# DISCUSSION POINTS
## FOR THE
# ABRWH'S WORK GROUP ON LANL
(Rev. 0)

(Last updated by ORAUT: April 6, 2012)

This document has been assembled by NIOSH as a follow-up to the Meeting of the Advisory Board's Work Group on LANL on May 2, 2011 at the Cincinnati Airport Marriott Hotel. The primary purpose of that meeting was to discuss remaining issues from the prior Work Group meetings held on April 29, 2010 and November 3, 2010. Many of these issues originated from report SCA-TR-SEC2010-0004, *SC&A's Review of NIOSH's Evaluation Report for Los Alamos National Laboratory Special Exposure Cohort Petition SEC-00109*. NIOSH has conducted additional research regarding these issues and has assembled relevant information for the Work Group. This working document is offered as a resource to guide the topics of discussion at the upcoming meeting scheduled for May 2012.

## WORK GROUP ISSUE 1: LANL CAPABILITY TO MONITOR AND MEASURE MIXED FISSION AND ACTIVATION PRODUCTS BY 1976

**WG ISSUE 1-A:** *NIOSH provided updated approach for handling MAP dose reconstruction based on ratios to Be-7. SC&A has questions on source data used in the model; is OK with methodology. NIOSH still needs to collect data which could be used for the model. NIOSH has not yet collected that data however, based on quarterly reports they believe sufficient data does exist. NIOSH will also investigate the stack sample system to determine whether the samples be used for ratio determination is representative of the workplace exposures. NIOSH will also investigate whether other workplace samples exist for comparison.*

### NIOSH RESPONSE TO WG ISSUE 1-A:

An updated WBC database has been provided by LANL. See Table 1 in the response below to Issue 3-2 for a summary of available data for years 1975 through 2003.

NIOSH has reviewed additional archived data at LANL relating to air monitoring at LAMPF and believes that the ratios to Be-7 determined previously are a reasonable representation of workplace exposures. NIOSH does not believe that it is necessary for the air monitoring data used to determine these ratios to be representative of the quantities to which workers were exposed, only to the nuclide ratios, because bioassay results are used to determine quantities.

The data used to determine the ratios to Be-7 include short-lived nuclides, so it does not appear that hold-up tanks were used.

NIOSH also reviewed extensive gross alpha-beta data from LAMPF, which included surface contamination, air monitoring, and nasal smears.

**WG ISSUE 1-B:** *SC&A concerned about use of reactor ratios for other, non-reactor, facilities where the ratios would no longer apply. NIOSH needs to obtain data from various types of facilities and determine whether methodology would apply.*

### NIOSH RESPONSE TO WG ISSUE 1-B:

NIOSH agrees that the MFP ratios from OTIB 0054 would not apply to non-reactor facilities or in cases where fission products may have been separated. NIOSH has not been able to locate sufficient data to determine nuclide ratios applicable to other facilities, such as CMR, where work campaigns involving separated fission products, for example Sr-90, may have occurred.

NIOSH has however found a tremendous amount of RWPs, workplace monitoring, and nasal smear data throughout the applicable time period for locations such as CMR and has evidence that appropriate bioassay methods were generally available.

**WG ISSUE 1-C:** *NIOSH provided extensive quarterly and monthly reports ranging from 75-91 showing had a program to identify who needed bioassay and for what specific nuclides.*

**NIOSH RESPONSE TO WG ISSUE 1-C:**

No NIOSH response required.

**WG ISSUE 1-D:** *SC&A will review materials that NIOSH compiled to determine whether program in place was effective in identifying significant hazards and individuals who needed bioassay (for Non-accelerator, non-reactor - MAP, MFP, exotics).*

**NIOSH RESPONSE TO WG ISSUE 1-D:**

No NIOSH response required.

**WG ISSUE 1-E:** *NIOSH will do biased sampling of checklist (driven by exotics, MAP and MFP) and determine whether individuals identified to receive bioassay samples actually had bioassay samples taken. NIOSH will also determine whether ALL workers associated with these 'project' driven bioassay sampling efforts did receive bioassay and if not determine approach for assigning dose. NIOSH will also review checklists to determine if workers were designated for bioassay (exotic, MAP and MFP) when a significant internal hazard existed (based on location and hazard type identified in other cells in the checklist).*

**NIOSH RESPONSE TO WG ISSUE 1-E:**

The Excel spreadsheet titled "LANL-Issue-1-E" in the **ABRWH\AB Document Review\LANL SEC-00109\Documents for 5-2012 WGMtg** folder shows the bioassay scheduling and samples provided based on isotopic exposure for 1977 and 1978. It should be noted that, in many cases, more samples are provided than are asked for because the checklists are snapshots in time when they were written. Checklists were required for new hires, re-hires, transfers, and film badge requests. Therefore, a person could be required to leave more samples after they entered a position.

This issue was to address MFPs, MAPs and exotics explicitly on the checklists. Plutonium and uranium have been included for completeness. It can be seen that MAP and MFP samples were requested and left according to the checklist. Note the Cs-137 scans for TA-53 workers and MAP/MFP for TA-3 (CMR alpha wing is a part), TA-48 and TA-50 workers, the latter being highlighted in yellow. However, other radionuclides (e.g., neptunium, curium, actinium) are not specified. The reason for this (as stated in the Evaluation Report) is that plutonium bioassay and alpha monitoring were required and covered all alpha emitters because of their similarities with plutonium being limiting. A procedural statement (**SRDB Ref ID 110067**) from 1975 for CNC-4 backs this up and states the following in part:

> *It is often necessary to prepare x-ray powder diffraction samples containing a radioactive actinide element as a constituent of the compound under investigation. Such samples are estimated at <= 10 micrograms in total weight; the actinide usually amounts to 50% by weight of the compound. Among actinides so treated have been Ac-227, Pa-231, Pu-239, Am-243, and Cm-244. Samples of thorium, uranium, and neptunium have also been examined; however, their activity is not as intense and does not present such a serious hazard. <u>However, for standardization of manipulation, all alpha emitters are treated in the same way</u>.* [Emphasis added]

All alpha activity was done in a glove box.

See document **SRDB Ref ID 110064** data capture for examples of urine sample requests from 1975-1979 in CMR beyond what is required on the checklists.

Checklists obtained from the 2/29/2012 data capture are similar to the 1977-78 checklists in regard to the radionuclides requested and sampled.

**<u>WG ISSUE 1-F</u>:** *NIOSH provided listing of radionuclides monitored for at LAMPF/ LANCE. SC&A followed up on memo stating that 'reference library' was inadequate. SC&A was unable to contact original authors of the memo. SC&A and NIOSH will set up a conference call with internal dosimetry group at LANL to discuss the significance of this issue.*

**NIOSH RESPONSE TO WG ISSUE 1-F:**

This issue originated with SC&A Report SCA-TR-SEC2010-0004, Review of Evaluation Report for SEC-00109. In that report, SC&A made numerous references to a July 9, 2001 DOE audit report. In that audit report, there was an Observation (not a Finding) about the "Lack of Analytical Service Agreement" between the internal dosimetry organization and the *in vivo* laboratory. The discussion included with that observation suggested that since LANSCE nuclides and thorium were not included in gamma spec libraries, or specifically looked for, that there may have been a lack of capability to monitor for those nuclides.

Per an email on February 19, 2012 from Joe Fitzgerald (SC&A) to Mark Griffon (Board Workgroup Chair for LANL) and Greg Macievic (DCAS): *The internal dosimetry group declined to be interviewed, but agreed to written questions.*

The written questions asked, along with the associated LANL responses, are attached to this document (Attachment A).

In summary, the LANL responses indicate that this observation regarding the reference libraries did not impact LANL's capability to detect and quantify Th-232 or mixed activation products. LANL indicated in its response that even presently, given the R&D nature of LANL radiological work, there may occupational exposures to secondary radionuclides that are not present in the reference libraries. However, this would not prevent measurement and assessment of dose from such secondary radionuclides. The trigger for reporting such secondary nuclides are "unidentified peaks" in report printouts. LANL provided current measurement procedures (**SRDB Ref ID 84156**) and procedures that were in place during the 2001 DOE assessment (**SRDB Ref ID 83663**), both of which detail the policy for addressing unidentified peaks and assigning intakes for radionuclides not listed in the reference libraries.

**WG ISSUE 1-G:** NIOSH posted the requested documents. No further action.

No NIOSH response required.

## WORK GROUP ISSUE 2: NIOSH'S ASSUMPTION REGARDING INTAKE VALUES FOR EXOTIC RADIONUCLIDES AT LANL

**WG ISSUE 2-1***: SC&A questions completeness of table of exotics provided by NIOSH.*

**NIOSH RESPONSE TO WG ISSUE 2-1:**

The internal dose bounding methodology listed in the Evaluation Report assigns intake values based on the co-worker intakes of ORAUT-OTIB-0062; the actual radionuclide presenting a potential exposure would be determined from case-specific information. The method provides enough flexibility to bound dose from any presumptive exposure to alpha-emitting radionuclides suggested by case data, so is not limited to those listed in the 'exotic' radionuclides table. It is also applicable to any era in which the dose reconstructor identifies a presumptive unmonitored exposure.

*Specifically, the following comments are offered:*

a. *Po-210 (verify only in early period; have bioassay in 2007-2008)*

   Unmonitored exposures are unlikely to occur in this era.

b. *Ac-227 – was all complete by 1975? Was it used in other areas?*

   No additional usage was discovered; however any presumptive exposure identified in case data can be bounded using the method described above.

c. *Bk-249 – OK as on NIOSH table*

   No specific response required.

d. *Cf-252 – OK as on NIOSH table*

   No specific response required.

e. *Cm-244 – later time? Other areas? Other Cm isotope? (document at DOE – "Alternative Nuclear Materials")*

   Presumptive exposures identified in case data can be bounded using the method described above.

*f. Am-241/243 – table ok; see item e above for special classified project.*

Presumptive exposures identified in case data can be bounded using the method described above.

*g. Np-237 – source term issues exist beyond 1975 (classified issues – Sam Glover is aware of this)*

Presumptive exposures identified in case data can be bounded using the method described above.

*h. Thorium – post 75? Consider tiger team -mentions low quantities; should verify if just lab quantities post 1975. SRDB-066599 (Hanford document) discusses scrap with thorium sent to LANL in the 80s.*

Presumptive exposures identified in case data can be bounded using the method described above.

*i. Protactinium – table seems OK. Check time frames for presence in CMR.*

Presumptive exposures identified in case data can be bounded using the method described above.

*NIOSH will follow-up on available monitoring records for above nuclides (see Nov 11 2010 action item).*

**WG ISSUE 2-2:** *SC&A questions whether the exposure path for all other radionuclides is similar enough to plutonium to accept the use of plutonium as a surrogate for all other exotics (handling is analogous to plutonium -- controlled exposure to same level of rigor as plutonium). If this can be proven than NIOSH approach, using plutonium coworker data for intake and calculating dose based on exotic nuclide of concern, or worst case, would likely be acceptable. SC&A will provide more information on cases which might be exceptions that don't fit into this approach (thorium, actinium, neptunium , curium (classified, see above).*

**NIOSH RESPONSE TO WG ISSUE 2-2:**

No NIOSH response required.

**WG ISSUE 2-3:** *No action.*

**<u>WG ISSUE 2-4</u>***: NIOSH to provide a matrix (from checklist data, HP quarterly report data, RWP data) to look at which workers (job types) were monitored for which exotic radionuclides over time. SC&A will review documents provided by NIOSH.*

**<u>NIOSH RESPONSE TO WG ISSUE 2-4</u>:**

This issue is an adjunct to Issue 1-E above. This issue requests the review of SWPs, RWPs, quarterly reports, and checklists for exotics, MFPs and MAPs based on job types. Before proceeding to new information, we have provided documents from previous work group meetings in the **ABRWH\AB Document Review\LANL SEC-00109\Documents for 5-2012 WGMtg** folder that have dealt with this issue. Here are two of those documents for further review: **Quarterly Survey Report Data Excel file** and **Quarterly Survey Data Statistics Excel file**. These two summary documents show the number of surveys performed at different facilities, some dosimetry, and incidents.

As with Issue 1-E, the data capture does not produce documents that show actinide bioassay requirements. Nasal smears, alpha contamination surveys, and alpha spectrometry were used in the control of alpha emitters, regardless of nuclide. This, of course, did not mean that they were unaware of the types of radionuclides present. In the **Quarterly Survey Report Data Excel file** also in the **ABRWH\AB Document Review\LANL SEC-00109\Documents for 5-2012 WGMtg** folder**,** under the Important Talking Points tab, you will find parts of documents that exemplify this point. In particular, see *Standard Operating Procedures for the Handling of Actinide elements*. It has explicit discussion of the careful handling of actinides and states:

> *Although H-Division is responsible for routine air sampling and surface monitoring, CNC-4 uses its own monitoring instruments. We check independently for alpha and gamma particularly during transfer operations.*

This is a 1973 document. We have included several example documents that show the hazards associated with LANL facilities:

- See **SRDB Ref ID 110062** for an example of Np-237 nasal smear data from CMR in 1984.
- See **SRDB Ref ID 109554** for examples of special work permits from CMR. All jobs required at least a full face respirator and nose wipes checked for alpha contamination.
- See **SRDB Ref ID 107704** for chemical/radiological hazards for NMT-1 personnel. All the actinides are listed.

- See **SRDB Ref ID 109446** for example of experiments and calculations for Pu-242, Am and Np-237 experiments (unclassified information).
- See CMR Building SM-29 Interim Safety Analysis Report Volume I, **SRDB Ref ID 69340**.
- See **SRDB Ref ID 109556** for examples of gamma spectroscopy of CMR SM-29 stacks.
- See **SRDB Ref ID 109450** for bioassay requirements for the Protection Force from 1981.
- See **SRDB Ref ID 110063** for special work permits for C-14, Th, Hg-197, Tritium tritide (Pd), and Np-237.
- In the **ABRWH\AB Document Review\LANL SEC-00109\Documents for 5-2012 WGMtg** folder, see the PDF document *Mixed Waste Streams Characterized from 1992 for Actinide and Tritide Information*.

## WORK GROUP ISSUE 3: COMPLETENESS AND RELIABILITY OF LANL IN-VITRO AND IN-VIVO DATA, AND ADEQUACY OF NIOSH COWORKER MODEL (ORAUT-OTIB-0062 AND ORAUT-OTIB-0063), POST 1975

**WG ISSUE 3-1.1:** *NIOSH posted database. No further action*

**WG ISSUE 3-1.2:** *Remains a NIOSH action item.*

**NIOSH RESPONSE TO WG ISSUE 3-1.2:**

A revised in vivo bioassay database was received from LANL. There are additional results contained in this database, although there was not a significant increase in the totals. However, this database demonstrates that not all nuclides are reported for every count. As previously discussed, database management of gamma spectroscopy results can become quite complicated because a large number of nuclides can potentially be detected in a single count, and not all are necessarily recorded, particularly if no activity is detected. Based on the database, we can add results to the coworker study by looking at the total number of body counts that were done in a year, and for counts where there's no Cs-137 result reported, we can assume that it was <MDA. See the response to 3.2 for the total number of WBCs per year. This should allow the coworker study to be reanalyzed, assessing each year individually rather than combining them into 5-year periods.

**WG ISSUE 3-2*:*** *Remains a NIOSH action item.*

**NIOSH RESPONSE TO WG ISSUE 3-2:**

A review of the recently-received updated database indicates that, although there was a drop in the number of Cs-137 results per year reported after 1993, the total number of whole body counts per year did not drop on average. Table 1 summarizes the number of whole body counts reported in the database by year. Note that this does not include chest counts, which were performed primarily for plutonium and uranium. Because gamma spectroscopy is used for the measurements, there are a large number of potential nuclides that can be reported for each assessment. After 1993, Eu-152 was more likely to have been recorded for a given measurement in the database than was Cs-137. Nuclides reported most frequently include Be-7, C-11/N-13, Mn-54, and Na-22. Table 2 breaks out each year by reported nuclide. Several nuclides may be reported for a given measurement so the totals will not match those in Table 1.

**Table 1: Total Reported Whole Body Counts Per Year**

| Year | No. of WBC | Year | No. of WBC |
|---|---|---|---|
| 1975 | 17 | 1990 | 66 |
| 1976 | 17 | 1991 | 71 |
| 1977 | 1 | 1992 | 88 |
| 1978 | 5 | 1993 | 120 |
| 1979 | 42 | 1994 | 72 |
| 1980 | 46 | 1995 | 57 |
| 1981 | 81 | 1996 | 64 |
| 1982 | 82 | 1997 | 62 |
| 1983 | 57 | 1998 | 67 |
| 1984 | 103 | 1999 | 70 |
| 1985 | 108 | 2000 | 108 |
| 1986 | 96 | 2001 | 75 |
| 1987 | 121 | 2002 | 89 |
| 1988 | 53 | 2003 | 66 |
| 1989 | 63 | | |

Table 2 (on the following three pages) shows the number of whole body counts per year by reported nuclides. Note that several nuclides may be reported for one count.

| Table 2: Number of Whole Body Counts Per Year by Reported Nuclides | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | AS-72 | BE-7 | BI-214 | BR-76 | BR-77 | C11N13 | CD-109 | CE-141 | CO-56 | CO-57 | CO57 CO58 | CO-58 | CO-60 | CR-51 | CS-134 | CS-137 | CU-64 |
| 1975 | | 2 | | | | 2 | | | | | | | 13 | | 13 | 14 | |
| 1976 | | 8 | | | | 8 | 1 | | | | | | 5 | | 4 | 4 | |
| 1977 | | | | | | | | | | | | | 1 | | 1 | 1 | |
| 1978 | | 3 | | | | 4 | | | | | | | 2 | | 2 | 2 | |
| 1979 | | 20 | | 2 | 2 | 20 | 2 | 2 | | | 1 | | 17 | | 17 | 19 | |
| 1980 | | 20 | | 2 | 2 | 20 | 2 | 2 | | | | | 15 | | 13 | 16 | |
| 1981 | | 38 | | 7 | 7 | 38 | 13 | 7 | | | | | 16 | | 14 | 16 | |
| 1982 | 3 | 51 | | 12 | 12 | 50 | 12 | 12 | 1 | 4 | | 1 | 13 | | 14 | 14 | |
| 1983 | 1 | 34 | | 8 | 9 | 32 | 8 | 8 | 1 | 1 | | 3 | 7 | 1 | 9 | 7 | 1 |
| 1984 | 1 | 59 | | 8 | 8 | 61 | 8 | 8 | 2 | 1 | | 4 | 6 | 2 | 8 | 6 | 2 |
| 1985 | | 52 | | 8 | 8 | 52 | 8 | 8 | 1 | 1 | | 2 | 13 | 2 | 16 | 10 | 1 |
| 1986 | 5 | 51 | | 3 | 3 | 51 | 3 | 3 | | 5 | | | 31 | | 34 | 32 | |
| 1987 | 1 | 43 | | 11 | 11 | 42 | 10 | 10 | 3 | 1 | | 3 | 53 | 3 | 54 | 55 | 3 |
| 1988 | 2 | 28 | | 5 | 5 | 28 | 5 | 5 | | 2 | | | 13 | | 14 | 14 | |
| 1989 | 2 | 37 | | 6 | 6 | 37 | 8 | 6 | | 1 | | | 11 | | 11 | 12 | |
| 1990 | | 52 | | 1 | 1 | 52 | 2 | 1 | | | | | 12 | | 12 | 13 | 1 |
| 1991 | | 55 | | 1 | 1 | 55 | 3 | 1 | | | | | 14 | | 14 | 14 | |
| 1992 | | 65 | | 1 | 1 | 65 | 4 | 1 | | | | | 19 | | 18 | 19 | |
| 1993 | | 97 | 6 | 1 | 1 | 97 | 2 | 1 | | | | | 14 | | 14 | 14 | |
| 1994 | | 64 | | 2 | 2 | 64 | 2 | 2 | | | | | 3 | | 3 | 3 | |
| 1995 | | 50 | | 1 | 1 | 50 | 1 | 1 | | | | | 4 | | 4 | 4 | |
| 1996 | | 51 | | 1 | 1 | 62 | 1 | 1 | | | | | 1 | | 1 | 1 | |
| 1997 | | 29 | | | | 58 | | | | | | | 2 | | | 2 | |
| 1998 | | 27 | | 1 | 1 | 58 | 1 | 1 | | | | | 9 | | | 7 | |
| 1999 | | 22 | | | | 69 | | | | | | | 5 | | | 6 | |
| 2000 | | 1 | | | | 105 | | | | | | | 3 | | | 3 | |
| 2001 | | | | | | 66 | | | | | | | 5 | | | 15 | |
| 2002 | | | | | | 74 | | | | | | | 13 | | | 21 | |
| 2003 | | | | | | 56 | | | | | | | 15 | | | 11 | |

