I3
International Isotopes Inc.
& International Isotopes Idaho Inc.

Designated Original
Docket: 40-09058

August 11, 2005

Mr. Michael Raddatz, Sr.
Uranium Processing Section
Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject: Response to U. S. NRC Comments Regarding the International Isotopes Inc Source Material License Application (TAC LU0086)

Dear Mr. Raddatz,

Please find International Isotopes Inc response to US Nuclear Regulatory Comments 3 a. through 3 d from your letter dated May 26, 2005, Docket No.: 40-9058.

NRC Comment:

3. There is very little detail provided regarding fire safety.
    a. Please provide a description and evaluation of fire scenarios that could result in chemical or radiological release. Staff would expect to see a HEPA filter fire, a major building fire, and localized fires that could result in a fluorine release or UF_4 dispersion.
    b. Describe in detail, the fire suppression, detection, prevention or consequence mitigation measures associated with these scenarios.
    c. Provide a commitment to the applicable NFPA codes, particularly NFPA 801 "Standards for Facilities Handling Radioactive Materials" as it provides guidance for administrative controls, including a fire prevention program, general facility design, and fire protection systems and equipment. The commitment need only be to those parts applicable to the facility.
    d. Provide copies of Insurance or other non-NRC fire inspection reports and any correspondence allowing deviations from fire related aspects of building codes or fire prevention codes.

I3 Response to NRC Comment 3a.:

Fire classifications from NUREG-1805, *Fire Dynamics Tools (FDT) Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program* are listed below for reference.

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Light (Low) Hazard
Light hazard occupancies are locations where the total amount of Class A combustible materials (including furnishings, decorations, and content), is a minor quantity. This can include some buildings or rooms occupied as offices, classrooms, churches, assembly halls, guest room areas of hotels/motels, and so forth. This classification anticipates that the majority of content items are either noncombustible or so arranged that a fire is not likely to spread rapidly. Small amounts of Class B flammables used for duplicating machines, art departments, and so forth, are included, provided that they are kept in closed containers and safely stored (Conroy, 1997 and NFPA 10).

Ordinary (Moderate) Hazard
Ordinary hazard occupancies are locations where of Class A combustibles and Class B flammables are present in greater total amounts than expected under light (low) hazard occupancies. These occupancies could consist of dining areas, mercantile shops, and allied storage; light manufacturing, research operations, auto showrooms, parking garages, workshop or support service areas of light (low) hazard occupancies; and warehouses containing Class I or Class II commodities as defined by NFPA 231, "Standard for General Storage," (Conroy, 1997 and NFPA 10).

Extra (High) Hazard
Extra hazard occupancies are locations where the total amount of Class A combustibles and Class B flammable (in storage, production, use, finished product, or combination thereof) is over and above those expected in occupancies classed as ordinary (moderate) hazard. These occupancies could consist of woodworking, vehicle repair, aircraft and boat servicing, cooking areas, individual product display showrooms, product convention center displays, and storage and manufacturing processes such as painting, dipping, and coating, including flammable liquid handling. Also included is warehousing or in-process storage of other than Class I or Class II commodities (Conroy, 1997 and NFPA 10).

The following fire scenarios where evaluated.

HEPA Filter Fire

Equipment Description:

A single HEPA filtered air mover provides filtered ventilation for the drum hood and the UF_4 powder mixing glove box, both of which are located in Room 304, Powder Handling. An NFS-RPS Model SP-700 HEPA filtered air mover is located above this room on the mezzanine. The SP-700 HEPA filtration unit is a portable, high efficiency filter/blower unit providing high efficiency particulate air filtration. Outside nominal dimensions of are 45" long x 19" high x 19" wide with an approximate weight of 140 pounds. The unit consists of an integrally-mounted cylindrical stainless steel filter housing and frame assembly with a 1 horsepower, 3450 rpm, 115 VAC, single-phase totally enclosed fan cooled motor. The metal framed glass fiber round HEPA filter is 17" diameter and rated at 500 CFM @ 1" sp.wg. Filtration of 99.97% efficiency for 0.3

micron particles DOP tested at 100% and 20% of rated flow. Air movement is provided by a direct drive, non-overloading blower with back curved blades and aluminum housing and wheel. This HEPA filtered air mover will be operated when the drum hood and/or UF_4 glove box are operated. The filtered exhaust is directed back into the facility.

Area Description:

As mentioned above, this HEPA filtered air mover serves the depleted uranium drum hood and glove box located in the powder handling room. There are no combustible or flammable materials stored or handled in this room, the drum hood or the glove box. The chemical forms of the depleted uranium associated with the proposed action are not pyrophoric nor are the mineral oxides mixed with the UF_4. The HEPA filtered air mover is located on the second floor mezzanine above the powder handling and depleted uranium storage rooms. The second floor mezzanine, the powder handling room and the adjacent depleted uranium storage room would each be classified as Light (Low) Hazard.

