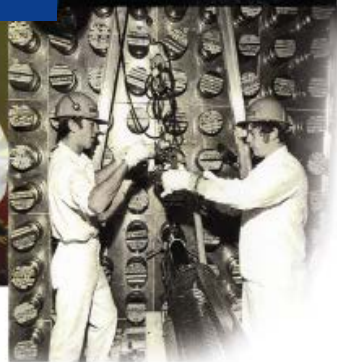


Source Term Monitoring at CANDU stations

GENERATING SUCCESS --- FOR 100 YEARS



By Y. Verzilov

ISOE International Symposium
Rio de Janeiro, Brazil • May 26-28, 2015

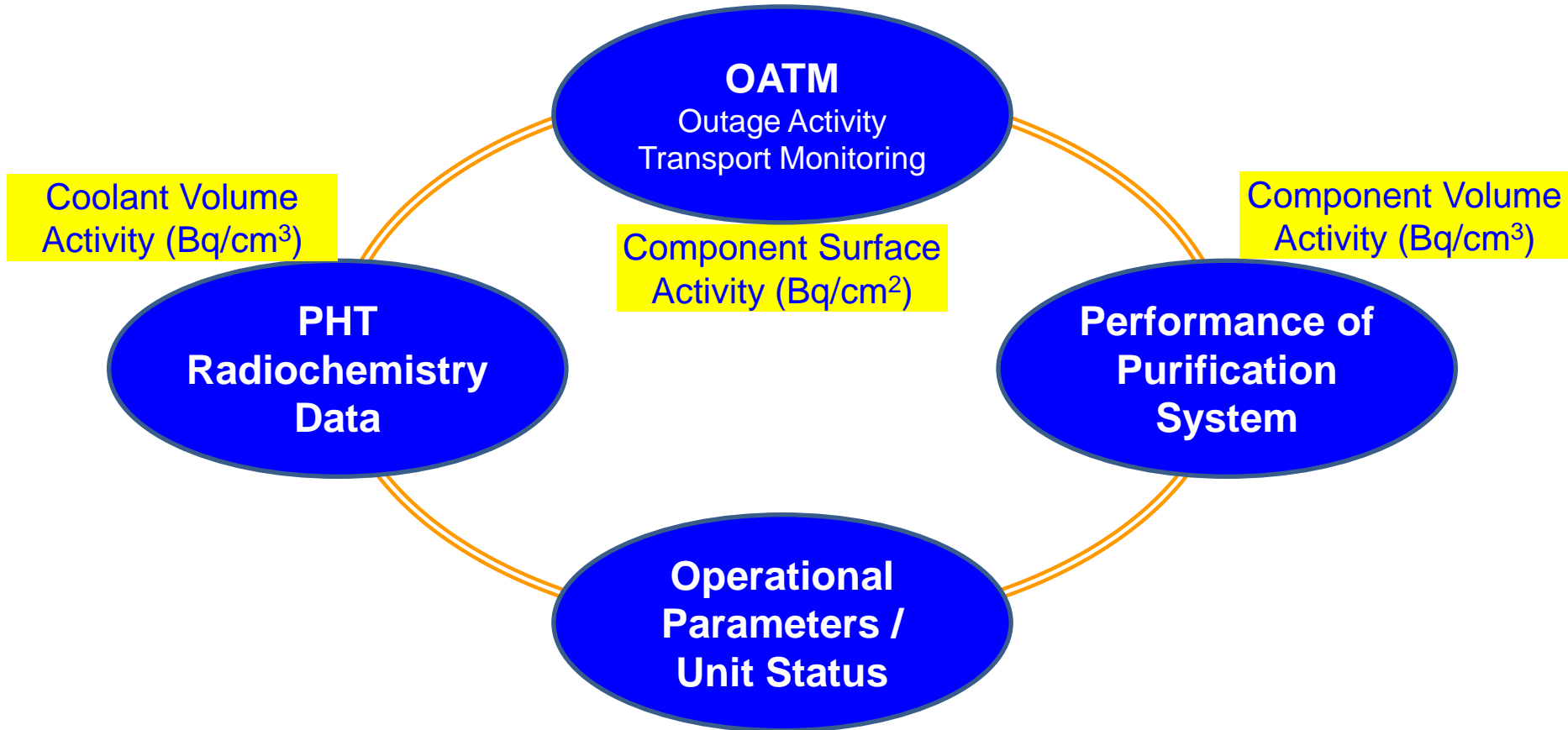


Discussion Points

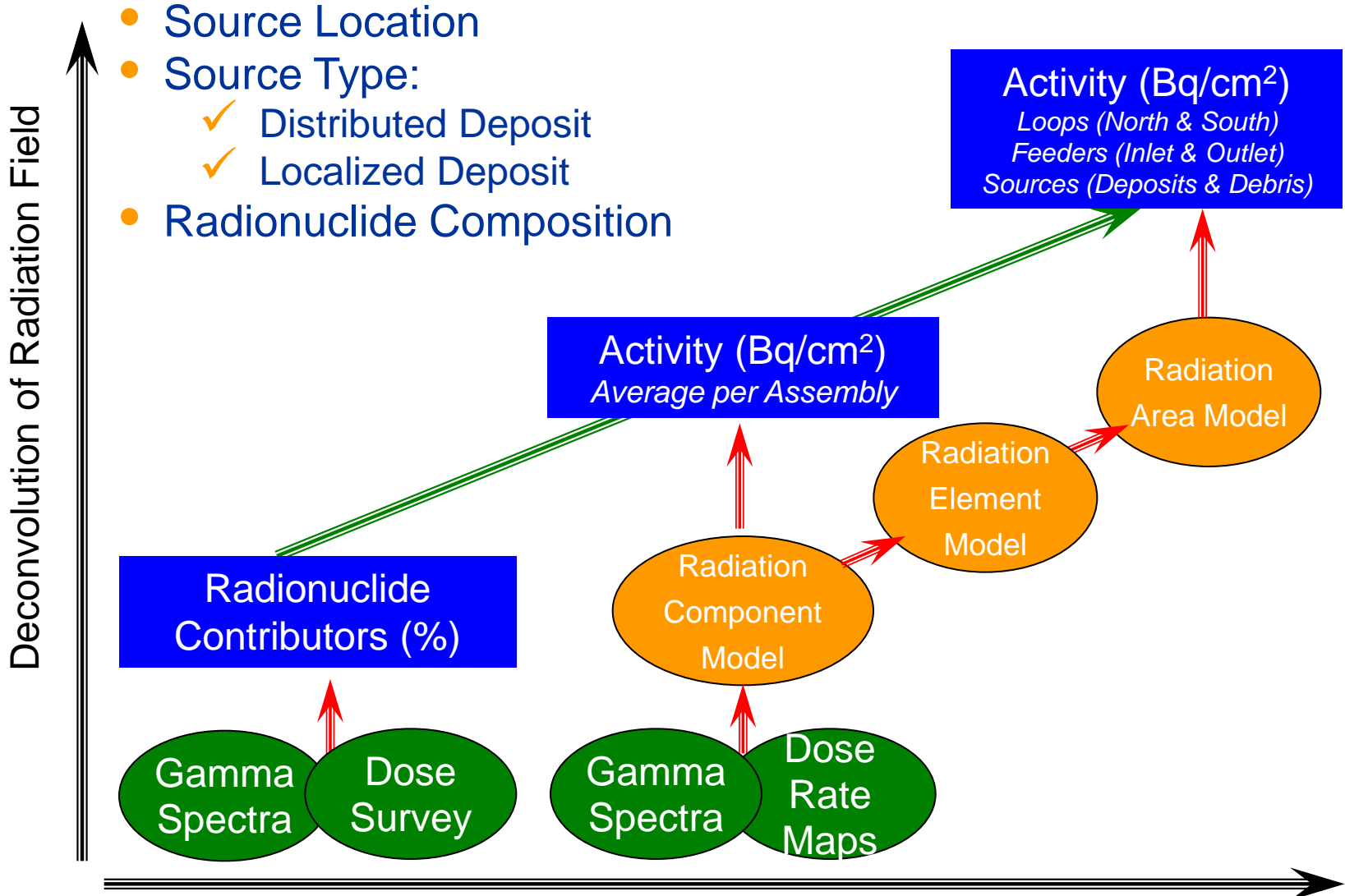


- I Methodology
- II **O**utage **A**ctivity **T**ransport **M**onitoring **S**urvey (OATM)
- III OATM Data and Trend Analysis
- IV Surface Deposited Activity vs PHT Coolant Activity
- V Performance of Purification System
- VI Data Integration

