
Draft

**SUMMARY AND RESOLUTION OF THE SEC ISSUES FOR
THE BROOKHAVEN NATIONAL LABORATORY**

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The following is a summary of the 13 BNL SEC issues identified during SC&A's technical analyses of NIOSH's evaluation of SEC-00113 (NIOSH 2009) and SEC-00196 (NIOSH 2012a). Following the summary of each SEC issue is the resulting resolution of that issue derived from deliberations between the BNL Work Group (WG), NIOSH, and SC&A, which were finalized during the Advisory Board Meeting of March 12, 2013, in Augusta, Georgia.

Finding 1: Determine if BNL applied any fading correction factors to neutron dose of record.
NIOSH 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 2012c) for discussion.
SC&A Reply - March 2013: The latest revised TBD (ORAUT 2013) recommends that a fading factor of 1.81 be applied to the recorded neutron dose measured by NTA film processed at BNL before 1985. SC&A finds this a reasonable adjustment factor, and that it was derived by BNL in 1972, as documented in a BNL document (Distenfeld & Klemish 1972, Ref ID 22489) for ambient temperature and humidity. After the processing was outsourced to Landauer during 1985–1995, SC&A found 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) is claimant favorable. 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 should result in sufficient fading compensation. SC&A considers this issue resolved.
Work Group Actions:
Board Action:

Finding 2: Check recent BNL dose reconstruction to see if fading and angular dependence correction factors were used for neutron dose as described in the current TBD (ORAUT 2013).
NIOSH Response: Specifically, fading is not to be applied, per the NIOSH's Response to Finding #1, and angular dependence is only considered for the neutrons >2 MeV. See the D.L. Strenge paper (NIOSH 2012b) for discussion.
SC&A Reply - March 2013: NTA film fading is addressed in the previous issue. An angular dependence correction factor of 1.3 is applied if appropriate as recommended in Section 6.10.2 of the revised TBD (ORAUT 2013). SC&A finds this recommendation acceptable and consistent with technical data. SC&A considers this issue resolved.
Work Group Actions:
Board Action:

Finding 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 Response: When several neutron dosimeters were used at the same time, the highest value was assigned as the dose of record. See Faust-Ruhter paper (NIOSH 2012c) for discussion.
SC&A Reply - March 2013: It was found from the documents reviewed to date that the highest of the neutron readings were recorded. Therefore, SC&A has no further comments on this issue and considers it resolved.
Work Group Actions:
Board Action:

Finding 4: Write up evaluation of the variation of NTA and Lexan dosimetry responses over various energy ranges. Determine if a correction factor needs to be adopted or if these variations even significantly impact dose reconstruction.
NIOSH 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 2012c) for discussion.
SC&A Reply - March 2013: The original issue was that even if the highest dose value was recorded, this does not mean that the highest dose value correctly represented the dose received for all exposure situations. According to several BNL articles (such as Xie & Rohrig 1985, Ref ID 50833 and Kahnhauser 2011, Ref ID 93609), there were issues concerning the ability of the BNL neutron dosimetry system to register all the neutron dose equivalent because of the energy response range of the various neutron dosimeters. In a few instances, SC&A found locations where a portion of the neutron dose equivalent (D.E.) may result from neutron with energies greater than 20 MeV (such as 50% of the D.E. at 2 out of the 15 exposure areas characterized using Bonner spheres around the Alternating Gradient Accelerator (AGS) in a memorandum by Xie & Rohrig 1985, Ref ID 50833). However, considering that a conservative relative biological effectiveness (RBE) [or Quality Factor (QF)] of 10 was used at BNL for determining neutron dose at all times (when the measured QF was approximately 5), and that an energy employee would only spend a small fraction of time in the vicinity of such an exposure area, an additional adjustment factor applied to all neutron dose records would be excessively conservative and not warranted. Additionally, special precautions and dosimetry were in place when personnel worked in the beam areas. SC&A considers this issue resolved.
Work Group Actions:
Board Action:

Finding 5: Look for Piesch memo on NTA film fading.
NIOSH Response: This memo has been found and has been entered into the SRDB as #91775 (Piesch and Sayed 1975) and is attached.
SC&A Reply - March 2013: SC&A has reviewed this document in light of Finding #1 above and considers the issue resolved.
Work Group Actions:
Board Action:

Finding 6: Provide WG with Site Research Database (SRDB) numbers with whole-body count (WBC) data for two individuals missing data in 1980 memo.
NIOSH Response: These data are no longer applicable, since the SEC period has been recommended to be extended through December 31, 1993.
SC&A Reply - March 2013: SC&A concurs with NIOSH's response, and considers this issue resolved.
Work Group Actions:
Board Action:

Finding 7: Report status of BNL requests for data.
NIOSH Response: BNL has remedied any problems they had with timeliness. NIOSH's Responses are now received in a timely manner.
SC&A Reply - March 2013: If this is correct, then SC&A has no further issues with this item and considers it resolved.
Work Group Actions:
Board Action:

Finding 8: Evaluate feasibility of the need for and ability to develop an internal coworker model:
<ul style="list-style-type: none"> 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 coworker dose, instead)? c. How complete is the existing dose record for those designated facilities/timeframes?
NIOSH Response: At this time there are no plans to develop a coworker internal dose model.
SC&A Reply - March 2013: These are details that were incorporated in Finding #12, and the issue has been resolved.
Work Group Actions:
Board Action:

Finding 9: Provide WG with NIOSH IDs for eight cases used in “in-house” data evaluation.
NIOSH 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 Reply - March 2013: SC&A concurs with NIOSH’s response, and considers this issue resolved.
Work Group Actions:
Board Action:

Finding 10: Update “in-house” study with any additional information provided by BNL.
NIOSH Response: The additional “in-house” review resulted in the determination that internal doses could not be completed with sufficient accuracy prior to December 31, 1993.
SC&A Reply - March 2013: SC&A concurs with NIOSH’s response, and considers this issue resolved.
Work Group Actions:
Board Action:

Finding 11: Try to determine if data were transferred from paper to a database or between databases. Determine if this transfer was verified to be accurate.
NIOSH Response: In 1985, all external dosimetry data were 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. [Clarification text inserted in bracket by SC&A.]
SC&A Reply - March 2013: During the latter part of February and the first part of March 2013, numerous e-mails and phone conferences took place between NIOSH, SC&A, and the WG in order to determine the history of the databases and to determine if there was a need for validation and verification (V&V) of the completeness and accuracy of the external dose records. NIOSH verified by correspondence with BNL that the external dose records prior to 1996 were complete and available in the form of hardcopies from the outside dosimetry vendor (Laudauer), and all the data, except the latter 4 months of 1995, were also available on microfiche. The external dose data did not need V&V, because the original data (or photocopies of it) are available, and reliance on transcribed data is not needed.
SC&A considers this issued addressed and resolved.
Work Group Actions:
Board Action:

Finding 12: Report what we are doing for individuals without internal dosimetry deemed to have the potential for greater than environmental internal dose.
NIOSH Response: At this time, there are no plans to develop a coworker internal dose model.
SC&A Reply - March 2013: The issue of the availability and completeness of internal bioassay records has been satisfactorily addressed with the analysis of the five example cases and associated discussions and documentation by the WG, NIOSH, and SC&A during the period May 2012–March 2013. Therefore, there is no need at this time for a coworker internal intake model. This issue can be considered resolved.
Work Group Actions:
Board Action:

Finding 13: Request the Radiological Footprint Project from BNL.
NIOSH 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 Reply - March 2013: The footprint document was discussed at the January 21, 2011, WG meeting [pages 131, 167, and 169 of the transcript (NIOSH 2011a)]. A search of the SRDB provided Ref ID #100494 dated June 23, 2011 (NIOSH 2011b), which states the following (page 2):
<ol style="list-style-type: none"> 1. <i>Document Description: Brookhaven Building Data Access Files - Rad Footprint Project - Information, Maps and Pictures</i> 2. <i>Project Document Number: 030086345</i> (NIOSH 2011b) <p><i>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.</i></p> <p>A search of the O-drive shows the present DOE Site Images directory for BNL to be empty at this time.</p> <p>This document was originally requested because of concerns that the internal dose records may not be complete for energy employees that could have potentially been exposed to intakes; hence, this document might assist in evaluating potential intakes. However, with the resolution of the internal bioassay records issue, this document is no longer needed. This issue can be considered resolved.</p>
Work Group Actions:
Board Action:

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Xie, Y., and N. Rohrig, 1985. BNL Memorandum from Xie and Rohrig to Malinowski, T. of BNL. *Bonner sphere neutron measurements at the AGS*. November 22, 1985. Brookhaven National Laboratory, Upton, New York. Ref ID 50833.