DEPARTMENT OF THE ARMY
HEADQUARTERS, U. S. ARMY MATERIEL COMMAND
5001 EISENHOWER AVENUE, ALEXANDRIA, VA 22333-0001

September 21, 1989

040-02253

Safety Office

U.S. Nuclear Regulatory Commission
Region I
ATTN: Materials Licensing Branch
475 Allendale Road
King of Prussia, Pennsylvania 19406

Reference: AMCSF-F/89-0100

Gentlemen:

Reference memorandum, Headquarters, Materials Technology Laboratory, SLCMT-DHS, 7 August 1989, subject: Amendment to License Number SUB-238, Request For.

Forwarded are four copies of the U.S. Army Materials Technology Laboratory's request to amend NRC Material License SUB-238. We recommend approval of the request with the following concern.

Paragraph 2a of referenced memorandum should require that the bioassay program be conducted IAW Regulatory Guide 8.11 or more frequently if the local Radiation Protection Officer deems it necessary. We do not believe that bioassay is a substitute for proper respiratory fit effectiveness.

Please acknowledge receipt of correspondence on the enclosed DA Form 209, Delay, Referral, or Follow-Up Notice. If you require additional information, please contact Ms. Patricia Elker, 202 274-9340.

Sincerely,

DARWIN N. TARAS
Chief
Safety Office

Enclosures

Copies Furnished:
HQDA(SGPS-PSP-E)
COMMANDER
LABCOM, ATTN: AMSLC-RK wo/encl
MTL, ATTN: SLCMT-DHS wo/encl
Director, USAMC Field Safety Activity, ATTN: AMXOS

DEPARTMENT OF THE ARMY
U.S. ARMY LABORATORY COMMAND
MATERIALS TECHNOLOGY LABORATORY
WATERTOWN, MASSACHUSETTS 02172-0001

REPLY TO ATTENTION OF

SLCMT-DHS (385)

7 August 1989
mc

MEMORANDUM THRU:

Commander, U.S. Army LABCOM, ATTN: AMSLC-SO (Borisky), 2800 Powder Mill Road, Adelphi, MD 20783-1145.

Commander, U.S. Army Materiel Command, ATTN: AMCSF-P (Elker), 5001 Eisenhower Avenue, Alexandria, VA 22333-0001.

FOR: U.S. Nuclear Regulatory Commission, Region I, ATTN: John T. Jensen, Nuclear Materials Safety Branch, 475 Allendale Road, King of Prussia, PA 19406.

SUBJECT: Amendment to License Number SUB-238; Request For.

1. Reference, our letter (copy attached) of 16 December 1985, entitled "Nuclear Regulatory Commission Inquiry on Application for Renewal of Source Material License SUB-238, Control Number 103878."

2. Request that the changes indicated below be incorporated into source material license number SUB-238.

a) Request that paragraph three (Item 8) on page 6 be changed to read as follows: Bioassays will also be performed whenever: 1) there is a question as to the effectiveness of respirator fit or 2) upon request of the Radiation Control Committee or Radiation Protection Officer;

b) Request that paragraph five (Item 9) on page 6 of the above referenced letter be changed to read as follows: Air sampling is conducted in any area where there is a likelihood of exposure to airborne radioactive materials as determined by the RPO. The frequency of breathing zone and general air sampling will be based on prior data characteristic to the particular operation. Random periodic sampling will also be undertaken. Stack effluent air samples will be taken during depleted uranium processing operations at least monthly and during any out of the ordinary operation suspected to possibly produce a higher effluent concentration. Air samples will be processed using guidance provided in Chapter 9 of AMC-385-25 (Ionizing Radiation Protection Program). Suitable Laboratory instrumentation will be used for this task.

c) Request that paragraph seven (Item 10) be written as follows: Each survey instrument is calibrated by the RPO or his designee, utilizing two points on each scale, and quarterly calibrations are documented and

records maintained for at least three years or as required by Army regulations. Calibrations will be within ±20% of the range of the meter scale and survey meters will have stickers affixed indicating the date calibrated, date calibration due, the calibrator, identification number and owner.