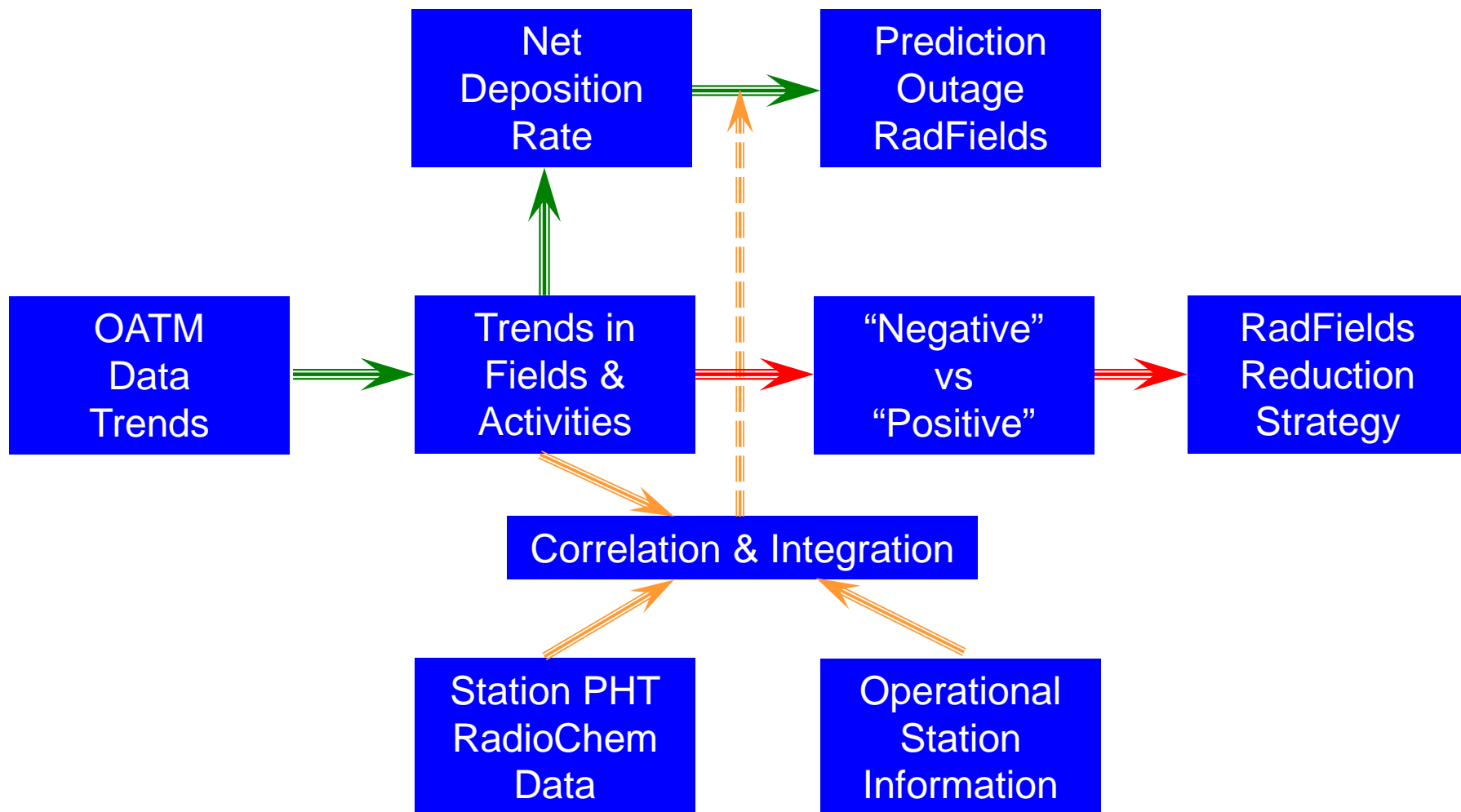
Source Term Monitoring



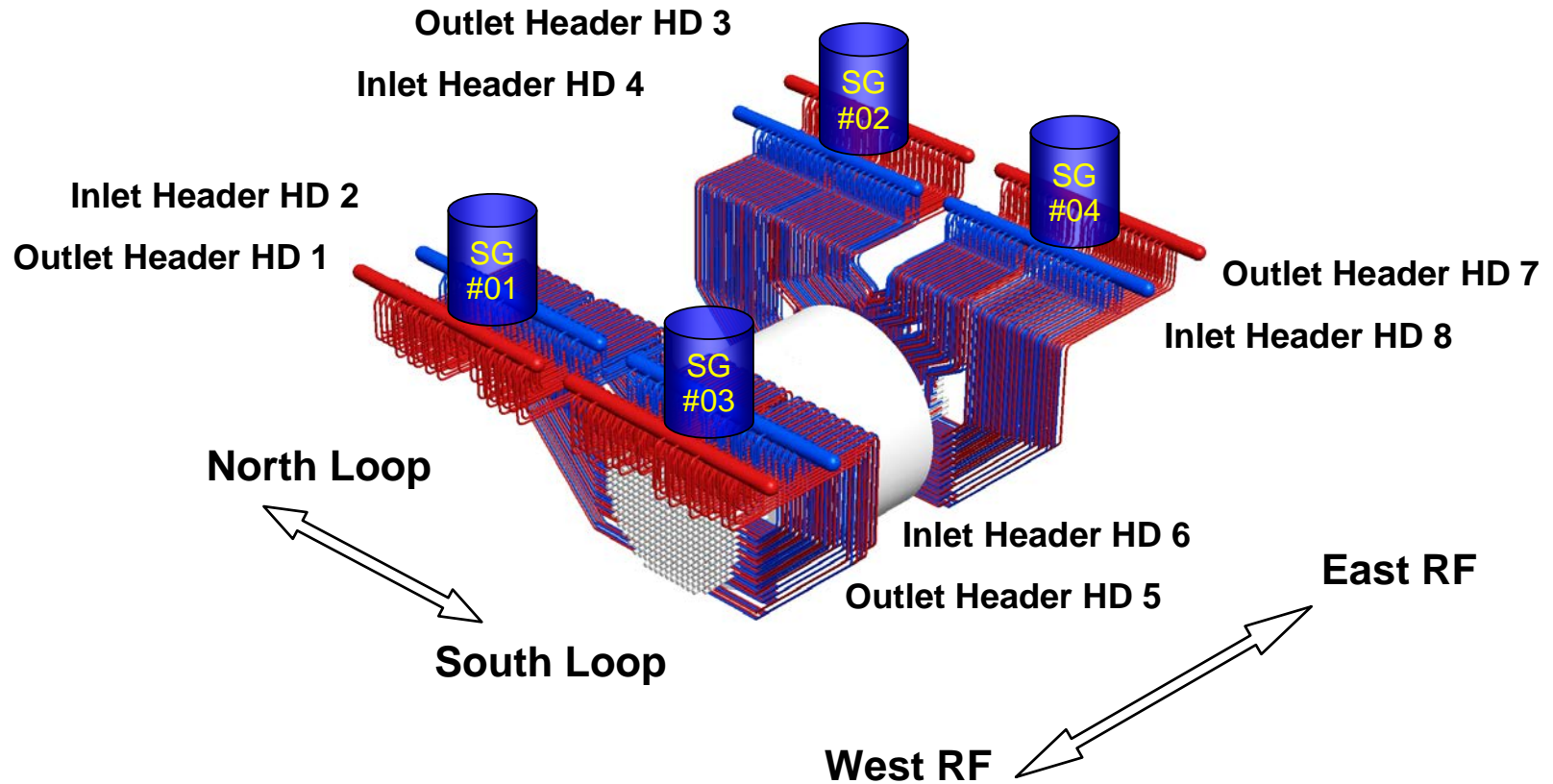
Evolution of OATM Survey Methodology



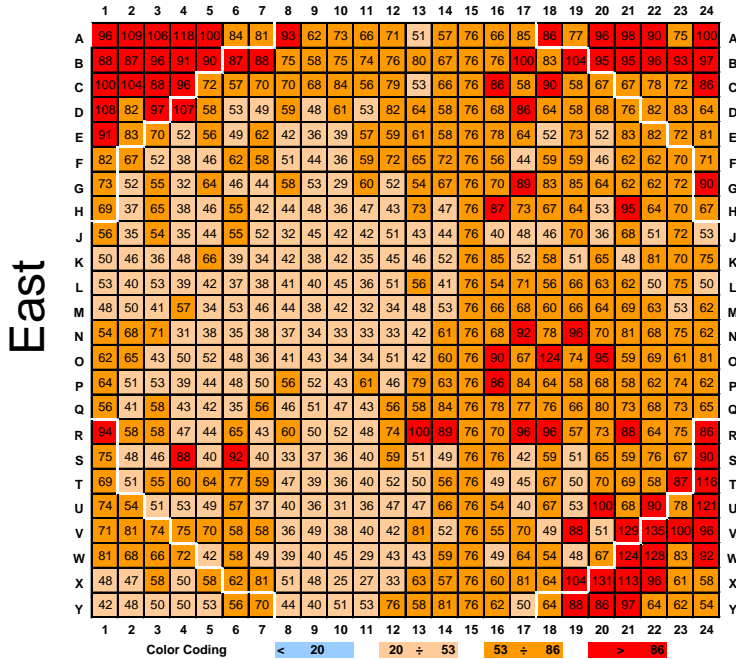
Data Integration & Interpretation



CANDU Reactor Unit

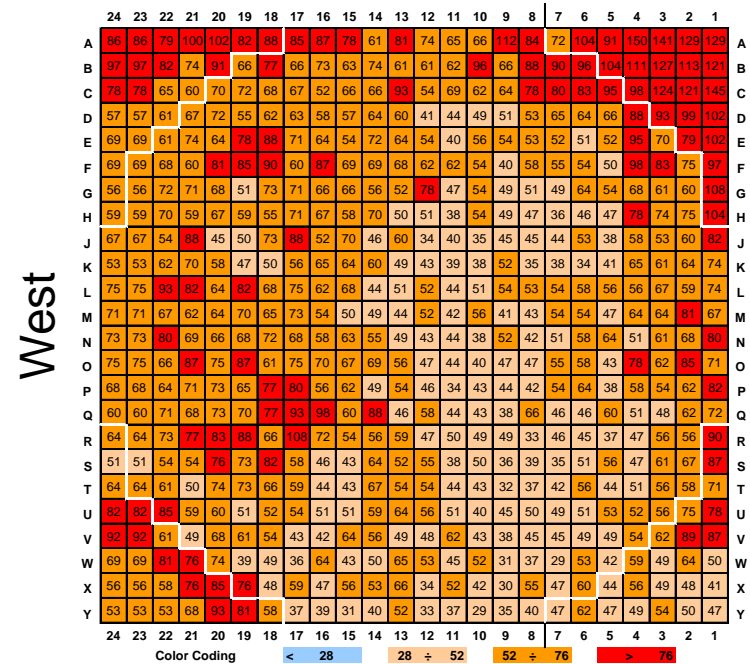


