U.S. DEPARTMENT OF ENERGY | OFFICE OF ENVIRONMENTAL MANAGEMENT

Expressing Concentrations

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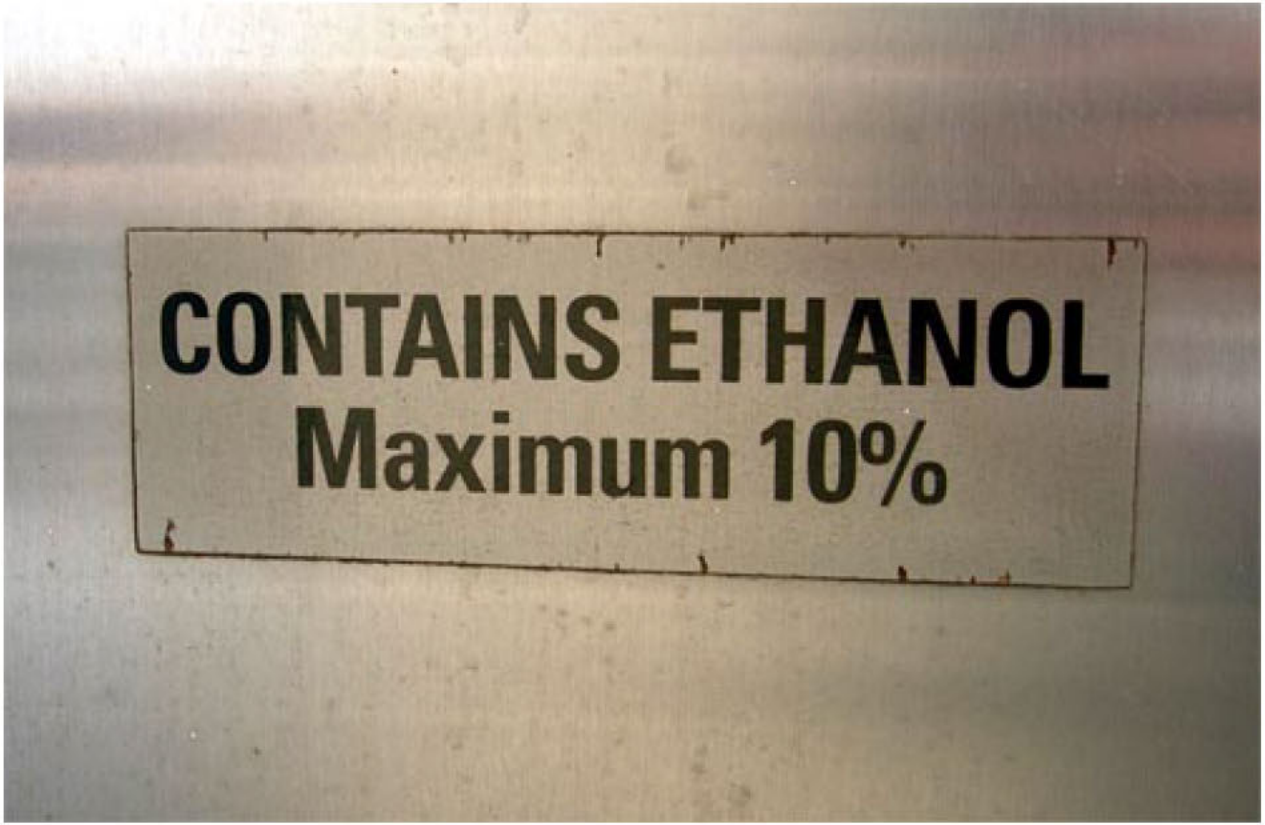
- The purpose of this presentation is to:
  - fulfill a 2015 Facilities Disposition and Site Remediation Work Plan topic
  - present information on some of the most common units of concentration used in CAB presentations

Acronyms:

- ppm – parts per million
- TCE – Trichloroethylene
- ppb – parts per billion
- mg – milligram
- kg – kilogram
- mL – milliliter
- L – Liter
- ug or μg – microgram
- dpm – disintegrations per minute
- Ci – Curie
- pCi – Picocurie

What is concentration?

- Concentration is the amount of something within something else.


CONTAINS ETHANOL
Maximum 10%

10 parts ethanol *per* *100 parts fuel*

10 percent

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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

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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[11]

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

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

15

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)

μg/kg — one microgram of lead per kilogram of soil

μg/L — one microgram of TCE per liter of water

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ppm
mg/kg
mg/L

ppb
ug/kg
ug/L
µg/kg
µg/L

are used for non-radioactive materials

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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

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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.

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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??