

Degradation Products of Dinitrotoluene


Why sampling is not practical
at Badger





Common Measurements of Concentration

- Part per Hundred (Percent) %
 - 1 of 100
- Part per Million (ppm or mg/L)
 - 1 of 1,000,000
- Part per Billion (ppb or $\mu\text{g/L}$)
 - 1 of 1,000,000,000



What is 1 of 1 billion (1,000,000,000)?

- 1 golf ball with a 1.62 inch diameter
 - Volume of 2.2 cubic inches or 0.00127 cubic feet
- One billion golf balls would take 1,270,000 cubic feet of space
- Example: a warehouse 127 feet wide X 1,000 feet long X 10 feet high
(not assessing closest packing of a sphere)
- One Red golf ball in this warehouse is 1ppb



Enforcement Standard (ES) for Dinitrotoluene (DNT) in groundwater

The ES of DNT is 0.05 ppb



At the (ES) for DNT of 0.05 ppb

0.05 of 1,000,000,000 is the same as

0.5 of 10,000,000,000 and

5 of 100,000,000,000 or

1 of 20,000,000,000



Golf Balls and DNT

- At the ES we are looking for 1 in 20,000,000,000
- If you place one red golf ball with 19,999,999,999 white golf balls the red golf ball would be 0.05 ppb
- That would be 1 red golf ball in 20 warehouses of golf balls



Degradation of DNT

- dissolved DNT degrades slowly
- When it degrades, smaller compounds separate from the original
- The separated parts are sometimes called “breakdown products”



Degradation Products

- The stoichiometry of DNT breakdown is 1 to 1
 - This means that 1 molecule breaks down to 1 different molecule + ions
 - This does not mean that all the DNT breaks down at once
 - The degradation product concentration cannot exceed the original concentration of DNT
- There are several steps to the breakdown of DNT
 - All of these steps are 1 to 1



Degradation Products (continued)

- The initial degradation of DNT takes the longest
 - The life expectancy of the breakdown products is much less than DNT in the environment



Application to Badger

- DNT concentrations are not uniform across the plumes
 - Levels of DNT are higher at the sources
 - Levels drop the further they are from the source to no detection
- Groundwater is not stationary
 - Groundwater flows at approximately 1 foot per day at Badger



Summary

- Even at the ES the DNT is at an exceedingly low concentration
- The degradation products of DNT breakdown more rapidly than DNT and therefore are not persistent in the environment



Final Assessment

We would be looking for an incredibly small amount of a compound that doesn't last very long