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First SNL/NM Tritium TPD Results and a Request for Help/Advice

PRESENTED BY

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Introduction to Temperature Programmed Desorption (TPD) aka Thermal Desorption Spectroscopy (TDS)

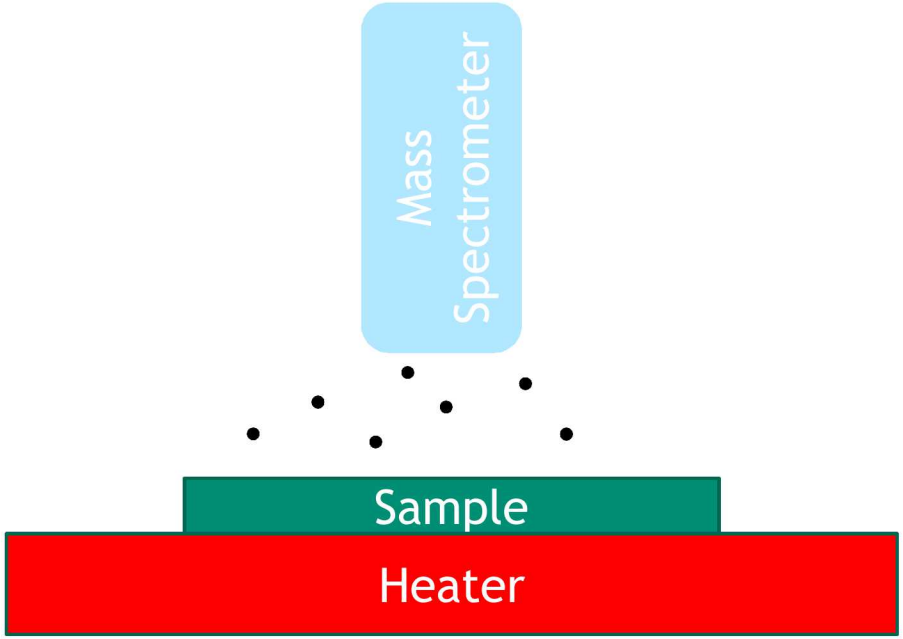
Linear temperature ramp, 0.5 C/s to 10 C/s are typical ranges

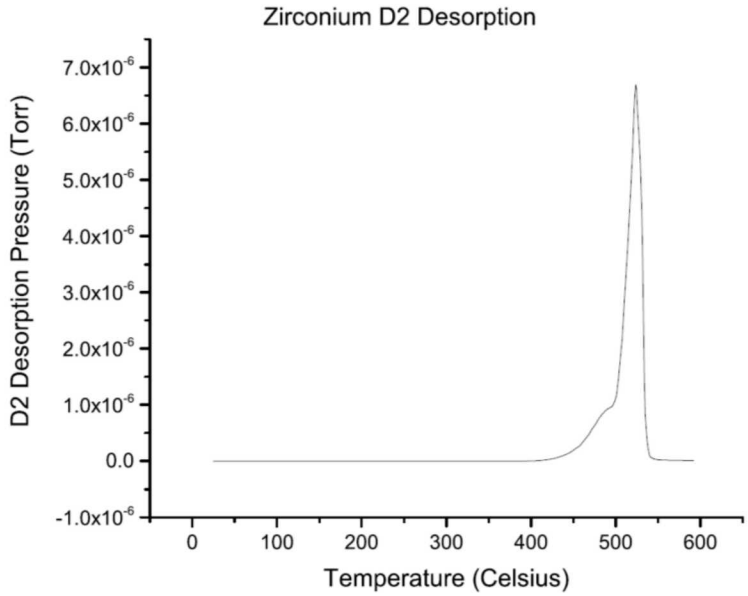
Detector either Time-of-Flight or quadrupole mass spectrometer.

