

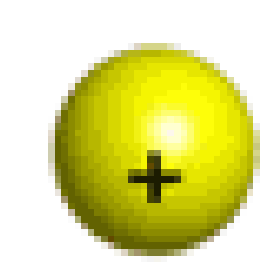
Atmospheric Tritium is a Groundwater Tracer

Atmospheric tritium in recharge water moves along the groundwater flow paths while it is influenced by matrix diffusion and decay.

What is tritium?

Three Nuclides of the Hydrogen Isotopes:

Protium



1 proton

normal

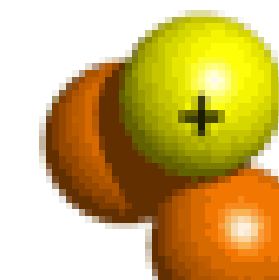
Deuterium



1 proton
1 neutron

heavy

Tritium



1 proton
2 neutrons

radioactive

3H

Radioactive isotope of hydrogen with a decay half-life of 12 years.

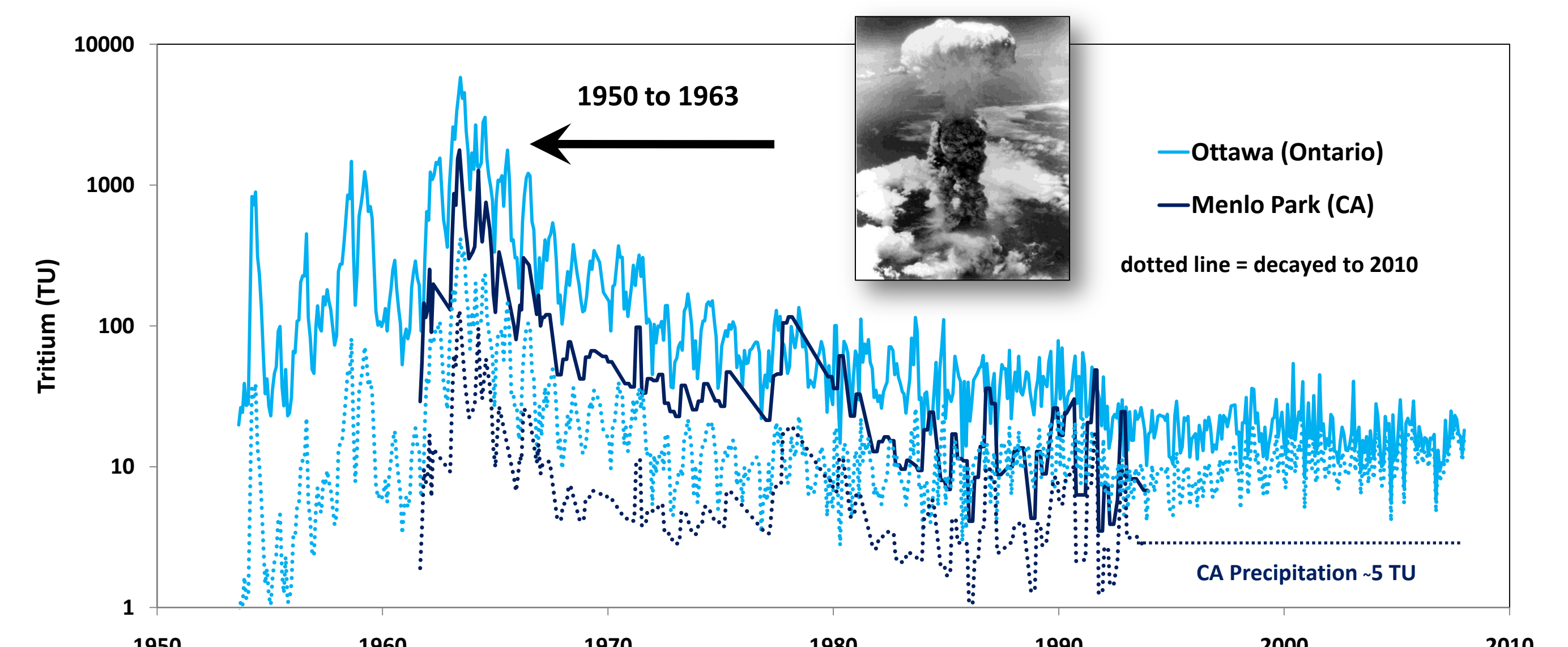
Units for tritium

Picocuries (pCi) – 2 disintegrations per minute

