

DRAFT

The following cross references are intended to support the NMI SEC Petition application sections E5, F1 and F2, for the years 1970 – 1983. We have been requested to describe specific dates and plant locations for unplanned and unmonitored activities that resulted in exposure of NMI employees to radiation contamination. In an attempt to comply with this request, we do not wish this response to replace the many exposure incidents or poor safety practices described in the various affidavits. The affidavits further provide evidence of general safety practices that were inadequate and management decisions and behavior that introduced additional safety risks.

After more than 40 years it is difficult to be specific as to dates. We have tried to reference published technical reports, internal reports and memos, where available, to bracket time periods.

A number of employees have since passed away. These include _____ with whom _____ worked, and _____, during the period 1978 to _____ 1980s. _____ was a _____ who has passed away.

_____, co-petitioner, was _____ in the 1978 – 1983 time frame. _____ was assigned to support his staff efforts to _____. Many of his activities and exposures can be confirmed by him. Indeed, he was also exposed to many of the same unmonitored exposures.

Incidents for unmonitored exposures can be characterized as both discrete, or chronic and daily. Discrete incidents may be associated with unique experiments and may number from one to a dozen, or more separate exposures. These exposures could be limited to one or several, depending upon the type of work and length of time the experiments were conducted. Chronic and daily exposures may be associated with standard operating procedures, such as drinking from Gatorade stations in process areas.

As for the lost records requirements of Section F2 of the application, NIOSH has a better feel for this deficiency than the petitioners. The petitioners are aware that in many of the claims that have been submitted there are large gaps in the records of exposure. NIOSH should be able to review the limited number of NMI claims to assess the degree to which records are unavailable. For the time period of this petition, there appears to be a significant loss of exposure data.

In cases of general work area monitoring, the petitioners are aware that much of the area monitoring that was performed was done poorly and did not reflect accurate area exposures. We will attempt to specifically identify these situations. In some cases, employees in their effort to increase output to meet production goals and bonuses would by-pass monitoring efforts in order to make their jobs easier.

The list of unmonitored exposures was based primarily upon the affidavit submitted by Citations by page, section and paragraph number refer to areas of this affidavit where specific unmonitored exposures are referred to. Other affidavits and their sections are identified specific to the appropriate affidavit.

Additional photos have been uncovered. These photos were from an album that documented the in the mid 1970s. What is remarkable is the limited use of work uniforms or no protective gear. Workers are shown performing standard process steps in their reusable work clothes along with personal clothing. In many cases even work gloves were not being worn. Personal glasses, but not safety glasses were worn. By the mid-1980s plastic safety glasses were required to be worn over prescription glasses in order to reduce radiation exposure to the eyes.

For some period after work gloves were required in the 1980s, their contamination and overuse was noted to be a problem. This required the more frequent retirement of used work gloves, particularly in . However, in the 1970s work glove use was not required. Workers were free to augment their uniforms with personal clothing. This was found to be a problem as these clothing articles were not cleaned by the outside source used for uniform cleaning. Even this outside source proved to be a problem as uniforms were not totally decontaminated upon cleaning.



loading heat treat furnaces. The same furnaces mentioned in the maintenance exposures. No work gloves, personal prescription glasses.



Unloading furnace billets. No work gloves, personal prescription glasses.



(deceased) preparing extrusion billets. No work gloves, personal prescription glasses, personal sweat shirt.



Unloading extrusion billets. No work gloves, no safety glasses.



Butting derby.. No work gloves, no safety glasses.



1400 ton extrusion press where eating, smoking & drinking were allowed.

E5 (?) or F.2 Unmonitored, unrecorded or inadequately monitored exposure incidents.

The following sections of specific affidavits support this section of our petition.

