



## MEMO

TO: BNL Work Group  
FROM: Ron Buchanan, SC&A  
DATE: May 22, 2012  
SUBJECT: SC&A's Reply to NIOSH's March 28, 2012, Responses to BNL SEC Issues

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The following 13 Brookhaven National Laboratory (BNL) Special Exposure Cohort SEC-00116 (NIOSH 2008) issues remained to be addressed from the January 21, 2011, work group meeting. A statement of each issue, NIOSH's response of March 28, 2012, and then SC&A's reply are provided below.

**1. Determine if BNL applied any fading correction factors to neutron dose of record.**

NIOSH's Response: BNL did not apply fading correction factors. This is because the calibration process accounted for any fading that may have occurred. See the Faust-Ruhter paper (NIOSH 2012b) for discussion.

SC&A's Reply: It appears that the vendor did calibrate the NTA film at the beginning of the exchange cycle and read them at the end of the cycle, therefore incorporating fading in the calibration cycle as if the whole dose was received on the first day of exposure (NIOSH 2011c), which is claimant favorable. An additional 9%/wk fading factor, as recommended on page 86 of the BNL technical basis document (TBD) (ORAUT 2010), is to be applied to the recorded dose. Note that the statement in the Faust-Ruhter paper (NIOSH 2012b) that, "...the NIOSH recommendation to apply a fading correction of 1.56 (2 week wear period)..." is incorrect according to the BNL TBD (ORAUT 2010, page 86); it should read 9%/wk. Although there may have been some differences in environments for the worn and stored badges, the favorable practice of exposing the calibration field at the beginning of the cycle, and applying an additional 9%/wk fading factor to the worn badges should result in sufficient fading compensation.

SC&A has no further comments concerning the issue at this time.

**2. Check recent BNL DRs to see if fading and angular dependence correction factors were used for neutron dose as described in the current TBD.**

NIOSH's Response: Specifically, fading is not to be applied, per the NIOSH Response to item 1 above, and angular dependence is only considered for the neutrons >2 MeV. See the D.L. Strenge paper (NIOSH 2012a) for discussion.

SC&A's Reply: If the angular dependence correction factor of 1.3 is applied as listed on page 86 of the BNL TBD (ORAUT 2010), then SC&A has no further comments concerning the issue at this time.

3. **See if any documentation can be found describing how BNL assigned neutron dose when NTA film was used with CR-39 and Lexan.**

NIOSH's Response: When the several neutron dosimeters were used at the same time, the highest value was assigned as the dose of record. See Faust-Ruhter paper (NIOSH 2012b) for discussion.

SC&A's Reply: It appears, from the documents reviewed to date, that generally the highest of the neutron readings were recorded. Therefore, SC&A has no further comments on the issue at this time.

4. **Write up evaluation of the variation of NTA and Lexan dosimetry NIOSH's Responses over various energy ranges. Determine if a correction factor needs to be adopted or if these variations even significantly impact dose reconstruction.**

NIOSH's Response: No correction factors are needed since the most appropriate dosimeter was generally used and the highest value was selected when multiple dosimeters were in service for any one individual. See Faust-Ruhter paper (NIOSH 2012b) for discussion.

SC&A's Reply: Even if the highest dose value was recorded, this does not mean that the highest dose value correctly represented the dose received. According to a March 16, 2011, BNL memo from H. Kahnhauser to Dr. Falco (Kahnhauser 2011):

*The next step was to interview the individual that had been the Personnel Monitoring Group Leader during the time that RSL was used as the vendor. His name is Carl Schopfer, who is now the Radiation Safety Officer at the National Urban Security Technology Laboratory, for the U.S. Department of Homeland Security in New York City.*

*This was his response to your query:*

*"I don't think all three were used simultaneously for too long, 2-3 years at most but the paper dosimetry reports should indicate. There should be a memorandum (to Landauer) in the records documenting how the neutron dose equivalent was to be assigned. I seem to recall that the decision was to take the highest of the three. The rationale was partly because of the differing energy response (e.g., trying to capture some significant part of the actual spectrum), but just as much because at the time all three were being used, one or the other component experienced catastrophic failure at anyone time. For example, total fading with NTA, or bad processing or counting procedure with the plastics. I don't think they ever correlated for a typical occupational exposure. Gradually, Landauer stopped even trying to perform with the NTA but did work to improve the other two, so when the NTA was dropped, the higher of the two plastics was used,*