Enclosure:

Edward S. Wright
Director

Enclosure

SLCMT-ISF-R (29 October 1985) 1st Ind 16 December 1985

SUBJECT: Nuclear Regulatory Commission Inquiry on Application for Renewal of Source Material License SUB-238, Control Number 103878.

DA, Materials Technology Laboratory, Arsenal Street, Watertown, MA 02172-0001

THRU: Headquarters, U.S. Army Laboratory Command, ATIN: AMSLC-SO, 2800 Powder Mill Road, Adelphi, MD 20783-1145

TO: Headquarters, U.S. Army Materiel Command, ATIN: AMCSF-P, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001

1. Information requested by basic letter is provided as follows:

Item 1. The percent by weight of Uranium-235 contained in the depleted uranium is approximately 0.3%.

Item 2. U.S. Army Natick Research and Development Laboratory, Sudbury Annex, Maynard, Massachusetts will not be utilitized for depleted uranium testing under this license renewal. The Termination Radiological Safety Survey is enclosed for your review. (See Enclosure 14).

Item 3. Training of employees will be under the direction of the Radiation Protection Officer (RPO) and documented on DA Form 750. (See Enclosure 1). Initial training to new employees who will be working in or frequenting any portion of a restricted area will be in accordance with 10 CFR 19.12. Duration of initial training will be not less than four hours. Upon completion of initial training, employees will be provided, each year, not less than four hours each month for not less than ten months per year of Radiological Safety Training commensurate with the potential radiological health protection problems in the restricted area. Training comprehension will be tested by written examination developed by the RPO and administered upon completion of each four hour training session. Written examinations such as the example exam provided in Enclosure 15, will test the trainee's knowledge of the following areas which will be covered over the ten month period:

(1) Principles and practices of radiation protection.

(2) Radioactivity measurements, use of instruments and monitoring techniques.

(3) Personal hygiene and contamination control.

(4) Math commensurate to use and measurement of radiation.

(5) Biological effects of radiation.

(6) Safety procedures utilitized for protection from radiation, chemical toxicity and pyrophoricity.

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SUBJECT: Nuclear Regulatory Commission Inquiry on Application for Renewal of Source Material License SUB-238, Control Number 103878.

Item 4. Drawings of the major existing processing areas and storage areas are provided by Enclosure 2. MTL uses depleted uranium for various test purposes, thus there is potential for any area within MTL to utilize small quantities of depleted uranium. These circumstances are evaluated and controlled under the direction of the RPO.

Item 5. Schematic description of ventilation systems was provided by Supplement V of basic application, dated 29 March 1985. The following air flow rates are provided as requested:

(1) Building 312, Uranium Machine Shop and Special Metals Laboratory - Approximately 11000 CFM total from all exhaust ducts, hoods, house cleaning lines. Face velocities as required by Supplement I, Item 3(c)(1) of basic application. (See Enclosure [illegible].

(2) Building [illegible] Facility - Approximately 5000 CFM total from general room [illegible] down draft table. (See Enclosure 4).

(3) Building [illegible] - Approximately 5000 CFM total exhaust from [illegible] (See Enclosure 5).

(4) Building 43, Uranium Melt Facility - (see Inclosure 6). Effluents will be monitored in accordance with Appendix D of basic application, dated 29 March 1985. Counting systems utilized include: Baird, Model 989, Accucount and Searle Analytic Gas Proportional Counter, Model 1152 B or equivalent.

Item 6. The Army Materials Technology Laboratory (MTL) has a long history of research with depleted uranium. Presently only two areas exist where personnel access is controlled for the purpose of contamination control. They are Building 43, Melt Facility, and Building 312, Uranium Machine Shop. (See Enclosure 2). The policy for controlling spread of contamination is personnel training in conjunction with the use of personnel monitoring devices at each change point (restricted area versus unrestricted area). Each crossover point is furnished with a monitoring device with instructions for its' use, posted acceptable release limits, protective clothing (rubbers, lab coats, etc.) and "sticky pads" to ensure no spread of contamination. In addition, the RPO or his designee provides frequent audits of these areas to insure proper implementation/compliance with this policy. Historically, this policy has been very effective for the control of contamination at MTL.

