

White Paper:

SEC-00116 United Nuclear Corporation Petitioner Issues

By:
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1. Introduction and Purpose

United Nuclear Corporation (UNC), located in Hematite, Missouri, manufactured uranium metal and uranium metal compounds from natural and enriched uranium for use as nuclear fuel. The facility became operational in 1956, initially producing uranium products for use in the naval fuel program. Specifically, the site was used to convert government-owned and leased uranium hexafluoride (UF₆) gas of various uranium-235 (U-235) enrichments to uranium oxide, uranium carbide, uranium dioxide pellets, and uranium metal. These products were manufactured for use by the federal government and government contractors and by commercial and research reactors approved by the Atomic Energy Commission (AEC). Research and development was also conducted at the site, as were uranium scrap recovery processes (Site Assessment, 2005, pdf p. 16).

This white paper addresses the specific issues raised by the petitioners regarding those items not addressed in the body of the SEC-00116 UNC Evaluation Report (NIOSH, 2010).

2. Background

From its inception in 1956 through 1974, the Hematite facility was used primarily in support of government contracts that required production of high-enriched uranium (HEU) products. From 1974 through the plant closure in 2001, the focus was on commercial fuel production (Decommissioning Plan, 2005, pdf p. 16). The Hematite plant used enriched uranium derived in part from recycled fuel, resulting in the potential for the presence of trace amounts of transuranic radionuclides, neptunium-237 (Np-237), plutonium-239/plutonium-240 (Pu-239/240), and americium-241 (Am-241) (Hard-To-Detect Radionuclides, 2009, pdf p. 10). For an approximately nine-month period in 1964, UNC also blended thorium dioxide powder with uranium dioxide powder to produce fuel pellets for use in fuel assemblies for the Elk River Reactor (Pellet Plant Data, 1964; Swallow, 1963; Swallow, 1964a).

The primary source of the internal radiation exposure was deposition of alpha-emitting materials via inhalation and ingestion of airborne uranium and thorium (and progeny). Operations at the UNC-Hematite facility potentially would have resulted in external exposures primarily to uranium and uranium decay products.

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3. Petitioner Issues

Issue 1: Recycled uranium may have been processed at the site. Therefore, it is suspected that some of the enriched uranium trucked into the Hematite plant may have contained neptunium, plutonium, and other transuranics as well as fission products, including technetium-99.

Response 1: NIOSH recognizes that recycled uranium was processed at the site and that there exists the potential for intakes of transuranic radionuclides, neptunium and plutonium, as well as technetium-99. Intakes of these contaminants found in recycled uranium can be estimated by using uranium bioassay data and assuming ratios for the contaminants present. Details of this approach are described in ORAUT -OTIB-0004. NIOSH has evaluated site sampling and analysis data to ensure that application of the contaminant ratios presented in ORAUT-OTIB-0004, relative to uranium, will result in bounding and claimant-favorable dose estimates for UNC workers. This evaluation has been documented in a recent NIOSH white paper entitled *Exposure to Transuranics from Recycled Uranium Buried at United Nuclear Corporation*.

Issue 2: Many of the workers at the Hematite site worked bare-handed without proper protective masks, clothing, gloves, and other protective equipment, etc.

Response 2: Dose reconstructions for this site are based on internal and external dosimetry data. Site workers were issued external radiation monitoring devices (e.g., film badges); internal dose reconstructions are based on internal monitoring (e.g., urine bioassay data).

Issue 3: The petition quotes the following statement from a NIOSH Report of Dose Reconstruction:

Even in instances when radiation dosimetry data are available, they rarely specify dose to an organ and are often based on monitoring procedures that do not meet modern standards.

Response 3: This quotation was taken from boilerplate language included in the introduction section of all NIOSH dose reconstruction reports. The introduction section is provided to explain why dose reconstructions are necessary. For example, if an applicant submits a claim for lung cancer, NIOSH must consider all available dosimetry and other available information to estimate the radiation dose to the lung. NIOSH must also consider the monitoring limitations and account for dose that could have been missed by monitoring.

Issue 4: The workers at the Hematite site were also exposed non-radioactive substances, such as strong mineral acids (hydrochloric, hydrofluoric, and nitric) and extremely hazardous volatile organic chemicals, including but not limited to trichloroethylene, perchloroethylene,

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and other volatile organic chemicals that were sometimes used as cleaning agents to mop the shop floors.

