

ORISE

OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

August 7, 1995

Mr. Blaine Murray
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

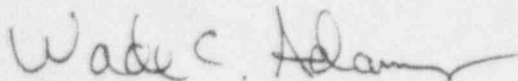
**SUBJECT: DOCUMENT REVIEW - DECOMMISSIONING PLAN FOR THE L-77
RESEARCH REACTOR, BRIGHAM YOUNG UNIVERSITY, PROVO, UTAH
(DOCKET NO. 050-262)**

Dear Mr. Murray:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) has reviewed the revised subject document and the licensee's responses to a previous ESSAP document review letter dated on July 25, 1994. In general, it is the opinion of ESSAP that the document still lacks certain information/data that is necessary to determine the complete radiological status of the site. The data presentation is difficult to follow. It was the intent of the original document review letter to provide guidance on what items should be included within the report and which items needed to be clarified for better understanding. Although each comment was addressed by the licensee, ESSAP does not feel that the licensee completely understood the intent of the comments. The inclusion of additional information, as described in the attached comments, many which are repetitive of the July 25, 1994 comment letter, would substantially improve the thoroughness and technical quality of the document. Further direction from the NRC, in terms of survey scope, is requested by ESSAP to enable preparation of a proposed survey plan.

The attached comments are offered for your consideration. If you have any questions or comments please contact me at (615) 576-0065 or William L. (Jack) Beck at (615) 576-5031.

Sincerely,



Wade C. Adams
Health Physicist/Project Leader
Environmental Survey and
Site Assessment Program

WCA:tsf

cc. R. Uleck, NRC/NMSS/TWFN/7F27
D. Tiktinsky, NRC/NMSS/TWFN/8A23
PMDA, NRC/NMSS/TWFN/8A33

E. Abelquist, ORISE/ESSAP
W. Beck, ORISE/ESSAP
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DOCUMENT REVIEW
DECOMMISSIONING PLAN FOR THE
L-77 RESEARCH REACTOR
BRIGHAM YOUNG UNIVERSITY
PROVO, UTAH
(DOCKET NO. 050-262)

GENERAL COMMENTS

1. The primary contaminants at this site and the applicable exposure rate and surface contamination guidelines should be specified. Survey results should be reported in the same units as the guidelines and should be directly compared to those guidelines. The data provided in this report are not sufficient to demonstrate compliance with the NRC surface contamination guidelines.

The licensee's response was that "the facility was a research reactor...(and that)...the primary contaminants were ^{235}U and associated fission products." They also expressed that ^{137}Cs was one of the more common fission products which has a relatively long half-life. Strontium (Sr)-90 is also a fission product to be concerned with and should be considered when selecting appropriate guidelines. ESSAP recommends that all of the possible contaminants be identified along with the associated activation products such as ^{60}Co . ESSAP recognizes that activation products produced during the operation on the reactor may be short-lived radionuclides which would have decayed by the time of the surveys, but this should be part of the explanation.

^{235}U is mentioned as a possible contaminant, and in some cases, alpha measurements and beta measurements were performed. Uranium contamination guidelines are expressed in terms of alpha activity; and, ^{235}U emits alpha to beta activity in a 7 to 4 ratio. Measurements of beta activity levels, rather than alpha activity levels, provide a more accurate representation of uranium surface activity, due to conditions of building surfaces, (e.g., dusty, porous, or rough surfaces), which may selectively attenuate the alpha activity. Therefore, for uranium beta activity, ESSAP calculates an adjusted fixed average surface contamination criteria as 2,900 dpm/100 cm^2 and a maximum fixed surface contamination criteria as 8,600 dpm/100 cm^2 . The guidelines listed in Enclosure A are not inclusive for maximum contamination guidelines. It is also noted that the licensee indicates that the average fixed contamination criteria for alpha contamination is 100 dpm/100 cm^2 , and for removable is 20 dpm/100 cm^2 . Please provide an explanation for the use of the limits listed in item #9, page 2 of the March 9, 1992 letter to A. Adams.

2. In general, it is the opinion of ESSAP that the documentation lacks certain information/data that are consistent with that provided from similar facilities in which similar types of work have been performed. Further detail should be provided for the technical reviewer to evaluate the adequacy of:

(a) Methodologies for:

(1) surface scans (alpha, beta, and gamma)

The licensee did not describe the surface scan methodologies. Perhaps the description of surface scans could read as follows: Typically, surface scans are performed by passing the probe (detector) slowly over the surface with the distance between the probe and the surface at approximately 1 cm. Identification of elevated levels are based on increases in the audible signal or the deflection of the ratemeter needle.

(2) direct measurements

The licensee's description of the measurements for alpha and beta surface activity is as follows: "these probes are uniformly scanned over the surface (in close proximity) and the counts recorded for 5 minutes. Correction for detector efficiency, ..., local background, detector area, and count time results in a measure of the residual radioactivity averaged over 1 m^2 . Measurement of the maximum surface radioactivity averaged over 100 cm^2 within that 1 m^2 is done, if warranted, by similarly scanning an area of 100 cm^2 for a period of one minute and performing the necessary corrections as described." The method described is not a direct measurement; instead it is a well documented surface scan [See General Comment #2(a)].