Item 7. Personnel who participate in melting and/or casting operations will be provided ring dosimeters.

Item 8. In re-evaluating MTL's bioassay program, a review of the past three years of air sample results of areas having a potential for airborne radioactive materials indicates that MTL meets the criteria addressed in Regulatory Guide 8.11 for only a minimum bioassay program.

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This determination of bioassay program need is based on the Uranium Melt Facility, Building 43 and the Uranium Machine Shop, Building 312, where personnel are potentially occupationally exposed to respirable form of uranium in sufficient quantity that measurements of Uranium concentrations in air are required by present license conditions to ensure protection of workers. In accordance with Paragraph c(3)(a) of Regulatory Guild 8.11, the following values for the quarterly average of air sample results are summarized for the years 1983, 1984 and 1985.

$\overline{X}^{c}_{Qtr}$ = Average Quarterly Concentration $\left(\frac{(uCi)}{cc}\right)^{*}$		
YEAR	U-LAB (BLDG 312)	MELT LAB (BLDG 43)
1983	5.53 E-13	1.7 E-13
1984	8.7 E-14	2.0 E-12
1985	1.25 E-13	1.0 E-13

*Data utilized is deemed to be representative of personnel exposures.

The values of $\overline{X}^{c}_{Qtr}$ are compared to 10% of the Derived Air Concentration (DAC) from Appendix B to 10 CFR 20.

DAC = 1 E-10 uCi/cc for U-238
1/10 DAC = 1 E-11 uCi/cc

To meet criteria for minimum Bioassay Program the following condition must be achieved:

$$\frac{\overline{X}^{c}_{Qtr}}{1/10\ DAC} < 1.0$$

For U-Lab, Building 312:

1983 - $\frac{5.53\ E-13}{1\ E-11} = 5.53\ E-2$

1984 - $\frac{8.7\ E-14}{1\ E-11} = 8.7\ E-3$

1985 - $\frac{1.25\ E-13}{1\ E-11} = 1.25\ E-2$

For Melt Lab, Building 43

1983 - $\frac{1.7\ E\text{-}13}{1\ E\text{-}11} = 1.7\ E\text{-}2$

1984 - $\frac{2.0\ E\text{-}12}{1\ E\text{-}11} = 2\ E\text{-}1$

1985 - $\frac{1\ E\text{-}13}{1\ E\text{-}11} = 1\ E\text{-}2$

The maximum values used to compute the X^c_{Qtr} values are now compared to 25% X DAC to meet the following condition:

$$\frac{X^c_i}{25\% \times DAC} < 1$$

For the U-Lab, Building 312

1983 - $\frac{7.8\ E\text{-}13\ uCi/cc}{2.5\ E\text{-}11} = 3.12\ E\text{-}2$

1984 - $\frac{1.5\ E\text{-}13}{2.5\ E\text{-}11} = 6\ E\text{-}3$

1985 - $\frac{1.6\ E\text{-}13}{2.5\ E\text{-}11} = 6.4\ E\text{-}3$

For the Melt Lab, Building 43

1983 - $\frac{2.8\ E\text{-}13}{2.5\ E\text{-}11} = 1.12\ E\text{-}2$

1984 - $\frac{3.5\ E\text{-}12}{2.5\ E\text{-}11} = 1.4\ E\text{-}1$

1985 - $\frac{3.67\ E\text{-}13}{2.5\ E\text{-}11} = 1.47\ E\text{-}2$

Based on difficulty of interpretation of bioassay results, and the ability to derive intakes from this data, a more proactive intake assessment procedure, such as breathing zone air sampling, can yield quicker, and more accurate assessments of intakes and be far more sensitive than bioassay. In addition, such early information can be used to initiate corrective action as well as confirmation bioassays. Calculations shown in Enclosure 12 indicate that MTL can detect intakes down to a level which would result in a committed dose of less than 1 millirem per exposure sampling period.

This technique of assessment is deemed to be more conclusive, sensitive, proactive, and not raise undue concerns by workers. Bioassay can, however, provide a good quality assurance check for other elements of our internal radiation protection program.

The Derived Investigation Level (DIL) established at MTL for an air sample result is any value of an air sample (X^c_i) that exceeds 25% of the DAC (2.5 E-11 uCi/cc) provided the air sample is representative of an employees' actual exposure condition as determined by the RPC.

MTL is dedicated to maintaining exposures As Low As Reasonably Achievable (ALARA) and has a history of very low levels of airborne radioactive materials through the effective monitoring of the working environments, elaborate engineering controls, and contamination control.

In the development of MTL's Bioassay Program the following conditions were evaluated in order to calculate derived investigation levels (DIL's) for a bioassay result:

1. Chronic occupational exposure to 1/10 the Derived Air Concentration (DAC) for a period of one year . (MTL operates below this level under normal circumstances).

2. Airborne contaminant of 1.0 micron AMAD Depleted Uranium with a specific activity of 3.6 E-7 microcuries per microgram. (10 CFR 20).

3. ICRP 23 Reference Man and ICRP 30 Metabolic Data.

With the above conditions a derived maximum chronic occupational exposure intake rate can be calculated to be:

$$1\ E\text{-}10\ \frac{uCi}{cc} \times \frac{1}{10} \times 9.6\ E{+}6\ \frac{cc\ breathed}{work\ day} \times \frac{1\ uGm}{3.6\ E\text{-}7\ uCi} = 266.7\ \frac{uGms}{day}$$

The chemical compound classes used in this evaluation are based on simulated lung solubility studies by Mr. D. Allard of conditions at a contractually affiliated DU facility as referenced in "Evaluation of Urinalysis Data of Workers Exposed to Aerosols of Depleted Uranium" by Kenneth W. Skrable, dated 12 August 1983.

Computer generated in vivo and in vitro bioassay DIL tables which evaluate the above conditions and provide expectation values for Uranium in urine, feces, nasal passage, lungs, systemic body, GI tract and total body are shown in Enclosure 13. The in vitro bioassay DIL for instantaneous urine (page 4) shows that after a very short time of chronic exposure, approximately 60 days, uranium reaches equilibrium at about 50 ugms/liter and will remain at this equilibrium value for the duration of the chronic exposure period (365 days in this case).

In determining the frequency between bioassay measurements, Figure 3 of Regulatory Guild 8.11 was evaluated using the measurement sensitivity limit of 1 ugm/liter which is equivalent to 3.0 pCi/liter. This yields a time between specimens of 300 days. This frequency, however, would be used to detect 1 MPD_c which is an upper bound condition.

For the purpose of a quality assurance assessment of MIL's Internal Radiation Protection Program bioassays will be performed semi-annually with a DIL of 50 ugms/liter.

Bioassays will also be performed whenever: 1) respiratory protection is utilitized for the protection of individuals to airborne radioactive material, In such cases, results of bioassays will be used to insure that the integrity of respiratory protection was maintained or 2) upon request by the Radiation Control Committee or Radiation Protection Officer.

In the unlikely event of an intake greater than the air sample DIL of 25% of the DAC averaged over a 40-hour work week (i.e. 10 mpc-hrs) or a bioassay result greater than the bioassay DIL of 50ugms/liter, MIL will implement additional bioassays on a frequency required by Regulatory Guild 8.11 with the evaluation of bioassay results and estimates of intakes to the extent that the recommendations meet the intent of the ICRP in their report "Recommendations of the ICRP" (ICRP Publication Number 26) and "Limits for Intakes of Radionuclides by Workers" (ICRP Publication Number 30).

Item 9. Air sampling is conducted in any area where there is a likelihood of exposure to airborne radioactive materials as determined by the RPO. Areas which have historically shown a greater potential for airborne radioactive material, such as the Uranium Melting Facility and the Uranium Machine Shop, are sampled on a monthly basis utilizing instack isokinetic sampling, general area sampling, and breathing zone sampling as described in Supplement 1 (Item 7), paragraph (3)(c)(3) of basic application, dated 29 March 1985. Monthly sampling is conducted within the controlled areas of the Uranium Melt Laboratory and the Uranium Machine Shop at locations determined by the RPO for the purpose of best determining actual exposure conditions.