Ours is optimized with a 1-6 AMU quadrupole

Also has TOF

Other analytical tools, can also do electron and ion stimulated desorption





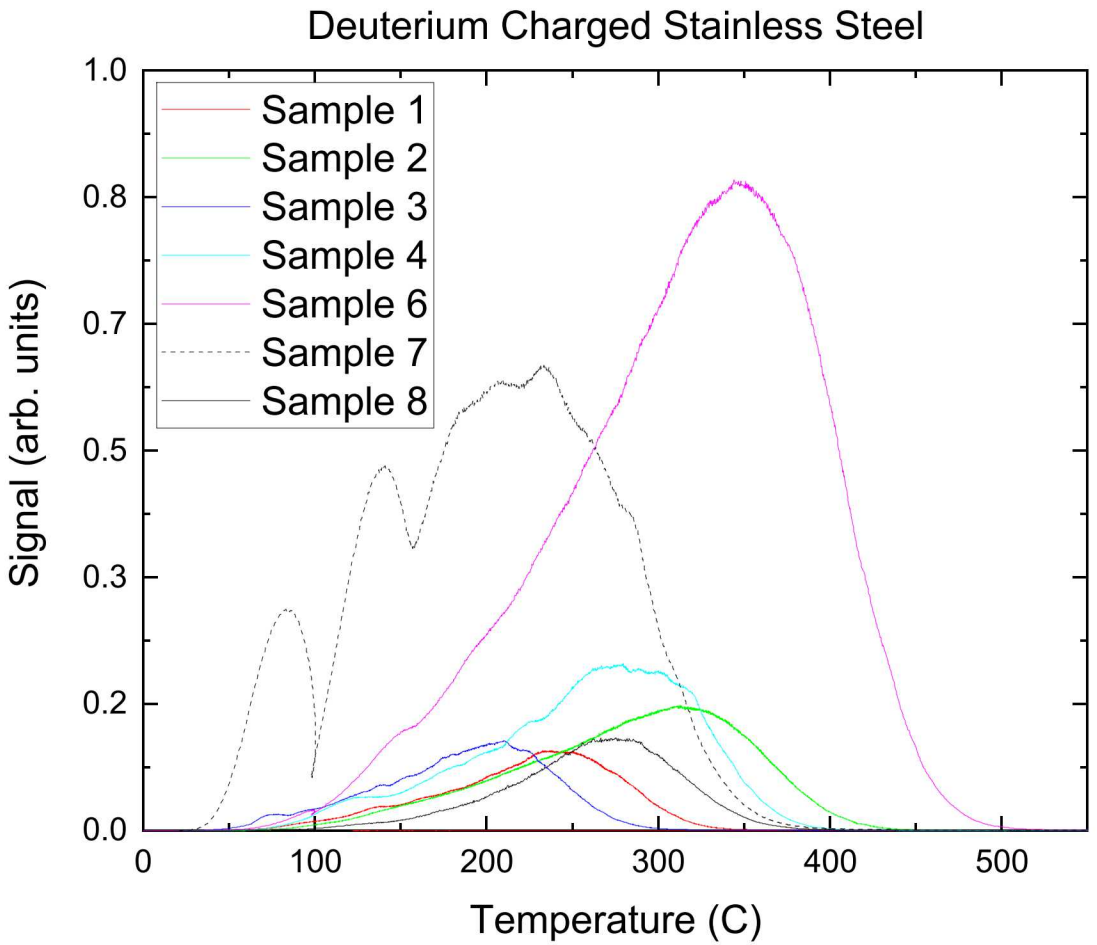
Test Samples of Deuterium Charged Stainless Steel from SNL/CA

