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Richland Operations Office
P.O. Box 550
Richland, Washington 99352
DEC 20 2001

02-DMST-009

Mr. Douglas R. Sherwood
Hanford Project Manager
U.S. Environmental Protection Agency
712 Swift Boulevard, Suite Five
Richland, Washington 99352

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EDMC

Dear Mr. Sherwood:

ACCEPTABILITY OF BUILDING 233-S WASTE IN THE ENVIRONMENTAL
RESTORATION DISPOSAL FACILITY (ERDF)

Non-destructive assay (NDA) of waste items removed during the decontamination and decommissioning (D&D) of the 233-S Plutonium Concentration Facility began in late 1998. Bechtel Hanford, Inc. (BHI), the D&D contractor for 233-S subcontracted the NDA work to Fluor Hanford, Inc. (FHI). Several boxes containing 233-S waste items were disposed of in ERDF as Low Level Waste (LLW) based on the results of NDA with portable equipment. It was learned in June 2001 that the FHI analysis of the data from the portable NDA equipment was done with an incorrect efficiency calibration factor, several other systematic errors were made in the data reduction and, in many cases, the sensitivity of the detector was inadequate to accurately measure the activity. As a result of these deficiencies, the reported activities of the waste items were significantly lower than they would have been had the analysis been done correctly. Consequently, many of the waste items that had been categorized as LLW based on the FHI NDA results potentially exceeded the allowable activity level for designation as LLW and may be transuranic (TRU) waste.

The activity level in each box that was placed in ERDF was recalculated by FHI based on re-analysis of the original raw NDA data for each of the 233-S waste items, using validated analysis routines and an independent over check. In the case of those items for which there was no detectable activity, it was necessary to ascribe to them the Minimum Detectable Activity (MDA) corresponding to their individual counting conditions. The MDA value, which in many cases was well in excess of the ERDF waste acceptance limit, represents an upper limit on the activity that could be present. This recalculation resulted in seven of 28 boxes having activity levels that potentially exceeded the criterion for LLW. The activity of one of these seven boxes, Box 233S-01-0039 (herein after referred to as Box #39), potentially exceeded the limit by the greatest margin (366 nCi/g, compared to the limit of 98 nCi/g for this waste).

As described in more detail in the attachment to this letter, the strategy to resolve the issue with the boxes placed in ERDF was to retrieve and re-assay the box with the highest potential activity. That box, Box #39, was exhumed on November 24, 2001, and re-assayed *in toto* using a suitable detector system with approved procedures under a valid quality assurance plan. The data were analyzed by validated methods and resulted in an activity level for the box (95 nCi/g) that

is close to the ERDF waste acceptance criterion (for this waste the Class C Waste limit is 98 nCi/g). The remaining six boxes in question have lower potential activity levels than Box #39 and contain similar waste items, more than half of which are at MDA. As shown in the attachment to this letter, the box with the next highest potential activity is at 68% of the Box #39 activity. Thus, it is reasonable to conclude that the other six boxes are consistent with the ERDF waste acceptance criteria and are neither TRU waste nor Greater Than Class C waste.

Based on the re-assay results, Box #39 will not be reburied in ERDF, but will be appropriately dispositioned in consultation with EPA. Your concurrence is requested in accepting the disposal of the other six boxes in question as low-level waste in ERDF. These six boxes are designated 233S-00-0002, 233S-00-0004, 233S-00-0005, 233S-00-0013, 233S-00-0015 and 233S-00-0057, respectively.

If you have questions, please contact Phil Loscoe, of my staff, on (509) 373-7754.

Sincerely,



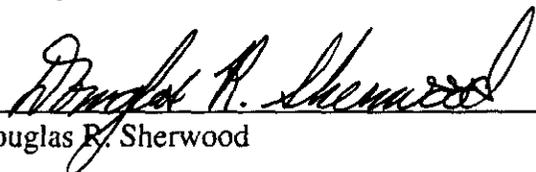
Michael H. Schlender, Deputy Manager
for Site Transition

DMST:PGL

Attachment

cc w/attach:
L. Cusack, Ecology
R. Gay, CTUIR
J. S. Hertz, FHI
M. C. Hughes, BHI
R. Jim, YN
O. S. Kramer, FHI
T. M. Martin, HAB
E. S. Murphy-Fitch, FHI
K. Niles, Oregon Energy
P. Sobotta, NPT
R. F. Stanley, Ecology
E.-K. Thomson, FHI
M. A. Wilson, Ecology
Administrative Record ✓

APPROVED:

 12/26/01

Douglas R. Sherwood Date

SUMMARY OF ACTIONS TAKEN TO ADDRESS POTENTIAL IMPROPER DISPOSAL OF TRANSURANIC WASTE IN THE ENVIRONMENTAL RESTORATION DISPOSAL FACILITY (ERDF)

BACKGROUND

Bechtel Hanford (BHI) has been performing D&D of the 233-S facility in the 200 West area of Hanford since 1997. This facility was added to the REDOX canyon complex and was used for final purification and concentration of plutonium solutions by a condensation and ion exchange process. A fire in 1963 spread plutonium contamination throughout the facility. From September 1998 to May 2001, Fluor Hanford (FHI) performed NDA of items removed from the facility by BHI to determine the amount of plutonium contamination in/on the items. Non-destructive assay (NDA) makes use of the gamma radiation characteristics of plutonium and other transuranic elements to measure the amount of such material present in a sample. A detector is calibrated using a known amount of plutonium so that the recorded count rate from an unknown object can be related to the amount of plutonium in or on the object (either as activity in Curies or fractions thereof, or mass in grams or fractions thereof).

In that two-and-a-half year time period, FHI assayed more than 600 packages of waste removed from the 233-S Facility at Hanford. In June 2001 it was determined that from May 1999 forward, the efficiency calibration factors for the instruments used in the non-destructive assay were incorrectly entered into the data reduction spreadsheet, and that other errors had been made in the data analysis. The majority of the measurements were made with a portable hyperpure germanium (HpGe) detector, while a few were done with a sodium iodide (NaI) detector. Of the surveyed items, 113 were classified as low-level waste (LLW) on the basis of the flawed analyses. All of these 113 items had been shipped, together with other LLW, to the Environmental Restoration Disposal Facility at Hanford in seven shipments totaling 28 boxes.

In addition to the analysis errors, it was subsequently determined that the portable hyperpure germanium instrument used in the majority of the measurements was not sensitive enough to correctly characterize packages weighing less than about 10 to 20 pounds (depending on the counting geometry) even if there were no analysis errors. Thus, in many cases, items were reported to have no measurable plutonium activity, when they should have been assigned the minimum detectable activity (MDA) for their particular counting geometry. This MDA represents an upper-limit on the plutonium activity that may be present.

FHI performed a reanalysis of the original gamma spectra from the 113 items, with correct calibration and other factors, and with a validated analysis procedure, in July through mid-September 2001. These analyses resulted in higher plutonium

concentrations for those items that were actually measurable, and showed that the MDA for those that were not was generally well in excess of the ERDF waste acceptance limit. Thus, on an item-by-item basis, many of the individual packages in the boxes placed in ERDF are actually (or potentially, in the case of those for which only a minimum detectable activity could be assigned) transuranic (TRU) waste. It should be noted that of the 113 items placed in ERDF, 84 (or 78%) turned out to be MDA on reanalysis.

The ERDF acceptance limits for this waste are dominated by transuranic isotopes (^{238}Pu , ^{239}Pu , ^{240}Pu , ^{242}Pu , ^{241}Am and ^{237}Np) and by ^{241}Pu (which, while heavier than uranium, is not included in the definition of transuranic waste since it has a half-life shorter than 20 years and decays principally by beta emission). The activity concentration of the transuranic isotopes cannot exceed 100 nCi/g using the "sum of fractions method" of 10 CFR 61.55 and, in addition, the activity concentration of other isotopes present (principally ^{241}Pu) must be less than the Class C Waste limits of 10 CFR 61.55 and the ERDF Waste Acceptance Criteria (WAC). Since the isotopic mix for the 233S waste is known and nearly constant, the ^{241}Pu activity concentration will not exceed the Class C Waste limit provided that the transuranic activity concentration does not exceed 98 nCi/g. Thus, the acceptance limit on the transuranic activity concentration for the 233S waste in ERDF is 98 nCi/g.

PATH TO RESOLUTION

BHI's procedure for dispositioning items removed from the 233-S facility is to separate the waste packages, on an item-by-item basis, based on their transuranic activity per gram as determined by non-destructive assay or other means. That is, each individual item is categorized as either LLW or TRU waste *before* being packaged into a disposal container.

All boxes contained items (like soft waste) that were categorized as LLW by other than NDA, as well as the waste items that were declared LLW based solely on the NDA results. A review by BHI of the waste records allowed, for the most part, an item-by-item reconstruction of the contents of each box disposed of in ERDF. Based on the inventory - and the weights of all the radioactive items in the box - it was possible to determine the activity per gram of waste in the box and compare it to the ERDF waste acceptance limit. The initial cut at this was done in mid August 2001 after the FHI reanalysis of the first 232 non-destructively assayed items was issued by FHI. Table 1 shows the average activity per gram for the waste boxes in ERDF that were identified as being near or potentially in excess of the acceptance limit, based on the initial review.

Table 1. Box-Average Activity for Waste Disposed of in ERDF (Initial)

Box Identification	Total Waste Activity (nCi)	Total Waste Weight (g)	Max. Avg. Activity (nCi/g)	Activity Rel. to Box 39
233S-00-0002	2.34E8	9.51E5	246	0.67
233S-00-0013	1.40E8	6.11E5	229	0.62
233S-00-0015	2.46E7	2.49E5	99	0.27
233S-00-0057	1.79E7	1.69E5	106	0.29
233S-01-0039	1.19E8	3.24E5	366	1

The strategy for resolving the issue was developed based on this initial assessment and the following considerations: 1) more than three-quarters of the items in the boxes that were designated LLW based on the original NDA results turned out, on reanalysis, to be upper-limit MDA values; 2) NDA, even when done correctly, tends to conservatively over estimate the activity in samples (largely because the necessary corrections for attenuation, etc., are applied conservatively); 3) wholesale retrieval/removal of all the boxes that could potentially exceed the ERDF limits could result in damage to the ERDF environmental barrier and expose the workers involved to unnecessary risk. Based on these considerations, a decision was made to retrieve the box with the highest potential activity and re-assay it *in toto*, with a suitable detector system and according to approved and audited procedures. If this re-assay resulted in an activity per gram below the ERDF waste acceptance limit then, by inference, all of the other potentially high-activity boxes in Table 1 would also be below the ERDF limit. Note that even if Box #39 is at or somewhat higher than the limit, the other six boxes would still be below the limit since the next highest potential activity is 68% of that of Box #39.

After this strategy was set in motion, an over check by BHI of the inventories of the boxes sent to ERDF surfaced a problem with one of the earlier shipments. The records for that shipment did not specify what item was placed in what box, only that the items were placed in one of several boxes that made up the shipment. In Table 1 above, all those items were considered to have been placed in the box designated 233S-00-0002. BHI was able to reconstruct the probable contents of each of the boxes in that shipment based on the item descriptions, since it was the practice to place like items (e.g., pipe sections) in the same box. This resulted in items that had previously been lumped together as one box being distributed among six boxes.

The task was further complicated by the fact that the reanalysis of the NDA data was done by FHI in two parts, the first of which was delivered on August 7, 2001 and the second on September 21, 2001. The latter report contained NDA results for items that were categorized and disposed of based on other data (i.e., not on NDA results); for some of those items, the reanalyzed NDA result would categorize them as TRU waste. Thus, the BHI re-review resulted in the identification of several more boxes that contained items that were non-destructively analyzed (although in most cases the results weren't used to designate the waste category). In a few cases, individual item weights were

corrected. Of these additional boxes, two were identified that could exceed the ERDF waste acceptance criteria.

As a result, the original BHI summary (mid-August 2001) of the contents of boxes sent to ERDF - six shipments totaling 14 boxes with five potentially exceeding the ERDF waste acceptance criteria based on the re-analyzed NDA results - was revised for the reasons described above, to eight shipments totaling 28 boxes with seven potentially exceeding the ERDF limit. The revised box-average activity data is shown in Table 2 below.

Table 2. Box-Average Activity for Waste Disposed of in ERDF (Revised)

Box Identification	Total Waste Activity (nCi)	Total Waste Weight (g)	Max. Avg. Activity (nCi/g)	Activity Rel. to Box 39
233S-00-0002	2.69E8	1.08E6	250	0.68
233S-00-0004	2.23E7	2.37E5	94	0.25
233S-00-0005	3.27E7	2.49E5	131	0.36
233S-00-0013	1.10E8	6.11E5	180	0.49
233S-00-0015	2.81E7	2.55E5	110	0.30
233S-00-0057	1.79E7	1.69E5	106	0.29
233S-01-0039	1.19E8	3.24E5	366	1

These final results are provided for completeness. The changes resulting from the re-review did not affect the agreed-upon strategy, as Box #39 remained the one with the highest potential average activity per gram of waste.

RESULTS OF RE-ASSAY OF BOX #39 AND IMPLICATIONS

Box #39 Results

BHI/Duratek retrieved Box #39 from ERDF on November 21, 2001 and Canberra Industries personnel conducted the first re-assay measurements on November 27. The results of this series of measurements, which were performed outdoors in damp weather, were discarded because of anomalies in the system response attributed to moisture. The box was moved into a maintenance garage and the re-assay was conducted satisfactorily on November 30, 2001.

