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*Draft*

**ADVISORY BOARD ON  
RADIATION AND WORKER HEALTH**

*National Institute for Occupational Safety and Health*

*Review of the Linde Ceramics Plant  
Special Exposure Cohort (SEC) Petition 00107  
And the NIOSH SEC Petition Evaluation Report*

**Addendum**

**Contract No. 200-2009-28555  
SCA-SEC-TASK5-0006 Addendum**

Prepared by

S. Cohen & Associates  
1608 Spring Hill Road, Suite 400  
Vienna, VA 22182

Saliant, Inc.  
5579 Catholic Church Road  
Jefferson, Maryland 21755

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Effective Date: September 21, 2009	Revision No. 0 – DRAFT	Document No. SCA-SEC-TASK5-0006 Addendum	Page No. 2 of 9
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## DISCUSSION

At its September 2, 2009, meeting in Cincinnati, the Advisory Board on Radiation and Worker Health (the Board or ABRWH) Linde Work Group (WG) discussed SC&A’s report, *Review of the Linde Ceramics Plant Special Exposure Cohort (SEC) Petition 00107 and the NIOSH SEC Petition Evaluation Report*, June 18, 2009 (SC&A 2009), and requested that SC&A assess in a supplemental report (this report) whether SC&A 2009 addressed all petitioner representative concerns.

Table 2 of SC&A 2009 summarizes the nine issues that SC&A identified in SEC Petition 00107, and also summarizes SC&A’s assessment of how NIOSH’s SEC Evaluation Report (NIOSH 2008a) addresses each of the petitioner issues (SEC 00107 2008). Table 1 summarizes the 11 findings of SC&A 2009. The correspondence between the nine petitioner issues and the 11 SC&A findings may not be immediately apparent; however, Attachment 1 to this report correlates, in a sense, the two tables. It should be noted that the information presented in this report is not “new,” as it is derived from SC&A 2009, and that the reader should refer to the latter report for a more complete understanding of the issues.

The first two columns of Attachment 1 reproduce Table 2 of SC&A 2009: namely, SC&A’s summary of the nine issues and concerns of the SEC petition (SEC 00107 2008) and corresponding NIOSH responses to these issues (NIOSH 2008a). The last column of the attachment takes portions of SC&A 2009 and “maps” them against the nine petition issues and notes whether each issue has been addressed. As seen, SC&A believes that SC&A 2009 addresses all the petitioner issues that it identified.

Effective Date: September 21, 2009	Revision No. 0 – DRAFT	Document No. SCA-SEC-TASK5-0006 Addendum	Page No. 3 of 9
---------------------------------------	---------------------------	---	--------------------

## REFERENCES

Bechtel 1982. *Preliminary Engineering Evaluation of Remedial Action Alternatives*; Bechtel National Inc. (Bechtel); November 1982; SRDB Ref ID: 14704.

Heatherton, R.C. 1950. *Decontamination and Survey of Uranium Refinery Plant*, NYO-1536; December 14, 1950; SRDB Ref ID: 29822.

NIOSH (National Institute for Occupational Safety and Health) 2008a. *SEC Petition Evaluation Report, Petition SEC-00107: Linde Ceramics Plant*, Submittal Date: November 3, 2008.

NIOSH (National Institute for Occupational Safety and Health) 2008b. *An Exposure Matrix for Linde Ceramics Plant (including Tonawanda Laboratory)*, ORAUT-TKBS-0025, Rev. 01, November 4, 2008.

ORAUT (Oak Ridge Associated Universities Team) 2005, *Technical Information Bulletin: Estimation of Radium-226 Activity in the Body from Breath Radon-222 Measurements*, NIOSH Dose Reconstruction Project, ORAUT-OTIB-0025, Rev. 00, April 5.

ORAUT (Oak Ridge Associated Universities Team) 2008. *Dose Reconstruction During Residual Radioactivity Periods at Atomic Weapons Employer Facilities*. ORAUT-OTIB-0070, Rev. 0, March 10, 2008.

SC&A 2009. *Review of the Linde Ceramics Plant Special Exposure Cohort (SEC) Petition 00107 and the NIOSH SEC Petition Evaluation Report*, SCA-SEC-TASK5-0006, Rev. 0, draft, June 18, 2009.

SEC 00107 2008. *Linde Ceramics SEC Petitions: SEC00106, November 1, 1947 through December 31, 1953; SEC00107, January 1, 1954 through July 31, 2006 – Linde Ceramics Facility, Tonawanda, New York*, March 19, 2008.

Effective Date: September 21, 2009	Revision No. 0 – DRAFT	Document No. SCA-SEC-TASK5-0006 Addendum	Page No. 4 of 9
---------------------------------------	---------------------------	---	--------------------

**Attachment 1. Linde SEC Petition 00107 Issues Matrix<sup>(a)</sup>**

<b>Petition Issue</b>	<b>NIOSH SEC Evaluation Report</b>	<b>SC&amp;A Findings and Comments from its Review of SEC Petition 00107 and the NIOSH Evaluation Report (SC&amp;A 2009)</b>
<p>1. Inability to evaluate the precise grade levels of the pitchblende African ore processed at Linde during its operational period from 1942–1953.</p>	<p>Table 5-2. Types of Material used in the Operation of the Linde Ceramics Plant (pg. 15).</p>	<p><u>Section 2.0 “Overview of the SEC Petition 00107 and the NIOSH Evaluation Report”</u></p> <p>“Appendix B contains a memorandum of June 4, 2009 to SC&amp;A from a Linde SEC petitioner..., attaching four memoranda from 1944, and asserting that, contrary to NIOSH’s assumption in its site profile of 8%–12% U<sub>3</sub>O<sub>8</sub> content for African pitchblende feedstock, ‘65% Belgian Congo ore was processed at Linde during the operational time period.’ After examining how NIOSH reconstructed exposures for the residual period, SC&amp;A observes that, regardless of the validity of the petitioner’s assertion, estimated radon levels in the residual period are based on actual measurements, not on calculations from assumed feedstock concentrations, and, thus, the feedstock concentration issue does not appear to be germane to the SEC evaluation issues and will not be addressed further in this report. This issue may become relevant if NIOSH decides to use indirect means, such as ore composition or data from other sites, to address the radon measurement issues raised in this review.”</p> <p><b>PETITION ISSUE ADDRESSED</b></p>

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Effective Date: September 21, 2009	Revision No. 0 – DRAFT	Document No. SCA-SEC-TASK5-0006 Addendum	Page No. 5 of 9
---------------------------------------	---------------------------	---	--------------------

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<b>Petition Issue</b>	<b>NIOSH SEC Evaluation Report</b>	<b>SC&amp;A Findings and Comments from its Review of SEC Petition 00107 and the NIOSH Evaluation Report (SC&amp;A 2009)</b>
2. The deficient, unreliable, and incomplete dosimetry data available to NIOSH for Linde residual radiation workers.	“No personnel bioassay monitoring data has been identified for Linde Ceramics workers during the residual period; however, NIOSH does have access to survey data, including air monitoring data for both the decontamination activities at Linde (conducted just prior to the start of the residual radiation period) and several distinct, major investigations during the residual radiation period. The residual period surveys include soil characterizations, building surveys, and air sampling results” (pg. 19).	SC&A 2009 does not explicitly take a position on this petition issue; however, several findings (Nos. 1-6) express concerns about the data.  <b>PETITION ISSUE ADDRESSED</b>
3. The destruction of Linde documents described in an affidavit.	Not specifically addressed by NIOSH in the ER.	<u>Section 2.0 “Overview of the SEC Petition 00107 and the NIOSH Evaluation Report”</u> “The investigation of this issue could be complex and may delay consideration of the significant number of technical issues analyzed in this report. In the interest of a timely initiation of the process of comment resolution, we are submitting this review of technical issues, while continuing to pursue the issue of document destruction, starting with a further interview with petitioners.”  <b>PETITION ISSUE ADDRESSED</b>
4. Internal exposure to uranium dust during renovation/construction activities.	“It is reasonable to assume that this renovation work could have resulted in elevated airborne radioactivity; however, specific assessment of the potential dose associated with this work has not been included in ORAUT-TKBS-0025 [ORAUT 2005]. For the purposes of this evaluation and assessing the ability to bound radiological exposures for members of the proposed worker class, the renovation work will be compared to the operational period D&D work, which is included and	<u>Section 3.2.2.3 “Exposure During Building Renovation”</u> <b>Finding 7.</b> “The process selected to establish the pre-decontamination dust level does not appear to be claimant favorable, based on the cited data source (Heatherton 1950).” <b>Finding 8.</b> “The assumed decontamination factor of 8 is based on pre- and post-decontamination values taken in different areas. Examination of the full dataset

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<b>Petition Issue</b>	<b>NIOSH SEC Evaluation Report</b>	<b>SC&amp;A Findings and Comments from its Review of SEC Petition 00107 and the NIOSH Evaluation Report (SC&amp;A 2009)</b>
	<p>assessed in ORAUT-TKBS-0025” (pg. 22). “Heatherton (1950) documents the results of air dust samples collected during six different kinds of D&amp;D operations conducted in Building 30” (pg. 23).</p>	<p>suggests that the differences in the potential internal exposures between the early and later decontamination activities may be negligibly small.”</p> <p><b>Finding 9.</b> “It is not clear that the bounding approach used in the SEC-00107 Petition Evaluation Report is more claimant favorable than that proposed in TBD-6001.”</p> <p><b>Finding 10.</b> “The mix of alpha-emitting radionuclides in the airborne dust needs to be quantified for renovation activities, taking into consideration that raffinates might have been present.</p> <p><u>Section 3.2.3 “Application of Bounding Approach”</u></p> <p><b>Finding 11.</b> “NIOSH needs to explain how internal exposures should be apportioned among the various exposure scenarios.”</p> <p><b>PETITION ISSUE ADDRESSED</b></p>
<p>5. Internal dose exposure estimates that rely on air concentration data for the residual radiation period are unreliable, due to a tendency to underestimate internal dose exposure.</p>	<p>“Based on available Linde D&amp;D survey data and residual radiation surveys conducted in association with FUSRAP activities, NIOSH has the necessary data to support bounding internal exposures for uranium, uranium progeny, and radon during the residual period. Radioactive operations terminated at the end of the operational period and source term materials were removed from the site. The application of this survey data will result in overestimates of exposures and doses during the general activities and will result in conservative [sic] estimates of exposure during the highest-risk activities at Linde Ceramics during the period evaluated in this report” (pg. 24).</p>	<p><u>Section 3.2.2.1 “Exposure During General Building Occupancy”</u></p> <p><b>Finding 6.</b> “NIOSH’s use of a constant air concentration, rather than an exponentially declining concentration, is not claimant favorable and is not consistent with the guidance in ORAUT-OTIB-0070 [ORAUT 2008]. Back extrapolation needs to be technically justified by examination of potential site-specific changes in residual contamination.”</p> <p><b>PETITION ISSUE ADDRESSED</b></p>

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Effective Date: September 21, 2009	Revision No. 0 – DRAFT	Document No. SCA-SEC-TASK5-0006 Addendum	Page No. 7 of 9
---------------------------------------	---------------------------	---	--------------------

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Petition Issue	NIOSH SEC Evaluation Report	SC&A Findings and Comments from its Review of SEC Petition 00107 and the NIOSH Evaluation Report (SC&A 2009)
6. Raffinate-related exposures were not evaluated in the site profile.	“Waste materials (raffinates) were transported offsite (to Lake Ontario Ordnance Works and/or Ashland) prior to the end of operations. Therefore, workers outside the operational period would have had minimal exposure potential to these materials in their concentrated form. To determine the exposure potential from residual surface contamination on the site, a review of available isotopic data was conducted. Isotopic data from soils and sediments on site are summarized in Attachment One of this evaluation report and can be used to determine exposure from uranium progeny” (pg. 23).	<p><u>Section 3.2.2.1 “Exposure During General Building Occupancy”</u></p> <p><b>Finding 4.</b> “The NIOSH assumption that a single air sample taken in the 1970s can be used to bound plausible internal exposures to uranium, Th-230, and Ra-226 for over 50 years beginning in 1954 is highly questionable.”</p> <p><b>PETITION ISSUE ADDRESSED</b></p>
7. Exposure from contaminated burlap bags in the storage area of Building 30. (Includes possible exposure from radium and radon gas, and pro-actinium, actinium, and thorium from the African ore stored in those bags.)	This issue is not specifically addressed by NIOSH in the ER, but it has been addressed by NIOSH and the Board in Work Group meetings and discussed in Attachment E of Revision 1 of the Linde Site Profile (NIOSH 2008b).	<p><u>Section 3.3 “External Exposure”</u></p> <p>“This issue, popularly referred to as the ‘burlap bag issue’ and included in the SEC petition under Issue 9, was extensively analyzed and modeled by both NIOSH and SC&amp;A during the Linde Site Profile review and resolution process. Both parties determined that, if this scenario needed to be addressed in future dose reconstructions involving Linde site workers, plausible and bounding external exposures to those individuals could be estimated. As such, the burlap bag issue was closed. In fact, Appendix E of the latest version of the Linde site profile (NIOSH 2008b) discusses at length the evolution of the burlap bag issue. SC&amp;A concludes that this issue is resolved. In addition, if it is determined at a later date that external exposure to burlap bags was plausible during the residual period, scientifically valid external dosimetry models can be used to place a plausible upper-bound</p>

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Petition Issue	NIOSH SEC Evaluation Report	SC&A Findings and Comments from its Review of SEC Petition 00107 and the NIOSH Evaluation Report (SC&A 2009)
		<p>on such exposures.”</p> <p><b>PETITION ISSUE ADDRESSED</b></p>
<p>8. Air concentration data used are based on results of random air samples in general area and breathing zones, but not in continuous area sampling in high-risk or high-dose areas.</p>	<p>“Based on available Linde D&amp;D survey data and residual radiation surveys conducted in association with FUSRAP activities, NIOSH has the necessary data to support bounding internal exposures for uranium, uranium progeny, and radon during the residual period. Radioactive operations terminated at the end of the operational period and source term materials were removed from the site. The application of this survey data will result in overestimates of exposures and doses during the general activities and will result in conservative estimates of exposure during the highest-risk activities at Linde Ceramics during the period evaluated in this report (January 1, 1954 through July 31, 2006)” (pg. 24).</p>	<p><u>Section 3.2.1 “Bounding Radon Exposures”</u></p> <p><b>Finding 1.</b> “The observation that data taken after decontamination of Building 31 were higher than before decontamination calls into question the quality of the radon measurements. This finding is supported by a statement made by the authors of Bechtel 1982 that the radon data from Building 31 were ‘unconfirmed,’ again indicating concerns about data quality.”</p> <p><b>Finding 2.</b> “Use of the geometric mean (GM) rather than the 95<sup>th</sup> percentile as the appropriate exposure metric needs to be justified for use in a bounding calculation, particularly since measurements taken in 1976 are used to characterize the entire residual period beginning in 1954. Use of 1976 data for a much earlier period needs to be justified by demonstration of equivalent (or less contaminated) radiological conditions.”</p> <p><b>Finding 3.</b> “Use of measurements taken in 1981 to characterize radon exposures up to 28 years earlier may not be bounding. Use of such data needs to be technically justified.”</p> <p><b>PETITION ISSUE ADDRESSED</b></p>

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9. Failure to account for vanadium tailings from concentrated sludge in 15%–20% black uranium oxide, yellow cake concentrated sludge containing 10%–15% U <sub>3</sub> O <sub>8</sub> , and incineration of burlap and paper bags.	See issues 6 and 7.	See issues 6 and 7.  <b>PETITION ISSUE ADDRESSED</b>
<b>Issue to note:</b> Redesignation of the Linde site (Buildings 30, 31, 37, and 38) as a DOE facility. “Consequently, the NIOSH-defined residual radiation time period for Linde workers employed in these buildings is now eliminated from compensation coverage under Part B of EEOICPA. Any Linde worker who began working at the Linde facility in one of these buildings after 1953 is no longer eligible for compensation.”	Not specifically addressed by NIOSH in the ER.	As was discussed during the September 2, 2009, Work Group meeting, this issue falls under the jurisdiction of the Department of Labor.  <b>PETITION ISSUE ADDRESSED</b>

Notes:

(a) The first two columns of this table reproduce Table 2 of SC&A 2009.