Not all samples are identical

Two groups, a thin and a thick

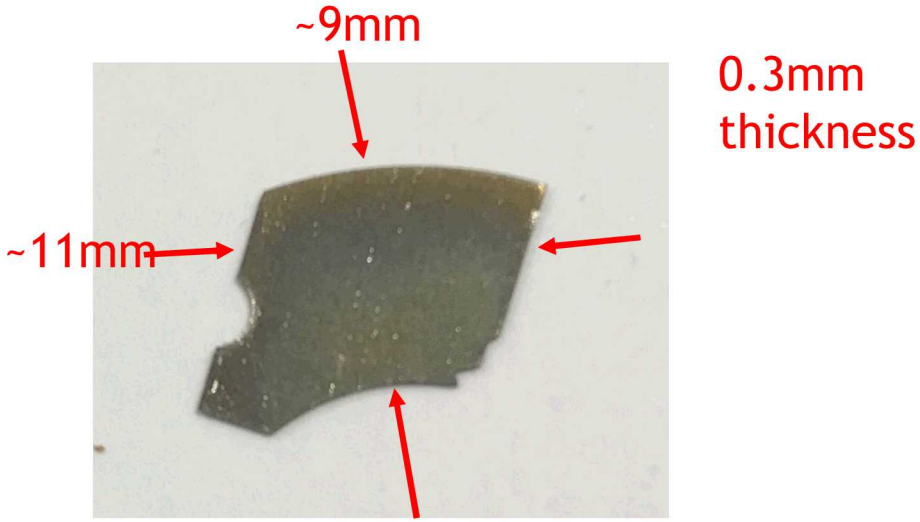
Thin =

Thick =



First Tritiated Sample Studied is from SRNL and Dale Hitchcock

- Sample is a leftover piece cut from a broken C-shaped fracture toughness specimen
- Original cuts were made to prepare samples for small angle neutron scattering (SANS) at ORNL.
- The activity of the sample is <0.2 Ci
  - Assuming a loading of 1600appm
  - Not accounting for decay or and loss
- Sample is a “slice” so both faces have been cut using EDM
  - This ensures they are parallel