On the basis of six measurements the transuranic activity per gram of waste in Box #39 was found to be 95 nCi/g. This is below the criterion for TRU waste (100 nCi/g) but is close to the Class C Waste limit (98 nCi/g) based on the sum of isotopic fractions as specified in 10 CFR 61.55. In view of the circumstances, a conservative decision was made not to re-bury Box 39 in ERDF.

Evaluation of Remaining Six High Potential Activity Boxes

Consistent with the strategy discussed above, an evaluation was done of the implications for the remaining six boxes discussed above. Recall that each of these boxes was

calculated to have an activity per gram value that was close to, or potentially exceeded, the ERDF waste acceptance criterion. As noted previously, however, many of the corrected activity values for the waste items in the boxes were the minimum detectable activity for the conditions under which they were counted. Thus, if all were retrieved and re-assayed with a suitable detector system, it would be reasonable to assume that they would have significantly lower activities (as did Box #39).

The evaluation was based on several considerations, including the re-assay results for Box #39 as compared to its calculated activity, as well as on comparisons of surveys by Canberra and FHI of individual waste items from 233S similar to those in the boxes. Additionally, some comparisons of transuranic concentrations as determined by NDA and by analytical laboratory analyses were considered. This information was used to determine a conservative value of the factor by which the calculated NDA activity in each of the six boxes should be reduced to account for the upper-limit MDA values used in arriving at the Table 1 (and Table 2) activity values.

Corrected activity values for four waste items from 233S, that had been assayed by FHI and were in storage, were compared to results obtained from a re-assay by Canberra Industries. The four items chosen had corrected FHI activity values that were MDA (i.e., upper limits) and represented a range of weights, from relatively light to relatively heavy. The ratios of FHI value to Canberra value were 23.4, 1.3, 5.1 and 2.4, respectively. The average of the ratios from this small sample is 14.6; however, a conservative approach is to discard the highest and lowest values, which results in an average ratio of 3.7. That is, the FHI MDA values over estimate the transuranic activity in the samples by a factor of 3.7. While it is probably a coincidence, the ratio of the FHI Box #39 activity value (366 nCi/g) to the Canberra re-assay value (95 nCi/g) is 3.8. There are also at least two instances where a waste item was non-destructively assayed then subsequently isotopically analyzed in the laboratory; the ratio of the NDA value for transuranics to the analytical result was quite large (>100) and may not be typical. For that reason, the more conservative ratio of 3.7 was used in adjusting the probable activity values for the six boxes.

Since this factor only applies to the NDA activities of items in the boxes (and not to the activities determined by other than NDA), the adjusted values were determined by adding the unaltered non-NDA activities to the reduced NDA activities. The sum was then divided by the total mass of the waste (in grams) to arrive at the best-estimate value of the activity in each box. Table 3 shows the result of this evaluation.

Table 3. Adjusted Waste Activity in ERDF Boxes

Box Identification	Total Waste Activity (nCi)	Non-NDA Activity (nCi)	NDA Activity (nCi)	Adj*. Total Waste Activity (nCi)	Adj. Total Waste Activity (nCi/g)
233S-00-0002	2.69E8	1.55E5	2.69E8	7.27E7	67
233S-00-0004	2.23E7	7.44E4	2.22E7	6.1E6	26
233S-00-0005	3.27E7	8.14E4	3.26E7	8.89E6	36
233S-00-0013	1.10E8	3.94E5	1.10E8	3.37E7	55
233S-00-0015	2.81E7	4.47E5	2.77E7	7.93E6	31
233S-00-0057	1.79E7	2.88E5	1.77E7	5.07E6	30

*Adj. Tot. Act. = (NDA Act./3.7) + Non-NDA Act.

Note that the activity per gram of waste in each of the boxes is well below the ERDF waste acceptance criterion (i.e., is neither TRU waste nor Greater Than Class C waste).

Cheryl,

Mr. Schlender stopped by my office with this **original** letter and asked if we could get a cc: list together. Once we have a list we need to run it by Phil Lascoe.

My suggested list:

cc:

Usual TPA list (tribes etc.)

M. C. Hughes, BHI

D. Sherwood, EPA

L. Cusack, Ecology

E. K. Thomson, FH

Thanks,
Ellen

P.S. YERXA can help if needed.

cc, List ok for Lascoe
ok to distribute

12-27-01

df