Response 4: Although NIOSH does not dispute that chemical exposures may have occurred at the site, cancers due to chemical exposures are not covered by the EEOICPA program.

Issue 5: Workers often wore their work clothes home, thus contaminating their homes and families.

Response 5: In interviews conducted with two recently-retired managers (employed [redacted] and [redacted], respectively), both stated that workers were required to shower before leaving the plant and were monitored with Geiger counters after the showers (Personal Communication, 2009a; Personal Communication, 2009c). NIOSH has found other evidence that personnel monitoring for contamination was performed on workers prior to exiting the plant. Affidavits provided with the petition also confirm this. In any case, NIOSH does not dispute that workers could have brought some contamination home with them at times. Dose reconstructions at this site are based on internal and external dosimetry data. Internal dose to workers due to the presence of contamination at their homes is accounted for with bioassay measurements. Family members who may have received radiation dose from contamination at home are not covered by the EEOICPA program.

Issue 6: Although the Hematite site is designated as an Atomic Weapons Employer (AWE) facility and not a Beryllium Employer (BE), beryllium was present at the Hematite site. The petitioners request that the Department of Energy and the Department of Labor add a BE designation to the present classification.

Response 6: Facility designations for beryllium are not determined by NIOSH. Although beryllium is covered under the EEOICPA, NIOSH only conducts occupational radiation dose reconstructions for compensation under The Act.

Issue 7: A limited amount of work with thorium compounds was performed at the facility as part of early research into the use of thorium in the fuel cycle.

Response 7: NIOSH recognizes that thorium was processed at the site during a well-defined period of time in 1964, and that the potential for thorium intakes existed as a result of those operations. A method for bounding thorium intakes, based on air monitoring data, is described in the NIOSH technical basis document for UNC, DCAS-TKBS-0008. NIOSH has also evaluated the representativeness of the available air monitoring data in a recent white paper entitled *Representativeness and Applicability of United Nuclear Corporation Air Sampling for Reconstructing Thorium Intakes*.

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Issue 8: According to the petition: *One cold night when all skilled plant personnel was scheduled off, a criticality occurred. Apparently an anhydrous ammonia tank had leaked.*

Response 8: The “criticality” mentioned appears to have been a toxic chemical spill and not a nuclear criticality. A criticality event did occur at a United Nuclear site in Wood River Junction, Rhode Island (Wood River Incident, 1964). However, NIOSH has not found any evidence or indications of a criticality accident ever occurring at the Hematite site. Compensation for exposure to toxic chemicals is not authorized under the EEOICPA.

Issue 9: No site profile of the Hematite facility has been performed.

Response 9: Although a site profile is not a prerequisite for the performance of dose reconstruction, NIOSH developed DCAS-TKBS-0008, *Technical Basis Document for the United Nuclear Corporation Hematite, Missouri*, which provides a site profile for UNC-Hematite.

Issue 10: The employees did not receive routine internal monitoring such as bioassays, blood samples, and breath tests.

Response 10: During the AWE operational period for UNC-Hematite (1958 through 1973), workers were monitored by bioassay and required to submit urinalysis samples on a specified frequency (ranging from monthly to every three-to-six months, depending on job assignment and year). Although the bioassay program was discontinued in 1961, air sampling continued in both process and non-process areas and the data were evaluated by the site for potential internal doses. A routine bioassay program was re-instituted in December 1962 (UNC *In Vivo*, 1963-1965). Examples of existing internal data are in the following documents (listed in detail in the References section):

Reference	SRDB Ref ID	Reference	SRDB Ref ID
Bioassay Results, 1964	62390	<i>In Vivo</i> Counts, 1967-73	62419
Bioassay Results, 1965	62386	Special Bioassay, 1970	62373
Bioassay Results, 1966	62383	UNC urinalysis, 1962-1964	11713
Bioassay Results, 1967	62381	UNC urinalysis, 1963-1964	11714
Bioassay Results, 1968	62379	Various Authors, 1963	11724
Bioassay Results, 1969	62377	Whole Body, 1969	62334
HP Standards, 1968	62363	Whole Body Counts, 1968-73	62412
<i>In Vivo</i> and Bioassay, 1960s	62338	Whole Body Issues, 1968-69	62429

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Issue 11: The former Atomic Energy Commission, the Department of Energy, the Nuclear Regulatory Commission, nor NIOSH has thorough personnel monitoring data. As far as we know, NO Hematite personnel radiation dose records have been provided to NIOSH and possibly do not exist.

Response 11: NIOSH has obtained bioassay, air sampling, and external dosimetry data in sufficient quantity and quality to adequately represent internal and external dose for the UNC-Hematite class under evaluation over the entire operational period (see Sections 6.1, 6.2, and 6.3 of the UNC Evaluation Report) (NIOSH, 2010). These data can also be used to support the evaluation of the UNC-Hematite external dose over the site's Residual Radiation period. See Response 10 for a list of documents containing internal data.

Issue 12: Initial plans for decommissioning the site were being made in 1973. However, the site was not dismantled; instead, it remained active as a commercial manufacturer until 2000 without a proper decommissioning. Residual contamination is evidently present and just as radioactive today.

Response 12: NIOSH understands that the site has remained operational after 1973 and that residual contamination has persisted at the site throughout the Residual Radiation period. The site is designated an AWE site from 1958-1973; the Residual Radiation period is from 1974 through October 2009. Knowledge of the AEC process operations performed during the operational period, and the available data for the associated timeframes, support NIOSH's ability to reconstruct dose during the Residual Radiation period at the site. For the UNC-Hematite residual period, only the personnel exposures to AEC-related residual radioactivity are assessed. This topic is discussed further in Sections 7.2.2 and 7.3.2 of the UNC Evaluation Report (NIOSH, 2010).

Issue 13: A report sent from Westinghouse dated November 14, 2006 that includes an "alleged" bioassay of [name redacted] could, in fact, be a falsified document. (Exposure Data, 2006)

Response 13: An affidavit provided in the petition (NIOSH, 2010) states:

At the end of each work week I took home a specimen bottle, which I returned at the beginning of the next work week with a urine sample.

A second affidavit provided in the petition states there were:

...no breath tests [or] internal monitoring. [I] did have urine test[s]. [I] had whole body counts yearly.

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Both of these petitioners' periods of employment encompassed the period of the petitioner cited in Issue 12 and their statements show that a monitoring program did exist.

Based on its review and assessment of the available data in the SRDB and in NOCTS, NIOSH has not found evidence that would corroborate the petitioner's claim of falsified or destroyed personnel monitoring records. During data capture visits to the Hematite site in March and April 2009, NIOSH verified that hundreds of records boxes and other data files were present in multiple on-site locations and maintained under appropriate document control procedures, including key access and Westinghouse administrator control.

4. References

Bioassay Results, 1964, Various handwritten bioassay results for Hematite workers; United Nuclear Corporation; 1964; SRDB Ref ID: 62390

Bioassay Results, 1965, Various handwritten bioassay results for Hematite workers; United Nuclear Corporation; 1965; SRDB Ref ID: 62386

Bioassay Results, 1966, Various handwritten bioassay results for Hematite workers; United Nuclear Corporation; 1966; SRDB Ref ID: 62383

Bioassay Results, 1967, Various handwritten bioassay results for Hematite workers; United Nuclear Corporation; 1967; SRDB Ref ID: 62381

Bioassay Results, 1968, Various handwritten bioassay results for Hematite workers; United Nuclear Corporation; 1968; SRDB Ref ID: 62379

Bioassay Results, 1969, Various handwritten bioassay results for Hematite workers; United Nuclear Corporation; 1969; SRDB Ref ID: 62377

DCAS-TKBS-0008, *Technical Basis Document for the United Nuclear Corporation, Hematite, Missouri*, Rev. 0; National Institute for Occupational Safety and Health (NIOSH), Division of Compensation Analysis and Support; March 21, 2011; SRDB Ref ID: 93712

Decommissioning Plan, 2005, Hematite Decommissioning Plan, DO-04-004, Rev. 2; Westinghouse; August 2005; SRDB 56413

Exposure Data, 2006, *Exposure Data for [Name redacted]*, Westinghouse; letter from J. A. Buddie (Westinghouse) to R. Thogmartin (U.S. Dept. of Labor) with attached 1972 letter from Gulf United Nuclear Fuels Corporation; November 14, 2006; SRDB Ref ID: 102230

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Hard-To-Detect Radionuclides, 2009, *Derivation of Surrogates and Scaling Factors for Hard-To-Detect Radionuclides*, DO-08-008, Rev. 0; Westinghouse; July 2009; SRDB 78741