Data from SRNL Tritium Charged Sample

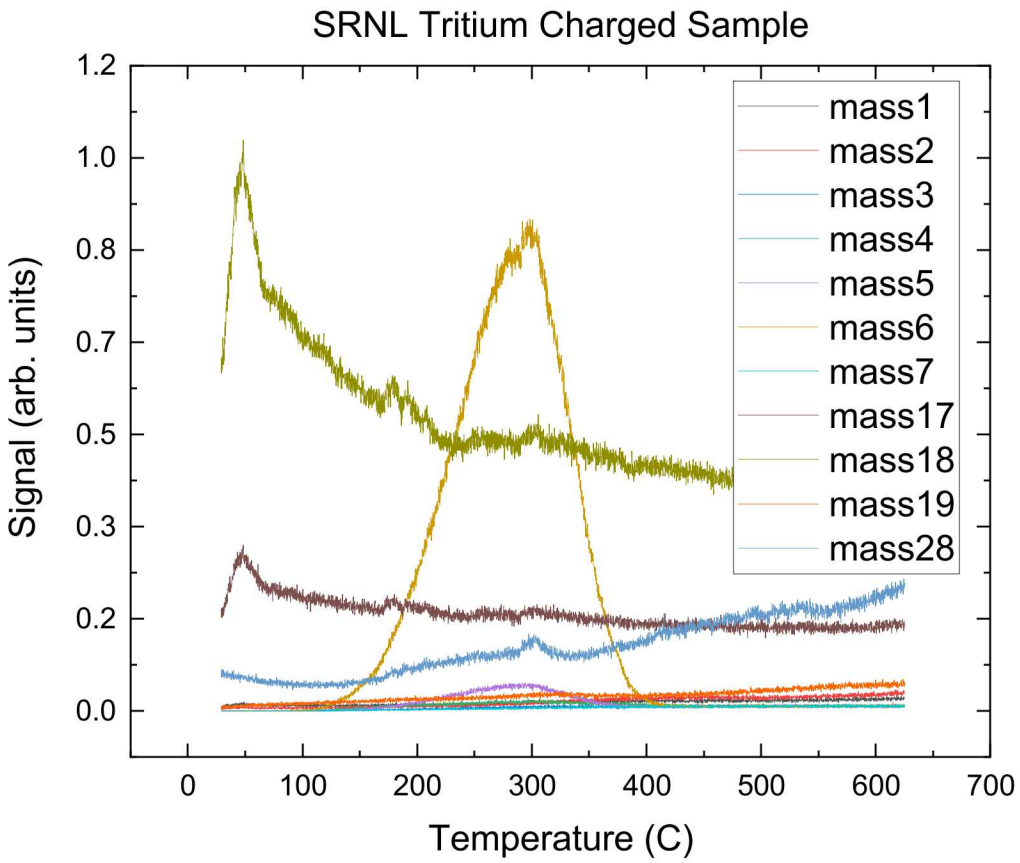
Clear signature for mass 6

May need to clean up the vacuum more since water (mass 18) is very strong

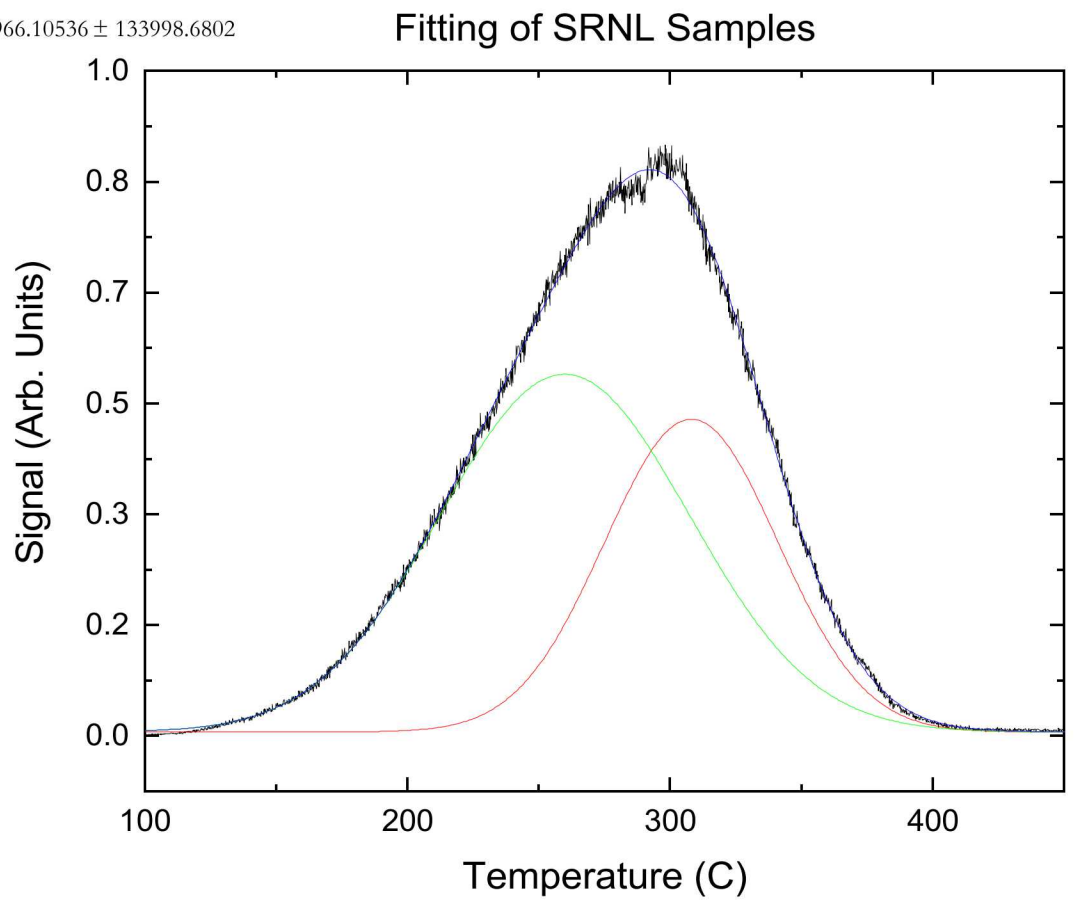
System had a glitch so stopped at 625 C.

Do not see much Helium-3.