Affidavit:

Exposure: **1. Salt Water Processing of Uranium Machine Chips Resulting in Unmonitored Fire and Explosion**
Type of Exposures: Fire during testing. No respirators or PAM worn.
Page: 2
Paragraph: 1 – 6
Other supporting documents: Test stand photo, page 2
Plant Building: D
Process Area: Empty area where large caliber CNC machining was later installed.
Date: early 1979
Number of Incidents: One
Personnel Exposed:

Witnesses:

Exposure: **2. Development of a Foam Encapsulation Alternative to Concrete for Machine Turning Packaging for Shipment and Burial Resulting in Unmonitored Fires and Airborne Exposures**
Type of Exposures: Fires involving foam encapsulated DU chips being tested or during processing for test package preparation. No respirators or PAMs worn.
Page: 3 - 5
Paragraph: 4 – 9
Other supporting documents: page 3 and 4 photographs, Appendix D- Foam Encapsulation reports and photos
Plant Building: Building and area
Process Area: inside and outside
Date: 1979 – 1981
Number of Incidents: 12-15
Personnel Exposed:

Witnesses:

Exposure: **3. Uranium Chemical Recycling Development Resulting in Unmonitored Airborne Releases of Uranium Tetrafluoride, Uranium Oxides and Uranyl Fluoride, and their hydrates**

Type of Exposures: HF acid treatment of DU machine chips permitting the release of acid fumes and airborne contamination. Para 1 - 5

Hydrated UF₄ precipitate decanting, washing, drying, ball milling and magnesium blending with the use of respirators or PAMs. Para 2, 3

Lab scale reductions in an unvented resistance heating lab furnace. Para 6

Opening and breaking out mini derbies using a hammer without respirator or PAM use. Para 7

Page: 5 - 6

Paragraph: 1 - 7

Other supporting documents: Page 5 photographs, USAARDC Report No. ARLCD-CR-83018, Appendix D

Plant Building: Building

Process Area:

Date: 1980 - 1983

Number of Incidents: Chronic, Daily over several years of experiments

Personnel Exposed:

Witnesses:

Exposure: **4. Continuous Induction Solutionizing of Uranium Bars and Unmonitored Contaminated Process Water Exposures**

Type of Exposures: Contaminated quench water of DU at 850 °C - water spray on clothing, face and hands. Para 1 - 3

Lack of PAM monitoring Para 4

The use of contaminated work gloves with no monitoring of gloves to determine the appropriate time for replacement. (general observation)

Page: 6 - 7

Paragraph: 2 - 4

Other supporting documents: photograph on page 6

Plant Building: Building C

Process Area: motor generators

Date: 1979

Number of Incidents: 20 over a two month period
Personnel Exposed:
Witnesses:

Exposure: **5. Uranium Alloy Development and Unmonitored Exposure to Used Crucibles**

Type of Exposures: Crucible mold wash application to previously used furnace crucibles without the use of respirators, safety glasses or ring badges. Para 1, 2

Drinking coffee during melting and casting Par 3

Crucible lid pacification resulting in flash flame and detonation of vapor deposited DU and daughter products without the use of respirators. Para 4 - 6

Post casting crucible inspection without the use of respirators. Para 7

Failure to rotate used tooling to permit a cooling off period for radioactive daughter product decay. Para 9

Lack of safety glasses used during all activities. Para 8

Drinking from Gatorade stations in area. Page 18
Para 4

Page: 7 – 8, 18

Paragraph: 2 – 9, 4

Other supporting documents: Page 7 Photographs of my foundry work

Plant Building: Building

Process Area:

Date: 1979 – 1982

Number of Incidents: 24 over several years

Personnel Exposed:

Witnesses:

Exposure: **6. UF₄ Reduction Process Development and Unmonitored Airborne Exposures**

