SC&A's Evaluation of the NIOSH SEC ER Proposed Use of FAP Bioassay Indicator Radionuclides (in Conjunction with OTIB-54 and TBD-5) for Assessment of FAP and Actinide Intakes at INL

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Four Important Assumptions for Assigning FAP and Actinide Intakes

A) **Sr-90 and Cs-137 –** Sufficient fission-activation product (FAP) bioassay records are available to assign Sr-90 and/or Cs-137 intakes.

B) **FAPs –** Using a bioassayed indictor radionuclide (Sr-90 and/or Cs-137) all other significant FAP intakes can be assigned by using the ratio method.

Four Assumptions (continued)

C) **Actinides –** Using a bioassayed indictor radionuclide (Sr-90 and/or Cs-137), all significant actinide (alpha-emitter) intakes can be assigned by the ratio method.

D) **Special Bioassay –** If actinide intakes occurred that were not directly associated with an FAP indicator (Sr-90 and/or Cs-137) in a known ratio, “special” bioassays were performed and are available in the worker’s records.

This Presentation

Addresses:

- **Item B** – FAPs
- **Item C** – Actinides
- **Item D** – Special Bioassays

Item A (sufficiency of FAP bioassays) is addressed in a separate report.

FAP and Actinide Intakes

- NIOSH's ER recommends using Sr-90 and/or Cs-137 bioassay results in conjunction with ratios in OTIB-0054 to assign FAP intakes.
- NIOSH's ER recommends using Sr-90 and/or Cs-137 bioassay results in conjunction with ratios in TKBS-0007-5 to assign actinide intakes.

Evaluation of Ratios

- The ratio values were derived mostly by computer simulation (ORIGEN)
- SC&A searched for documentation that would provide measured radionuclide ratios
- SC&A searched the following:
  - NOCTS
  - SRDB
  - INL electronic bioassay database

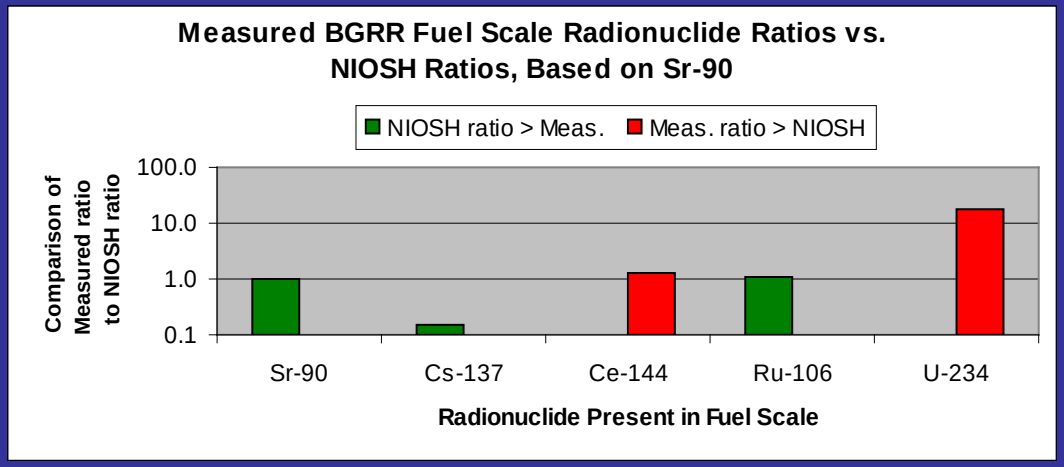
Evaluation of Ratios (continued)

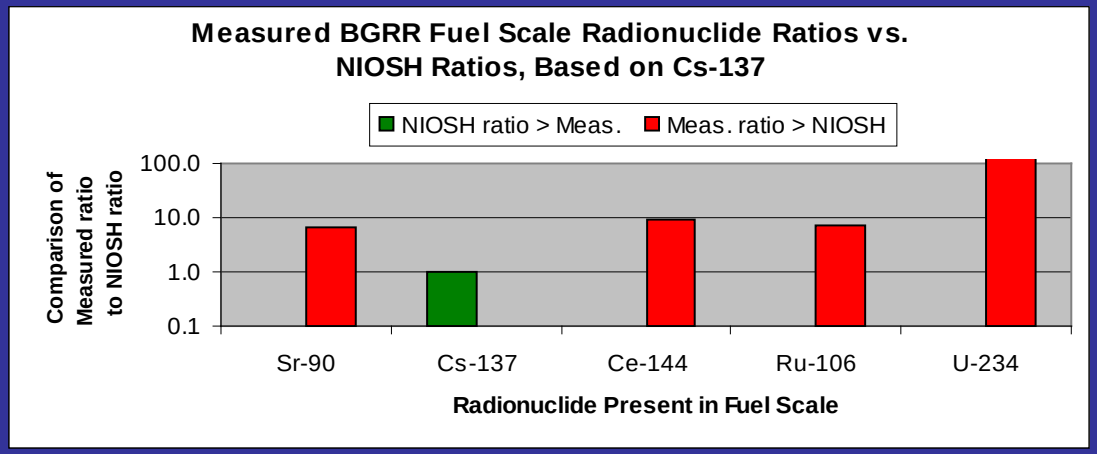
SC&A located measured quantitative radionuclide analyses of:

- Nasal swabs
- Urinalyses
- Fuel element scale
- Fuel storage contamination swipes
- Air filters

A total of 42 samples were located and analyzed for radionuclide ratios.

Example of Resulting Plots





Summary of Results

1. **FAP** intakes assigned using NIOSH's recommendations in OTIB-0054 based on Sr-90 intake values are generally (but not always) equal to, or greater than, those derived from actual measured values.

Summary of Results (continued)

2. **The Cs-137/Sr-90** ratios are not always 1:1 as assumed in OTIB-0054 and TKBS-0007-5; frequently, large variations in the ratio exist. This brings into question the validity of using an indicator radionuclide when deriving FAP and actinide intakes. This may be the most important result of this study, because a Cs-137/Sr-90 value of 1:1 is one of the cornerstones for use of the ratio method at the INL.

Summary of Results (continued)

3. **Actinide** intakes assigned using NIOSH's recommendations in TKBS-0007-5, Table 5-22, based on Sr-90 intake values, or Table 5-23, based on Cs-137 intake values, are sometimes significantly less than those derived from actual measured values.

Summary of Results (continued)

4. **Special bioassays.** It is difficult to evaluate when “special” (situations where actinides were not tied to a fission product in a given ratio) bioassays were needed, if they were performed, and if they are indicated as such in the bioassay records.

Recommendation #1

It needs to be determined if records of analyses of dissolver contents (containing the fuel elements) are available; preferably, for a variety of INL reactor fuel elements, and also fuel elements from off-site reactors.

Recommendation #2

Further INL document research is needed to evaluate NIOSH's recommended ratio values, especially for actinides and Cs-137/Sr-90. Records with quantitative radionuclides analyses are especially important.

“Special” Bioassays

In the past, there was no apparent need to recognize, or emphasize, radionuclide ratios for assigning intakes and doses; hence, there was no obvious reason to treat bioassays taken for situations where actinides were not tied to an indicator FAP radionuclide any different than other bioassays.

Recommendation #3

It needs to be determined if special or non-routine bioassays were associated with special exposure events, such as are referred to in the ER, or if instead the term "special," or *"non-routine," bioassay was applied to the priority of processing over "routine" bioassays.*

How will special bioassays be identified to insure adequacy for dose reconstruction?

Comments and Questions