*as I recall. Then as before the rationale was more reliability, e.g., hedging our bets during instances of component failure (hoping that both did not fail at the same time) rather than the spectrum issues. High-energy neutron dose equivalent, such as at AGS was probably missed since NTA was history, and it did not seem despite assertions that the Lexan really did cover the range. The QC test program showed how the detectors performed (or didn't) on a routine basis to the neutron source, but tests with accelerator spectra were not conducted.* [Emphasis added.]

*“RCD Staff looked for the referred to memorandum in the Personnel Monitoring files and were unable to find it in the personnel monitoring records.”*

Obviously, this article does not speak well of the recorded neutron doses correctly reflecting the actual doses received on a consistent basis.

The use of NTA, Lexan, and CR-39 at the BNL throughout the years has seen numerous problems. The issues of the detectors' lack of response to low-energy and high-energy neutrons (below their threshold and above their calibrated range) has not received a workable solution, nor has the noted inconsistency of the dose readings within a given detector type, or among the different detectors, been satisfactorily addressed by BNL or NIOSH. The use of a quality factor (QF) of 10 does not address, nor compensate, for these shortcomings. These problems were discussed in detail in SC&A's evaluation (SC&A 2009) of the BNL site profile document (2006) and SC&A's review (SC&A 2010) of NIOSH's SEC ER (NIOSH 2009). This information indicates that the neutron doses at BNL were not measured and recorded with sufficient accuracy to allow reasonable neutron dose reconstruction without further consideration of adjusting the recorded neutron dose to account for unregistered neutron dose, until the DOELAP accreditation in 1995 and onsite processing began in 1996 (ORAUT 2010, page 89). An overall evaluation of the neutron dosimetry problems indicates that the recorded dose may have been  $\leq 50\%$  of the actual dose in some areas; therefore, an adjustment factor of 2 to 4 is needed to ensure claim favorability.

## **5. Look for Piesch memo on NTA film fading.**

NIOSH's Response: This memo has been found and has been entered into the SRDB as #91775 (Piesch 1975) and is attached.

SC&A's Reply: SC&A has reviewed this document in light of Issue #1 above and has no further comments at this time. However, it should be noted that it appears that NIOSH did not obtain the BNL TBD-recommended fading factor of 9% from this document.

**6. Provide WG with SRDB numbers with WBC data for 2 individuals missing data in 1980 memo.**

NIOSH's Response: This data is no longer applicable since the SEC period has been recommended to be extended through 12/31/1993.

SC&A's reply: SC&A concurs with NIOSH's response.

**7. Report status of BNL requests for data.**

NIOSH's Response: BNL has remedied any problems they had with timeliness. NIOSH's Responses are now received in a timely manner.

SC&A's Reply: If this is correct, then SC&A has no further issues with this item.

**8. Evaluate feasibility of the need for and ability to develop an internal coworker model.**

- a. What BNL facilities and timeframes are relevant for an internal dose co-worker application by virtue of exposure potential and numbers of workers affected?
- b. Would any existing claimants be affected (i.e., they have been assigned ambient environmental, but should be assigned a co-worker dose, instead)?
- c. How complete is the existing dose record for those designated facilities/timeframes?

NIOSH's Response: At this time, there are no plans to develop a coworker internal dose model.

SC&A's Reply: These are details that should be incorporated in Issue #12 and addressed along with that issue.

**9. Provide WG with NIOSH IDs for 8 cases used in "in-house" data evaluation.**

NIOSH's Response: These eight cases were used as part of the justification for the 1979 end period of the previously established SEC. Because the SEC period has been extended, these cases are no longer applicable.

SC&A's Reply: SC&A concurs with NIOSH's response.

**10. Update "in-house" study with any additional information provided by BNL.**

NIOSH's Response: The additional "in-house" review resulted in the determinations that internal doses could not be completed with sufficient accuracy prior to 12/31/1993.