Type of Exposures: Reduction Vessel burn throughs para 3, 12, 13

Magnesium fluoride slag removal para 6

UF₄/Magnesium blending station para 3, 4

Reduction vessel transfer spilling of UF₄ para 3, 7
Sweeping spilled UF₄ para 4, 5
Manually packing reduction vessels para 7
Vacuuming spilled UF₄ causing clogged vent systems para 8
Power failures causing vent system shutdown para 8
Power failures causing furnace explosions para 8
Failure to rotate used tooling to permit a cooling off period for radioactive daughter product decay. Para 10, 13, 24
Enriched uranium recycling and associated exposures to radon and fission products. Para 13, 14, 17 – 21
Unmonitored Radon exposures Para 17 – 23
Moist storage impact on unmonitored Radon exposures Para 13 - 16

Page: 8 - 12
Paragraph: 3 – 8, 10, 13 – 14, 17 - 24
Other supporting affidavits: , Page 1, Para 9
, Page 4 - Para 1-2, Page 5 - Para 1-8, Page 6 –
Para2
, Page 3 - Para 3-7, Page 4 – Para 1
Plant Building: Building
Process Area:
Date: 1979 - 1982
Number of Incidents: Chronic, daily
Personnel Exposed: ,

Witnesses:

Exposure: **7. Patented Carousel Chip Cleaning & Drying System to Prep Machine Chips for Briquetting Resulting in Fires and Unmonitroed Airborne Contamination**

Type of Exposures: Carousel operation para 1 - 6

DU chip handling without ring badges para 4

DU fires without respirators or PAMs para 5 - 6

Page: 12 - 13
Paragraph: 1 - 6
Other supporting documents: US Patent No. 4,501,073 Award Diagram & USAARDC Report No. ARLCD-CR-83018
Plant Building: Building
Process Area: near 300 ton extrusion press
Date: 1980 - 1983
Number of Incidents: 120 days of processing, 6 fires
Personnel Exposed:
Witnesses:

Exposure: **8. Uranium Penetrator Test Range Fragment Recycling and Unmonitored Airborne Exposure to Contaminated Dust**

Type of Exposures: Emptying waste drums and screening sand/fragments without respirators, PAMs or ring badges para 1 - 2

Page: 13 - 14
Paragraph: 1 - 4
Other supporting documents: Photos and USAF AFATL Report No. AFATL-TR-82-49 Appendix D

Plant Building: Building
Process Area:
Date: 1981 - 1982
Number of Incidents: 6 months of active processing
Personnel Exposed:

Witnesses:

Exposure: **9. Developmental Molten Salt Recycling of Uranium Chips and Unmonitored Airborne Exposure**

Type of Exposures: Handling very dry DU machine chips para 1 - 4

Manually dropping chips into molted salt potsPara 1 - 2

DU chip fires para 2

Page: 14
Paragraph: 1 - 4
Other supporting documents: Photos and USAF AFATL Report No. AFATL-TR-82-49 Appendix D

Plant Building: Building
Process Area: near 300-Ton Press
Date: 1981 - 1982
Number of Incidents: 6 months of active processing

Personnel Exposed:

Witnesses:

Exposure: **10. Off Site Heat Treatment Experiments and Unmonitored Exposures**

Type of Exposures: Uranium transport to Cleveland para 1 – 2

Page: 14 - 15

Paragraph: 1 - 4

Other supporting documents: none

Plant Building:

Process Area:

Date: 1981

Number of Incidents: two weeks

Personnel Exposed:

Witnesses:

Exposure: **11. Off Site Ordnance Testing and Unmonitored/Unavailable Exposures**

Type of Exposures: DU explosive testing Para 1 - 3

Target inspections Para 2

Page: 15 - 16

Paragraph: 1 - 3

Other supporting documents: Photos and Final Technical Reports, Appendix D

Plant Building:

Process Area: Test sites

Date: 1980 - 1987

Number of Incidents: 50

Personnel Exposed:

Witnesses:

Exposure: **12. Unmonitored Exposures - Heat Treatment Furnace Maintenance**

Type of Exposures: Airborne exposures during furnace maintenance Para 1 - 3

Page: 16

Paragraph: 1 - 3

Other supporting documents: none

Plant Building: Building

Process Area:

Date: 1978 - 1983

Number of Incidents: numerous

Personnel Exposed:

Witnesses:

Exposure: **13. Unmonitored Exposures – Uranium Liner Forming**
Type of Exposures: Airborne exposures during DU part forming Para 1 - 3
Page: 16 - 17
Paragraph: 1 - 3
Other supporting documents: none
Plant Building: Building
Process Area:
Date: 1978 - 1983
Number of Incidents: numerous
Personnel Exposed: , ,

Witnesses:

Exposure: **14. Unmonitored Exposures – Extrusion Press**
Type of Exposures: Airborne exposures during DU extrusion of bare billets with molten salt Para 1 - 2
Page: 17
Paragraph: 1 - 2
Other supporting documents: none
Plant Building: Building
Process Area:
Date: 1978 - 1983
Number of Incidents: 12
Personnel Exposed:
Witnesses:

Exposure: **16. Plant Material Handling, Employee Access and Traffic Pattern Contamination**
Type of Exposures: physical spread of contamination to uncontrolled internal and external areas
Page: 18 – 19 Para 1 - 3, Page 21 – Section 17 – Para 12-14 and 17-19, Page 20 – Section 17 – Para 4, Page 22 – Section 17 – Para 21
Paragraph: 1 - 10
Other supporting documents: other affidavits
Plant Building:
Process Area:
Number of Incidents: numerous
Personnel Exposed:
Witnesses:

The following are additional unmonitored exposures that are described in various sections of the affidavit submitted by . These exposures were not reviewed separately but were discussed in various sections.

Exposure: **17. Unmonitored Radon Exposure**
Type of Exposures: Radon generation and unmonitored exposures as a result of spent fuel rod recycling and the presence of unexpected radionuclides in government furnished DU
Page and Paragraph: Page 19 - Section 17 - Para 2, Page 20 - Section 17 - Para 5, Page 22 - Section 17 - Para 27
Other supporting documents: DoE spent fuel recycling, Utah Dept. of Public Health report on moist versus arid DU storage the impact on radon generation

Plant Building:
Process Area:
Date: 1970 - 1983
Number of Incidents: chronic and daily
Personnel Exposed:
Witnesses:

Exposure: **18. Unmonitored Exposures - Post enriched uranium use and failure to decontaminate process areas after enriched license expiration**

Type of Exposures: airborne and external
Page and Paragraph: Page 20, Section 17, Para 4-6
Page 20, Section 17, Para 10
Other supporting documents: DoE spent fuel recycling, 1993 Division of Waste Management report, EPA Report EPA-402-R-06-011 Page 32

Plant Building:
Process Area:
Date: 1970 - 1983
Number of Incidents: chronic and daily
Personnel Exposed:
Witnesses:

Exposure: **19. Unmonitored Exposures – DoE Recycling of Spent Fuel Rods and unknown DU contamination with Fission Products**

Type of Exposures: airborne and external
Page and Paragraph: Page 22, Section 17, Para 26
Page 20, Section 17, Para 10
Other supporting documents: DoE spent fuel recycling, 1993 Division of Waste Management report, EPA Report EPA-402-R-06-011 Page 32

Plant Building:
Process Area:
Date: 1970 - 1983
Number of Incidents: chronic and daily

Personnel Exposed:
Witnesses:

Exposure:

**20. Unmonitored Exposures – Gatorade Stations in
DU Process Areas**

Type of Exposures:
Page and Paragraph:

internal
Page 18, Section 16, Para 4
, Page 1, Para 4
, Page 2, Para 3
, Page 6, Para last
, Page 7, Para 2

Other supporting documents: DoE spent fuel recycling, 1993 Division of Waste
Management report, EPA Report EPA-402-R-06-011 Page
32

Plant Building:

Process Area:

Date: 1970 - 1983

Number of Incidents: chronic and daily

Personnel Exposed:

Witnesses: