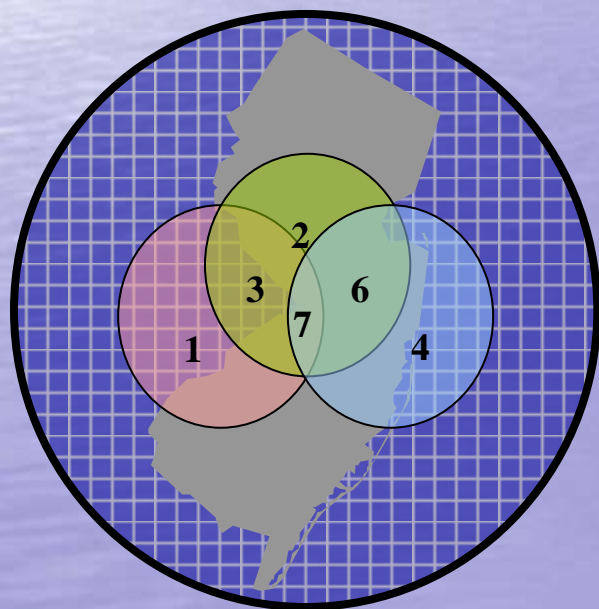




Remedial Priority System

Soil Site Condition Score and
Soil Exceedance Quotient



March 2012





Site Condition Scores

(based on the electronic sampling results submitted to the Department)

There are three Media that are evaluated as part of the RPS Model and each media has a separate method to calculate Exceedance Quotients and Site Condition Score.

- **Ground Water**
- **Soil**
- **Vapor**





Soil Site Condition Score

Definitions

- An **exceedance quotient** (EQ) is a normalized value that enables SRP to compare contaminants with different properties and different concentrations across distance and time. The soil EQ takes into account the depth of a sample and the lowest regulatory criteria.
- An **Site Condition Score** is one value that represents the site and is calculated using the Soil Exceedance Quotients.





Soil Site Condition Score

Data used to calculate Soil Site Condition Score

- The RPS uses all samples that exceed the health based soil cleanup criteria to calculate the Soil Site Condition Score. Exceptions are:
 - ❖ those samples that can be documented to have been excavated, remediated and/or re-sampled.





Soil Site Condition Score

Calculate the Soil EQ

- Steps to Calculate a Site Condition Score
 1. Calculate an EQ for each analyte that exceeds the health based soil cleanup criteria to normalize the results
 2. Calculate a SCS from the EQ values





Calculate the Soil EQ

Exceedance quotient Calculation

Adjustments to the initial concentration

- most stringent health based soil cleanup criteria
- soil exposure pathways (samples are grouped based on depth)
- Natural log (normalize the population)
- Soil sample Groups
 - **Surface Soils:** samples collected less than 2 ft. below surface. The potential risk of exposure (dermal, ingestion or inhalation) is highest in this horizon.
 - **Subsurface Soil:** samples collected from 2 to 10 ft. below surface. Exposure of these soils would require excavation. This group is based on the average excavation depth that occurs at a site during normal construction.
 - **Deep Soil:** samples collected greater than 10 ft. below surface. Exposure of these soils would require excavation of the soil. This horizon is based on the depth of extreme excavations that may occur.





Calculate the Soil EQ

- In order to consider the potential risk of exposure for the soil contamination, the initial contaminant concentration is adjusted based on the depth to the sample.
 - ❖ Adjustment: The concentration is divided by the Soil Qualifier

The potential risk factor is:

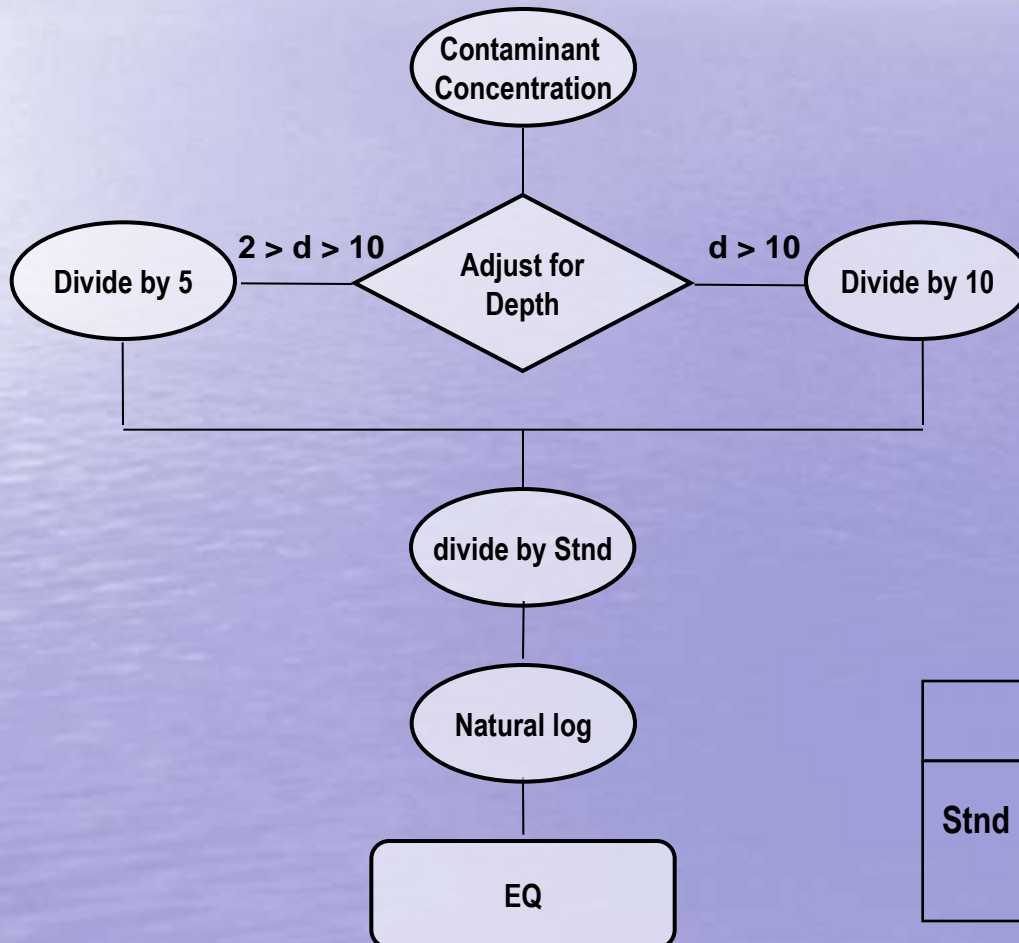
<u>Soil Group</u>	<u>Soil Qualifier</u>
❖ Surface (0-2 feet)	1
❖ Subsurface (2-10 feet)	5
❖ Deep samples (> 10 feet)	10