SC&A's Reply: SC&A concurs with NIOSH's response.

**11. Try to determine if data was transferred from paper to a database or between databases. Determine if this transfer was verified to be accurate.**

NIOSH's Response: In 1985, all external dosimetry data was summarized as quarterly totals [onto hardcopies] and the old [hardcopy] records were destroyed. It is not certain if the summary information is in an electronic database, or if only the [quarterly] hardcopy exists as provided by BNL for claims. Consequently, for BNL, the only external dosimetry information available prior to 1985 is quarterly [hardcopy] summaries, although most workers were monitored on a monthly basis. No information is available regarding verification of the data transfers. In about 1967, internal dosimetry records (at least for reactor workers) were transferred from old forms to a new standard form. The new forms indicate the information transfer was verified with a signature of the verification included on the form.

SC&A's reply: This presents a question of the completeness and accuracy of the external dose database, either in hardcopy or electronic form, prior to 1985. Additionally, the question still remains if the original external dose data from 1985 forward have been transferred to any new databases, and if the transfer(s) was verified for completeness and accuracy.

**12. Report what we are doing for individuals without internal dosimetry deemed to have the potential for greater than environmental internal dose.**

NIOSH's Response: At this time there are no plans to develop a coworker internal dose model.

SC&A's reply: This response does not answer the question of what will be done in cases where an Energy Employee had the potential for intake, but was not bioassayed or the results are not available, after 1993. Details from Issue # 8 are also applicable to this issue.

**13. Request the Radiological Footprint Project from BNL.**

NIOSH's Response: This was a document that the work group had mentioned seeing at one of the meetings. We have been unable to identify or locate this document.

SC&A's reply: The footprint document was discussed at the January 21, 2011, work group meeting (NIOSH 2011a, pages 131, 167, and 169 of the transcript). A search of the SRDB provided Ref ID #100494 dated June 23, 2011 (NIOSH 2011b), which states the following on page 2:

- 1. Document Description: Brookhaven Building Data Access Files - Rad Footprint Project - Information, Maps and Pictures*

2. *Project Document Number: 030086345* (NIOSH 2011b)

*Type of information: large number of related files including multiple Access databases. This information can be found at the following file location: O:\DOE Site Images\Brookhaven National Laboratory\030086345 - BNL Building Data Access Files.*

However, the directory on the O-drive for the DOE Site Images for BNL is empty at this time.

## References

Kahnhauser 2011. ORAU Team Dose Reconstruction Project from NIOSH Data Request, H. Kahnhauser to Dr. Falco, March 16, 2011. SRDB 93609.

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NIOSH 2009. *SEC Petition Evaluation Report, Petition SEC-00113*, Rev. 0. National Institute for Occupational Safety and Health, Office of Compensation Analysis and Support, Cincinnati, Ohio. September 29, 2009.

NIOSH 2011a. *Work Group On Brookhaven National Laboratory – January 21, 2011*. National Institute for Occupational Safety and Health, Office of Compensation Analysis and Support, Cincinnati, Ohio. January 21, 2011.

NIOSH 2011b. “*Brookhaven Building Data Access Files - Rad Footprint Project - Information, Maps and Pictures*.” National Institute for Occupational Safety and Health, Office of Compensation Analysis and Support, Cincinnati, Ohio. June 23, 2011. SRDB 100494.

NIOSH 2011c. Telephone Interview between Landauer Personnel and M.H. Chew personnel, July 27, 2011. National Institute for Occupational Safety and Health, Office of Compensation Analysis and Support, Cincinnati, Ohio. SRDB 100347.

NIOSH 2012a. Strenge, D. *Neutron Dose Calculations at BNL*. National Institute for Occupational Safety and Health, Office of Compensation Analysis and Support, Cincinnati, Ohio. February 22, 2012.

NIOSH 2012b. Faust, L.G. and Ruhter, P.E. *NIOSH Response to BNL NTA Fading and Lexan Use Issues*. National Institute for Occupational Safety and Health, Office of Compensation Analysis and Support, Cincinnati, Ohio. March 28, 2012.

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