Typically, direct measurements are performed on surfaces to determine direct radiation levels. Count rates are usually integrated over 1 minute in a static position, and the activity levels converted to $\text{dpm}/100\text{ cm}^2$ by dividing the net rate by the 4π efficiency and correcting for the active area of the detector. Also, typical calibration efficiencies are calculated in a static mode; please explain how the instrumentation was calibrated and the sensitivities determined in a scanning mode and how the data relates back to the NRC guidelines.

(3) grid block averaging

Typically, several direct (static) measurements would be performed in a 1 m^2 grid block and the data for that grid block would be averaged as in Draft NUREG/CR-5849, Section 8.5.2.

- (4) miscellaneous sample collection if applicable (drain, vents, residues)

Except for the collection of a water sample, there is no indication in the report that states that miscellaneous (concrete block, brick, residue, etc.) samples were collected.

- (5) calculations of direct measurements and MDAs

The licensee provided an explanation for the MDA approximations, but it is difficult to follow. Example calculations should be provided. It should also be noted that it was the intent for Draft NUREG/CR-5849 equations 5.2 and 5.3, that the MDA be calculated for a static measurement and not a scanning measurement.

- (b) Instrument calibration and QC procedures (i.e. routine operational checks)/operating parameters (including efficiencies, backgrounds, and detection capabilities)

The licensee provided information on the operational checks and efficiencies, but did not provide information on the backgrounds and detection capabilities.

- (c) Procedures for evaluating results, relative to guidelines and conditions.

ESSAP concurs with the response.

3. The report presents the results, but does not provide a discussion and/or assessment of the data. ESSAP recommends that information be included that discusses the final status of the decommissioned areas.

Please provide Section 6 of the survey document which compares the results with the acceptance criteria.

4. In general, the quality of data presentation and report preparation is poor. Although the raw data (e.g., for removable surface contamination and sample analyses) are provided, the results are not tabulated. Figures, when provided, are not drawn to scale or labeled clearly. Figures should also be labeled with the direction and should have a figure title and a legend. It is also recommended that the pages in each section be physically bound (e.g., by a staple) and the sections separated (e.g., by a title page). Page numbers would be useful in determining if data or text is in a particular order or missing.

The licensee states that "there are no Beta survey measurements that are within 100 dpm of the acceptance criteria." Even if the limits proposed in General Comment #1 were used, all beta measurements are still below the criteria. However, there are quite a few data points with large negative numbers and this leads to another question as to whether or not the appropriate backgrounds were subtracted [See Specific Comment #2(b)].

5. Measurement locations should be indicated on the figures, or if taken in a particular pattern, e.g. at 1 m intervals, the pattern should be identified.

ESSAP concurs that this was done.

6. It is not clear from the report whether there are miscellaneous parts/items/equipment to be released, for which ESSAP is expected to perform radiological surveys?

It is ESSAP's understanding that confirmatory surveys will need to be performed on all parts that are included in the survey.

SPECIFIC COMMENTS

1. Page 4-1: Proposed Final Radiation Survey Plan

- (a) It appears that this is section 4 of a larger report. If so, then perhaps other portions of the report may contain vital information that should be provided in a final status report, i.e., site history, procedures, guidelines, etc.

The entire decommissioning plan was added to the report.

- (b) How were termination survey locations selected?

ESSAP concurs with the licensee's response.

- (c) Please explain what is meant by the word "surveyed"? Does this mean that surfaces were scanned and that direct (static) measurements and removable activity measurements were performed? Please provide a description of the procedure (See General Comment 2).

The method described is not appropriate for direct measurements and the results cannot be directly compared to the NRC guidelines (Reg. Guide 1.86) in which the limits are for static (fixed) measurements. What is the basis for the approval of this survey technique?

- (d) Provide an explanation for establishing a "virtual" 3-m square grid. What criteria was used to select a single 1 m square grid out of the 3-m square grid pattern for survey activities?

ESSAP concurs with the licensee's response.

- (e) Provide more detail on drain and floor penetration survey activities. Were there other types of penetrations i.e., walls, ceilings, and ventilation systems that should have been accounted for in the survey?

It is unclear as to which data in the data tables refers to the smear data for the drains.

- (f) The report states that 1 m² averages of grid blocks are determined by performing a 5 minute surface scan over the 1 m² surface and integrating the counts. The maximum activity in a 100 cm² area (hot-spot) was determined in a similar manner with a one minute surface scan. Removable activity was estimated for each 1 m² area by smearing a 100 cm² area of each 1 m². Were these techniques appropriate and how can these measurements be directly compared to NRC guidelines, particularly for the maximum guideline condition?

See Specific Comment 1(c).

- (g) Are the calibration sources (Th-230 and Tc-99), used to calibrate the survey instrumentation, appropriate for the radionuclides of concern (See General Comments 1 and 2)?

ESSAP concurs with the licensee's response.

- (h) Provide the model number for the Eberline alpha scintillation detector.

ESSAP concurs with the licensee's response.