Calculate the Soil EQ

Statistical Calculation Flowchart



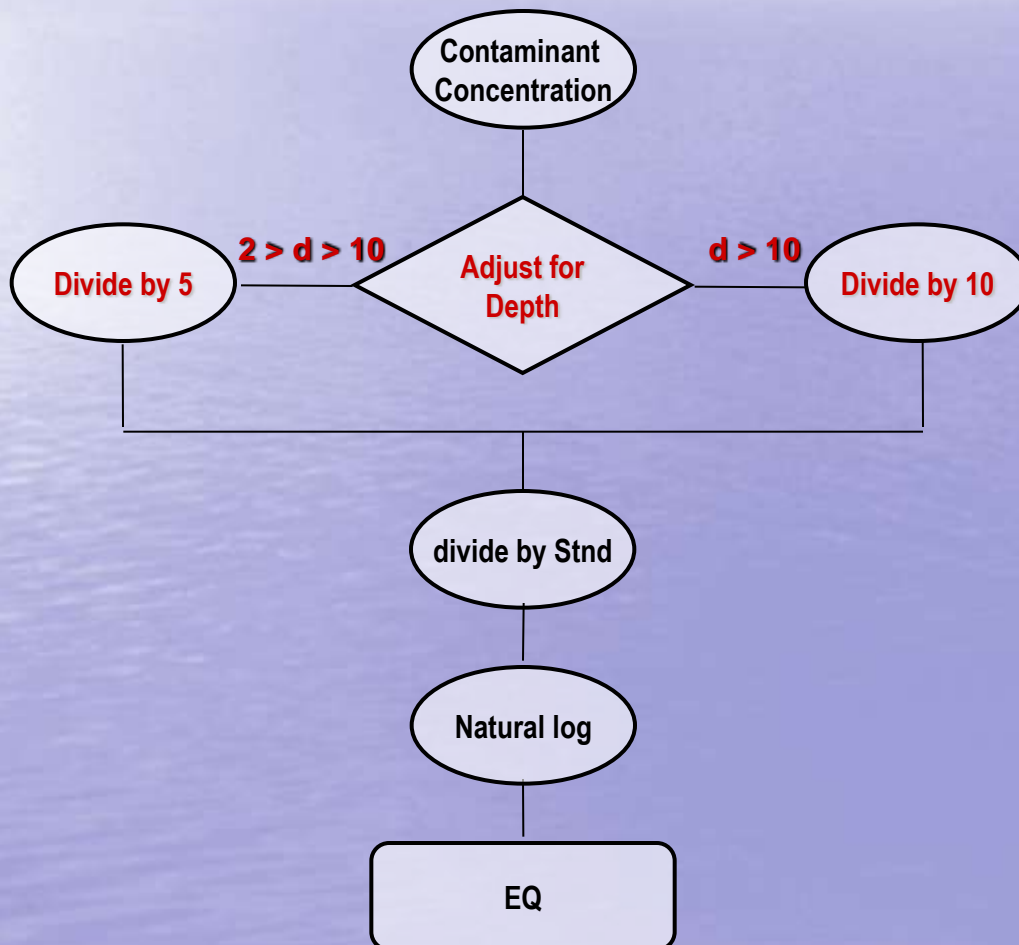
Legend
Stnd = most restrictive health based soil cleanup criteria





Calculate the Soil EQ

Statistical Calculation Flowchart



1. Adjust for Contaminant Depth

Start with the Contaminant concentration that exceeds the appropriate soil cleanup criteria