Any other areas where depleted uranium may be utilitized, stored or processed will be sampled at locations and frequencies determined by the RPO to best determine actual exposure conditions using the procedures described in Supplement 1, paragraph 3(c)(3) of basic application dated 29 March 1985.

Item 10. Each survey instrument is calibrated by the RPO or his designee, utilitizing two points on each scale and the quarterly calibrations will be documented on a calibration report, which are maintained for at least three years. (See Enclosure 7). Results of individual calibration points will not be more than ± 20% over the range of the instrument and survey meters will be affixed with calibration decal indicating: date calibrated; date due; who performed calibration; and what instrument calibrated. Graphs will be affixed to survey instruments in the event that ± 20% cannot be achieved during routine calibration. The above procedures will also be implemented following any servicing of survey instruments.

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SUBJECT: Nuclear Regulatory Commission Inquiry on Application for Renewal of Source Material License SUB-238, Control Number 103878.

Item 11. The research work performed at MTL which utilizes depleted uranium varies from year to year, thus, the waste volume changes. Historically the types of waste generated consist of solid metal scrap, uranium oxide (from incineration process), and contaminated trash, (i.e., compacted paper goods, rubber, labcoats, wood, etc.). Volumes for the past three years are as follows: 1983 - 225 cubic feet, 1984 - 188 cubic feet, 1985 - 556 cubic feet.

The recording of receipts, transfers and disposals are handled through a depleted uranium accountability program under the direction of the RPO. See Enclosure 8 for sample forms used in the transfer/accountability of depleted uranium at MTL.

The MTL radioactive waste storage facility is located at the west end of the Installation, Building 241 (see back cover of basic application, dated 29 March 1985). This is a roofed, prefabricated metal storage building which is locked at all times and access controlled by the RPO.

Presently the Army is utilizing Chemical Nuclear Systems Inc., License Number 097, and U.S. Ecology Inc., License Number WN-I019-2, as its prime waste disposal contractors.

Item 12. The Army has several internal auditing agencies for the purpose of evaluating effectiveness of radiation protection programs. One is the Army Environmental Hygiene Agency in Maryland, another is the Army Field Safety Activity in Indiana, and a third is the Army Laboratory Command in Maryland. All audit all Army radiation protection programs on a reoccurring basis and provide a written report of the evaluation with recommendations to the Installation Commander and Director through the command channels.

The following formats/forms or equivalents are used by MTL for recording purposes:

(1) Results of personnel monitoring (see Enclosure 9) are provided by Army Ionizing Radiation Dosimetry Center, Lexington, Kentucky.

(2) Results of radiological instrument calibration. (See Enclosure 7).

(3) Results of radiological surveys are provided on survey forms developed for each individual area. (See Enclosure 10 for a sample form).

(4) Quantities of radioactive effluents are calculated and recorded on enclosed form. (See Enclosure 11).

(5) Forms utilized for source accountability are provided by Enclosure 8.

(6) The format utilized for recording non reportable discrepancies/-incidents in the unlikelihood of an accident is for the RPO to document circumstances, results and corrective actions in writing on internal disposition forms for review by the Radiation Control Committee, the Commander and the Director through the command channels.

SLCMT-ISP-R (29 October 1985) 1st Ind 16 December 1985
SUBJECT: Nuclear Regulatory Commission Inquiry on Application for Renewal of Source Material License SUB-238, Control Number 103878.

( ) The format for recording audits/evaluations of the Radiological Protection Program is provided above.

2. Please contact Mr. William A. Lorenzen, Health Physicist, RPO, of my staff if further information and/or clarification is required.

3. LABCOM/MTL - Providing Leaders the Decisive Edge.

Edward S Wright
EDWARD S. WRIGHT
Director
Materials Technology Laboratory

15 Encls
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