Reactor Face Radiation Fields



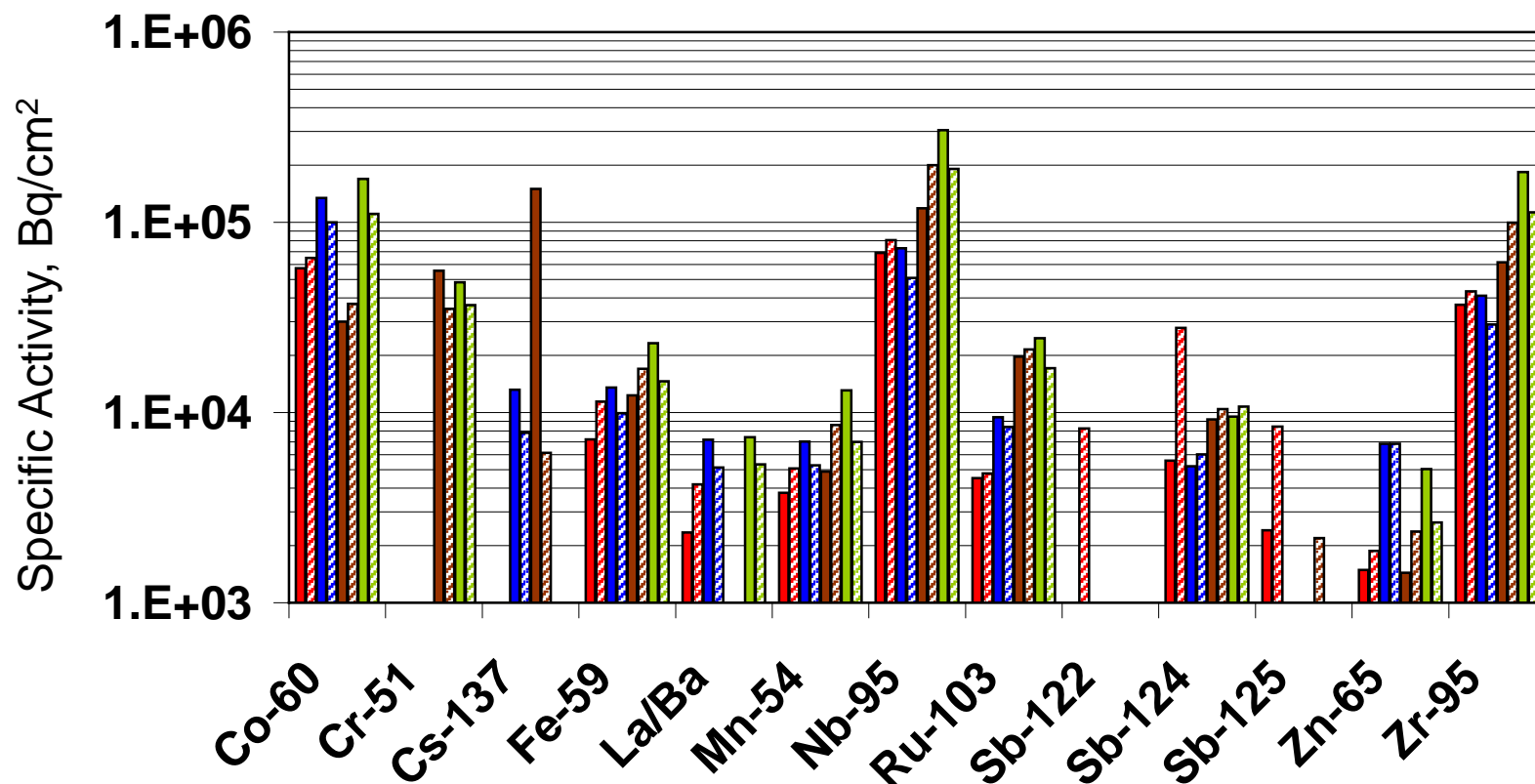
Pale Blue
Tan
Orange
Red

$r_i < R-3\sigma$
 $R-3\sigma \leq r_i \leq R$
 $R < r_i \leq R+3\sigma$
 $r_i > R+3\sigma$



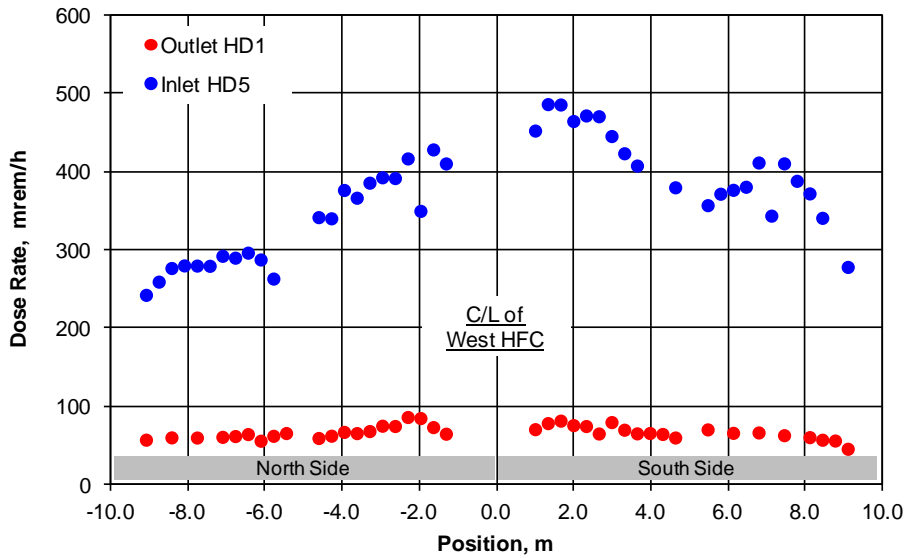
Face/Loop	North, N	South, S	N/S
West, W	66 ±13	59 ±22	1.12
