0.056
		SPLP	0.051
DDT	5260	Field	0.00253
		SPLP	0.00252

Adjustment of SPLP Aqueous Extract Concentration to the Field Leachate Concentration

The USEPA 1312 extract concentration must be adjusted to field leachate concentration:

$$C_L = \frac{C_T}{K_d + \frac{\theta_w + \theta_a H'}{\rho_b}}$$

- C_L: Field (environmental) leachate concentration
- C_T: Total contaminant concentration in soil
- K_d: From leaching test and total contaminant concentration
- $\frac{\theta_w + \theta_a H'}{\rho_b}$: Soil conditions in environment

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Rearrange Equation to Standard Form of USEPA Soil-Water Partition Equation to Calculate Acceptable Soil Concentration from Field Leachate Concentration and Kd:

$$C_T = C_L \left(K_d + \frac{\theta_w + \theta_a H'}{\rho_b} \right)$$

- C_T: Acceptable total contaminant concentration in soil
- C_L: Leachate criterion (LC)
- K_d: From leaching test (EPA Method 1312)
- $\frac{\theta_w + \theta_a H'}{\rho_b}$: Soil conditions in environment

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Negative Kd Values from SPLP Test

- Can occur when contaminant concentration in the sample submitted for total analysis is less than the contaminant concentration in the sample submitted for SPLP testing.
- Indicates soil sample mismatch or volatile loss from sample submitted for total analysis during collection or handling

$$K_d = \frac{(C_T M_S - C_{SPLP} V_L)/M_S}{C_{SPLP}}$$

- C_T: Total mass of contaminant in soil (C_T from sample submitted for total analysis)
- C_{SPLP}: Total mass of contaminant in leachate (C_{SPLP} from sample submitted for SPLP testing). Cannot be more than total mass.

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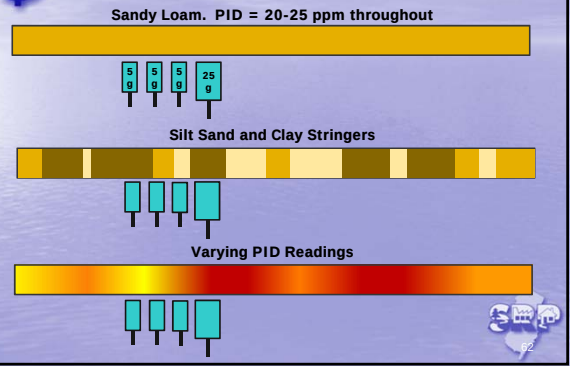
Sampling Considerations

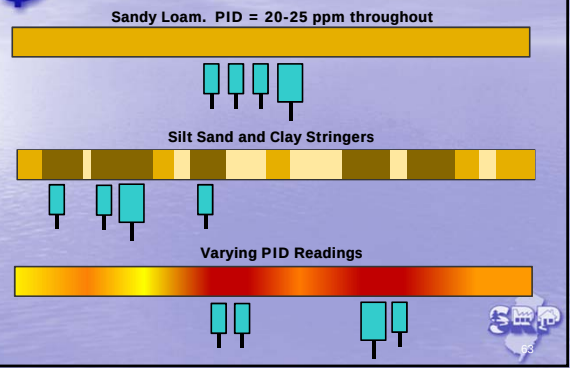
- **Lithology**
  - Highly variable lithology (e.g., silt-sand-clay stringers)
- **Field Screening Readings**
  - Varying field screening readings over short intervals

Each of the above conditions can complicate obtaining samples with consistent concentrations in each of the EnCore® samplers

Sampling Considerations (cont.)



Sampling Considerations (cont.)



Sampling Considerations (cont.)

- Collect a sufficient number of samples for potential SPLP analyses
- Have lab extract and hold for SPLP analyses
- Be mindful of holding times for SPLP extraction and VOC analyses
- Costs for "extra" 25g EnCore® samplers and SPLP extractions are minimal relative to re-sampling
- Don't forget the sample for dry weight

Sample Selection

Minimum Number of Samples vs A Good Idea

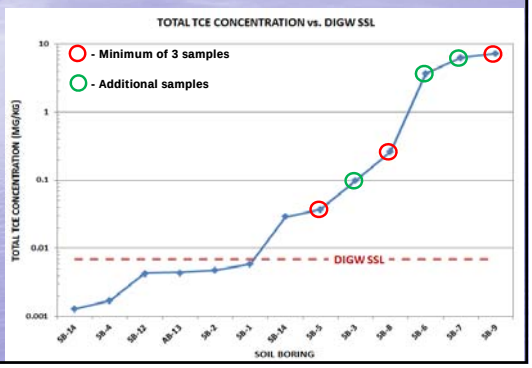
- Minimum - 3 samples per SPLP Guidance (per AOC and Soil Type)
  - UHOT exception: 1 sample (in current EPH guidance)
- A Good Idea – More than 3

Sample Selection cont.

- **Samples to Release for SPLP Analyses**
  - Guidance suggests range of concentrations including maximum detected total concentration
  - May not be a good idea for VOCs
  - Will be dependent of soil type, total organic carbon, individual VOC of concern, and total concentrations

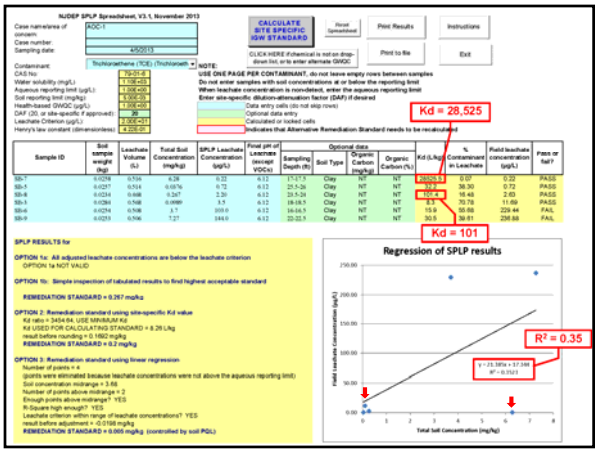
Use your Professional Judgment and Experience

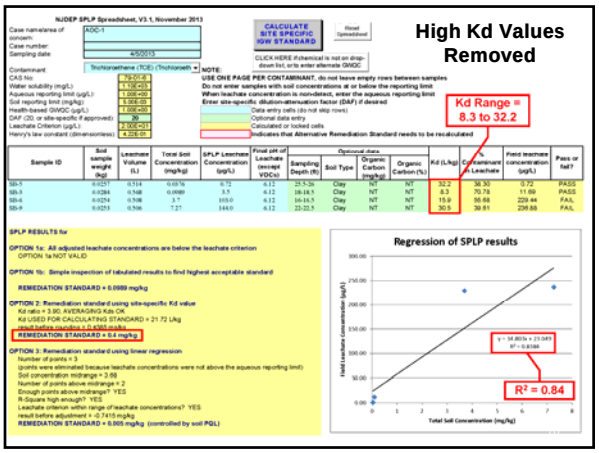
Sample Selection

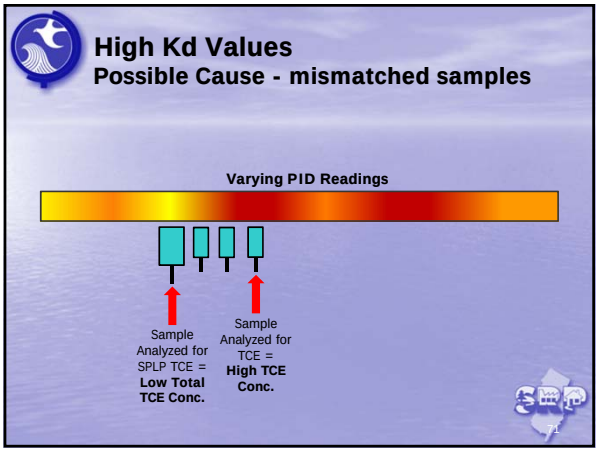


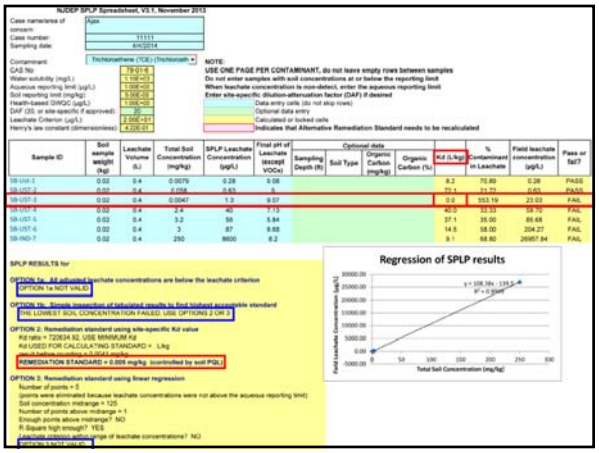
Data Evaluation

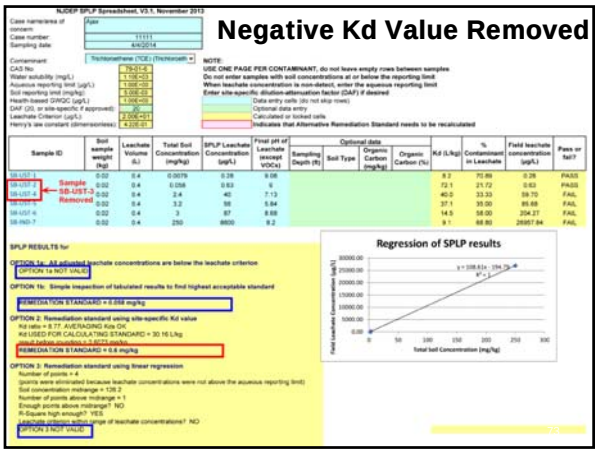
- Are Data Valid - Do Results Make Sense
- High Kd Outlier Example
- Negative Kd Outlier Example



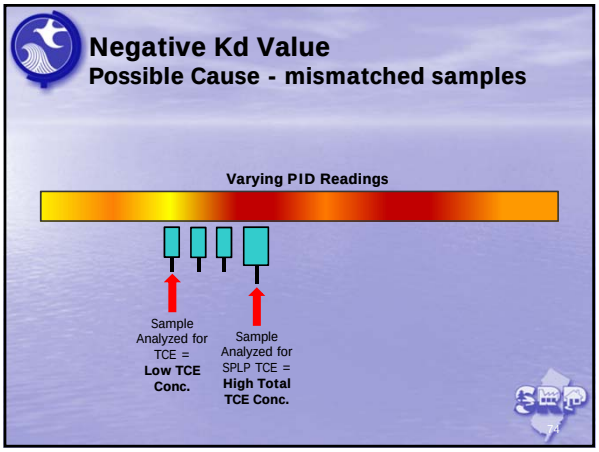

NJDEP SPLP Spreadsheet, V3.1, November 2013
CALCULATE SITE SPECIFIC IGW STANDARD
High Kd Values Removed
Kd Range = 8.3 to 32.2
Regression of SPLP results
R² = 0.84
Total Soil Concentration (mg/kg)


High Kd Values
Possible Cause - mismatched samples
Varying PID Readings
Sample Analyzed for SPLP TCE = Low Total TCE Conc.
Sample Analyzed for TCE = High TCE Conc.


NJDEP SPLP Spreadsheet, V3.1, November 2013
Regression of SPLP results
Total Soil Concentration (mg/kg)



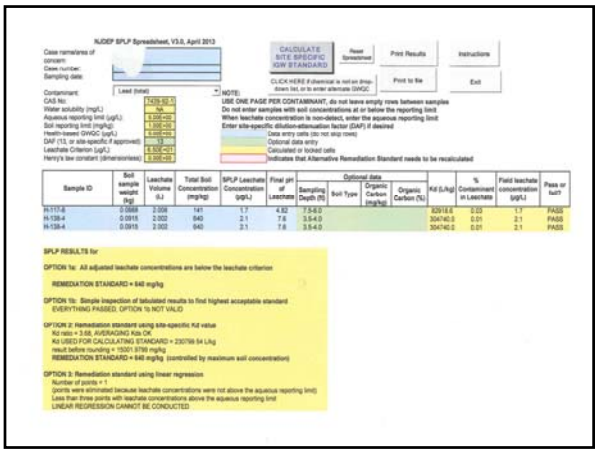
Negative Kd Value
Possible Cause - mismatched samples



Other Considerations

1. Cannot use samples where total contaminant concentrations are below MDL

- This may happen in cases with minimal exceedances above the IGWSRS. In such cases, one or two samples are acceptable, but the reason why there are only one or two samples must be explained in the report.
- With one or 2 samples, preferentially use the equation to manually calculate IGWSRS. If spreadsheet is used, replicate a sample to make up 3 samples. Explain in report
- Sample spreadsheet



Other Considerations

2. When leachate concentrations are non detect, the data can still be used. The spreadsheet will use aqueous reporting limits as the concentration present. The results are conservative, but the only alternative is to resample and obtain results that are not non detects.

3. Are the samples which are undergoing SPLP representative of the AOC? Has additional sampling revealed higher total concentrations or different soil?

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Other Considerations

4. The same sample must be collected and split for total contaminant analysis and leachate procedure. The Department has received samples for total concentrations correlated with leachate samples sampled months or even years later. **This is not acceptable**

5. Samples used in the SPLP procedure show lower contaminant concentrations than initial sampling round. Resample, or use professional judgment to determine if sampling effort is adequate.

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Questions

Using SESOIL/AT123D with New Jersey sites for mobile contaminants in the unsaturated soil zone

Paul Sanders
NJDEP

SESOIL/AT123D for NJ Sites

- May be used when ground water is already impacted
- SEVIEW 7 required, in order to simultaneously model contamination source in both vadose zone and ground water
- Models contaminant transport through both soil and groundwater
- Less restrictive than previous version of guidance with regards to length of time allowed to attain Ground Water Remediation Standards. Is now linked with the ground water Classification Exception Area (CEA) time frame, rather than a 5 year time frame

SESOIL/AT123D for NJ Sites

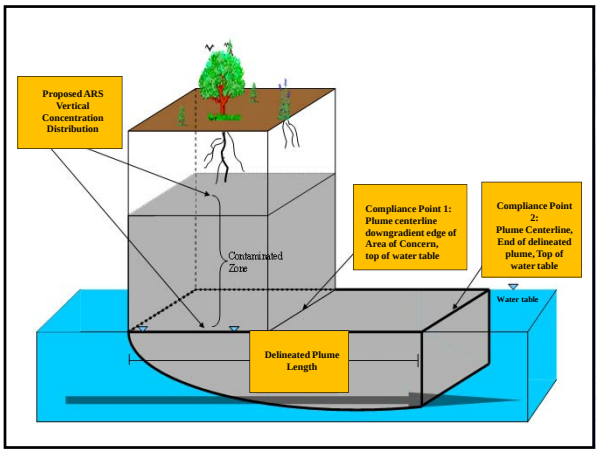
- Since groundwater remediation will be ongoing for several years, NJDEP allows for some additional contamination to enter groundwater from unsaturated soil zone
- No current or future receptors can be present in the ground water
- No vapor intrusion risk may be present
- Site may not be capped above contaminated vadose zone. Natural ground water recharge must occur
- Ground water monitoring required to confirm model predictions

SESOIL/AT123D for NJ Sites

- SESOIL used to model leaching from proposed contaminant concentration distribution in vadose zone
- SESOIL provides leaching input to AT123D model
- If AT123D results not acceptable, trial and error used to develop acceptable contaminant concentration distribution in vadose zone

AT123D Modeling

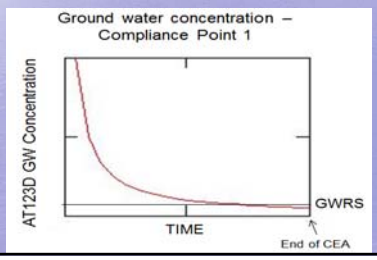
AT123D is used to model contaminant concentration in ground water as a function of time at two compliance points



AT123D Modeled GW Concentration at Compliance Point 1

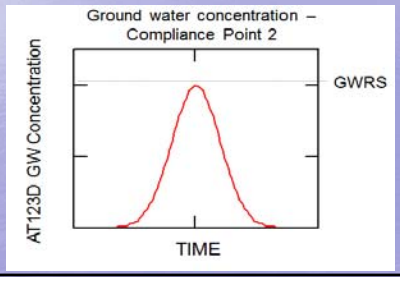
AT123D predicted GW concentration must be at or below the Ground Water Remediation Standard at the down gradient edge of the modeled SESOIL source input by the end of the duration of the CEA.

NOTE:
Time zero is when the SESOIL run starts, not when the contaminant hits the water table!



AT123D Modeled GW Concentration at Compliance Point 2

The AT123D predicted GW contaminant concentration must never exceed the Ground Water Remediation Standard at the down gradient edge of the delineated GW contaminant plume.



SESOIL / AT123D Guidance

- Soil texture:
  - MUST be determined for the vadose zone
  - optional for saturated zone
- Soil organic carbon (vadose and saturated zone)
  - MUST be determined when using the combination SESOIL/AT123D model in SEVIEW 7
- SEVIEW 7
  - required when running SESOIL/AT123D
- SEVIEW 6 or SEVIEW 7
  - OK when running SESOIL model alone

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SESOIL: Entering Soil Concentrations into the Vadose Zone

- Can model existing concentrations
- Can model concentrations that will remain behind after remediation
- Can model theoretical maximum concentrations

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SESOIL: Entering Soil Concentrations into the Vadose Zone (cont'd)

- Must enter a concentration for each depth interval (normally 1-foot interval)
- Depth intervals without data are not "0". They are filled in with data from above or below the interval
- Enter worst-case concentration from all borings in Area of Concern for a particular depth interval

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Depth Interval (sublayer interval) (ft)	Boring #1	Boring #2	Boring #3	SESOIL model concentrations
0-1	-	-	-	74.1
1-2	-	74.1	-	74.1
2-3	-	-	-	487
3-4	487	-	-	487
4-5	-	-	-	487
5-6	-	nd	-	0
6-7	-	-	-	0
7-8	-	1.2	-	0
8-9	-	-	-	0
9-10	-	27	-	0
10-11	89.5	-	-	89.5
11-12	-	-	283	283
12-13	-	-	669	669
13-14	-	-	-	669
14-15	-	-	226	226
15-16	-	-	-	226
16-17	-	nd	183	183
17-18	342	-	-	342
18-19	-	-	-	342

- = not determined
nd = not detected

Note: IGW screening level = 30 mg/kg

SESOIL/AT123D Site Specific Standards

- Not a single number
- Are generally a depth-dependent concentration distribution in soil based on modeled soil concentrations. Standard is a depth-dependent table.

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Determining Soil Texture

- Boring logs not sufficient
- Sieving alone generally not sufficient, does not separate out silt and clay
- Generally hydrometer or pipette method used to separate silt and clay
- SESOIL soil parameters “calibrated” to USDA soil texture

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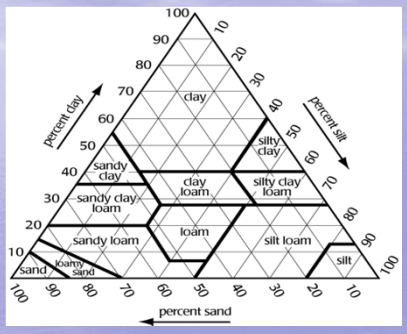
USDA Soil Texture

- First, remove gravel (> 2 mm)
- Sand: 2 mm to 0.05 mm
- Silt: 0.05 mm to 0.002 mm
- Clay: <0.002 mm

USDA Soil Texture



USDA Soil Triangle

Soil Texture Methods: ASTM Method D422-63

- Uses 0.075 mm cutoff for sand, instead of 0.05. Recommend substituting 0.05 mm sieve (#270)
- Determines <0.001 mm (colloids) and <0.005 mm fractions. USDA clay fraction (<0.002 mm) may be estimated by averaging the <0.001 mm and <0.005 mm fractions.

Soil Texture Methods: ASTM Method F1632-03

- For golf course putting greens and sports fields
- Determines sand, silt and clay with correct particle sizes using the pipette method

Determination of SESOIL Soil Texture

- For New Jersey, use of a single soil texture recommended
- Measure texture once every two feet or for each distinct soil layer
- Select a median soil texture
- Use soil parameters listed in NJDEP guidance (from SEVIEW and SESOIL documentation)

SESOIL: Multiple Soil Texture Layers

- It is preferred to use a single representative soil texture for the entire soil column
- Simulations submitted with multiple soil textures will be subject to more detailed review by NJDEP
- Only one parameter (intrinsic permeability) can be varied with depth
- Suggest using depth-weighted intrinsic permeability to determine representative soil texture for other two parameters
- Clay or silty clay layers probably won't work or be accepted

Site-Specific Determination of SESOIL Soil Input Parameters:

intrinsic permeability, disconnectedness index, effective porosity

- More involved than using lookup values based on soil texture
- Various ASTM methods are available for sample collection and preparation, moisture retention curve determination, permeability measurements, etc.
- Would require doing calculations beyond what is covered in the ASTM methods (e.g. disconnectedness index)

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Site-Specific Determination of SESOIL Soil Input Parameters cont.

- Probably only worthwhile for large, expensive cases
- Would need to be adequately documented and reviewed by NJDEP
- Availability of labs to run the methods is issue
- Cost and time involved in running the methods is an issue

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Site-specific Soil Organic Carbon

- Minimum 3 samples (if one soil layer modeled)
- Layer-specific foc samples allowed. Need 3 samples per layer
- Use Lloyd Khan method – high temperature oxidation followed by measurement of evolved CO_2
- Unacceptable methods: furnace method, wet oxidation method, EPA Method 9060, EPA Method 5310

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Finding the climate station

Table of climate station locations by municipality and county added

County	Municipality	Climate Station	Latitude	Longitude
Atlantic	Egg Harbor	ATLANTIC CITY AIRPORT	39.450	74.567
Atlantic	Hamilton	MAYS LANDING 1 W	39.450	74.750
Atlantic	Hammonton Town	HAMMONTON 2 NNE	39.650	74.800
Bergen	Bergenfield	BERGENFIELD	40.924	73.999
Bergen	Cliffside Park	CLIFFSIDE PARK	40.821	73.989
Bergen	Englewood	ENGLEWOOD	40.893	73.973
Bergen	Fair Lawn	FAIR LAWN	40.936	74.120
Bergen	Fort Lee	FORT LEE	40.849	73.974
Bergen	Garfield	GARFIELD	40.880	74.108

RUNNING AT123D- SEVIEW 7

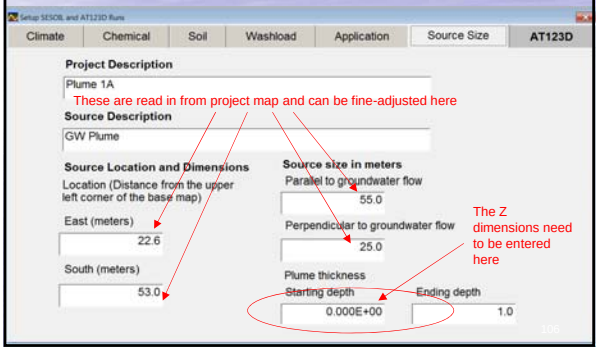
- When SESOIL model is run, ground water contaminant loads from unsaturated soil zone contamination will automatically be prepared for AT123D
- If you have filled in “Establish Default AT123D Data”, other parameters will be filled in as well.

RUNNING AT123D-SEVIEW 7

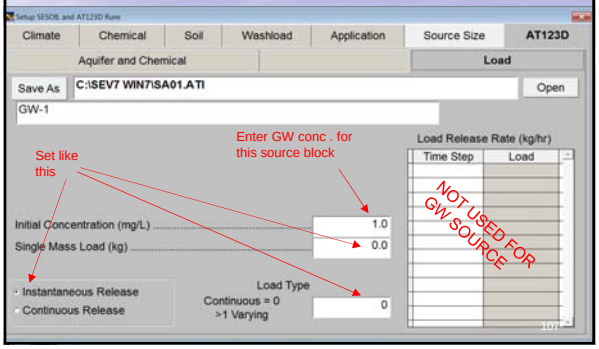
- Add one or more AT123 sources representing existing ground water contamination source onto the SEVIEW 7 project map
- Should be ground water concentrations in the source area, not the entire ground water plume
- Initial concentration for each source entered under “Load” tab for each source. Instantaneous Release, Load type=0

0.5 µg/L	0.5 µg/L
1 µg/L	
0.5 µg/L	

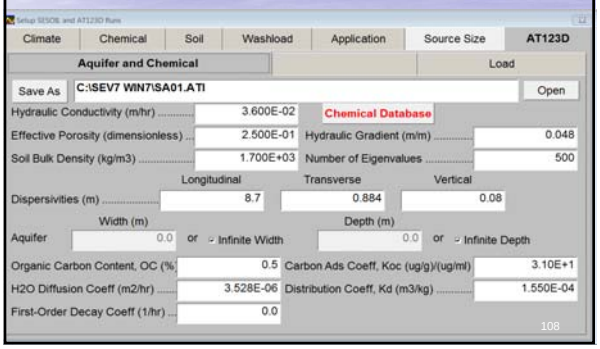
AT123D Input: Source Size Tab – One For Each Source Block in GW



AT123D Input: Load Tab – One For Each Source Block in GW



AT123D Input Parameters: Aquifer and Chemical Tab



AT123D Input Parameters: Aquifer and Chemical Tab

- Must use site-specific hydraulic conductivity and hydraulic gradient. Guidance on determination is in the Monitored Natural Attenuation Technical Guidance:

  http://www.nj.gov/dep/srp/guidance/srra/mna_guidance_v_1_0.pdf

- Set aquifer width to infinite

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AT123D Input Parameters: Aquifer and Chemical Tab cont.

- If contaminated plume does not reach bottom of aquifer, set aquifer thickness to infinite
- If contaminated plume does reach bottom of aquifer, use actual aquifer thickness but compare to infinite thickness run for reasonableness

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AT123D Input Parameters: Aquifer and Chemical Tab

- Calculate longitudinal dispersivity from delineated plume length using Xu and Eckstein formula:

$$\alpha_L = 0.83(\log_{10} L)^{2.414}$$

NOTE: UNITS ARE METERS!

- Transverse and vertical dispersivities are 1/10 and 1/100 the longitudinal dispersivity

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AT123D Input Parameters: Aquifer and Chemical Tab

- Bulk density – can use 1,500 kg/m3, can determine site specifically, or can determine soil texture and use average value for texture type from SEVIEW documentation: sand, 1,400 kg/m3; silt, 1,500 kg/m3; clay, 1,800 kg/m3

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AT123D Input Parameters: Aquifer and Chemical Tab

- Effective porosity – Can use 0.25, can determine site specifically, or can determine soil texture and use average value for texture type from SEVIEW documentation:

Clay	0.10
Silt	0.20
Fine Sand	0.20
Med. Sand	0.22
Coarse Sand	0.28
Gravel	0.22

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AT123D Input Parameters: Aquifer and Chemical Tab

- Chemical properties should be same as for SESOIL, except BTEX degradation rate is zero in aquifer unless site-specific determination is made.
- If Kd entered directly, must divide SESOIL Kd by 1,000 to convert from L/kg to m3/kg.
- SESOIL diffusion coefficients are multiplied by 3,600/10,000 to convert from cm2/sec to m2/hour
- Must have site-specific organic carbon measurements of aquifer material

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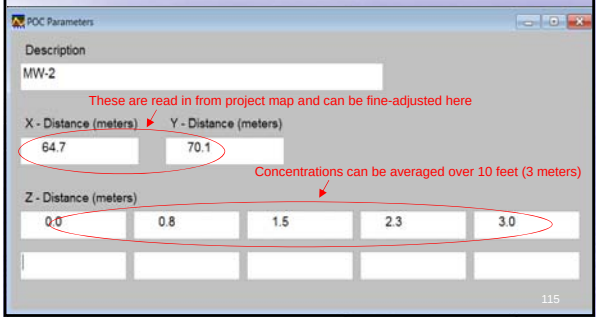
AT123D Input Parameters: Point of Compliance Input – Need at Least 2 of These: Compliance Point 1 and 2



SESOIL/AT123D Submission Requirements

- Model output from SESOIL model (normally 4 pages per contaminant)
- Supporting documentation for SESOIL and AT123D site-specific input parameters
- Recommend submitting SESOIL model table, showing sampling results along with concentrations entered into SESOIL as a function of depth
- AT123D source concentration table
- Map of delineated GW plume, showing modeled AT123D sources

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SESOIL/AT123D Submission Requirements (cont.)

- Submit SEVIEW project map
- Submit all SESOIL output pages
- Submit all point of compliance reports, showing that concentrations never exceed GWRS at compliance point 2, and that concentrations have decreased below GWRS at compliance point 1 at the end of the CEA time period
- Recommend submitting *.prj files

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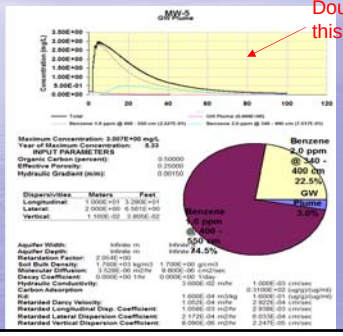
AT123D Output – Compliance Point 1 - Showing Concentrations at Final Timepoint

Double-click on this graph



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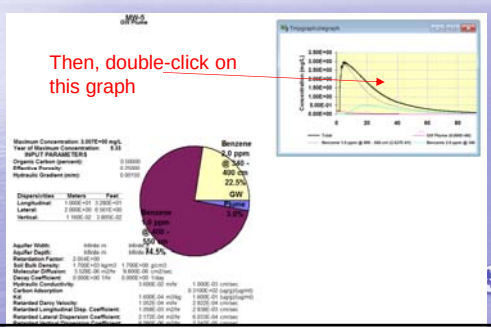
AT123D Output – Compliance Point 1 -Showing Concentrations at Final Timepoint

Then, double-click on this graph



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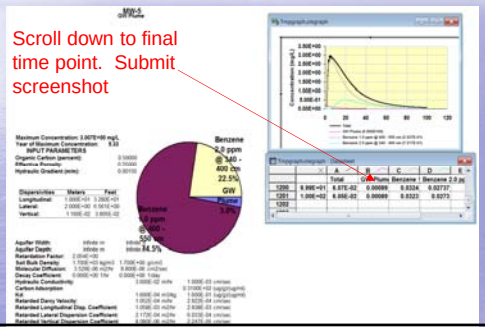
AT123D Output – Compliance Point 1 - Showing Concentrations at Final Time Point

Scroll down to final time point. Submit screenshot



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Questions

Appropriate Ground Water Quality Standards

MaryAnne Kuserk
NJDEP

Ground Water Quality Standards

- Default criteria are based on Class IIA GWQS's (N.J.A.C 7:9C).
- If the aquifer is not IIA, then IGW remediation criteria is derived on a site-specific basis.

IGW in Class I Ground Water

- GWQS's for Class I ground water are ecologically based and based on a anti-degradation policy.
- Numeric standards are based on "Natural Background" Levels.
- For VOC's and SVOC's the numeric criteria is set at the promulgated PQL.

IGW for Class III Ground Water

- Class III Ground Water
  - Class III-A: Aquitards
    - Based on permeability
    - Mapped in GWQS's or make site specific determination
  - Class III-B : Areas of Salt Water Intrusion
    - > 3000 mg/l chloride
    - > 5000 mg/l TDS
    - Mapped in GWQS's or make site specific determination

IGW Class III Ground Water

- No numeric criteria
- Narrative Criteria:
  - No impacts to structures (VI)
  - No violation of surface water criteria
  - No impairment of existing uses
  - Can't be flowing into gw with more stringent classification.

IGW Class III Ground Water

- In developing gw criteria, must demonstrate no impact to above.
- Many times just evaluating existing levels is appropriate. Use that level in calculating IGW.
- In other cases where receptors have potential to be impacted, using the default SSL's or SW standards in calculation is appropriate

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Compliance

Stephen Posten & Swati Toppin

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Compliance/ Attainment

http://www.nj.gov/dep/srp/guidance/srra/attainment_compliance.pdf

- Pre-requisite for implementing attainment options is that extent of contamination must be known
- Vertical Zones (note these differ from Direct Contact vertical zones)
  - first zone 0-2 above water table
  - second zone 2ft above WT to surface
- Functional Area – AOC (including offsite)

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Options for Compliance

- Arithmetic Averaging
- ProUCL
- Thiessen Polygons
- 75/10x rule (post remediation)

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Arithmetic Averaging

Arithmetic averaging can only be used in the following two scenarios:

When there are nine or fewer total sample values

- Example 1: 13, 12, 2, 5, 6, 12

or only two distinct sample values

- Example 2: 0.1, 4, 0.1, 4, 4, 0.1, 0.1, 4, 0.1, 0.1, 0.1 .....
- (where MDL is 0.1 and sample concentration is ND)

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Pro UCL

- Need a minimum of 10 values
- Need 3 or more distinct values
- Use 95% UCL of the mean

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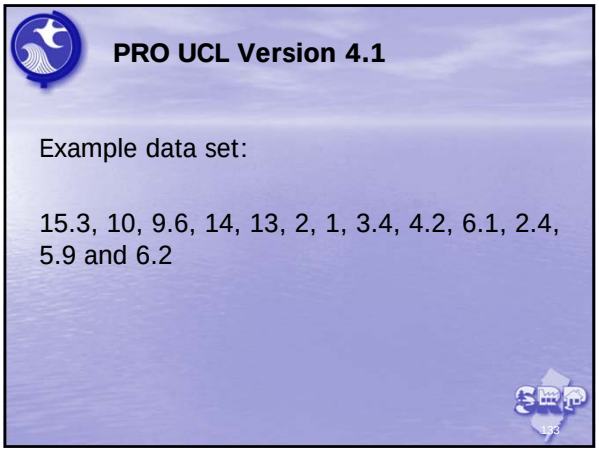
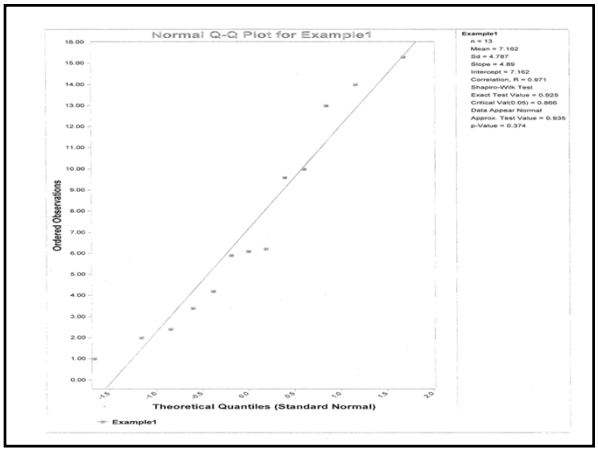
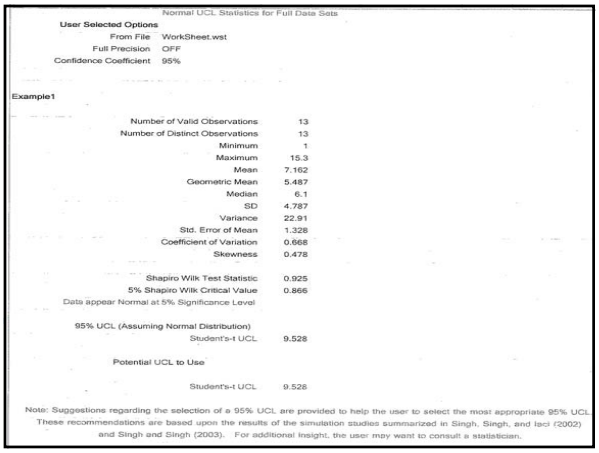
PRO UCL Version 4.1

Example data set:

15.3, 10, 9.6, 14, 13, 2, 1, 3.4, 4.2, 6.1, 2.4, 5.9 and 6.2







Normal UCL Statistics for Full Data Sets

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%

Example1

Number of Valid Observations	13
Number of Distinct Observations	13
Minimum	1
Maximum	15.3
Mean	7.162
Geometric Mean	5.487
Median	6.1
SD	4.787
Variance	22.91
Std. Error of Mean	1.328
Coefficient of Variation	0.668
Skewness	0.478
Shapiro Wilk Test Statistic	0.925
5% Shapiro Wilk Critical Value	0.866

Data appear Normal at 5% Significance Level

95% UCL (Assuming Normal Distribution)

Student's-t UCL	9.528

Potential UCL to Use

Student's-t UCL	9.528

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

75/10X Option (only applicable after delineation and remediation)

- Example: When IGWSRS is 6 ppm, and post excavation sample results are : 10, 7, 2, 3, 4, 1, 5, 3.

  Compliance has been achieved because:

  No sample is over 60. 6/8 or 75% of samples are below 6 ppm.

- Sampling Requirements: Minimum of 8 post remediation samples needed for up to 125 cubic yards of impacted soil; 12 post remedial samples for up to 3000 cubic yards and 12 post remedial samples for every 3000 cubic yards thereafter

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Thiessen Polygons

Steve Posten,
AMEC

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Compliance Averaging - Spatially Weighted Average (e.g., Thiessen Polygons)

- Thiessen Polygons:

  Polygons generated from a set of sample points. Each Thiessen polygon defines an area of influence around its sample point, so that any location inside the polygon is closer to that point than any of the other sample points. Thiessen polygons are named for the American meteorologist Alfred H. Thiessen (1872-1931).

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Example from Guidance (Thiessen Polygons)

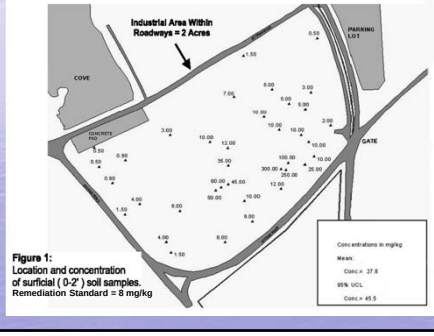

Figure 1:
Location and concentration of surficial (0-2') soil samples.
Remediation Standard = 8 mg/kg

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Example from Guidance (Thiessen Polygons)

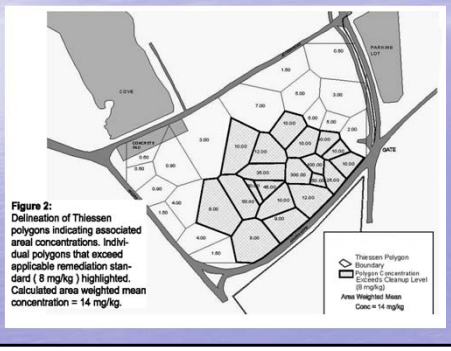

Figure 2:
Delineation of Thiessen polygons indicating associated areal concentrations. Individual polygons that exceed applicable remediation standard (8 mg/kg) highlighted.
Calculated area weighted mean concentration = 14 mg/kg.

140

Example from Guidance (Thiessen Polygons)

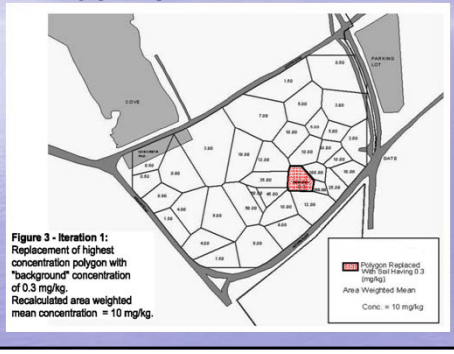

Figure 3 - Iteration 1:
Replacement of highest concentration polygon with "background" concentration of 0.3 mg/kg.
Recalculated area weighted mean concentration = 10 mg/kg.

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Example from Guidance (Thiessen Polygons)

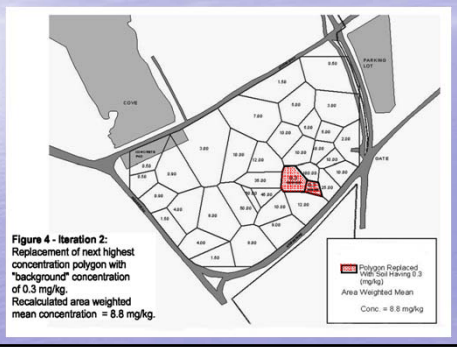

Figure 4 - Iteration 2:
Replacement of next highest concentration polygon with "background" concentration of 0.3 mg/kg.
Recalculated area weighted mean concentration = 8.8 mg/kg.

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Example from Guidance (Thiessen Polygons)

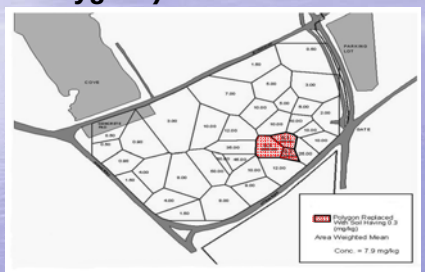

Figure 5 - Iteration 3:
Replacement of next highest concentration polygon with "background" concentration of 0.3 mg/kg. Recalculated area weighted mean concentration = 7.9 mg/kg.
Area weighted mean concentration below applicable remediation standard. Remediation complete.

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Project Example (Thiessen Polygons)

- Site ~ 10.5 ac
- All AOCs (20+) associated with prior operations/discharges previously remediated
- Remaining sporadic/low level contamination distributed across site
- All sample results in 0-2' zone above WT < criteria
- Spatially weighted averaging analysis performed on sample data in overlying zone to surface.

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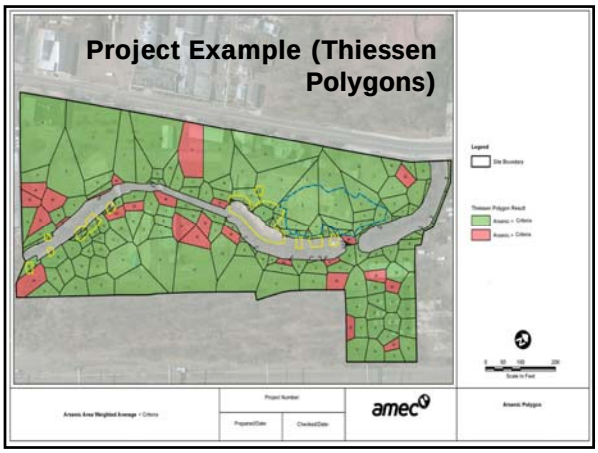
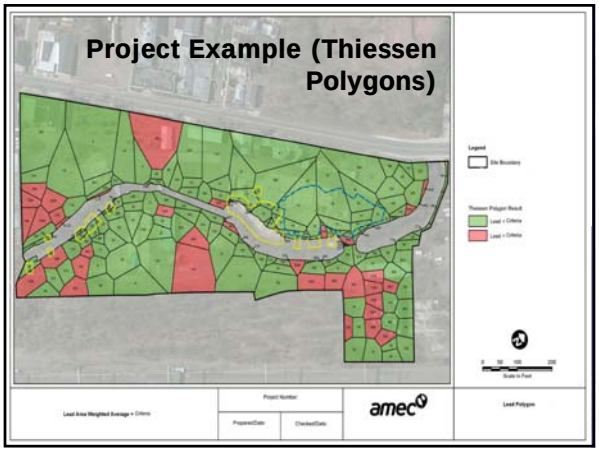
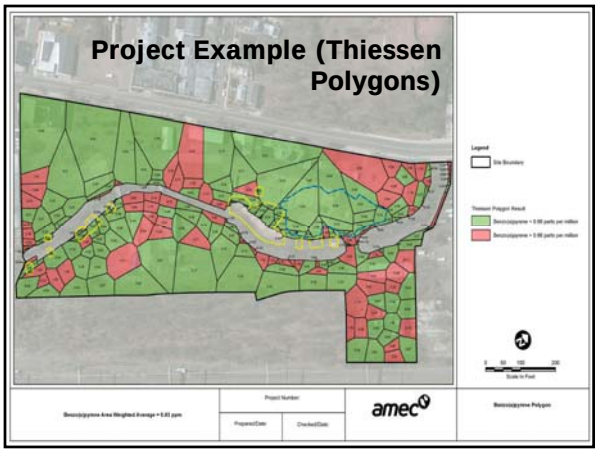
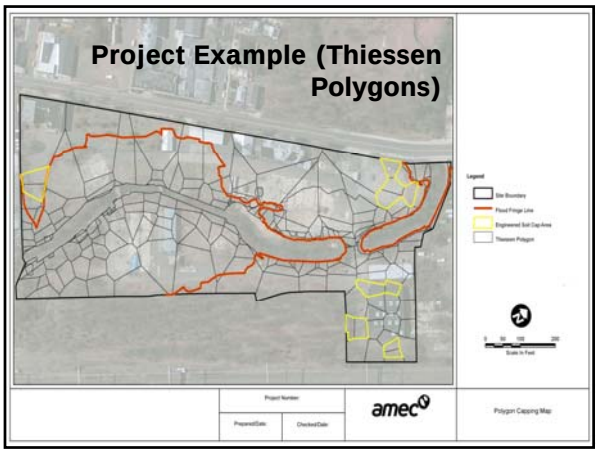

Project Example (Thiessen Polygons)
amec

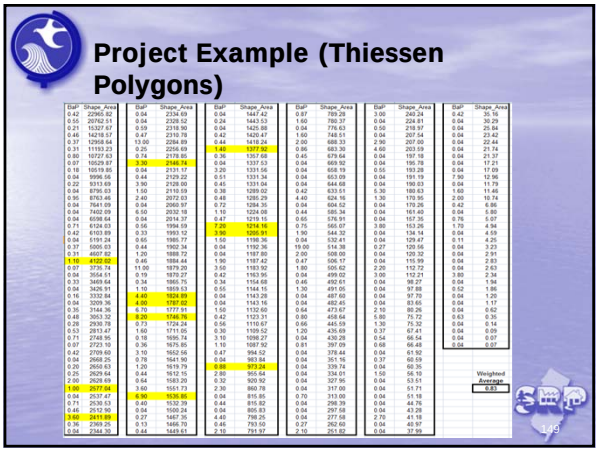

Project Example (Thiessen Polygons)
amec


Project Example (Thiessen Polygons)
amec

Project Example (Thiessen Polygons)



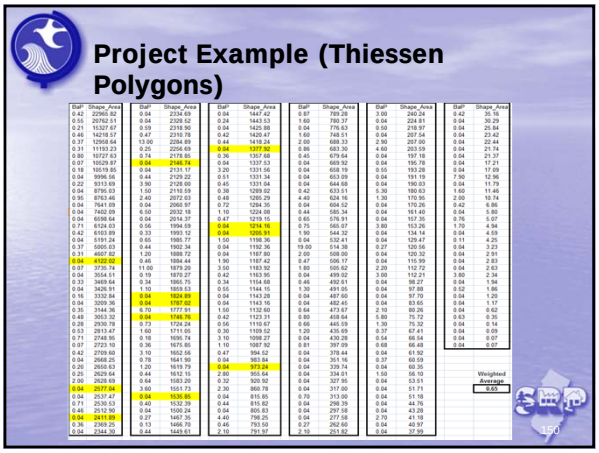
Project Example (Thiessen Polygons)



BaP	Shape_Area
0.42	22965.82
0.55	20762.51
0.21	15327.67
0.46	14218.57
0.37	12958.64
0.31	11193.23
0.80	10727.63
0.07	10529.87
0.18	10519.85
0.04	9996.56
0.22	9313.69
0.04	8795.03
0.95	8763.46
0.04	7641.09
0.04	7402.09
0.04	6598.64
0.71	6124.03
0.42	6103.89
0.04	5191.24
0.37	5065.03
0.31	4607.82
1.10	4122.82
0.07	3735.74
0.04	3554.51
0.33	3469.64
0.04	3426.91
0.16	3332.84
0.04	3209.36
0.35	3144.36
0.48	3053.32
0.28	2930.78
0.53	2813.47
0.71	2748.95
0.07	2723.10
0.42	2709.60
0.04	2668.26
0.20	2650.63
0.25	2629.64
2.00	2628.69
1.00	2577.04
0.04	2537.47
0.71	2530.53
0.46	2512.90
3.60	2411.89
0.36	2369.25
0.04	2344.30
0.04	2334.69
0.04	2328.52
0.59	2318.90
0.47	2310.78
13.00	2284.89
0.25	2256.69
0.74	2178.85
1.30	2146.74
0.04	2131.17
0.44	2129.22
3.90	2128.00
1.50	2110.59
2.40	2072.63
0.04	2060.97
6.50	2032.18
0.04	2014.37
0.56	1994.59
0.33	1993.12
0.65	1985.77
0.44	1962.34
1.20	1888.72
0.46	1884.44
11.00	1879.20
0.19	1870.27
0.34	1865.75
1.10	1859.53
4.40	1824.89
4.00	1787.02
6.70	1777.91
8.20	1746.76
0.73	1724.24
1.60	1711.05
0.18	1695.74
0.36	1675.85
3.10	1652.56
0.78	1641.90
1.20	1619.79
0.44	1612.15
0.64	1583.20
1.60	1551.73
6.90	1535.86
0.40	1532.39
0.04	1500.24
0.27	1467.35
0.13	1466.70
0.44	1449.61
0.04	1447.42
0.24	1443.53
0.04	1425.88
0.42	1420.47
0.44	1418.24
1.40	1377.92
0.36	1357.68
0.04	1337.53
3.20	1331.56
0.51	1331.34
0.45	1331.04
0.38	1289.02
0.48	1285.29
0.72	1284.35
1.10	1224.08
0.47	1219.15
7.20	1214.16
3.90	1205.91
1.50	1198.36
0.04	1192.36
0.04	1187.80
1.90	1187.42
3.50	1183.92
0.42	1163.95
0.34	1154.68
0.55	1144.15
0.04	1143.28
0.04	1143.16
1.50	1132.60
0.42	1123.31
0.56	1110.67
0.30	1109.52
3.10	1098.27
1.10	1087.92
0.47	994.52
0.04	983.84
0.88	973.24
2.80	955.64
0.32	920.92
2.30	860.78
0.04	815.85
0.44	815.82
0.04	805.83
4.40	798.25
0.46	793.50
2.10	791.97
0.87	789.28
1.60	780.37
0.04	776.63
1.60	748.51
2.00	688.33
0.86	683.30
0.45	679.64
0.04	669.92
0.04	658.19
0.04	653.09
0.04	644.68
0.42	633.51
4.40	624.16
0.04	604.52
0.44	585.34
0.65	576.91
0.75	565.07
1.90	544.32
0.04	532.41
19.00	514.38
2.00	508.00
0.47	506.17
2.20	506.62
1.80	505.62
0.04	499.02
0.46	492.61
1.30	491.05
0.04	487.60
0.04	482.45
0.64	473.67
0.80	468.64
0.66	445.59
1.20	435.69
0.04	339.74
0.04	334.01
0.04	327.95
0.04	317.00
0.70	313.00
0.04	298.39
0.04	297.58
0.04	277.58
0.27	262.60
2.10	251.82
3.00	240.24
0.04	224.81
0.50	218.97
0.04	207.54
2.90	207.00
4.60	203.59
0.04	197.18
0.04	195.78
0.55	193.28
0.04	191.19
0.04	190.03
1.30	180.63
1.30	170.95
0.04	170.26
0.04	161.40
0.04	157.35
3.80	153.26
0.04	134.14
0.04	129.47
0.27	120.56
0.04	120.32
0.04	115.99
2.20	112.72
3.00	112.21
0.04	98.27
0.04	97.88
0.04	97.70
0.04	83.65
2.10	80.26
1.50	75.72
1.30	75.32
0.37	67.41
0.54	66.54
0.68	66.48
0.04	61.92
0.37	60.59
0.04	60.35
1.50	56.10
0.04	53.51
0.04	51.71
0.04	51.18
0.04	44.76
0.04	43.28
2.70	41.18
0.04	40.97
0.04	37.99
0.42	35.16
0.04	30.29
0.04	25.84
0.04	23.42
0.04	22.44
0.04	21.74
0.04	21.37
0.04	17.21
0.04	17.09
7.90	12.96
0.04	11.79
1.60	11.46
2.00	10.74
0.42	6.86
0.04	5.80
0.76	5.07
1.70	4.94
0.04	4.59
0.11	4.25
0.04	3.23
0.04	2.91
0.04	2.83
0.04	2.63
3.80	2.34
0.04	1.94
0.52	1.86
0.04	1.20
0.04	1.17
0.04	0.62
0.63	0.35
0.04	0.14
0.04	0.09
0.04	0.07
0.04	0.07

Weighted Average: 0.83

Project Example (Thiessen Polygons)



BaP	Shape_Area
0.42	22965.82
0.55	20762.51
0.21	15327.67
0.46	14218.57
0.37	12958.64
0.31	11193.23
0.80	10727.63
0.07	10529.87
0.18	10519.85
0.04	9996.56
0.22	9313.69
0.04	8795.03
0.95	8763.46
0.04	7641.09
0.04	7402.09
0.04	6598.64
0.71	6124.03
0.42	6103.89
0.04	5191.24
0.37	5065.03
0.31	4607.82
0.04	4122.82
0.07	3735.74
0.04	3554.51
0.33	3469.64
0.04	3426.91
0.16	3332.84
0.04	3209.36
0.35	3144.36
0.48	3053.32
0.28	2930.78
0.53	2813.47
0.71	2748.95
0.07	2723.10
0.42	2709.60
0.04	2668.26
0.20	2650.63
0.25	2629.64
2.00	2628.69
0.04	2577.04
0.04	2537.47
0.71	2530.53
0.46	2512.90
0.04	2411.89
0.36	2369.25
0.04	2344.30
0.04	2334.69
0.04	2328.52
0.59	2318.90
0.47	2310.78
13.00	2284.89
0.25	2256.69
0.74	2178.85
1.30	2146.74
0.04	2131.17
0.44	2129.22
3.90	2128.00
1.50	2110.59
2.40	2072.63
0.04	2060.97
6.50	2032.18
0.04	2014.37
0.56	1994.59
0.33	1993.12
0.65	1985.77
0.44	1962.34
1.20	1888.72
0.46	1884.44
11.00	1879.20
0.19	1870.27
0.34	1865.75
1.10	1859.53
0.04	1824.89
0.04	1787.02
6.70	1777.91
0.04	1746.76
0.73	1724.24
1.60	1711.05
0.18	1695.74
0.36	1675.85
3.10	1652.56
0.78	1641.90
1.20	1619.79
0.44	1612.15
0.64	1583.20
1.60	1551.73
0.04	1535.86
0.40	1532.39
0.04	1500.24
0.27	1467.35
0.13	1466.70
0.44	1449.61
0.04	1447.42
0.24	1443.53
0.04	1425.88
0.42	1420.47
0.44	1418.24
0.04	1377.92
0.36	1357.68
0.04	1337.53
3.20	1331.56
0.51	1331.34
0.45	1331.04
0.38	1289.02
0.48	1285.29
0.72	1284.35
1.10	1224.08
0.47	1219.15
0.04	1214.16
0.04	1205.91
1.50	1198.36
0.04	1192.36
0.04	1187.80
1.90	1187.42
3.50	1183.92
0.42	1163.95
0.34	1154.68
0.55	1144.15
0.04	1143.28
0.04	1143.16
1.50	1132.60
0.42	1123.31
0.56	1110.67
0.30	1109.52
3.10	1098.27
1.10	1087.92
0.47	994.52
0.04	983.84
0.04	973.24
2.80	955.64
0.32	920.92
2.30	860.78
0.04	815.85
0.44	815.82
0.04	805.83
4.40	798.25
0.46	793.50
2.10	791.97
0.87	789.28
1.60	780.37
0.04	776.63
1.60	748.51
2.00	688.33
0.86	683.30
0.45	679.64
0.04	669.92
0.04	658.19
0.04	653.09
0.04	644.68
0.42	633.51
4.40	624.16
0.04	604.52
0.44	585.34
0.65	576.91
0.75	565.07
1.90	544.32
0.04	532.41
19.00	514.38
2.00	508.00
0.47	506.17
2.20	506.62
1.80	505.62
0.04	499.02
0.46	492.61
1.30	491.05
0.04	487.60
0.04	482.45
0.64	473.67
0.80	468.64
0.66	445.59
1.20	435.69
0.04	339.74
0.04	334.01
0.04	327.95
0.04	317.00
0.70	313.00
0.04	298.39
0.04	297.58
0.04	277.58
0.27	262.60
2.10	251.82
3.00	240.24
0.04	224.81
0.50	218.97
0.04	207.54
2.90	207.00
4.60	203.59
0.04	197.18
0.04	195.78
0.55	193.28
0.04	191.19
0.04	190.03
1.30	180.63
1.30	170.95
0.04	170.26
0.04	161.40
0.04	157.35
3.80	153.26
0.04	134.14
0.04	129.47
0.27	120.56
0.04	120.32
0.04	115.99
2.20	112.72
3.00	112.21
0.04	98.27
0.04	97.88
0.04	97.70
0.04	83.65
2.10	80.26
1.50	75.72
1.30	75.32
0.37	67.41
0.54	66.54
0.68	66.48
0.04	61.92
0.37	60.59
0.04	60.35
1.50	56.10
0.04	53.51
0.04	51.71
0.04	51.18
0.04	44.76
0.04	43.28
2.70	41.18
0.04	40.97
0.04	37.99
0.42	35.16
0.04	30.29
0.04	25.84
0.04	23.42
0.04	22.44
0.04	21.74
0.04	21.37
0.04	17.21
0.04	17.09
7.90	12.96
0.04	11.79
1.60	11.46
2.00	10.74
0.42	6.86
0.04	5.80
0.76	5.07
1.70	4.94
0.04	4.59
0.11	4.25
0.04	3.23
0.04	2.91
0.04	2.83
0.04	2.63
3.80	2.34
0.04	1.94
0.52	1.86
0.04	1.20
0.04	1.17
0.04	0.62
0.63	0.35
0.04	0.14
0.04	0.09
0.04	0.07
0.04	0.07

Weighted Average: 0.65

Remediation Standards Update
Impact to Ground Water

Barry Frasco
NJDEP

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Remediation Standards

Current Status:
Adopted June 2, 2008
Expires June 2, 2015

Goals:
- Do not let the regulation expire
- Have ample time to propose rule changes and respond to comments

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Remediation Standards

Plan of Action:
- Readopt regulation without change prior to rule expiration
- Propose and adopt amendments to the rule
- These two activities are occurring in parallel

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Remediation Standards

Readoption without Change:

- Recent changes in the Administrative Procedures Act (APA) allow for a streamlined process to readopt an existing regulation provided there are no proposed "substantive" changes to the regulation
- Goal - Publish rule readoption without change proposal in Spring 2015

Remediation Standards

Proposal and Adoption of Rule Amendments:

- Rule amendments proposal published in 2015
- Rule amendments adopted within one year of rule proposal (2016)

Remediation Standards

Rule amendments to include soil impact to ground water exposure pathway

Will be called "Migration to Ground Water Pathway"

Remediation Standards

Rule will include:

- Soil remediation standards based on soil – water partition equations
  - Direct soil measurement
  - Concentration of contaminant in soil that will not result in an exceedance of the ground water quality/remediation standard

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Remediation Standards

Rule will include:

- Soil leachate remediation standards based on SPLP analysis
  - Leachate measurement
  - For a given contaminant, leachate standard is the ground water quality/remediation standard x DAF

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Remediation Standards

Key changes from and updates to current IGWSSLs

- The GWQS, not the health based GWQC, is the proposed endpoint. This differs from current IGWSSLs.
- If MGWSRS exceeds the contaminant's Csat value, the contaminant does not pose a risk to pathway, therefore no remediation standard will be proposed
- Chemical properties will be updated

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Remediation Standards

Rule will NOT include existing guidance documents (e.g.):

- Immobile Chemicals
- SESOIL
- SESOIL/AT123D
- Capping
- Site Soil and Ground Water Analytical Data Evaluation
- Compliance/Attainment

Remediation Standards

Existing guidance documents will remain as guidance and will be available for use

What vs. How

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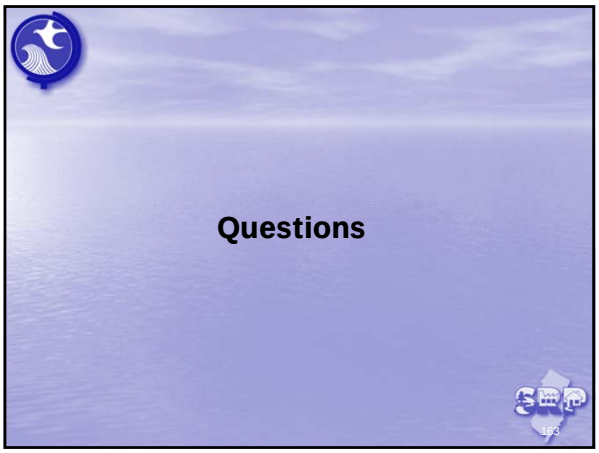
Questions