Independent Verification of MARSSIM Final Status Surveys

EPRI Decommissioning Topical Workshop
License Termination and Final Site Release

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Introduction

- Outline
  - Verification process
  - In-process decommissioning inspections
  - Review of documentation (using NRC's SRP) and some examples of deficiencies
  - Program experiences verifying MARSSIM final status surveys

First things first…

- Independent Verification Contractor (IVC) does NOT perform another MARSSIM FSS
- The IVC is NOT the regulator, and only makes recommendations to the regulator
- The verification survey is NOT a replacement or supplement to the final status survey – rather, it validates the FSS

Goals of Verification

- Independent evaluation of final site conditions and validation of final survey procedures, results and documentation
- Increases probability of complete remediation and documentation - greatly enhances public credibility since it’s a second look at the D&D process

Verification…Big Picture

- Document reviews (most important)
- Confirmatory analyses of samples
- Independent verification field surveys
- In-process decommissioning inspections of MARSSIM final status surveys

In-Process Decommissioning Inspection Plan

- Major program elements:
  - General
  - Identification of contaminants and DCGLs
  - FSS procedures and instrumentation
  - Analytical procedures for soil samples
  - Miscellaneous inspection activities
  - Instrument comparison activities and independent field surveys

In-Process Decommissioning Inspections…streamlining verification

- Shortcomings w/ “back-end” verification
  - For contractor with good track record, 1 to 10% verification was too many measurements
  - If significant problems identified with FSS, rather late in D&D process to resolve issues
- In-Process Decommissioning Inspections: “the DQO Process applied to conventional verification process”

Document Reviews: Final Status Survey Procedures

- Instrument selection and survey techniques
  - Identify survey instruments and equipment
  - Discuss calibration procedures and MDCs
  - Discuss operating procedures for instruments
- Survey procedures
  - Statistical sample size determination
  - Scan MDC and $DCGL_{EMC}$
  - Field and laboratory techniques (backgrounds)

Document Reviews: Interpretation of Survey Results

- Techniques for reducing/evaluating data
  - Review DQOs
  - Conduct preliminary data review—basic statistical quantities, posting plots, histograms
- Statistical evaluation
  - Apply the statistical tests (WRS or Sign)
  - Elevated measurement comparison
  - Evaluate the survey results

NRC's Standard Review Plan and Independent Verification

- Expect the NRC's SRP to form the basis of NRC in-process inspections of final status surveys, particularly Section 14.0 on Facility Radiation Surveys

SRP Document Reviews of MARSSIM FSS

- Ensures the following are provided:
  - preliminary survey considerations
  - survey design parameters
  - field measurement methods and instrumentation
  - sampling and analysis plans
  - survey results presentation and interpretation

SRP Document Reviews of MARSSIM FSS (cont.)

- 14.1 Release Criteria
  - Table or list with $DCGL_W$ for each radionuclide
  - Area factor table for determining $DCGL_{EMC}$
  - When multiple radionuclides are present, site-specific application of DCGLs (gross activity DCGLs, unity rule, use of surrogates)

SRP Document Reviews of MARSSIM FSS (cont.)

- 14.2 Characterization Surveys - verifies that the licensee has determined radiological status of property to permit planning for remediation, ES&H, and FSS:
  - measurements of impacted media
  - field and laboratory instruments and use
  - tables or charts of concentrations
  - maps of impacted vs. non-impacted areas

SRP Document Reviews of MARSSIM FSS (cont.)

- 14.2 Characterization Surveys (cont.)
  - non-impacted justification
  - overall adequacy of characterization
  - justification of radionuclide ratios if used for implementing DCGLs

SRP Document Reviews of MARSSIM FSS (cont.)

- 14.3 Remedial Action Support Surveys
  - Adequacy of surveys to demonstrate remediation was successful (methods used)
  - Use of survey data to update estimates of contaminant concentrations and variabilities

SRP Document Reviews of MARSSIM FSS (cont.)

- 14.4 Final status survey design
  - maps showing area classifications and survey units
  - background reference area and material description
  - statistical test summary and EMC for Class 1
  - instrumentation description for scanning, field measurements, and sample analysis
  - sample collection and handling
  - investigation levels

SRP Document Reviews of MARSSIM FSS (cont.)

- 14.5 Final status survey report
  - general results overview/changes to original plan
  - sample number calculations
  - survey results
    - » sample results by survey unit
    - » survey unit maps
    - » statistical evaluation for each survey unit
    - » judgmental sample data (hot spots)
    - » investigation results
    - » H_0 rejected?

IVC Comments Based on Document Reviews

- Inadequate historical site assessment and current radiological status summary
  - More required information concerning:
    - » transportation routes, when spread and spillage of source material has occurred
    - » potential burial areas and spills described
    - » subsurface soil investigations does not detail the findings
- Improper survey design to address hard-to-detect nuclides (HTDN)

IVC Comments Based on Document Reviews (cont.)

- Improper survey area classification
  - Only have Class 1 and Class 3 areas - numerous areas are potentially Class 2
- Scan MDCs for the various instruments were either not provided or incorrectly calculated
- Calibration procedures were not in accordance with MARSSIM which recommends use of the ISO-7503 approach

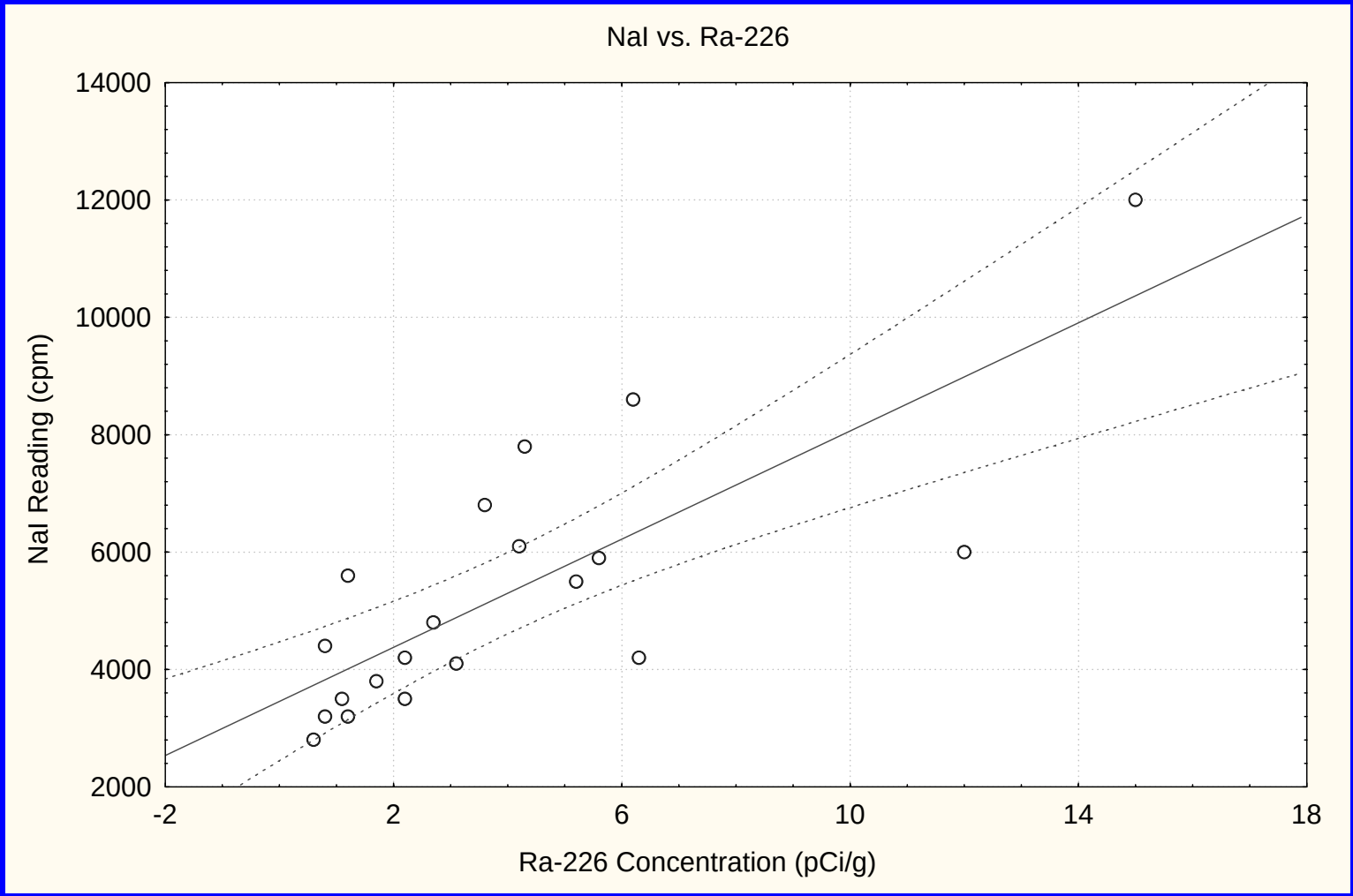
Program Experiences with MARSSIM FSS…a Case Study

- Application of new survey approaches and instrumentation (using ISOCS, scanning with E600, new field methods, etc.)
  - Prepare detailed technical justification explaining how your conclusions were reached
  - Use the DQO Process (it works!)
  - Err on the side of conservatism

Program Experiences with MARSSIM FSS (cont.)

- Example: Using NaI readings to demonstrate compliance with Ra-226 in soil
  - D&D contractor desires to establish a relationship between NaI readings and windblown Ra-226 soil concentration in pCi/g
  - Process knowledge supports Ra-226 on surface
  - Data were collected in 20 grid blocks that correlate NaI counts and Ra-226 in pCi/g

Program Experiences with MARSSIM FSS (cont.)



Program Experiences with MARSSIM FSS (cont.)

- Suppose a D&D contractor wants to set action level that flags Ra-226 concentration at 6 pCi/g
- Best fit straight line:

  NaI reading = [460.7 ☞ (Ra-226 in pCi/g)] + 3457,

  yields a reading of 6220 cpm…But this action level will underestimate Ra-226 50% of time
- Solution: Draw line that reduces probability of underestimating Ra-226 to 5% ~5500 cpm

Program Experience with MARSSIM FSS…Some Random Thoughts

- Document results of investigations—e.g. survey data exceeding investigation levels
- Documentation must provide basis for initial classification of areas, as well as justification for reclassifications
- Good idea to err on the side of conservatism

Conclusions

- Verification survey data are compared to FSS data, not necessarily to release criteria
- Conventional verification is still performed, but in-process decommissioning inspections are an improvement
- Document reviews are the single-most important verification function