

Zion Nuclear Power Station Lessons Learned Decommissioning Surveys and Experiences

John Clements, CHP

Rhex Edwards, Bill Lin, John Hickman,

Bruce Watson, CHP

U.S. Nuclear Regulatory Commission



Zion Nuclear Power Station Units 1&2



Site History



- The Zion Nuclear Power Station (ZNPS) consists of two (Units 1 and 2) Pressurized Water Reactors (PWR).
- 1998 - was permanently shut down on February 13, 1998
- 2000 - license was transferred from ComEd to Exelon Nuclear Generation, LLC (Exelon)

Site History



- 2008 - Exelon and ZionSolutions, LLC submitted an Application for License Transfers and Conforming Administrative License Amendments
- 2010 - the licenses were transferred from Exelon to ZionSolutions.
- 2014 – License Termination Plan submitted to NRC

Characterization

- Initial characterization performed in soils and concrete (buildings) mostly measuring easy-to-detect gamma emitters
 - Limited number of hard-to-detect laboratory measurements (looking for radionuclides such as H-3, C-14, Tc-99, Ni-63, Sr-90, and alpha emitters) taken during characterization at highest gamma locations
- Challenges:
 - Understanding the extent of contamination
 - Environmental transport phenomena may differ for easy-to-detect and hard-to-detect radionuclides
 - Development of surrogate ratios

Characterization

- Solutions :
 - Licensee agreed to perform “continuing characterization” of hard-to-detect radionuclides during decommissioning
 - Licensee committed to a re-evaluation of assumed surrogate ratios based on findings during continuing characterization
- Lessons Learned:
 - Characterization is extremely important
 - Important to fully evaluate all radionuclides of concern during characterization efforts
 - Environmental transport phenomena may affect sampling strategies

Total Activity Approach

- Licensee first proposed to utilize a total activity approach for compliance by assessing the total activity remaining in demolished reactor basements for compliance calculations
- Approach differed from MARSSIM concentration based Derived Concentration Guideline Level (DCGL) approach
- As proposed, total activity could be shifted between different areas, and all doses would be added together at the end (e.g., basement walls/floor, fill, piping, groundwater, soil)

Total Activity Approach

- Challenges in the total activity approach:
 - Difficult to inspect and perform confirmatory surveys (no set action level to use; a “moving target”)
 - Not clear how areas of elevated contamination (hot spots) are considered using this approach
- Solution: Licensee developed a concentration based DCGL
- Lessons Learned: Inspectable and consistent cleanup goals are important

In-Situ Gamma Surveys

- Licensee proposed plans to utilize *in-situ* gamma spectroscopy to effectively replace scanning per MARSSIM
- Challenges:
 - In-situ methods average results over the entire field of view
 - Elevated areas of contamination may be missed if they are averaged
 - When using in-situ methods to meet a percent coverage requirement, overlap of circular fields of view may be required

In-Situ Gamma Surveys

- Solutions:
 - Licensee committed to preliminary scan surveys using traditional methods
 - Licensee committed to investigate when a lower “operational DCGL” was encountered
 - Overlap of fields of view was implemented
- Lessons Learned:
 - Inspectable and consistent cleanup goals are important to the regulator
 - When using *in-situ* methods to meet a percent coverage requirement, overlap of circular fields of view may be required

Conclusions

- Characterization
 - Consideration of all radionuclides of concern
 - Consideration of different environmental transport phenomena
- Novel approaches are not discouraged
 - May take longer time to review
 - Ongoing communication between the licensee and the regulator is key
 - Consider the “inspectability” from the regulator’s point of view

Conclusions



Conclusions



Speaker Contact Information



John Clements, CHP
john.clements@nrc.gov
301-415-5878