| Table 2: Number of Whole Body Counts Per Year by Reported Nuclides (cont.) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | CU-67 | EU-152 | FE-59 | FISSION PRODS | GE67 GA67 | GE68 GA68 | HF-173 | HG-195M | HG-197 | HG-197M | HG-203 | I-123 | I-125 | I-131 | I-132 | MN-54 | NA-22 |
| 1975 | | | | 1 | | | | | | | | | | | | 2 | |
| 1976 | | | | 1 | | | | | | | | | 4 | | | 8 | |
| 1977 | | | | | | | | | | | | | | | | | |
| 1978 | | | | | | | | | | | | | | | | 4 | |
| 1979 | | 2 | | | | | | 2 | 2 | 2 | 2 | | | | | 20 | 7 |
| 1980 | | 2 | | | | | | 2 | 2 | 2 | 2 | | 8 | | | 20 | 20 |
| 1981 | | 13 | | | | | | 7 | 13 | 7 | 13 | | 17 | | | 38 | 38 |
| 1982 | | 12 | | | | | | 12 | 14 | 13 | 14 | | 2 | 1 | | 51 | 50 |
| 1983 | 1 | 8 | 1 | | | | | 8 | 10 | 8 | 9 | | 7 | 2 | | 34 | 32 |
| 1984 | 2 | 8 | 2 | | | | | 8 | 12 | 8 | 8 | 2 | 26 | 2 | | 59 | 59 |
| 1985 | 1 | 8 | 1 | | 1 | 2 | | 8 | 8 | 8 | 8 | | 39 | 1 | | 55 | 52 |
| 1986 | | 3 | | | 1 | 2 | | 3 | 3 | 3 | 3 | | 10 | | | 51 | 51 |
| 1987 | 3 | 10 | 3 | | 2 | 2 | | 10 | 10 | 10 | 10 | | 21 | | | 42 | 43 |
| 1988 | | 5 | | | | | | 5 | 5 | 5 | 5 | | 10 | | | 28 | 28 |
| 1989 | | 8 | | | | | | 6 | 8 | 6 | 8 | | 8 | | 1 | 37 | 37 |
| 1990 | | 2 | | | | | | 1 | 2 | 1 | 2 | | | | | 52 | 52 |
| 1991 | | 2 | | | | | | 1 | 2 | 1 | 2 | | | | | 55 | 55 |
| 1992 | | 4 | | | | | | 1 | 4 | 1 | 4 | | | | | 65 | 65 |
| 1993 | | 2 | | | | | | 1 | 2 | 1 | 2 | | 2 | | | 97 | 97 |
| 1994 | | 2 | | | | | | 2 | 2 | 2 | 2 | | 3 | | | 64 | 64 |
| 1995 | | 1 | | | | | | 1 | 1 | 1 | 1 | | 2 | | | 50 | 50 |
| 1996 | | 12 | | | | | | 1 | 1 | 1 | 1 | | | | | 51 | 62 |
| 1997 | | 28 | | | | | 2 | | | | | | | | | 29 | 57 |
| 1998 | | 34 | | | | | | 1 | 1 | 1 | 1 | | | | | 27 | 58 |
| 1999 | | 47 | | | | | 1 | | | | | | | | | 22 | 69 |
| 2000 | | 104 | | | | | | | | | | | | | | 1 | 105 |
| 2001 | | 66 | | | | | | | | | | | | | | | 66 |
| 2002 | | 74 | | | | | | | | | | | | | | | 74 |
| 2003 | | 56 | | | | | | | | | | | | | | | 56 |

| Table 2: Number of Whole Body Counts Per Year by Reported Nuclides (cont.) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | NA-24 | ND-147 | OS-185 | RB-83 | RB-84 | SB-124 | SC-46 | SE72 AS72 | SE-75 | SM-145 | TA-179 | TE-132 | TL-201 | TL-202 | V-48 | ZN-65 | ZR-95 |
| 1975 | 2 | | | | | | | | | | | | | | | | |
| 1976 | 8 | | | | | | | | | | | | | | | | |
| 1977 | | | | | | | | | | | | | | | | | |
| 1978 | 3 | | | | | | | | | | | | | | | | |
| 1979 | 13 | 2 | 2 | 2 | 2 | 2 | | | 2 | 2 | 2 | | 2 | 2 | | | |
| 1980 | | 2 | 2 | 2 | 2 | 2 | | | 2 | 2 | 2 | | 2 | 2 | | | |
| 1981 | | 7 | 7 | 7 | 7 | 7 | | | 7 | 7 | 13 | | 7 | 7 | | | |
| 1982 | | 12 | 13 | 12 | 12 | 12 | 4 | | 12 | 12 | 12 | | 12 | 14 | 1 | | |
| 1983 | | 8 | 9 | 8 | 8 | 8 | 2 | | 8 | 8 | 8 | | 8 | 8 | 1 | 1 | |
| 1984 | | 8 | 8 | 8 | 8 | 8 | 1 | | 8 | 8 | 8 | | 8 | 8 | 3 | 2 | |
| 1985 | | 8 | 8 | 8 | 8 | 12 | | 1 | 9 | 8 | 8 | | 8 | 8 | 1 | 2 | 2 |
| 1986 | | 3 | 3 | 4 | 4 | 3 | 5 | 1 | 4 | 3 | 3 | | 3 | 3 | | | 1 |
| 1987 | | 10 | 10 | 11 | 11 | 10 | 1 | 2 | 13 | 11 | 10 | | 10 | 10 | 3 | 4 | |
| 1988 | | 5 | 5 | 7 | 5 | 5 | 2 | 1 | 11 | 5 | 5 | | 5 | 5 | | | |
| 1989 | | 6 | 6 | 6 | 6 | 6 | 1 | | 6 | 6 | 8 | 1 | 6 | 6 | | | 1 |
| 1990 | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | 3 | | 1 | 1 | | 1 | |
| 1991 | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | 2 | | 1 | 1 | | | |
| 1992 | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | 4 | | 1 | 1 | | | |
| 1993 | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | 2 | | 1 | 1 | | | |
| 1994 | | 2 | 2 | 2 | 2 | 2 | | | 2 | 2 | 2 | | 2 | 2 | | | |
| 1995 | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | | 1 | 1 | | | |
| 1996 | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | | 1 | 1 | | | |
| 1997 | | | | | | | | | | | | | | | | | |
| 1998 | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | | 1 | 1 | | | |
| 1999 | | | | | | | | | | | | | | | | | |
| 2000 | | | | | | | | | | | | | | | | | |
| 2001 | | | | | | | | | | | | | | | | | |
| 2002 | | | | | | | | | | | | | | | | | |
| 2003 | | | | | | | | | | | | | | | | | |

## WORK GROUP ISSUE 4: FEASIBILITY OF DOSE ESTIMATION FOR NEUTRON EXPOSURE AT LANL, POST 1975

**WG ISSUE 4-1:** *NIOSH provided proposed method for using ratios from 80-82 to extrapolate back to 76-79. NIOSH needs to follow-up on site data based on jobs and areas to assure operational documents support approach. If operational data supports NIOSH intends on using a distribution of n/p ratios for estimating neutron doses from 76-79.*

### NIOSH RESPONSE TO WG ISSUE 4-1:

This issue pertains to taking NP ratio distributions from 1980-1982 and using them for the period 1976-1979. We could find no information to show that significant operational variations occurred during the period 1976 to 1982. Information previously sent to the work group showed that any changes in manpower and increase of dosimetry records began with the mid-1980s and would not be part of this extrapolation. In the **ABRWH\AB Document Review\LANL SEC-00109\Documents for 5-2012 WGMtg** file, we have included an Excel spreadsheet, **ISSUE 4-1**, based on NOCTS data base job titles and descriptions cross-referenced to neutron and photon dose and NP ratio. It shows NP ratios to be in the range of the NP ratio distribution sent to the work group in previous meetings. We will also send to the work group a new white paper entitled *LANL Neutron-to-Photon (NP) Dose Ratio Analysis* that discusses the NP ratio over time based on instrument measurements. This document is currently under classification review by LANL. There are several neutron/photon survey documents from the 2/29/2012 data capture that pertain to LAMPF, where a large percentage of the neutron dose is received. These are: **SRDB Ref IDs 109442, 109441, 45498, 109565, and 109579**. In none of these documents is there information that contradicts the use of 80-82 NP ratio data for use in the years 1976-79.

Based on these data, we feel the extrapolation approach is valid and should be used.

**WG ISSUE 4-2:** *SC&A will review provided documents from NIOSH. SC&A generally OK with approach.*

### NIOSH RESPONSE TO WG ISSUE 4-2:

No NIOSH response required.

## WORK GROUP ISSUE 5: FEASIBILITY OF DOSE ESTIMATION FOR RADIOLOGICAL EXPOSURE SOURCES AT LAMPF/LANSCE (EXPOSURE TO WORKERS ADJACENT TO THE FACILITY)

**WG ISSUE 5-1:** *LAMPF and LANCE examples considered as part of response to issue 4 – include in distribution.*

**NIOSH RESPONSE TO WG ISSUE 5-1:**

No NIOSH response required.

**WG ISSUE 5-2:** *Remains a NIOSH action item*

**NIOSH RESPONSE TO WG ISSUE 5-2:**

This issue pertains to LAMPF holding pond data and the ability to bound dose. Several documents were collected from LANL in the 2/29/2012 data capture pertaining to LAMPF lagoon survey data. LANL staff was contacted about the lagoon sampling and they stated that there are sufficient sampling data available for our needs; this was confirmed during the data capture visit. The following documents show examples from the mid-1980s of non-tritium radionuclides: **SRDB Ref IDs 45509, 109619, 109613, 109621, 109622, 109624, 73424, 109620, and 45421**. There are several more documents like this at LANL from other years, but the data contained in these files can be used to produce an estimate of dose. Specific to tritium, a PDF on 1986 tritium concentrations is provided in the **ABRWH\AB Document Review\LANL SEC-00109\Documents for 5-2012 WGMtg** folder. It is entitled *TA 53 Lagoon Tritium Concentration Plot 1986*.

A model can be constructed from these data to bound dose from the east and west over-flow lagoons.

## WORK GROUP ISSUE 6: RADIATION EXPOSURE TO SPECIAL TRITIUM COMPOUNDS

**WG ISSUE 6-1:** *NIOSH will have to get into the classified documents further to better characterize the source term and potential for exposure (who could be exposed and to what).*

**NIOSH RESPONSE TO WG ISSUE 6-1:**

NIOSH has reviewed the classified documents and has found nothing to alter the previous response to this issue.

**WG ISSUE 6-2:** *Remains a NIOSH action item. SC&A is recommending that NIOSH consider two classified documents at Germantown related to this issue that should be considered (LANL related documents).*

**NIOSH RESPONSE TO WG ISSUE 6-2:**

NIOSH has reviewed the classified documents and has found nothing to alter the previous response to this issue.

## WORK GROUP ISSUE 7: UNMONITORED EXPOSURE OF SUPPORT SERVICE PERSONNEL

*No 05-02-11 issues listed for this item.*

## PETITIONER ISSUES RAISED DURING WORK GROUP MEETINGS

**PETITIONER ISSUE 1.2:** *NIOSH will specifically address firing site in table of exotic exposures.*

**NIOSH RESPONSE TO PETITIONER ISSUE 1.2:**

NIOSH acknowledges the firing site as a location where contamination may be present, including exotics contamination, and presumptive exposures to the so-called 'exotic' radionuclide may be addressed using the bounding internal dose estimate described in the Evaluation Report. This method assigns intakes based on co-worker intakes, leaving the

radionuclide of concern and the era of possible exposure to be determined based on case-specific data.

**PETITIONER ISSUE 1.3:** *NIOSH will not use badge access to determine dose. No further action.*

**PETITIONER ISSUE 1.4:** *No further action.*

**PETITIONER ISSUE 1.5:** *SC&A provided a response and NIOSH is considering SC&A response. Many are just clarifying questions. Two bigger issues: 1) adequacy of stack monitoring to estimate environmental doses and 2) resuspension from contamination should be further clarified (particularly of concern for support service workers).*

**NIOSH RESPONSE TO PETITIONER ISSUE 1.5:**

For the purpose of bounding dose, if intakes are based on bioassay, even surrogate bioassay, the adequacy of stack monitoring or the issue of resuspension would be irrelevant.

**PETITIONER ISSUE 1.6:** *NIOSH will address this in addressing the completeness of table on exotic source terms. Other areas which are of concern should be demonstrated to be covered by environmental exposure approach (see 1.5 of this section).*

**NIOSH RESPONSE TO PETITIONER ISSUE 1.6:**

No NIOSH response required. See Issue 2-1.

**PETITIONER ISSUE 1.7:** *NIOSH issued a white paper regarding approach for reconstructing doses to workers involved in fire. Doses based on available monitoring data as calculated by NIOSH were small. SC&A raised concerns about work by fire fighters in 'up close operations' where re-suspension might be an issue.*

**NIOSH RESPONSE TO PETITIONER ISSUE 1.7:**

For particle sizes in the range of dosimetric interest (1-5 microns), settling velocities are low over the entire range (for wildland fire research, PM10 are considered as a group). Thus, concentrations would not vary significantly between sampling height (approximately 48-66 inches) and closer to the ground. Larger, non-respirable, particle concentrations might vary

more in this region; however, studies of wildland fire smoke and particulate do not furnish detail on this issue. Similarly, low settling velocities also mean that samplers near the fire are likely to be representative, for particles in the range of interest. Since some samplers were close enough for clogging to be an issue, AND the highest concentrations were used, the method used in the white paper is both unrealistic and overestimating. AIRNET stations actually do measure resuspended dust (Reference SRDB Ref ID 35741, page 94) at all times.

**PETITIONER ISSUE 1.8*:*** *Remains an action for workgroup members.*

**NIOSH RESPONSE TO PETITIONER ISSUE 1.8:**

Even though LANL work has often been campaign-based like work at NTS, there are significant differences between the two sites when considering the quantity and quality of available data. The health physics program at LANL appears to have been considerably more robust during this time period. It is certainly is documented much better. NIOSH therefore believes the LANL site should be evaluated separately based on its own health physics and dose assessment programs.

## REFERENCES


- LANL (Los Alamos National Laboratory) 1994. *Los Alamos National Laboratory Environment, Safety and Health Division Personnel Dosimetry Operations – External Dosimetry Technical Basis Document*, ESH-4-PDO-94:005. Los Alamos National Laboratory, Los Alamos, New Mexico. February 8, 1994. [SRDB Ref ID: 27265]

- LANL (Los Alamos National Laboratory) 2001a. *Photodosimetry Evaluation Book, Volume VIII*. Los Alamos National Laboratory, Los Alamos, New Mexico. [SRDB Ref ID: 27292]

- LANL SEC-00109. 2008. *SEC Petition for all service support workers working in any Technical Area with a history of radioactive material at the LANL from 1976–2005*. National Institute for Occupational Safety and Health, Office of Compensation Analysis and Support, Cincinnati, Ohio. May 29, 2008.

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- ORAUT (Oak Ridge Associated Universities Team) 2007a. *Fission and Activation Product Assignment for Internal Dose-Related Gross Beta and Gross Gamma Analyses*, ORAUT-OTIB-0054, Rev. 00. ORAUT, Cincinnati, Ohio. November 19, 2007.

- ORAUT (Oak Ridge Associated Universities Team) 2007b. *Technical Information Bulletin: Internal Dosimetry Coworker Data for Los Alamos National Laboratory,* ORAUT-OTIB-0062, Rev. 00-C. ORAUT, Cincinnati, Ohio. April 18, 2007.

- ORAUT (Oak Ridge Associated Universities Team) 2009b. *Technical Basis Document for the Los Alamos National Laboratory – Occupational Internal Dose*, ORAUT-TKBS-0010-5, Rev. 01-F. ORAUT, Cincinnati, Ohio. June 16, 2009.

- ORAUT (Oak Ridge Associated Universities Team) 2009c. *Technical Basis Document for the Los Alamos National Laboratory – Occupational External Dose,* ORAUT-TKBS-0010-6, Rev. 01 PC-1-A. ORAUT, Cincinnati, Ohio. June 11, 2009.

- ORAUT (Oak Ridge Associated Universities Team) 2012. *White Paper: LANL Neutron-to-Photon (NP) Dose Ratio Analysis*, Rev. 00, ORAUT, Cincinnati, Ohio. March 15, 2012. (Document currently under LANL review)

## ATTACHMENT A: LANL INTERVIEW RESPONSES

**SC&A Site Expert Interview Questions & Responses**
**Los Alamos National Laboratory (LANL) Whole Body Counting/Assessment Staff**
**September 12, 2011; SRDB Ref ID: 110383 [reformatted]**

Following are collective responses by knowledgeable staff from the LANL Radiation Protection Program, corresponding to Advisory Board questions received by LANL on August 23, 2011.

**Question 1:** Does the LANL ES&H, health physics, internal dosimetry, or in vivo program have any record of this audit and/or the LANL program's response? If a written response is located, please provide a copy of it and any additional documentation pertaining to it.

LANL RESPONSE: *Yes, LANL has a copy of the assessment mentioned above and a copy of the LANL response [August 2, 2001; ESH-RPO:01-21; "Response to DOE-LAAO Report Number 2000-RP-1…"; Joseph Graf to Kenneth Zamora] (Attachments 1 & 2). This response documented corrective actions addressing Finding #1 of the assessment regarding management review of dosimetry enrollment. There is no additional documentation pertaining to this response available. Per instructions in the assessment report and convention at the time, there was no formal response to observations (opportunities for improvement) in the assessment report.*

**Question 2:** Is there anyone on staff who is familiar with this review, its findings, or LANL's response? If so, we would appreciate both a brief summary of what is known and an opportunity to discuss it with them. Likewise, if anyone is familiar with the issue of completeness of library reference peaks and how incomplete references may have affected LANL's historic in vivo counting program, we would like to talk with them.

