MEMO

TO: LBNL Work Group
FROM: Joe Fitzgerald and Ron Buchanan, SC&A
DATE: February 4, 2014
SUBJ: NIOSH December 4, 2013, Response to SC&A Comments

After reviewing NIOSH's December 4, 2013, response in its two white papers, *NIOSH Evaluation of the Internal and External Monitoring Programs at the Lawrence Berkeley National Laboratory* and *NIOSH Response to SC&A Comments Concerning Part of Issue 2 Regarding the Internal Monitoring Program at the Lawrence Berkeley National Laboratory*, we believed it useful to pose some clarifying questions and issues for the Work Group and NIOSH consideration prior to a formal Work Group meeting.

In general, our concern at this still early phase of review is over-reliance on contemporary technical studies and programmatic documents (e.g., policies and procedures) at the expense of a comprehensive assessment of actual routine and event-driven in-vivo and in-vitro bioassay records. As experience at other DOE sites (LANL, in particular) has illustrated, what bioassay data are actually recorded for exposure source terms often do not necessarily match the available monitoring technology or conform with existing policies or procedures governing routine bioassay program implementation.

With respect to LBNL, it appears that in the 1960s, there was an initiative to begin identifying some of the specific radionuclides in bioassay samples (e.g., SRDB Ref IDs #117632, 117754, 118311). However, when SC&A sampled LBNL claimants with job titles that would indicate potential exposures (i.e., Accelerator Operator, Chemist, Nuclear Physicists, HP, Technicians, Maintenance, etc.) who worked during the 1960s, 1970s, and 1980s, there appear to be few bioassays recorded (i.e., gross alpha, beta, gamma), and still fewer yet with any analyses for specific radionuclides.

The ability to identify, and the need to analyze, specific radionuclide intakes at the national labs (e.g., LANL, BNL, and LLNL) was still in its infancy in the 1960s; and, generally, these methods were not yet applied to bioassays on a routine basis (and the results recorded and rendered useful for dose reconstruction) until much later because they required considerable development time. An obvious question would be whether LBNL was much more advanced and ahead of its time than these other laboratories in this respect.

While LBNL was a forerunner in accelerator health physics, it appears from an SC&A preliminary evaluation of NIOSH claimant files for LBNL that the capability to analyze specific radionuclides may have remained in a laboratory development stage, as opposed to being applied to routine bioassays, especially for WBCs. LBNL claim files were searched for POCs <50% (to ensure a complete DR) and if there was a DR report on file (to see how the internal doses were determined). This resulted in 195 claims. Claims with job titles that indicated potential exposure were selected for investigation. This included Physicist, Nuclear Physicist, Chemist, Lab Tech, Technician, Researcher, Accelerator Operator, Maintenance, HP, Machinist, and

Magnet Tester. A total of 25 claimants that worked some time during the period 1960s–1980s were analyzed by reviewing their DOE Response files and DR reports to determine if bioassays were recorded, and if so, what bioassay information is available; i.e., frequency, urinalyses, WBCs, and radionuclide identification. From this review, there did not appear to be many bioassay results recorded, and very few routine bioassays; only 4 claimants had any bioassay records out of the 25 reviewed. What bioassays were recorded generally did not contain nuclide-specific information (mainly gross gamma, beta, and alpha counts) and did not appear to be used in the DR process, except for a 1971 P-32 measurement for a potential acute intake. It would seem reasonable to expect that some of the personnel that worked at the facilities on a routine basis, such as operators and technicians, would have some records of routine, or at least periodic, bioassays in their records if the HP program was firmly in place and operational by 1962.

For comparison sake, the same review process was also conducted for five claimants that had worked during the 1990s and 2000s. From this limited review, there were likewise very little bioassay data or radionuclide-specific information recorded.

SC&A has the following comments and proposes that the following clarifying questions be addressed by NIOSH to help resolve the aforementioned issues:

1. **Recorded Bioassays –** In response to SC&A's e-mail request of January 17, 2014, concerning the lack of claimant bioassay records, NIOSH provided a list of SRDB references in an e-mail response on January 23, 2014. SC&A reviewed some of the pages of all of these references (which consisted of thousands of pages) and found:

    a. Ref ID #21985 contained handwritten bioassay cards for workers with the last names beginning with A for the period 1965–1990, with some radionuclides recorded, but generally the results were gross beta dpm, alpha dpm, and gamma dpm or "negative." Results of WBCs were generally listed as "Normal" without providing any radionuclides, their quantities, or MDA values. Ref ID #21986 generally contained the same information for persons terminated during 1961–1983 with last names beginning with A.

    b. Ref IDs #32378–#32379 contained handwritten bioassay cards that listed the bioassays to be performed during the period 1960 through approximately 1967 for persons with last names starting from A–Z, with some bioassay results in the form of gross alpha, gross beta, and sometimes "no gamma peaks" noted; however, generally there were no specific radionuclides recorded.

    c. Ref IDs #32380–32392 generally contained computer-generated bioassay punch cards that listed the bioassays to be performed during the period 1960 through approximately 2002 for persons with last names starting from A–Z; however, generally there did not appear to be any results recorded in these files.

    d. Ref IDs #32393–32294 provide some examples of bioassay lab procedures for specific radionuclides during the period 1980–2002.

These documents indicate that bioassays were conducted at LBNL beginning by at least the 1960s; however, it is still not obvious that the persons that needed to be monitored were bioassayed on a routine basis, and sufficient radionuclide information recorded for DR purposes. This is especially true considering the results of SC&A's preliminary investigation of claimant files for bioassay records. *How does NIOSH reconcile the differences between what is indicated in these documents with what appears to be lacking in the claimant files? How does NIOSH propose to use gross alpha, beta, and gamma results (without specific radionuclide recorded) for DR purposes?*

2. **WBCs** – *Are there recorded bioassays during the period 1960s–1990s where the WBCs provided analyses of specific radionuclides on a routine basis?* If so, please identify some of the bioassays and radionuclides involved.

3. **Location-Specific Radionuclides** – *Are there examples of the recorded bioassay data providing results for specific radionuclides that match those that the worker was potentially exposed to for the given work location and time period?* Considering the number of accelerators and their long periods of use at LBNL, the use of WBCs to identify individual radionuclides (and recording the results) for mixed activation products (MAP) are of special concern since alpha urinalyses would not detect them. *Were workers around the accelerators monitored for MAP?* From some of the references (e.g., SRDB Ref IDs #117632, #117754, #118311), it appears that LBNL was developing the capability to analyze for specific radionuclides (these may have been for radionuclides brought into the labs in relatively large quantities). However, SC&A has not located any comprehensive characterization of some of the other potential exposure intakes, such as from accelerator activation of beamlines, shielding, targets, target enclosures, and radioisotope production, with their corresponding bioassay methodology for radionuclide identification, quantification, and recording. The TBDs for other national labs with accelerators, such as BNL, ANL, LANL, as well as LBNL, indicate a number of radionuclides generated from accelerator operations. *What results indicate that the LBNL workers were appropriately bioassayed and the results recorded for the radionuclides they were potentially exposed to?*

A bridge between LBNL written procedures, monitoring requirements, and capabilities for radionuclide identification, compared to the recorded bioassay data available for dose reconstruction, is not clear at this time. As we have found in the past, program directives and instrument capabilities do not necessarily equate to what was actually put into practice and is available for dose reconstruction.