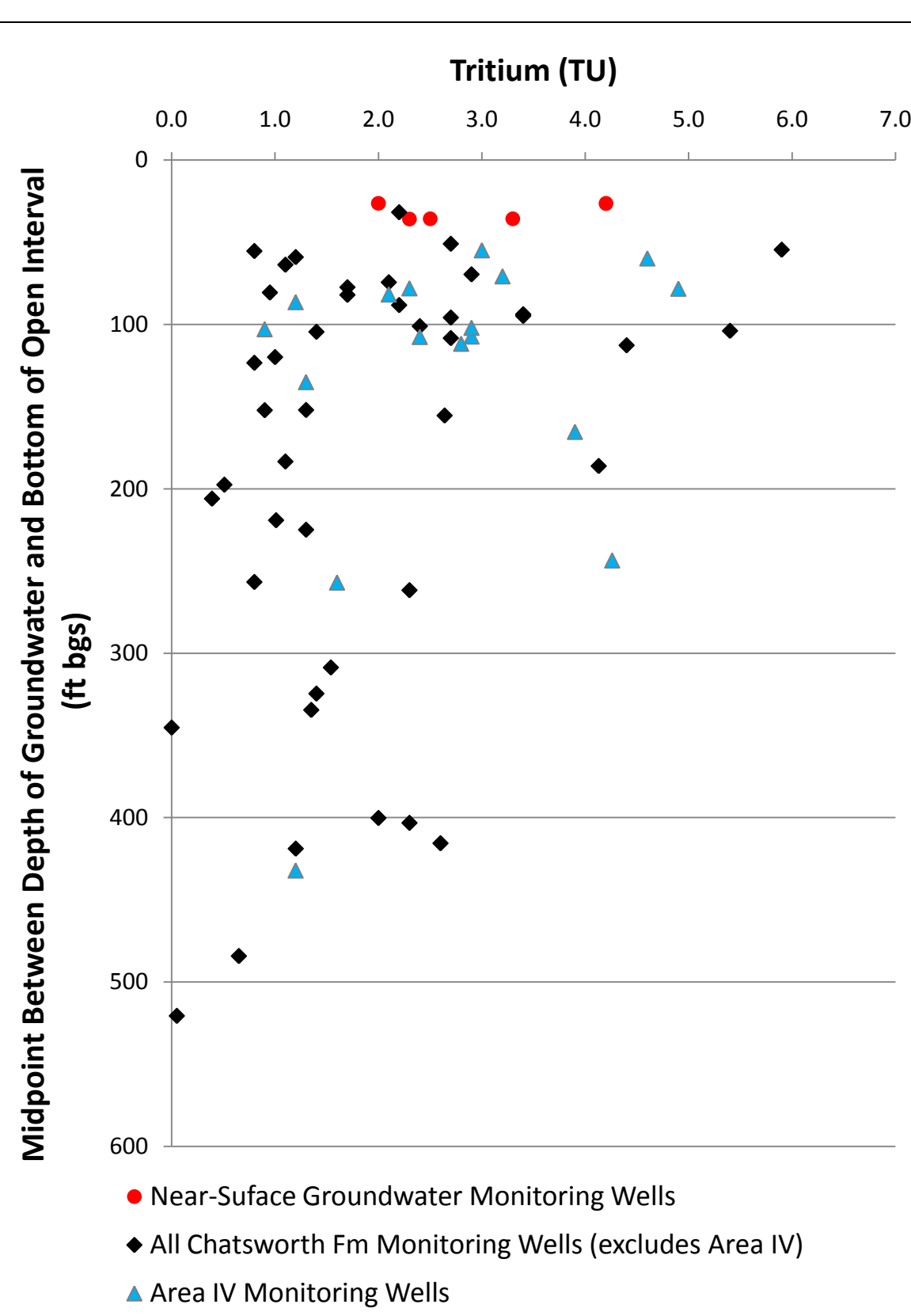
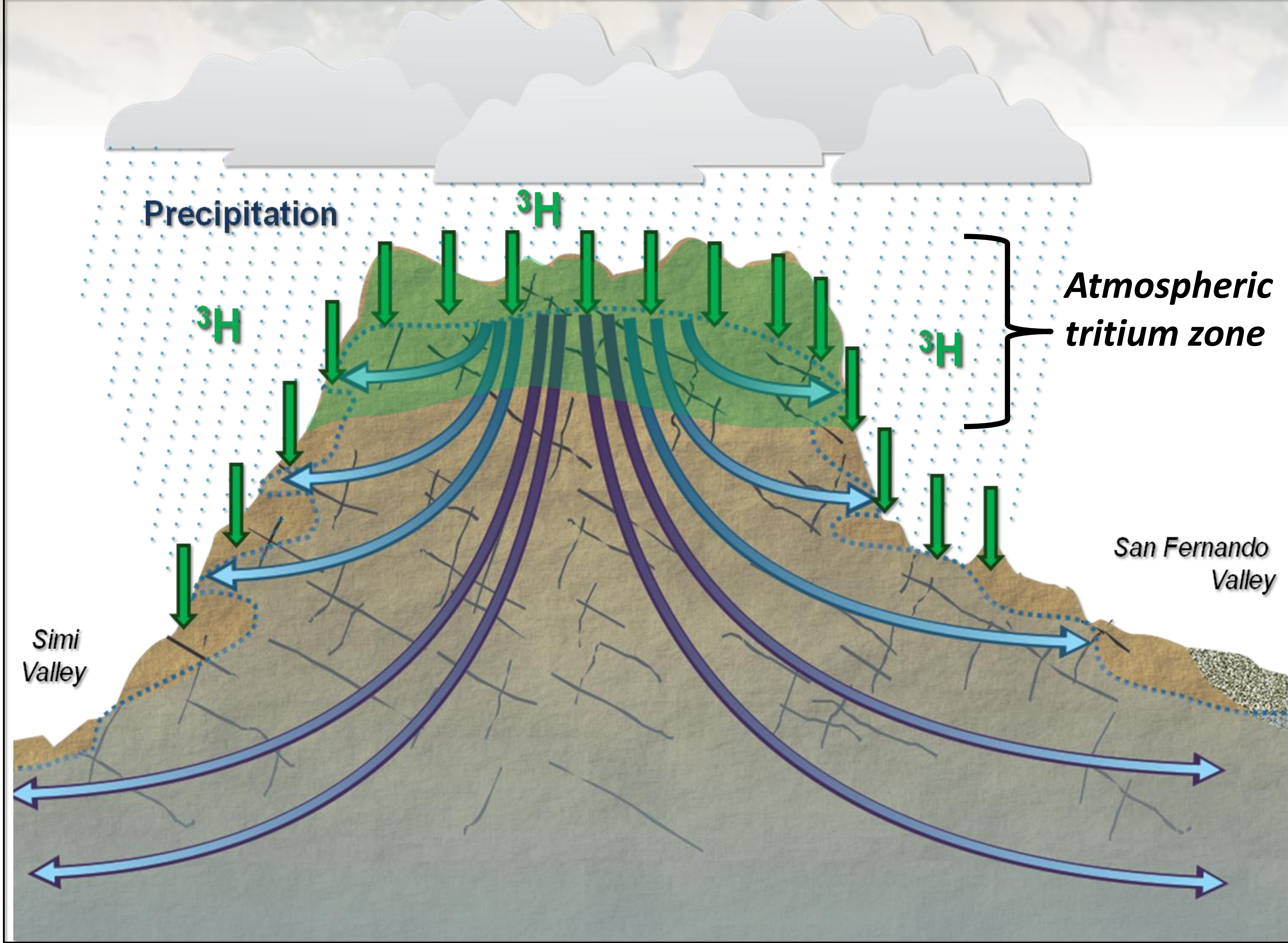
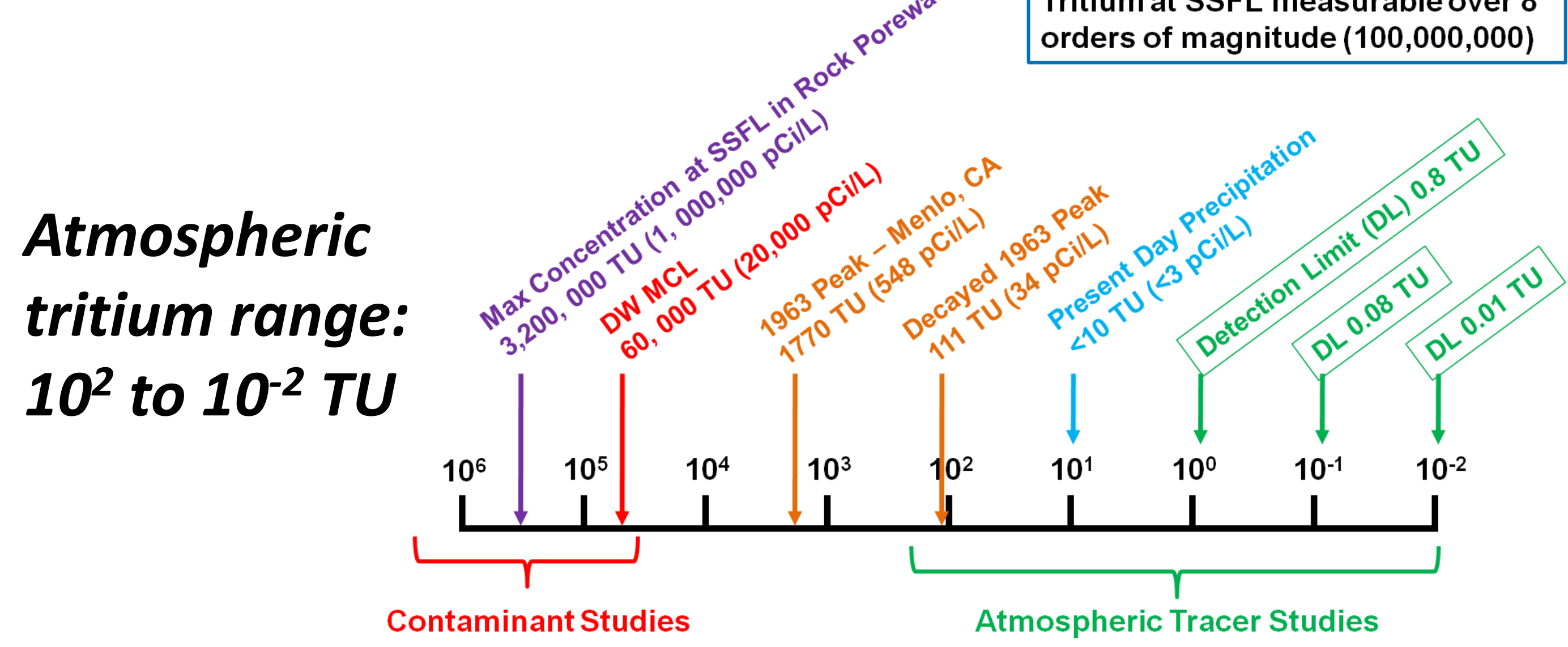
Tritium Unit (TU) – 1 tritium atom in 10^{18} hydrogen atoms