East, E	71 ±17	55 ±18	1.29
Ratio W/E	0.93	1.07	

Main Outage Radionuclide Contributors



East Face - solid color; West Face - pattern

Radiation Field in the Feeder Cabinets



West Horizontal Feeder Cabinet

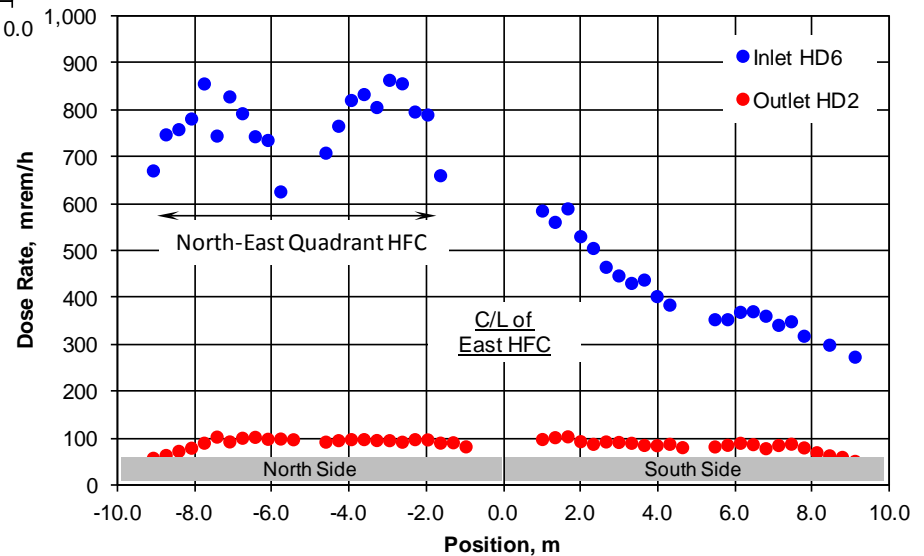
Observations in HFC - Consistent with RV!

