



U.S. DEPARTMENT OF  
**ENERGY**

OFFICE OF  
**ENVIRONMENTAL  
MANAGEMENT**

# Expressing Concentrations

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DOE-Savannah River

**Savannah River Site Citizens Advisory Board**

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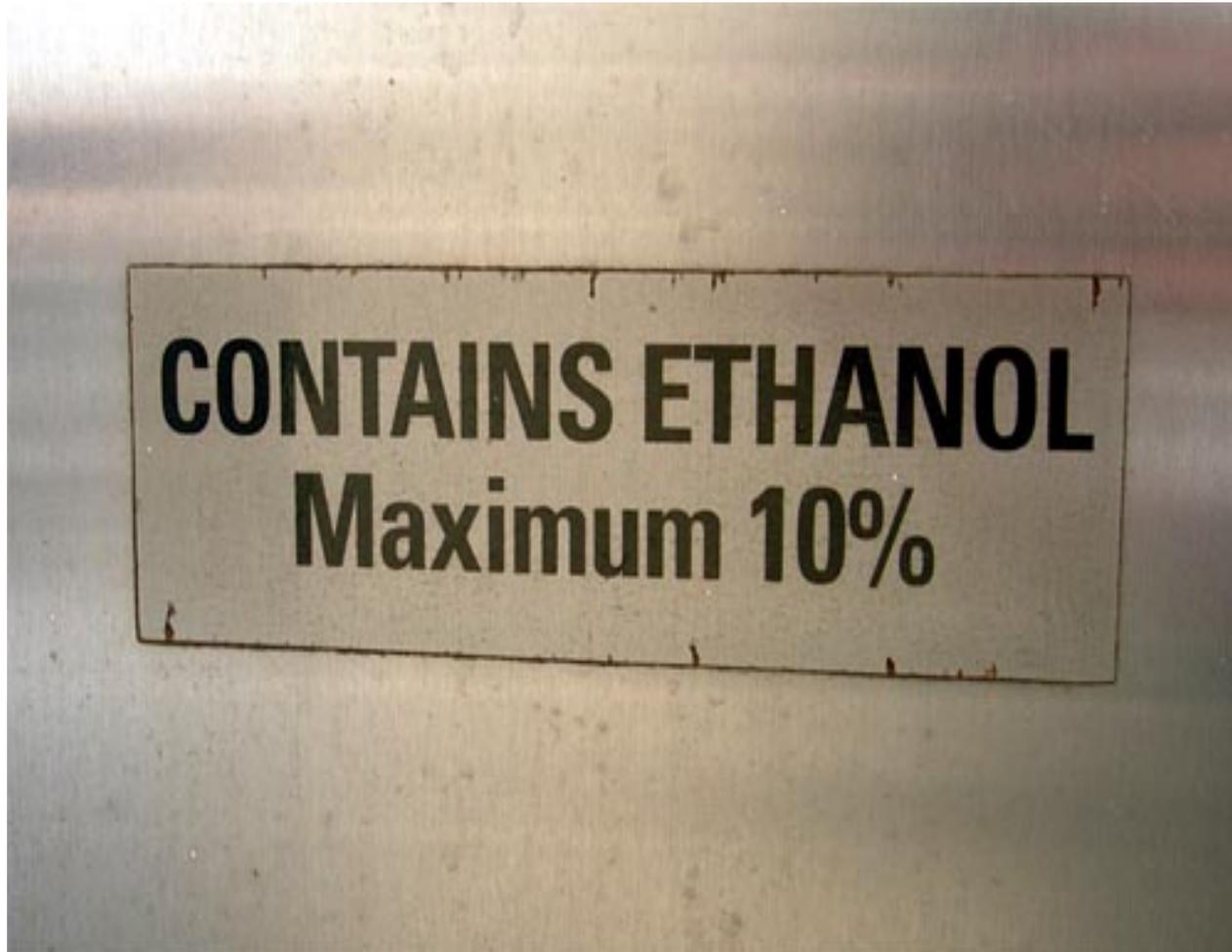
- The purpose of this presentation is to:
  - fulfill a 2015 Facilities Disposition and Site Remediation Work Plan topic
  - present information on some of the most common units of concentration used in CAB presentations

# Acronyms:

- ppm – parts per million
- TCE – Trichloroethylene
- ppb – parts per billion
- mg – milligram
- kg – kilogram
- mL – milliliter
- L – Liter
- ug or  $\mu\text{g}$  – microgram
- dpm – disintegrations per minute
- Ci – Curie
- pCi – Picocurie

# What is concentration?

- Concentration is the amount of something within something else.



*10 parts ethanol per 100 parts fuel*

**10 percent**

# *concentration of ethanol in fuel*

10 percent = 10 parts per hundred

$$= \frac{10}{100}$$

$$= 0.1$$

Concentrations of SRS contaminants  
are much less than 10 per cent,  
and even much less than 1 per cent!

1 part per hundred	$\frac{1}{100}$	0.01
1 part per thousand	$\frac{1}{1,000}$	0.001
1 part per million	$\frac{1}{1,000,000}$	0.000001
1 part per billion	$\frac{1}{1,000,000,000}$	0.000000001

# 1 part per million (1 ppm)

*one grain of salt.....*



*.....in 12 ounces of water*

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# 1 part per million (1 ppm)

*one drop of dye.....*



*.....in 12 gallons of water*

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**1 part per million (1 ppm)**

**mg/kg**

one milligram of lead  
per kilogram of soil

**mg/L**

one milligram of TCE  
per liter of water

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1,000 ppm = 0.1%

10,000 ppm = 1%

# 1 part per billion (1 ppb)

*one grain of salt.....*



*.....in 55 gallons of water*

# 1 part per billion (1 ppb)

*one drop of dye.....*



*.....in 240 55-gallon drums*

**1 part per billion (1 ppb)**

**ug/kg**

one microgram of lead  
per kilogram of soil

**ug/L**

one microgram of TCE  
per liter of water

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# 1 part per billion ( 1 ppb)

$\mu\text{g}/\text{kg}$

one microgram of lead  
per kilogram of soil

$\mu\text{g}/\text{L}$

one microgram of TCE  
per liter of water

ppm  
mg/kg  
mg/L

ppb  
ug/kg  
ug/L  
 $\mu\text{g/kg}$   
 $\mu\text{g/L}$

***are used for non-radioactive materials***

# MEASURING CONCENTRATIONS OF RADIOACTIVE MATERIAL

# Each “click” of a Geiger Counter represents the disintegration of one atom



The disintegration rate (*disintegrations per minute*) tells us how much radioactive material is present

Disintegration rate is expressed in **Curies**

1 Curie (Ci) = about 2 trillion disintegrations per minute (dpm)

***Curies are used for High Level Waste***

Environmental samples have much less radioactivity,  
so a smaller unit is used for soil, water, & tissue.

1 **picocurie (pCi)** = one-trillionth of a Curie

1 pCi = about 2 disintegrations per minute

**pCi/g** picocuries per gram (*soil, tissue*)

**pCi/L** picocuries per liter (*water*)

**pCi/mL** picocuries per milliliter (*water*)

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## NATURAL RADIOACTIVITY

Radioactivity exists naturally everywhere

Uncontaminated soil:	about 25	pCi/g
Uncontaminated groundwater:	about 10-50	pCi/L

**Please plan to attend  
Education Sessions Parts 2 & 3:**

**Oct.13 – Calculating Risk**  
**Dec.8 – Remedial Decisions**

**QUESTIONS??**