1 pCi ~ 3 TU

Tritium occurs in rainfall



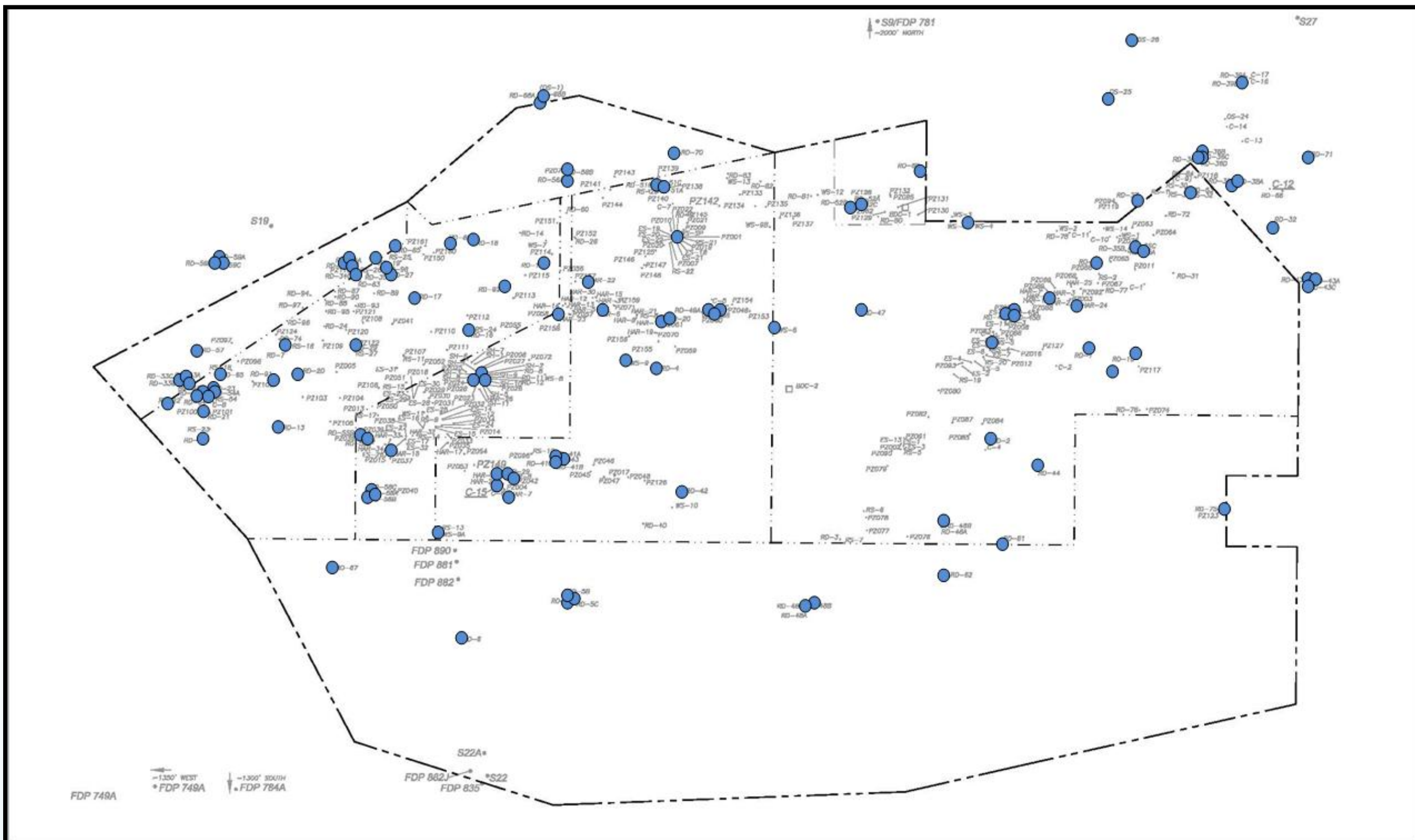
Tritium in rainfall caused by atmospheric nuclear tests.