2. Page 4-2:

- (a) Use of the Eberline PG-2 low energy gamma probe (NaI scintillator) for determining exposure rates by integrating over a 5 minute period within a 1 m² area is questionable. Any measurement of a gamma radiation level with this instrument is influenced by the specific energy of the gamma source for which the instrument was calibrated and calibration with Cs-137 might not be appropriate. The use of this instrument for measuring gamma radiation levels is an unusual

choice since it is a low energy gamma probe and its response to high energy gammas, which would most likely result from the possible contaminants, may be poor. Was the measurement performed at contact or 1 m above the surface?

ESSAP concurs with the licensee's response and the switch to an Eberline SPA-3 probe with an energy range of 40 keV to 1 MeV [See Specific Comment 4(b)].

- (b) Different surfaces have different backgrounds, such as sheetrock and brick walls, were these types of background differences accounted for during the final survey data calculations?

Based on the data presented in Enclosure C for alpha, beta, and gamma survey data, it appears that the backgrounds subtracted from the data may be inappropriate for some of the data points since there are quite a few negative numbers for different areas. Provide the alpha and beta background data for the different materials.

- 3. Letter to Alexander Adams on March 9, 1992, RE: Response to questions received from A. Adams on January 9, 1991.

- (a) ESSAP only received two pages of the completed letter since the signature page is missing.

ESSAP now has the complete copy.

- (b) Core samples were to be obtained by drilling a 1/4 inch hole in the respective material and then counting the material in a liquid scintillation counter. Was this performed, and, if so, what were the results?

ESSAP concurs with the licensee's response.

- (c) The guidelines provided do not include the maximum limit for a 100 cm² area and does not indicate that the guideline listed is for the average contamination over 1 m².

The efficiency used by the licensee was determined for a direct (static) measurement. Please justify the appropriateness of using this efficiency for scanning data.

4. Instrument Calibration Data

- (a) The efficiencies of 61% and 64% for an HP-260 seem high, and may be based on 2π geometry; if so, the measurement data may be underestimated by a factor of 2. The same may be true for the AC-3-7 alpha scintillator. Please provide more detail on how the calibrations were performed. For example, the calibration sheet should provide information on the calibration source used (i.e., radionuclide, activity, NIST traceability, etc).

After reviewing the data again, the licensee did take into account that the calibrations were for 2π and the licensee divided the efficiency listed by 2 to get a 4π efficiency. ESSAP concurs with the rest of the response.

- (b) The SPA-3 instrument, mentioned in the calibration data, is different from the one mentioned in Specific Comment 2a. This instrument was calibrated with Cs-137. Due to the energy dependence of the SPA-3, the response of this instrument to the gamma energies present should be indicated.

ESSAP concurs with the licensee's response [See Specific Comment 2(a)].

- (c) The lines on the QC Charts should be labeled to indicate QC Positive and QC Negative. On June 10, the QC Negative value was exceeded for the Gamma QC Chart and then the instrument was retested and passed. Please indicate how these values were calculated and what were the appropriate procedures to follow when an instrument failed its daily QC check.

ESSAP concurs with the licensee's response.

5. Figures

ESSAP concurs with the licensee's responses to Specific Comments 5 (a-g).

6. Raw Survey Data

- (a) The units for the data should be reported or presented in the column headings.

The units of removable alpha activity (R_{α}) should be (dpm/100 cm²).

- (b) Please provide an explanation for SLOC 01A-01F and if the measurements were performed in a particular pattern.

ESSAP concurs with the licensee's response.

7. Difference Data

- (a) It is stated that the raw count is multiplied by a correction factor to obtain the difference data. Provide an explanation for the terms used in the correction factor and include a sample calculation.

ESSAP concurs with the licensee's response.

- (b) Background data should be provided. Different surfaces have different natural backgrounds associated with the material from which it is made, i.e., a higher background measurement is typically associated with red brick than for asphalt or concrete (See Specific Comment 2b). It was not clear from the data how backgrounds were subtracted from individual measurements. Backgrounds should be subtracted prior to dividing by the correction factor.

ESSAP did not receive Section 6 which includes the background data. ESSAP concurs with the rest of the licensee's response.

- (c) Provide an explanation and an example calculation for the acronym BEU.

ESSAP concurs with the licensee's response.

- (d) With one exception, all of the GAMMAD measurements are negative. This appears to indicate that an inappropriate gamma background was used in the calculations. Provide more information on how background levels were determined. Were the backgrounds determined in the same manner as the raw counts, i.e., a 5 minute scan over a 1 m² grid block?

The licensee recalculated the gamma data with a new gamma background.

- (e) The Acceptance Criteria does not mention the maximum guideline value.

Explain the rationale for choosing the stated maximum acceptance criteria.

ADDITIONAL COMMENTS

1. Page A-6: The licensee states that a sample of the shielding water was collected and analyzed by the NRC. Was the NRC result consistent with the licensee's results?
2. For Enclosure C, please provide more detail (calculations and formulas) to describe how final data, MDAs and uncertainties were calculated. Were backgrounds determined by a 5 minute scan of a 1 m² area? It should also be stated that the data for each location is the average direct (scanned) data for a grid block.
3. Page G-2: What are the units for the measurements?