Significant Asymmetry in Distributions –

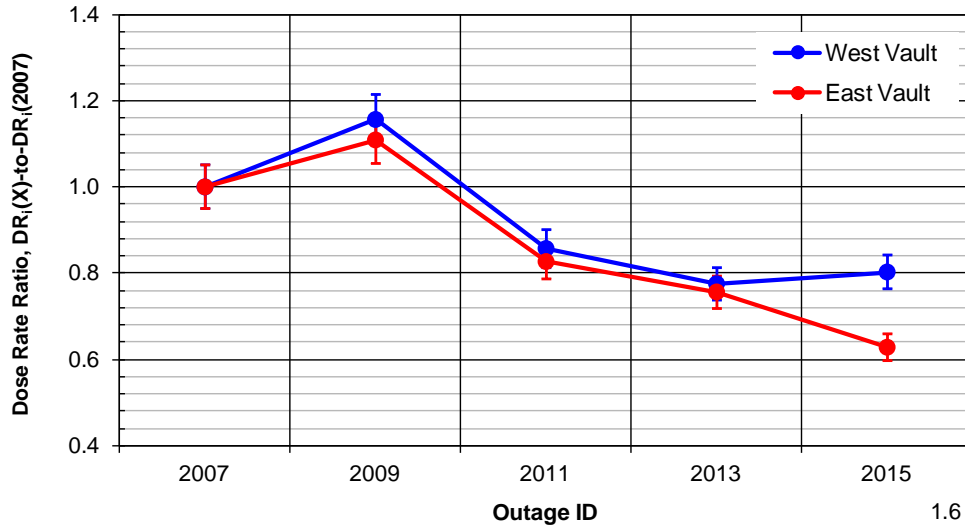
East Side - Elevated Level_ North-East;

West Side - Elevated Level _South-West

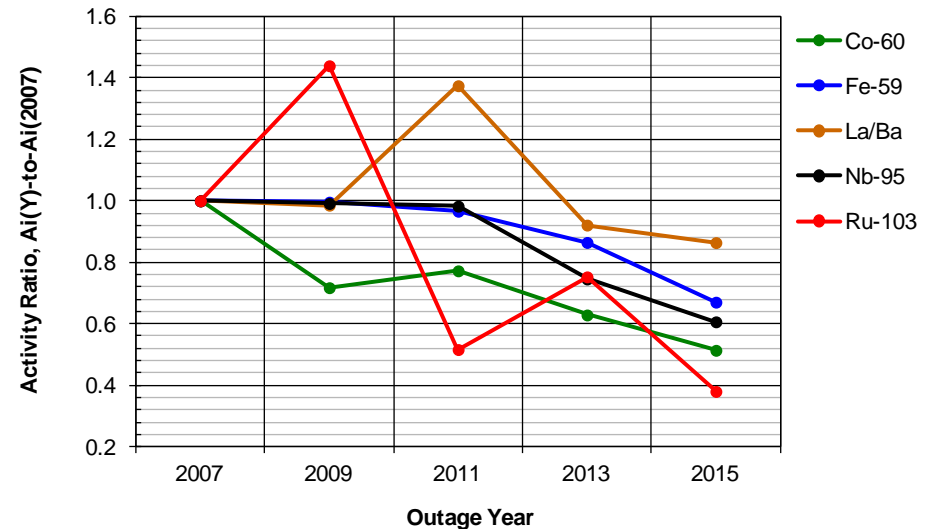
East Horizontal Feeder Cabinet



Trends in Radiation Fields on RF

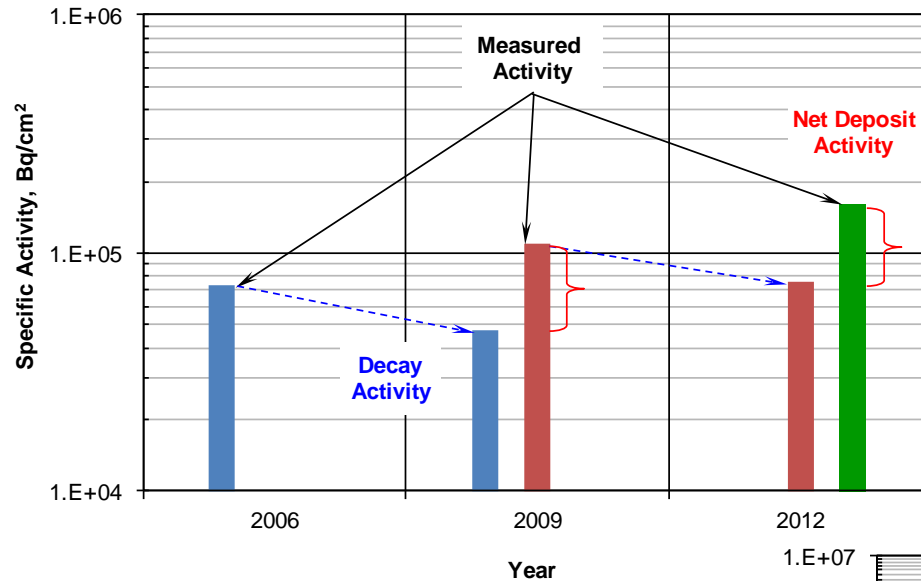


Radiation fields were measured at a distance of 6.2 m from the reactor face.
Data corrected to 10 days after shutdown.



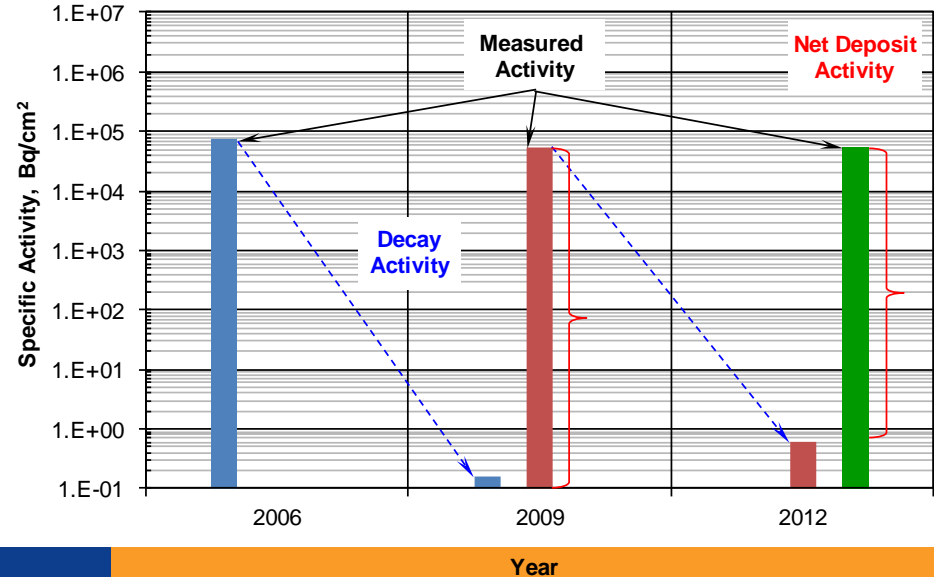
Activity Data corrected to 10 days after shutdown