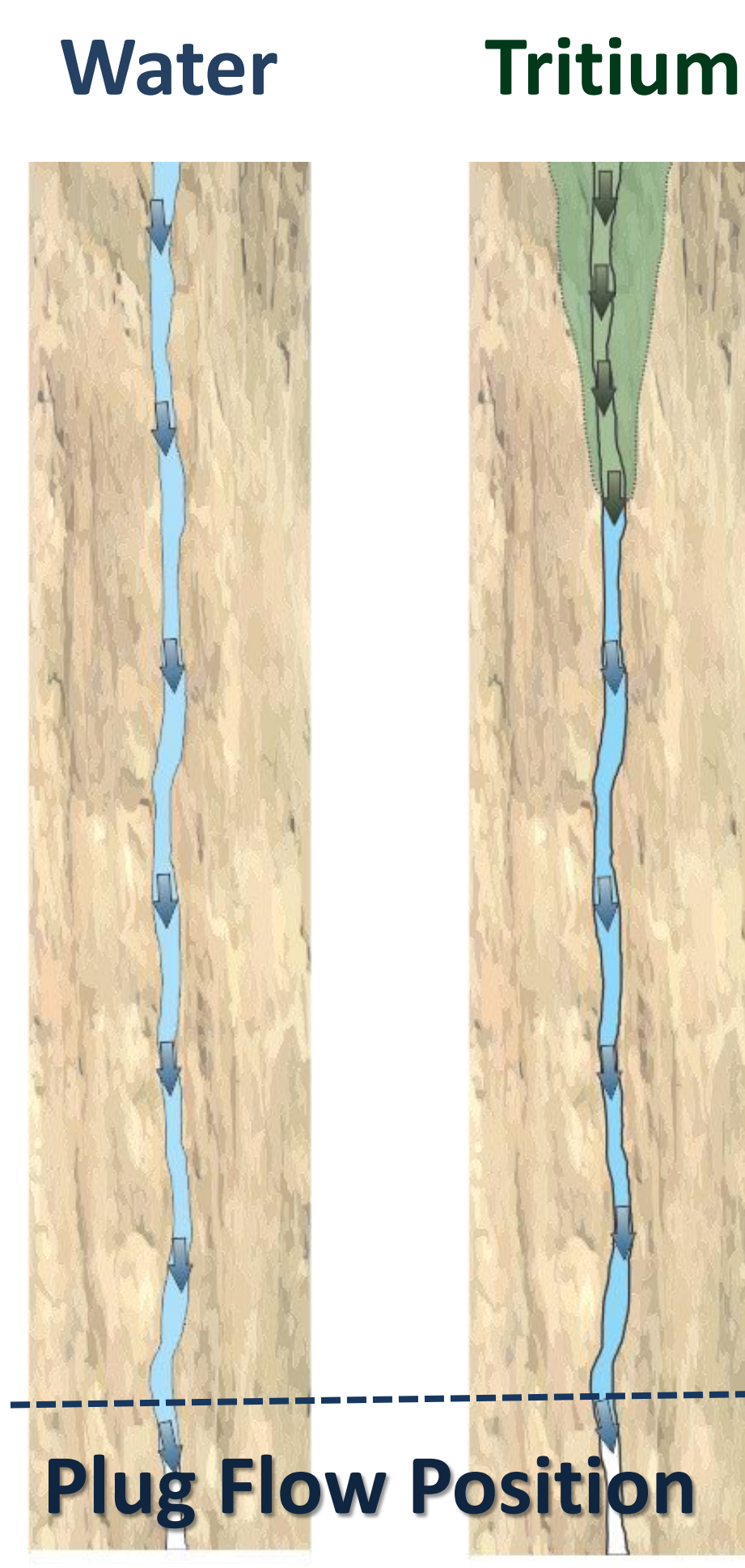
Atmospheric ^3H in monitoring wells decreases with depth.

Samples collected in 2007 through 2009 and historical values (1987-1998) adjusted for radioactive decay.

If the tritium molecules traveled at the same velocity as the groundwater in fractures, then high tritium would be found much deeper.