LANL RESPONSE: *Yes, there is current LANL staff familiar with the topics discussed in the assessment. Observation #2 was an opportunity for improvement regarding procedural formality and adding analysis libraries for the LANL In Vivo Measurements Laboratory. As is well documented, the internal dosimetry program at LANL was focused on primary nuclides of concern, which is still true presently. IVML analysis libraries have been added over time as warranted based on potential occupational exposures; these libraries improve the process efficiency for identifying and quantifying nuclides. Without these libraries, the IVML instrumentation was - and remains - capable of detecting nuclides outside these libraries. The process in place still enabled identification and quantification of intakes of other nuclides – this was just done manually (see response to Question 5). Observation #2 highlighted Th-232 and mixed activation products – both of these were detectable with*

*IVML instrumentation in 2001 and before that; the observation merely pointed out opportunities to improve formality and business efficiency.*

**Question 3:** How significant is this finding in terms of the LANL's in vivo counting program being able to detect and report radiation exposures for LANSCE releases and for thorium in the workplace? The DOE audit indicated that LANL had not maintained its capability to routinely monitor mixed activation products from LANSCE and thorium. Did lack of library references impair detection and reporting in any way?

LANL RESPONSE: *Observation #2 documented opportunities to improve formality and business efficiency. As stated in the response to Question 2, IVML had the capability to detect and quantify intakes of thorium and mixed activation products. The germanium detector system was operational and capable of detecting thorium intakes – the suggested improvement was to update procedures. Likewise, the IVML system was capable of detecting and quantifying mixed activation products – additional libraries would ease reliance on the manual process that was well-established.*

**Question 4:** What corrective actions were implemented in the internal dosimetry and/or in vivo program following the identification of deficiencies in the July 9, 2001 programmatic assessment?

LANL RESPONSE: *Per instructions in the assessment report, LANL was obligated to respond to findings (deficiencies), not observations (opportunities for improvement). The memo referenced in Question 1 contained corrective actions responsive to Finding #1 of the assessment. We were unable to locate a LANL response corresponding to Finding #2 regarding closure of previous radiobioassay issues by the Chemistry Division.*

**Question 5:** How are determinations made regarding what library references are maintained for various LANL sources, particularly the secondary ones that are either rarely measured or not radiologically as significant as Pu, Am, tritium, etc. What would trigger the in vivo program's reporting of such secondary radionuclides? What is the written policy for identification and quantification of results from unidentified peaks in spectra?

LANL RESPONSE: *Worker dosimetry is assigned based on the potential for occupational exposure using a process and system using location and activity-specific thresholds. The LANL Radiation Protection Program maintains internal (and external) dosimetry programs corresponding to these potential exposures. As indicated previously, LANL has added analysis libraries for the IVML counting systems over time, commensurate with these potential occupational exposures, to streamline the process of IVML measurements. Even*

*presently, given the R&D nature of radiological work at LANL, there may be an occupational exposure to some nuclide not explicity in an IVML analysis library. This would not prevent the detection, investigation, identification, quantification, and assessment of dose from such a secondary radionuclide.*

*The trigger for reporting such secondary nuclides is the instance of "unidentified peaks" in IVML measurement report printouts, as described in detail in the following procedures:*

*Attachment 3 is procedure ESH4-IVML-DP-37, R1, Performing Measurements and Analyses with SB-14 IVML Detectors (in place during the 2001 DOE assessment). Section 7.1.2 Analysis clearly prescribes the capability and process for identifying and quantifying unidentified peaks in IVML measurement spectra.*

*Attachment 4 is procedure RP2-ID-DP-12.IVML, R1 Performing Measurements with IVML Counting Systems (Current procedure). Section 8.2 and Attachments 1 & 2 from that procedure clearly prescribe the capability and process for identifying and quantifying unidentified peaks in IVML measurement spectra. This approach remains essentially consistent with the earlier procedure and the process that has been applied since establishing this capability at LANL.*

**Question 6.** What calibration sources are/have been used to calibrate in vivo detectors?

LANL RESPONSE: *Attachment 5 is a list of Radioactive Sealed Sources used currently and historically at IVML. On this list are sources dating back to the 1970s, including two broad-spectrum, mixed gamma sources from 1975 and 1977. These are indicators of the capability for identification of photon emitters of widely varying energies, enabling the detection of unidentified peaks discussed in the response to Question 5.*

## REFERENCES FOR ATTACHMENT A:

**Attachment 1:** Response to DOE-LAAO Report Number 2000-RP-1, Programmatic Assessment of the Internal Dosimetry Program at Los Alamos National Laboratory; **SRDB Ref ID: 84156**

**Attachment 2:** Programmatic Assessment of the Internal Dosimetry Program at Los Alamos National Laboratory; **SRDB Ref ID: 83663**

**Attachment 3:** Performing Measurements and Analyses with SB-14 IVML Detectors**; P**rocedure ESH4-IVML-DP-37, R1; **SRDB Ref ID: 110379**

**Attachment 4:** Performing Measurements with IVML Counting Systems; RP2-ID-DP-12.IVML, R1; **SRDB Ref ID: 110381**

**Attachment 5:** IVML Exempt Radioactive Source Inventory; **SRDB Ref ID: 110382**