Net Deposition Rate_Reactor Face



Long-lived
Radionuclide, Co-60
Long Term

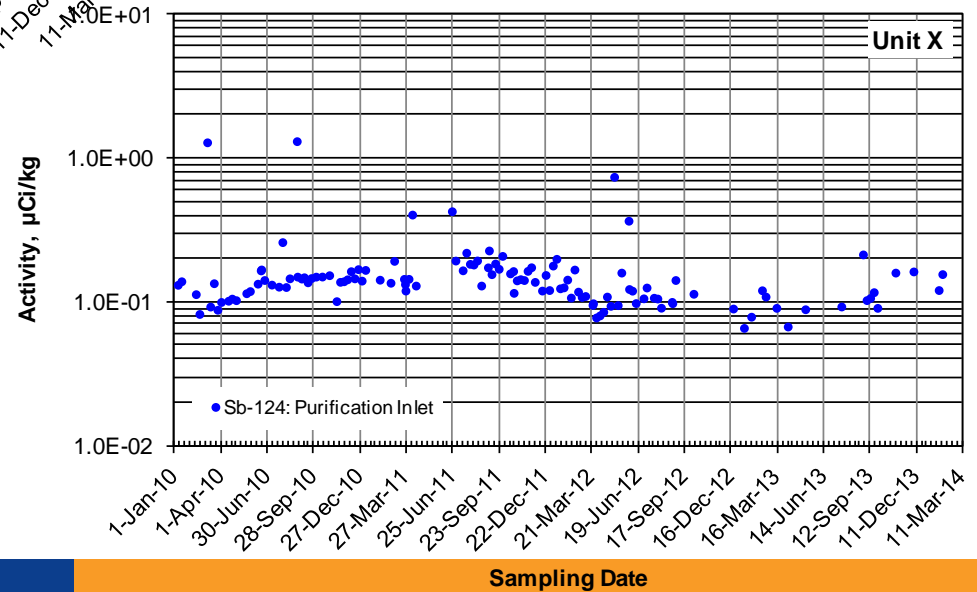
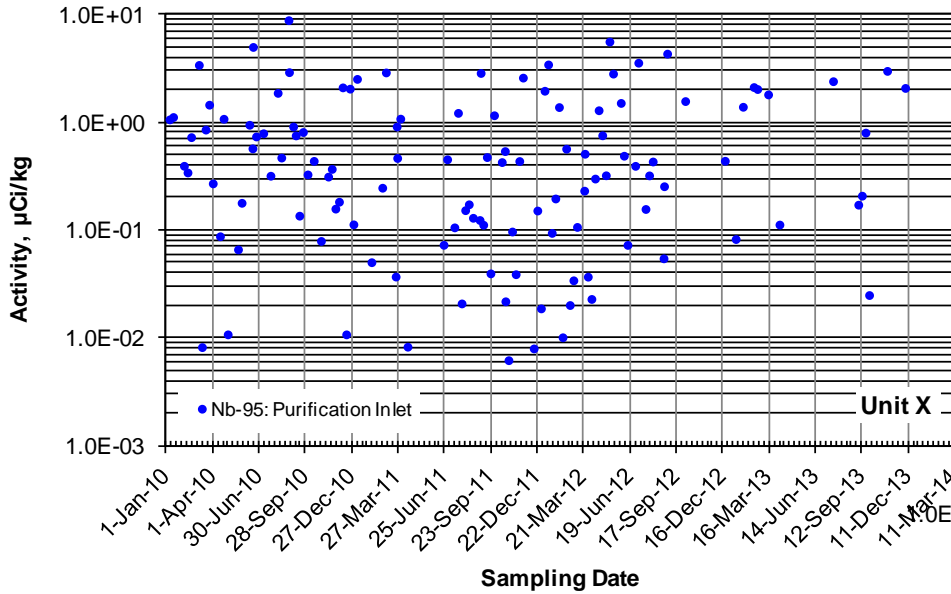
Short-lived
Radionuclide, Nb-95
Short Term (6 months before SD)