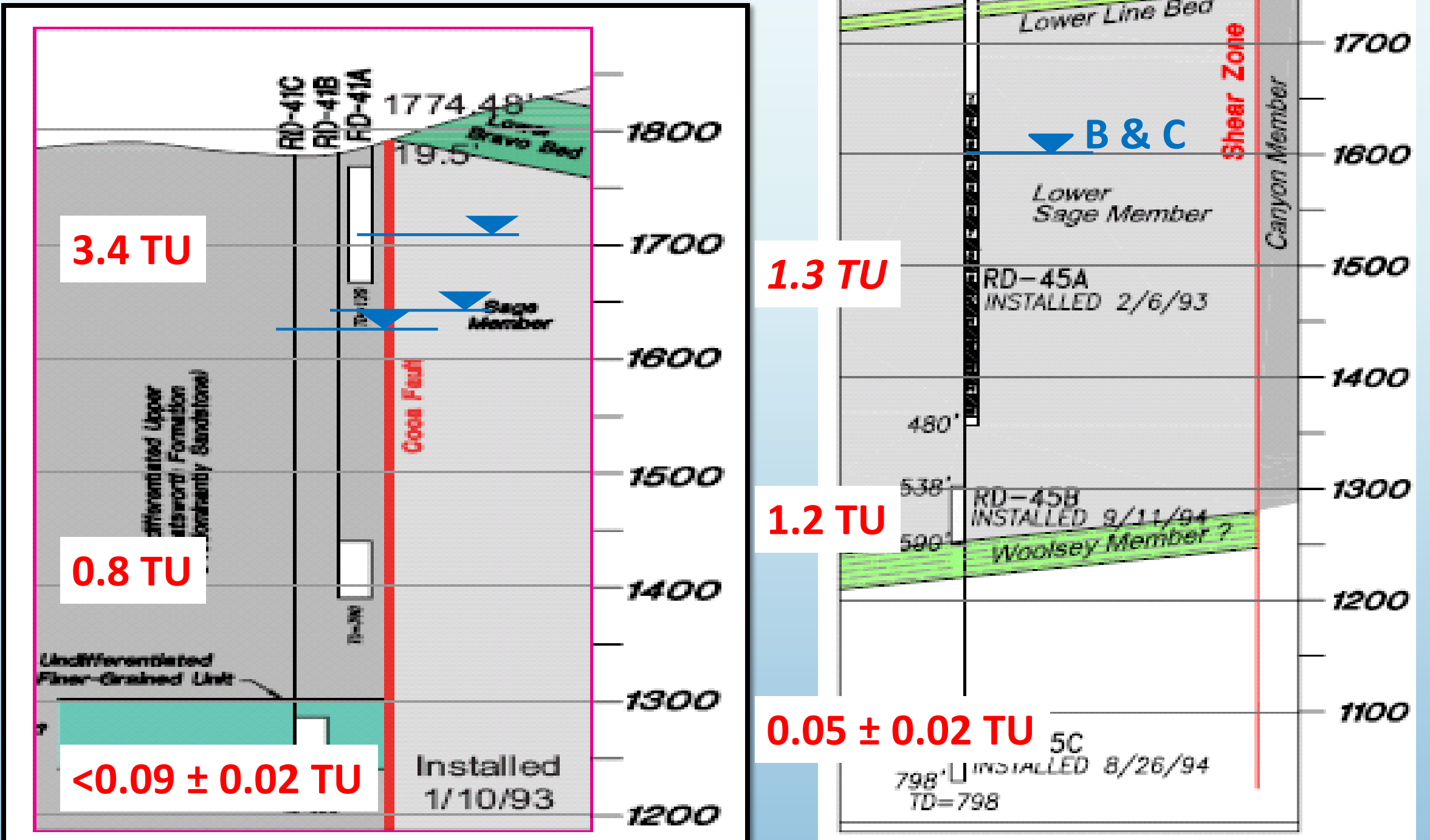


Monitoring wells across the site sampled for atmospheric tritium.



The tritium movement is much slower than the water because diffusion causes tritium to be transferred from the fracture into the rock matrix.

Examples from two cluster well locations; smaller tritium concentrations at greater depth.

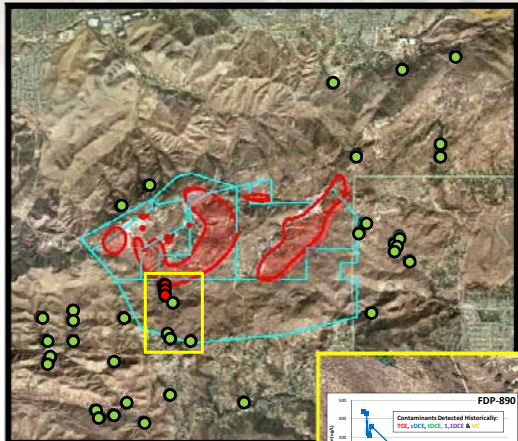
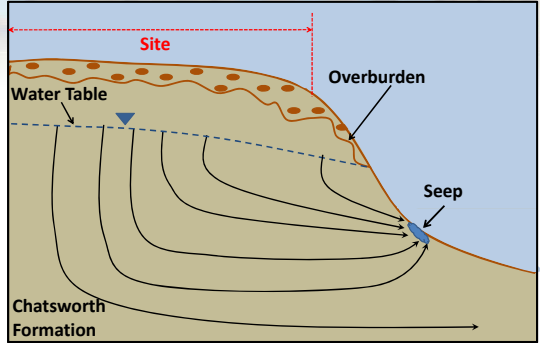


Conclusion:

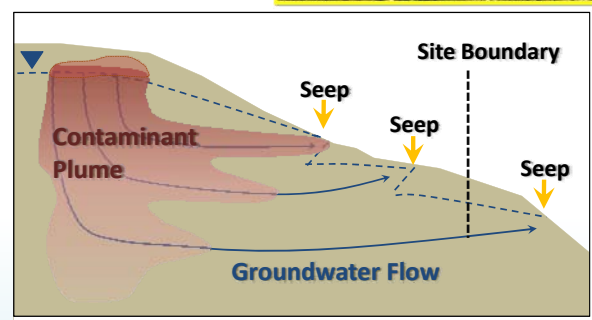
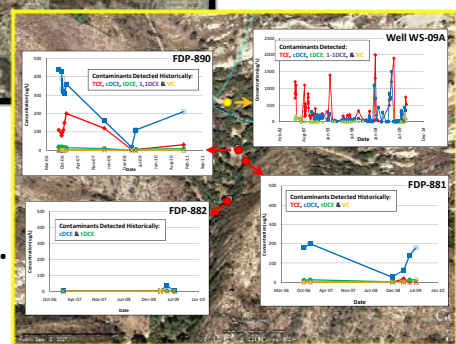
The distribution of atmospheric tritium contributes to understanding groundwater flow and the behavior of all types of dissolved contaminants in the Chatsworth Formation bedrock.

Seeps Investigations

Seeps on the mountain slopes are being investigated to determine nature of recharge water and where SSFL contaminants could emerge.



Contaminants have been found at 3 seeps in southwest drainage.



Contaminants were found at on-site seeps, but not at off-site seeps.

WHY?

- Because;
- Seep not on plume flow line
 - On plume flow line but not arrived
- Contaminants are actually at the seep but;
- Loss due to surface volatilization at seep
 - Trapped in the mud around the seep



Shaw Back-Pack Core Drill
Shallowest Drilling ~20 ft

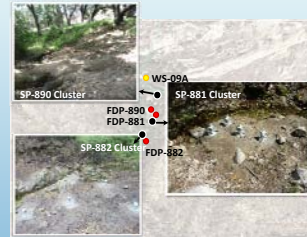
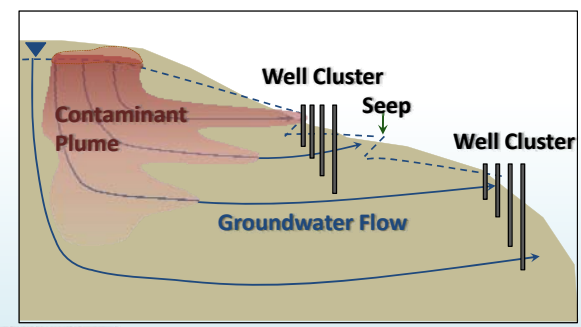


Winkie Drill
Deeper Drilling ~50 ft

Portable drilling equipment will be used to install monitoring wells at isolated seep locations.

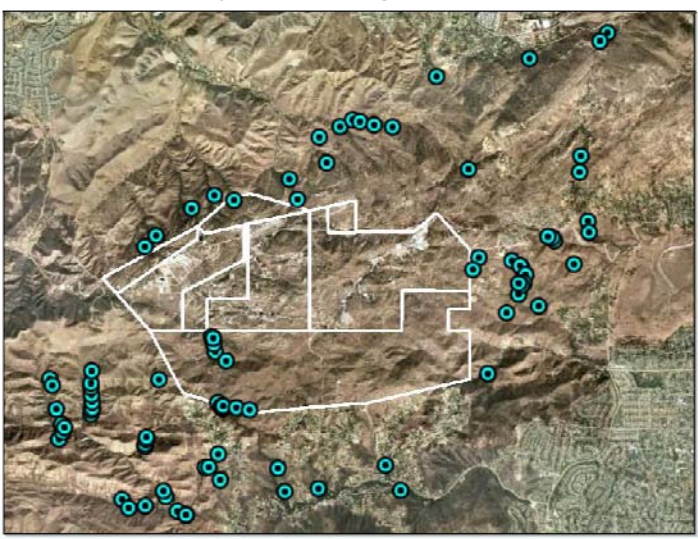


The Shaw Back-Pack Core Drill was used in May 2011 to core to a maximum depth of 20 feet.



Three monitoring well clusters consisting of four wells each were installed in May at on-site seeps in southwest.

Seeps are typically a mixture of groundwater from different travel paths and age.



154 seeps have been identified along the mountain slopes, 90 have been sampled.



Groundwater samples are collected in bottles from seeps at points of discharge.