

SUC-1275
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Comments in Response to Region I Technical Assistance Request With Regard Seneca Army Depot Activity (SEDA) Scenario B Null Hypothesis Approach

By: Xiaosong Yin
NMSS/DWMEP/DCD
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INTRODUCTION

Seneca Army Depot Activity (SEDA) is under decommissioning activities to terminate its NRC license, License No. SUC-1275. The licensed activities under this license are mainly for the possession and storage of depleted uranium commodities. The license termination report was sent to NRC Region I (RI) for review in June 2004. In August 2004, RI requested additional information concerning several issues in SEDA's license termination report. Among the issues, SEDA's compliance approach, i.e., using an MARSSIM Scenario B null hypothesis to demonstrate the residual radioactivity in survey units in SEDA facility is indistinguishable from background, is the focal point of concern.

Since this approach is a nonstandard method comparing to the agency default Scenario A null hypothesis, i.e., the residual radioactivity in the survey unit exceeds the release criteria, RI requested that NRC headquarters, NMSS/DWMEP/DCD to provide technical assistance to review the adequacy of SEDA's Scenario B approach.

STAFF REVIEW

In conducting the review of the RI request, NMSS/DWMEP/DCD staff reviewed SEDA License Termination Report, correspondences between the RI and SEDA, and relevant supporting statistical data information. Staff has used NUREG-1757 and NUREG-1505, A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys, as the primary references.

This report will be focused on the standard approaches if one is using Scenario B to release a site and then to summarize what SEDA has performed in this regard. Lastly, it will provide comments and suggestions in assistance of the RI decommissioning review regarding SEDA's license termination activities.

1. Scenario B Approach

When applying scenario B to a site decommissioning, there are two key conditions that generally apply when demonstrating indistinguishability from background: 1) when the residual radioactivity consists of radionuclides that appears in background, and 2) the variability of the background is relatively high. The high variability is generally defined as differences in estimated mean concentration measured in potential reference areas that are comparable to DCGLs.

The statistical tool used is the Kruskal-Wallis (K-W) test that will determine the probability of K exceeds a given critical value K_c . This test will conclude the selected reference areas have significantly different variability in their concentration distributions, when $K > K_c$, otherwise there is no significant variability among the reference areas, when $K < K_c$.

When the determination has been made that there is significant variability among the reference areas, the next step is to establish the concentration level at which any measurements greater than this level are considered distinguishable from background.

Perform Wilcoxon Rank Sum (WRS) Test, and if the survey unit passes, perform Quantile Test. Make sure all of the reference area measurements taken for the (K-W) test should also be used in the WRS and Quantile tests.

2. SEDA's Scenario B Approach

To demonstrate that the indistinguishability from background, SEDA selected five reference areas (A1107, B0806, C0912, D0405, E0403) for the igloos to be surveyed and two reference areas (722 and 2078) for the buildings to be surveyed. The subsequent Kruskal-Wallis tests on these reference areas concluded that there was significant variability among the five igloo reference areas. However, for the building reference areas it was inconclusive. The data collected from the building 2078 showed two consistent ranges in the building with a break of approximately 100 cpm to separate the two ranges. The building 722 did not demonstrate significant variability in the background.

In calculating the lower boundary of the gray region (LBGR), SEDA followed the methodology in NUREG-1505 except for building 722 where LBGR was set to zero.

By following NEREG-1505, both WRS and Quantile tests were performed to determine if a survey unit passes or fails to meet release criteria.

3. CONCERNS AND QUESTIONABLE AREAS

In most cases, NRC staff will consider Scenario A to be the appropriate choice. In some limited cases, a different assumption and null hypothesis, Scenario B may be appropriate. The key assumption, when using Scenario B, is that when DCGL is small compared to measurement and/or background variability.

In this case, the DCGLs for the radionuclides of concern, depleted uranium, gross activity $DCGL_w$ is 31,800 dpm/100 cm², which can be converted to cpm by using an instrument probe area and observed efficiency. For example, the Floor Monitor with a probe area of 425 cm² and 20% efficiency has a $DCGL_w$ of 27,030 cpm. From the following table, it is not difficult for one to tell that this DCGL level should be easily distinguishable from the variability exhibited in the background. Ideally, the Scenario A should have been chosen for SEDA's decommission activities since the DCGL is fairly large compared to the measurement variability. SEDA, however, adapted to use background variability for their justification to use Scenario B, although this variability from the background is insignificant in comparing to the site DCGLs.

DCGL _w	27,030 cpm			
	Alpha α	Beta β	α Floor Monitor	β Floor Monitor
Igloo LBGR	13.3 cpm	40.5 cpm		
Bldg 722 LBGR	2.1 cpm	417.6 cpm	0	567.7 cpm
Bldg 7028 LBGR	2.6 cpm	327.7 cpm	3.0 cpm	686.9 cpm

Statistically, the K-W tests appear acceptable since by strictly following NUREG-1505, section 13.2, the null hypothesis, the reference area means are distributed around overall mean with variance deviation $\omega=0$, i.e., there is no significant variability among reference areas, is rejected.

In determining the variability for the two selected building reference areas, SEDA treated each building differently. For building 722 it was treated as having many different sub-reference areas, e.g., metal, counter top, cinder wall, wood paneling, concrete floor areas, etc. For building 2078, there were no specific locations identified, instead two groups of survey data were used to demonstrate background variability. The K-W test was then performed on these "reference areas." Although there is no statistical restriction to this approach, it is more appropriate if SEDA had adapted a different approach, e.g., using one-sample test, to the building 722 case rather than treated different structure materials in a survey/reference area as different reference areas. Background in different media is not expected to be similar and should not be compared to each other. Also, an induced dose from a decommissioned site to a critical group member is based on the total residual radioactivity attribution not on an individual media material.

In addition, although building 722 failed to justify a significantly different variability by a K-W test, SEDA still proceeded with Scenario B approach statistically to release the survey units. It is not consistent with NUREG-1757 nor with NUREG-1505 guidance.

From the License Termination Report (LTR), some failed units by WRS test under the scenario A passed instead, from later submitted material, under Scenario B, for example, igloos A0706, A0710, A0711, A0901, and A0905 etc. While the conditions applying for the use of the scenario B are not strictly followed, this difference should require better technical justification from the SEDA.

The information submitted by SEDA on 02/28/2005 is different from the information contained in the LTR 06/04 with regard the compliance approach, i.e., Scenario A vs Scenario B. The attached tables to the LTR are all based on Scenario A methodology and the conclusions drawn in the LTR were based on this approach. With the newly submitted information, it is not clear how valid the LTR is now since 2/28/05 letter with enclosures has eventually re-concluded those survey units, with different pass or fail criteria. It is not clear if the same DCGLs are being used in these two sets of submittals.

COMMENTS AND/OR SUGGESTIONS

Based on the staff review, the following comments/suggestions have been provided:

1. Scenario B is not recommended for SEDA decommissioning activities. Although there is a statistical verification of variability existed in the igloo reference areas, the level of this variability is not significant enough to be comparable to the site DCGLs.
2. The K-W test performed on the two reference buildings are using either every different structure material as a separate reference area, which is not practically achievable, or two generally consistent data sets. Since the final dose to a critical group member after a survey unit is released is from a combined dose attribution from every possible source term within the unit, it is not practical to separate these dose contributions. In addition, one is not expecting to see background readings that are similar to each other from