Need to be careful saying Mass 3 = Helium-3 since can get fractionation from tritium and this mass 3 peak coincides right with mass=6 peak.



Model	Gauss	
Equation	y=y0 + (A/(w*sqrt(pi/2)))*exp(-2*((x-xc)/w)^2)	
Plot	Peak1(mass6)	Peak2(mass6)
y0	355.16374 ± 12.25785	355.16374 ± 12.25785
xc	308.0707 ± 0.2836	259.90097 ± 1.50749
w	66.06252 ± 0.71229	94.82238 ± 1.02349
A	2336587.35765 ± 131262.67005	3835966.10536 ± 133998.6802
Reduced Chi-Sqr	270067.46683	
R-Square (COD)	0.99898	
Adj. R-Square	0.99898	



A Request for Help and Advice: Overview of incident

Recent routine surveys found an increase in room contamination

Analysis determined several leaks in a manifold constructed from multiple KF fittings

Previous work had broken into a different section of this piping with minimal outgassing of tritium

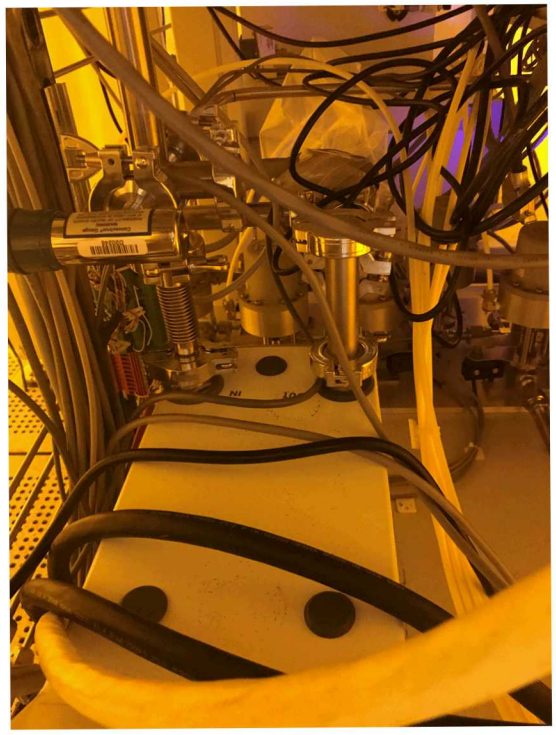
During work room alarms reached ~280 microCuries/cubic Liters

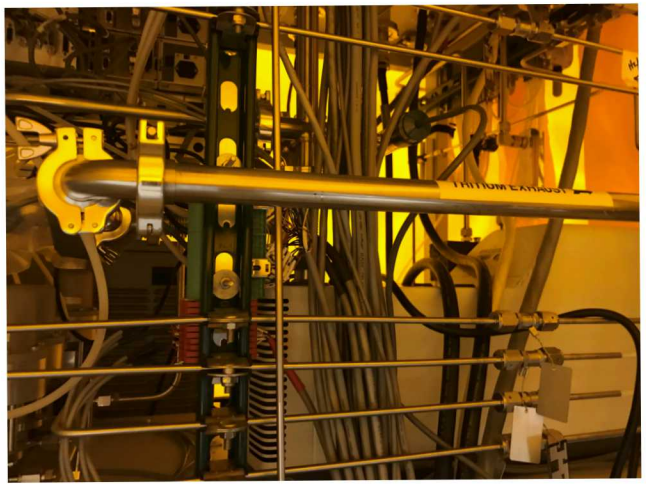
Local monitor reached ….

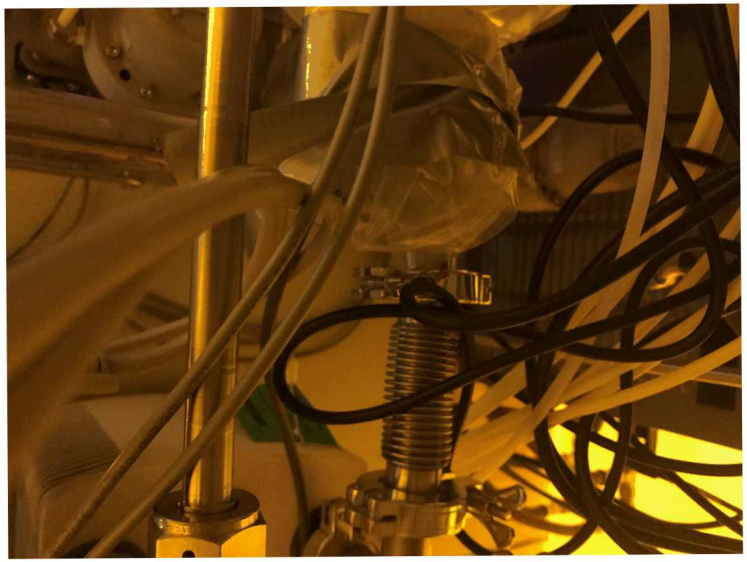
Put work in a safe state and exited the room

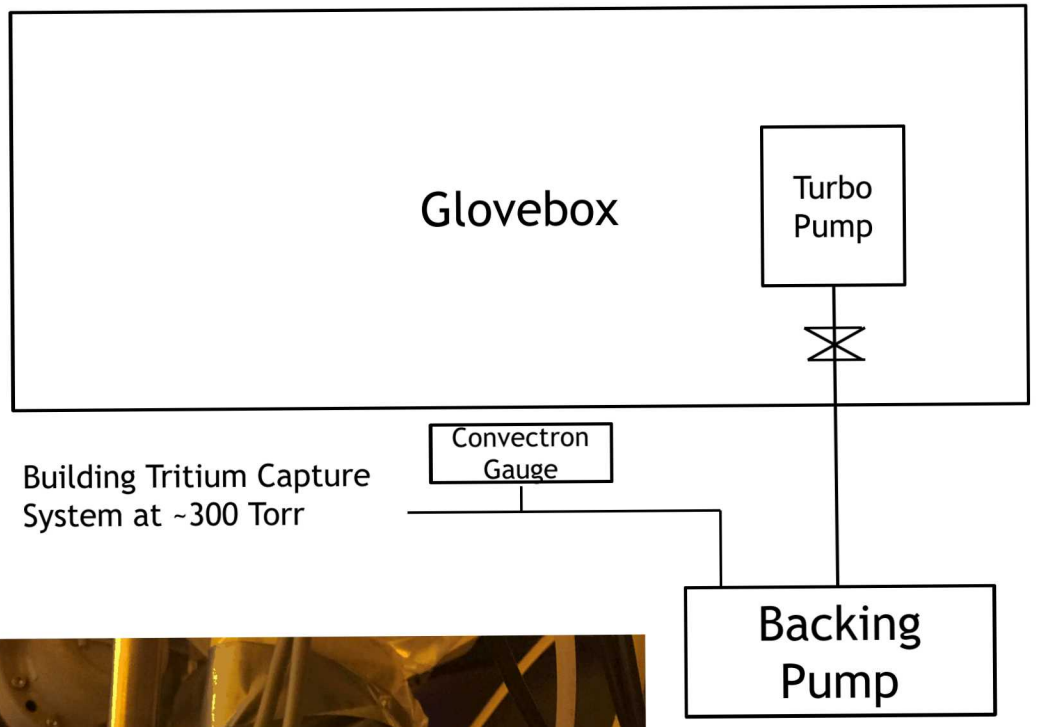
Bioassay afterwards found that one worker was exposed to 5 mRem

Schematic and pictures of the System









My Questions and Solicitation of Advice

I still need to do the repairs.

Are there any procedures that I can use to minimize tritium release to room?

- "Burp" the system?
- Purge the system with Nitrogen/Argon?
- Wrap heat tape and outgas the lines?
- ????

Are there any engineering controls that I can use to minimize tritium release to room?

- "Elephant trunk" to pull local air into building exhaust?
- Wrap in plastic?
- ????

Thank you for your help.