HP Standards, 1968, *H. P. Standards (Manual)*, interoffice memo with Health Physics Standards from L. J. Swallow to D. G. Darr; United Nuclear Corporation; August 12, 1968; SRDB Ref ID: 62363

In Vivo and Bioassay, 1960s, Various Personnel Selected for Whole-Body Counting Based on Urinalysis Results; United Nuclear Corporation; various dates in the 1960s; SRDB Ref ID: 62338

In Vivo Counts, 1967-73, *In-Vivo Count Results (ugm U-235)*, United Nuclear Corporation; 1973; SRDB Ref ID: 62419

NIOSH, 2010, *SEC Petition Evaluation Report for Petition SEC-00116, United Nuclear Corporation*; National Institute for Occupational Safety and Health (NIOSH); January 28, 2010; SRDB Ref ID: 101606

ORAUT -OTIB-0004, *Estimating the Maximum Plausible Dose to Workers at Atomic Weapons Employer Facilities*, Rev. 03 PC-2, Oak Ridge Associated Universities; December 6, 2006; SRDB Ref ID: 36191

Pellet Plant Data, 1964, *Pellet Plant Station Alpha Activity Data Sheets*, United Nuclear Company; various dates throughout 1964; SRDB Ref ID: 62343

Personal Communication, 2009a, *Personal Communication with [redacted] (various titles)*; Telephone Interview by ORAU Team and NIOSH; February 4, 2009; SRDB Ref ID: 61673

Personal Communication, 2009c, *Personal Communication with [redacted] (various titles)*; Telephone Interview by ORAU and NIOSH Team; February 12, 2009; SRDB Ref ID: 61676

SEC-00116 Petition, 2008, *Special Exposure Cohort Petition, Hematite Site, State of Missouri, June 13, 2008*, [petitioner names redacted], SEC Form B petition with supporting documents; received by NIOSH June 19, 2008; OSA Ref Id: 106292

Site Assessment, 2005, *Historical Site Assessment, Hematite Former Fuel Cycle Facility Decommissioning*, Westinghouse Electric Company LLC; 2005; SRDB Ref ID: 56469

Special Bioassay, 1970, *Bio-Assay Special Issue Log*, United Nuclear Corporation, 1970; SRDB Ref ID: 62373

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Swallow, 1963, *Health Physics Problems Associated with Thoria*, correspondence to A. Edelman (Nuclear Science & Engineering); October 31, 1963; SRDB Ref ID: 62315

Swallow, 1964, *SNM-33 Amendment to Permit Blending Fully Enriched UO₂ with Natural ThO₂ in the Pellet Plant*, correspondence to Mr. Donald Nussbaumer (U.S. Atomic Energy Commission); March 31, 1964; SRDB Ref ID: 56730

UNC *In Vivo*, 1963-1965, *In Vivo Monitoring Data Results and Correspondence for 8-19-63 to 8-25-65*; SRDB Ref ID: 17041

UNC Urinalysis, 1962-1964, *UNC Uranium in Urine Sample Results for 12-3-62 to 1-24-64*; SRDB Ref ID: 11713

UNC Urinalysis, 1963-1964, *UNC Uranium in Urine Sample Results for 6-14-63 to 1-4-64*; SRDB Ref ID: 11714

Various authors, 1963, *UNC Bioassay Program Information and Some Results for 4-19-63 to 11-4-63*; various authors; SRDB Ref ID: 11724

Whole Body, 1969, Whole Body Counting Results; interoffice memo from D. G. Darr to L. J. Swallow; United Nuclear Corporation; March 13, 1969; SRDB Ref ID: 62334

Whole Body Counts, 1968-73, *Results of Hematite Whole Body Counts*, memos and results, United Nuclear Corporation; various dates; SRDB Ref ID: 62412

Whole Body Issues, 1968-69, Various documents related to whole body counting parameters, results, job re-assignments, personnel restrictions, United Nuclear Corporation; 1968-1969; SRDB Ref ID: 62429

Wood River Incident, 1964, *Report of the AEC Technical Review Committee on the Criticality Incident of July 24, 1964, at the Wood River Junction, Rhode Island, Plant of the United Nuclear Corporation*; report written November 6, 1964; SRDB Ref ID: 4533

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