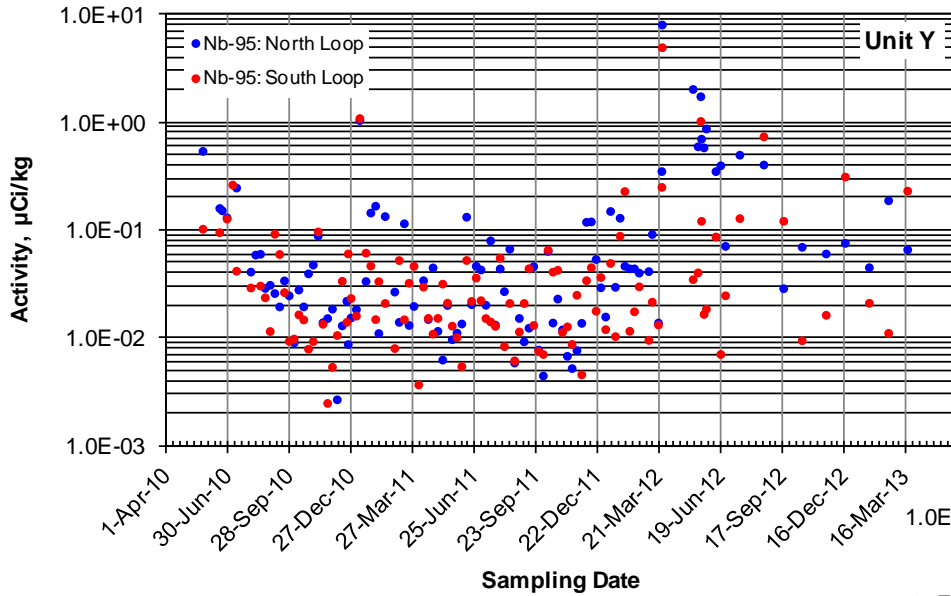
Radiochemistry Data_Unit X



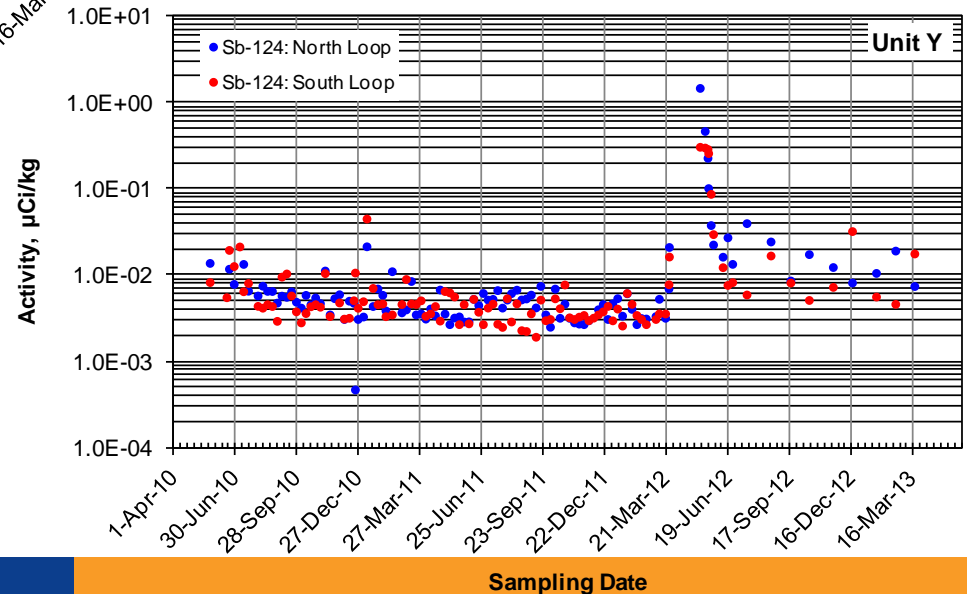
Station 1 Unit X



Radiochemistry Data_Unit Y



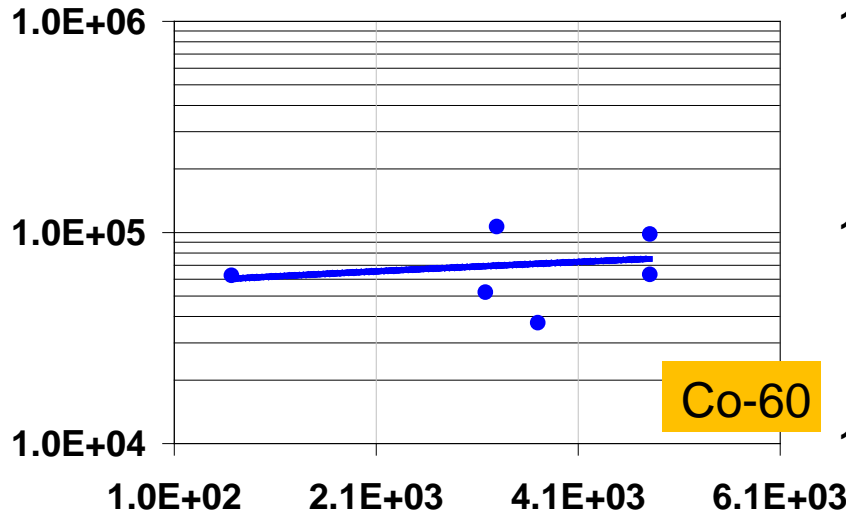
Station 2 Unit Y



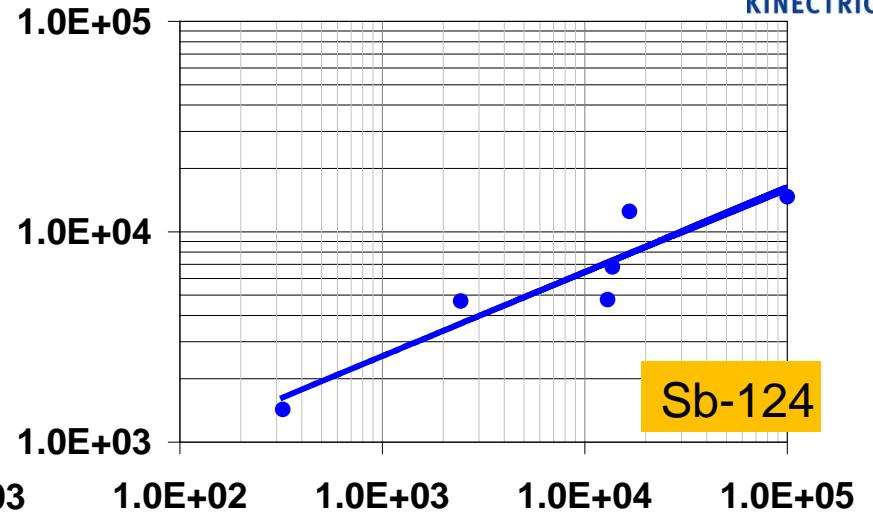
Surface Activity – vs - PHT Activity



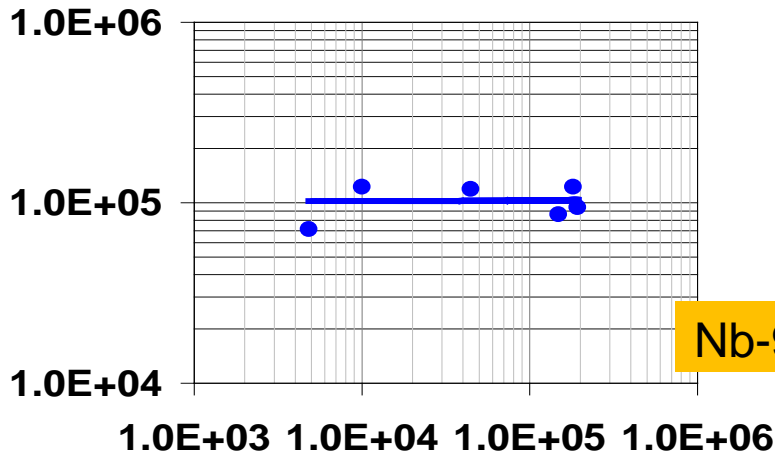
Surface Activity, Bq/cm²



Co-60



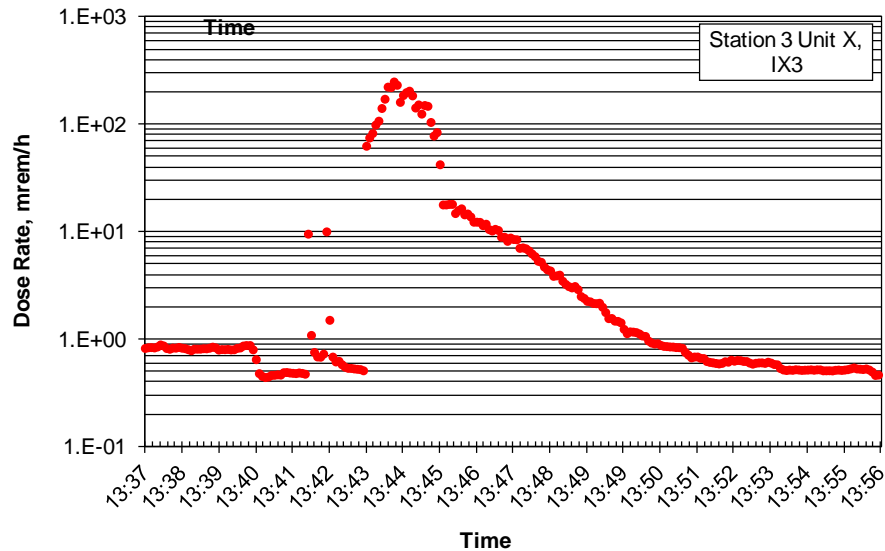
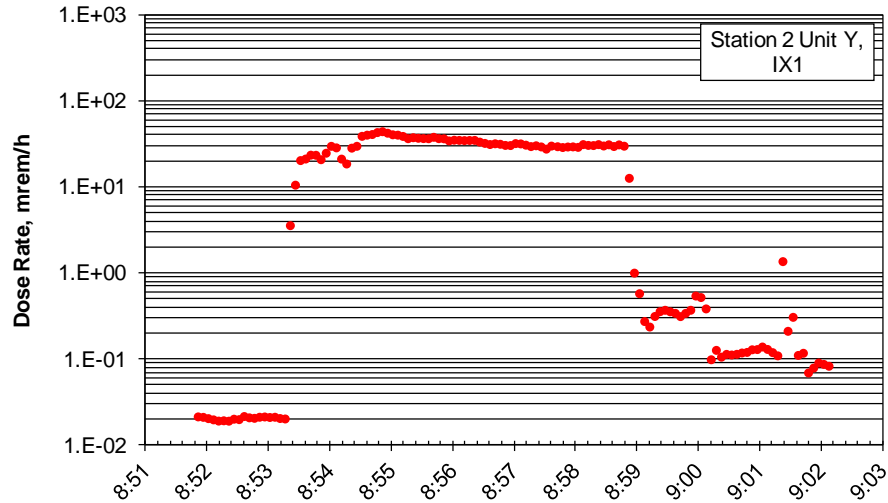
Sb-124



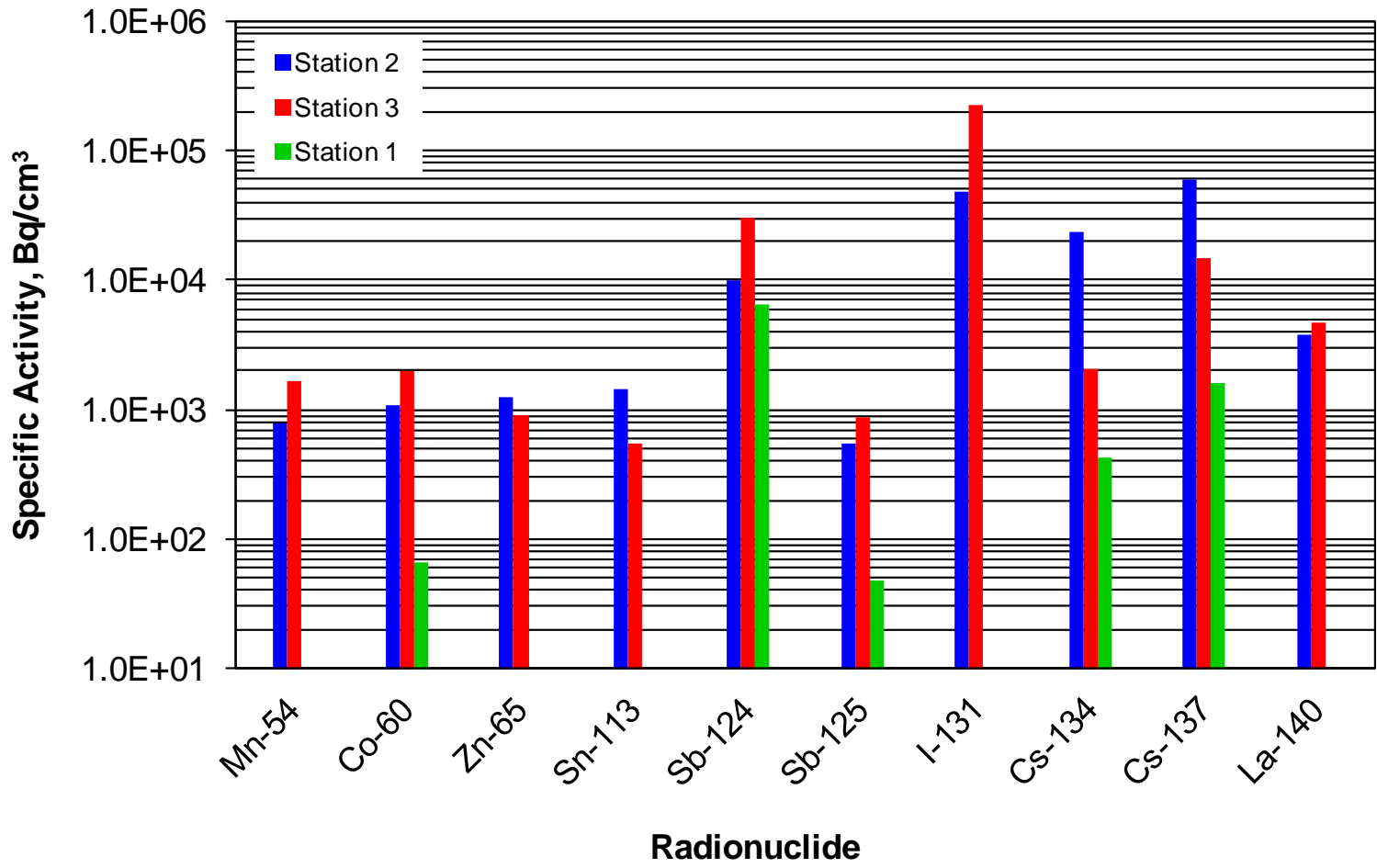
Nb-95

PHT activity, Bq/kg

Survey During Spent Resin Transfer



Radionuclides in Spent Resin



Future Objectives



- ❑ Develop an Understanding of Current Situation at the Station of how Operational Parameters such as Bleed Flow Rates, pH, MF&IX Performance and MF&IX Service Schedule Impact on the Outage Radiation Fields
 - ❑ Investigate the Effect of the Bleed Flow Rate on the Outage Radiation Fields
 - ❑ Analyze the Effect of Mechanical Filter Parameters based on the Actual Station Data
 - ❑ Analyze the Effect of Small Variations in pH Value
 - ❑ Develop the Radiation Trends for the various Reactor Components