Scenario:

A HEPA Filter fire resulting from normal process operations is not considered credible due to the lack of combustible materials associated with the process or the Light (Low) Hazard Classification given the area. Therefore it would be assumed that any HEPA filter fire would result from an electrical malfunction associated with the fan motor. It is also assumed that the blower unit would cease to operate before the fire spread to or enough heat was generated to degrade or ignite the HEPA filter, i.e. the HEPA filter burns under static flow conditions.

The Department of Energy has conducted thermal stress tests on glass fiber HEPA filters and concluded that the airborne release fraction (ARF) from the heat-induced damage to a HEPA filter is estimated to be very small. The following excerpts from DOE-HDBK-3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Non-Reactor Nuclear Facilities, Volume I - Analysis of Experimental Data* is provided for reference.

HEPA filters resisted temperature as high as 825 °C for period of tens of minutes before loss of efficiency and 500 °C for in access of 45 min (Hackney, 1983). The filter medium is very fine diameter glass fiber that softens and melts when heated and thus, tends to retain materials adhering to the fibers. The release rate for several types of HEPA filter in flowing air at elevated temperatures less than required to induce failure (up to 400 °C) are very low (Ammerich et al., 1989).

HEPA filters, both unused and removed from service due to high differential pressures (clogged), were tested using solid particles at a range of temperatures less than required for failure. The efficiencies of the filters prior to testing for 1.8 μm particles ranged from 99.97% to 99.9999989%. Two high flow (2000 cfm) and one 1000 cfm HEPA filters with glass fiber media and various sealant and gasket materials were tested. No releases were found at temperatures below 150 °C (175 °C for one of the high flow filters). For the 1000 cfm type filter, the release rates for temperatures from 175 °C and 190 °C started at 1E-6/min and reduced to 5E-8/min within 1 hour (the lower limit of detection was 2E-8/min). The high flow HEPAs were tested to temperatures of 200 °C and 250 °C with release rates starting at 2E-4/min and 2E-5/min and reducing to 3E-7/min in 30 min and 2E-8/min in 60 min. The decay in release was exponential during the initial 30-minutes approaching the 60-min rate asymptotically. There was no release of contamination from an oven-fired, mineral sealant, high flow type filter at temperatures up to 350 °C and the release in other types of HEPA filters is associated with the emission of smoke (binder, degradation of

inert dust on filter, pyrolysis of gaskets). Thus, it appears that the heat-induced release from 1000 cfm HEPA filter prior to failure may be as high as 1E-5. It is assumed that HEPA filters destroyed by flame intrusion or by the impact of air at a temperature sufficiently high to melt the glass fiber are subjected to high temperature air to result in the release given above for heat-induced release. The RF is assumed to be 1.0 without an experimental basis. ARFs for high-flowrate HEPA filter may be an order of magnitude higher (1E-4). On these bases, bounding ARF and RF values for the impact of heat upon loaded HEPA filters are assessed to be 1E-4 and 1.0.

Consequence:

The consequence associated with a HEPA filter fire is considered minimal. It is expected that bulk of depleted uranium activity contained in the filter media would be trapped within the melted glass fiber. Because the HEPA unit is horizontally mounted it is not expected that much if any melted filter media would flow outside the steel filter frame or stainless steel filter housing. Depleted uranium contamination that may escape from the HEPA filter would likely spread across a medium sized area of the second floor mezzanine. This area would require decontamination. Release to the environment would not be expected.

Localized Fire

There are two areas that would be more susceptible to a localized fire involving depleted uranium and/or fluorine gas. These two areas would be the Germanium Tetrafluoride Production hood located in Room 301 and in the Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS) hood located in Room 302, Analytical Laboratory.

Area Descriptions:

The GeF_4 production hood would contain both depleted uranium and fluorine gas in production quantities. The depleted uranium would be isolated within the reaction furnace. There is no open flame or fuel source associated with the furnace. Heat is generated through electrical resistance. The Furnace is equipment with an over temperature feature which secures power to the heating element. Should an overheating condition occur, the furnace insulation is expected to isolate the heat source and prevent damage to surrounding system components and piping. The remaining portion of the system is designed to handle hot gases and would be considered fire resistive.

A Perkin Elmer ICP-MS system is located within a fume hood in the Analytical Laboratory. The ICP-MS utilizes a high temperature plasma and flammable reaction gas (NH_3) to analyze small quantities of the fluorine gas product. The plasma is confined to the ICP torch and sampler cone. The NH_3 gas is used to enhance detection capabilities. By the time the sample exhaust exits the instrument it has cooled to a temperature allows the use of plastic exhaust stack.

Scenarios:

Furnace Overheat:

The furnace will only be operated when the facility is manned. The depleted UF_4 and GeO_2 mixture is preheated to 400 °C and held for a period of a few hours to drive off any moisture. The mixture is then heated to the reaction temperature of 700°C and held until

the reaction is completed. The system is monitored during this entire period. A furnace malfunction will result in automatic system shut down. If the automatic shut down fails, the system will be shut down manually.

ICP-MS Overheat:

The ICP-MS has temperature controls to minimize overheating. The volume of sample gases used in the ICP-MS is minimal. The amount of uranium associated with the gas samples is expected to be below the detection capabilities of the ICP-MS unit, in the parts per trillion range.

Consequence:

A localized fire or malfunction of the furnace would not be expected to generate sufficient heat to breach the stainless steel furnace vessel and would result in minimal if any damage to surrounding components. The depleted uranium mixture would have to be removed from the furnace and the 48 inch by 4 inch cylindrical furnace would be disposed of as radioactive waste.

A localized fire associated with the ICP-MS unit may result in a small release of fluorine gas into the ICP-MS fume hood, which has been sized to handle such a release. A localized fire would only be expected while the unit was operating which would require the presence of at least one person. It is expected that the unit would be secured and any flames would be extinguished using a fire extinguisher located in the lab.

Major Building Fire

The National Fire Protection Association ranks arson as the leading cause of non-residential structural fires. Other causes that may pertain to the International Isotopes Inc facility would be faulty electrical systems, poorly maintained heating systems, or improperly stored combustible materials. Regardless of cause it is assumed a major building fire would result in a total loss of the facility and release of fluorine gas. The consequence of a fluorine gas release was discussed extensively in the Emergency Response Planning Germanium Tetrafluoride Release Scenarios A-P ALOHA® 5.3.1 MARPLOT® 3.3.1 document submitted with the license application.

Consequence:

It is assumed a major building fire may result in a release of at least some of the fluorine gas. Gas cylinders are equipped with pressure relief valves. If a sufficient amount of heat is transferred to the cylinder, the internal pressure may exceed the bursting pressure of the rupture disc resulting in a release of GeF_4. A GeF_4 release is mitigated through the use of ventilated storage cabinets and a dilution ventilation system whose primary components are located exterior of the facility. It is assumed that only a minimal amount of depleted uranium would be available for release to the environment in the event of a

major building fire. Depleted uranium will be located in three areas in three different geometries.

1. Depleted uranium in 55 gallon metal drums, located in the material storage room or the powder handling room. With Light (Low) Hazard Classification it is unlikely that a fire would reach temperatures capable of breaching the metal 55 gallon storage drums.
2. Depleted uranium contamination in the UF_4 glovebox. In a major building fire the UF_4 glovebox would most likely melt. Administrative controls, such as routine decontamination of the glove box will keep this available material at a minimum. A conservatively high estimate of 0.1 kg of depleted UF_4 as surface contamination would be available for released. Data provided in DOE-HDBK-3010-94 AIRBORNE RELEASE FRACTIONS/RATES AND RESPIRABLE FRACTIONS FOR NONREACTOR NUCLEAR FACILITIES Volume I - Analysis of Experimental Data, Section 5.0 Surface Contamination; Contaminated, Combustible Solids was used to calculate the source term associated with this scenario.

Depleted Uranium

	Mass percent	GAW		$t_{1/2}$		GMWU
U238	99.8%	0.23805	kg	4.47E+09	y	0.237574
U235	0.199%	0.23504	kg	7.04E+08	y	0.000468
U234	0.001%	0.23404	kg	2.46E+05	y	2.34E-06
						0.238044

Mass Estimate:	0.1	UF4 kg/glovebox
GMWU =	0.238	kg/moleDU
GMWDUF4 =	0.314	kg/moleDUF4
	0.0758	DU kg/glovebox

Material At Risk

			Activity	
U238	7.56E-02	kg	0.025424	mCi
U235	1.51E-04	kg	0.000326	mCi
U234	7.58E-07	kg	0.004708	mCi

Source Term = MAR x DR x ARF x RF x LPF

Where:

ARF = Airborne Release Fraction = 5.3E-4
RF = Respirable Fraction = 1.0
DR = Damage Ratio = 1.0
LPF = Leakpath Factor = 1.0
MAR = Material at risk

The Source Term is then calculated as:

Source Term =	1.35E-02	uCi U-238
	1.73E-04	uCi U-235
	2.50E-03	uCi U-234

The Environmental Protection Agency COMPLY Code, Version 1.6. was utilized to calculate an effective dose equivalent to the MEI of 0.2 mrem. This Code is typically used to determine the dose received to the MEI due to planned releases over the course of a year. However in this case the code was used to estimate the dose to an emergency response person located 5 meters from the source.

The following additional parameters where utilized:

Release height 2 meters (assumes fire scenario, loss of building walls and roof).
Building height 3 meters (assumes fire scenario, loss of building walls and roof).
The source and receptor are on the same building.
Distance from the source to the receptor is 5 meters.
Building width 10 meters (assumes fire scenario, width of room).
Default volumetric flow rate from the stack used (0.3 cu m/sec)
Default mean wind speed used (2.0 m/sec).

3. Depleted uranium located in the furnace. The design of the furnace is such that a major building fire would not likely breach the furnace containment and therefore no release of material would be expected from the furnace in the event of a major building fire.

I[3] Response to NRC Comment 3b.:

Prior to submitting the license application an emergency response planning meeting was held on April 8, 2005 at the International Isotopes Inc. 1359 Commerce Way facility with representatives of the Idaho Falls Fire Department, Idaho Falls Hazardous Materials Team and Idaho Department of Environmental Quality. The meeting was conducted to familiarize the Idaho Falls Fire Department and Hazardous Material Team with the facility and the proposed activities and to confirm that the Idaho Falls Hazardous Materials Team had the capability to respond to a fluorine gas release. This capability was confirmed. International Isotopes Inc. provided the fire department with a facility preplanning checklist on April 12, as requested by fire department representatives.

The following table from Section 4.5.1 of the Emergency Plan & Fire Prevention Program, I4-ESH-06, dated April 21, 2005 was provided with the initial license application and summarizes the alarms associated with 1359 facility.

System	Location	Condition
Fire/Panic Alarm	Bldg. 1359, gas cabinet, pull stations at egress doors	Fire/temperature rise or employee activated
Alpha CAM	Bldg. 1359 Room 304 Powder Handling	> 1.0 DAC uranium particulate
Toxic Gas	Bldg. 1359 Rooms 301, 302 GeF4 Production and Analytical Laboratory, building exhaust	GeF_4, NH3 gas release
Public Address	Production areas, office areas via telephone system	Any, employee initiated
Burglar Alarm	Through out facility, and "Panic" Alarm function.	Break-in after hours, employee initiated during business hours

Portable fire extinguishers would be utilized by International Isotopes Inc employees in the event of a localized fire, be that a HEPA filter or furnace. International Isotopes Inc. employees are instructed to evacuate the facility in accordance with the Emergency Plan & Fire Prevention Program.

I³ Response to NRC Comment 3c.:

International Isotopes Inc. will comply with the applicable NFPA codes to the greatest extent possible. In cases when the NFPA standards contradicts what is considered good radiological work practices International Isotopes Inc. will operate in a manner that is consistent with its radiological control program. For example:

Paragraph 7.4.4.3 ***When gloves are not being used they, they shall be tied outside the box.*** This NFPA-801 requirement is arbitrary and provides no fire protection benefit to the facility. International Isotopes Inc. prefers to stow gloves inside the glove box when not in use to minimize the possibility that activities occurring adjacent to the glove box will not damage gloves hanging outside of the glove box.

Paragraph 7.4.4.1 ***The glove box, windows, and hood shall be of non-combustible construction.*** This NFPA-801 requirement does not consider the process or amount of material handled. With out a source of ignition restricting the construction materials of a glove box or hood to non-combustible materials is unwarranted. Acrylic is commonly used in the construction of glove boxes and hoods intended for handling of radioactive or toxic materials. International Isotopes Inc. selected an acrylic glove box because it is light weight, easily decontaminated, shatter resistance, and cost effective. Without a credible source of ignition and minimal amount of radioactive material handled within, there is no reason to exclude the use of acrylic in the construction of this glove box.

I[3] Response to NRC Comment 3d.:

International Isotopes Inc. held additional meetings with, Bonneville County Zoning and Planning. International Isotopes has reviewed the International Building and Fire Codes (2003) with Bonneville County Zoning and Planning and has concluded that a fire sprinkler system will not be necessary based upon anticipated quantities of toxic/corrosive chemicals.

Should you have any questions, please contact me by phone at (208) 524-5300 or by email at jjmiller@intisoid.com.

Sincerely,

John J. Miller, CHP
Radiation Safety Officer

cc:
J. J. Miller file (JJM-2005-18)