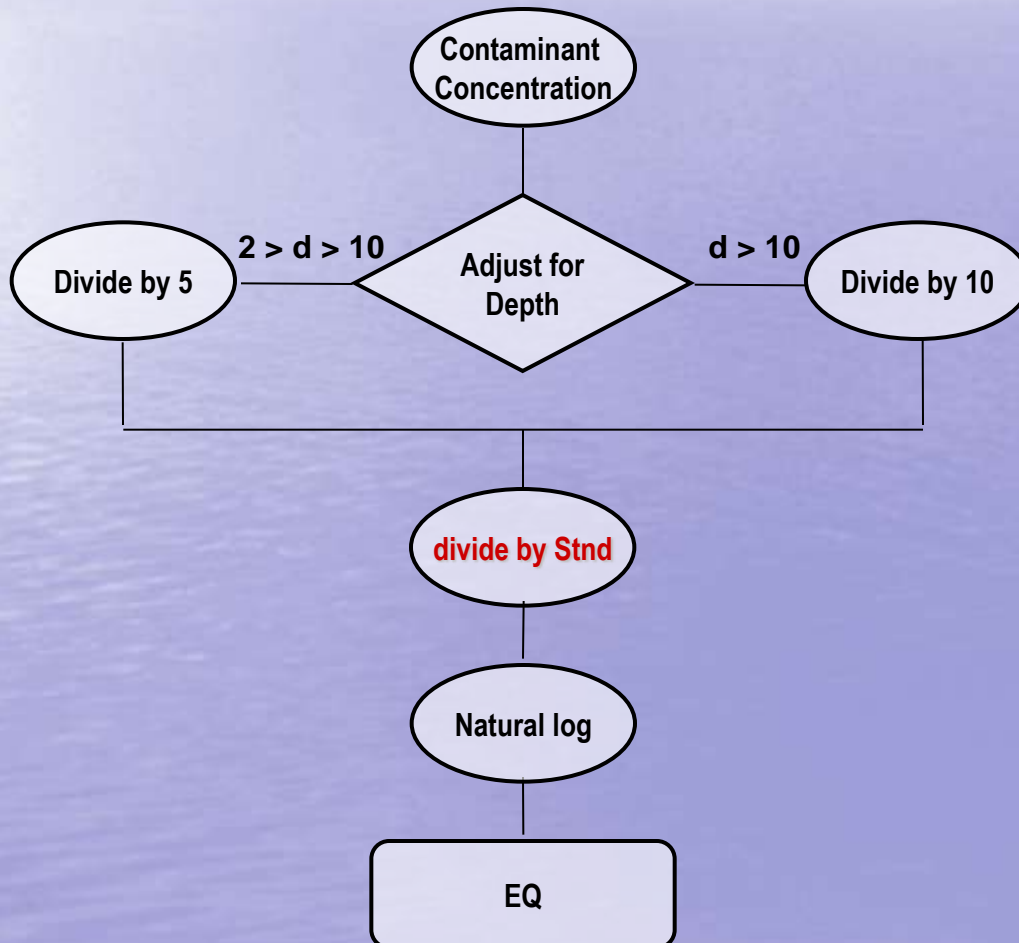
- Adjust for depth
 - 0-2 feet divide by 1
 - 2-10 feet divide by 5
 - 10-20 feet divide by 10





Calculate the Soil EQ

Statistical Calculation Flowchart



2. Compare to health based Soil Cleanup criteria

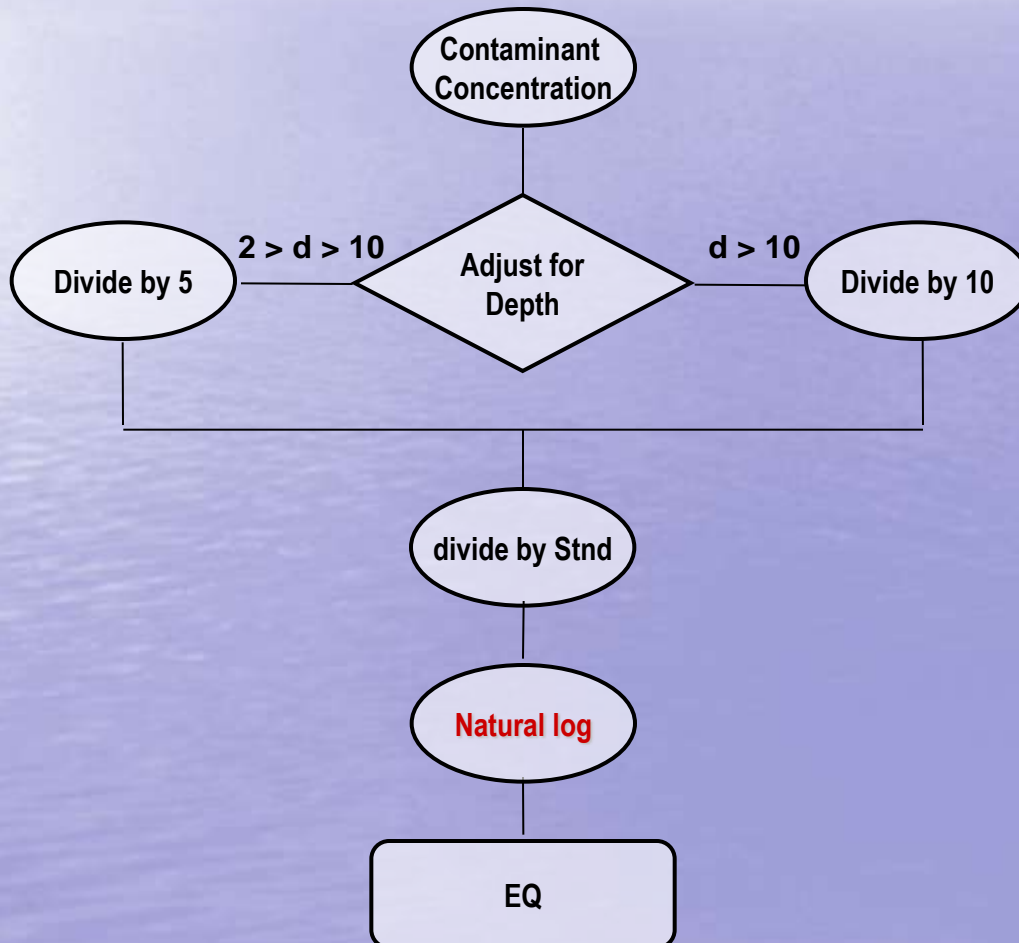
Divide the adjusted EQ by the appropriate soil standard





Calculate the Soil EQ

Statistical Calculation Flowchart



3. Natural log

Take the Natural log of the adjusted value





Calculate the Soil Site Condition Score

- The process to calculate a Site Condition Score for Soil includes 2 steps:
 - **Step 1**
 - calculate the average of the EQ for each soil sample
 - Step 2
 - calculate a 95% upper confidence limit (UCL) for the average of the EQs calculated in Step 1





Calculate the Soil EQ

- Calculate the EQ using depth and the most stringent soil cleanup criteria.

❖ Example Dataset

Boring	Contaminant	Depth (feet)	Conc (mg/kg)	Adjust for Depth (feet) (Divide by)		Adjust for Soil Criteria (Divide by Soil Stnd)		Natural Log	EQ
SB1-8	Benzene	8	10.5	divide by 5	1.79	divide by 2	0.85	0.85	-0.11
SB1-8	Toluene	8	7,500	divide by 5	1,500	divide by 6,300	0.24	0.24	-1.43
SB1-15	Benzene	15	12	divide by 10	1.2	divide by 2	0.6	0.6	-0.51
SB-2	TCE	1.0	15	divide by 1	15	divide by 7	2.14	2.14	0.76
SB-5	PCE	1.0	6.5	divide by 1	6.5	divide by 2	3.25	3.25	1.18





Calculate the Soil Site Condition Score

- The process to calculate a Site Condition Score for Soil includes 2 steps:
 - **Step 1**
 - calculate the average of the EQ for each soil sample
 - **Step 2**
 - calculate a 95% upper confidence limit (UCL) for the average of the EQs calculated in Step 1





Soil Site Condition Score

Calculate a 95% UCL of all the UCLs previously calculated for the rounds of wells and contaminants. There is now **one** UCL for the entire site.

❖ Example Dataset

Boring	Contaminant	EQ
SB1-8	Benzene	-0.11
SB1-8	Toluene	-1.43
SB1-15	Benzene	-0.51
SB-2	TCE	0.76
SB-5	PCE	1.18

Sample Count	Average	Standard Deviation	Significant Interval	95% UCL
5	-0.02	1.03	0.91	0.89

Soil SCS = 0.89

The Site Condition Score for Soil is the 95% UCL





Soil Site Condition Score

- Assorted Notes:
 - If a Site Condition Score is negative, 0.001 is substituted for the final Site Condition Score. The replacement of the negative value is needed to make sure that all of the numbers are positive.
 - Negative EQ values are used to Calculate the 95% UCL.

