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July 12, 2009

Rachel Browder
Nuclear Materials Licensing Section
U.S. Nuclear Regulatory Commission, Region IV
611 Ryan Plaza Drive, Suite 300
Arlington, TX 76011

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Ms. Browder,

In response to your request for additional information dated June 4, 2009, please find attached a decommissioning plan for the incinerator located at the Arctic Health Research Building. This decommissioning plan is for docket number 030-01179, license number 50-02430-07, and control number 471939.

Sincerely,

Tracey A. Martinson

Tracey A. Martinson, Ph.D.
Radiation Safety Officer
Industrial Hygienist

This document has been redacted in accordance with US NRC Regulatory Issue Summary 2005-031.

EXECUTIVE SUMMARY

The University of Alaska Fairbanks has an incinerator that was used to burn materials containing small amounts of ^{3}H and ^{14}C. The incinerator has been taken out of service and a new one is currently in use. The old incinerator is located in the Arctic Health Research Building on the UAF main campus. The room housing the incinerator is being renovated, along with the entire west wing of the building (former Animal Quarters). UAF wishes to decommission the incinerator and so that it can be released for unrestricted use, and wishes to have the incinerator room released so that it can be renovated.

In the 17 years that the incinerator was used to burn radioactive wastes, a total of approximately 19 mCi ^{3}H and 13 mCi ^{14}C were burned. This is approximately 3-4% of what we were permitted to burn over that time period. The incinerator was also used to destroy short-lived isotopes such as ^{32}P, ^{35}S, and ^{125}I, but these items were permitted to decay-in-storage for a minimum of ten half-lives prior to incineration. No alpha emitters were ever incinerated. The main purpose of the incinerator was to destroy animal carcasses, bedding, and other medical/veterinary waste.

Surveys of the room and of the incinerator do not reveal any evidence of radioactive contamination. Radiation levels at the surfaces of the walls and floors are no higher than those observed outdoors (0.01-0.03 mR/h for alpha and beta, 0.05-0.08 mR/h for low-energy gamma). Radiation levels in the incinerator chamber and close to the outer surfaces of the incinerator and stack are higher than background, but we believe that this is due to the presence of naturally-occurring thorium in the refractory brick. These values ranged from 0.5-0.8 mR/h when measured using a low-energy gamma probe, and from 0.01-0.07 mR/h when measured using a Geiger-Mueller detector. The thorium and uranium content of the refractory brick was evaluated using X-ray fluorescence spectroscopy, and was estimated to be 0.0055% and 0.0012%, respectively. Wipe tests of floors and walls, of the exterior surfaces of the incinerator, and of the interior surfaces of the incinerator that are currently accessible show that removable surface radioactivity is no different from background levels. Results obtained thus far indicate that neither the incinerator nor the room in which it is located are contaminated with radioactive materials.

UAF would like to dismantle and remove the incinerator from the AHRB, and to begin renovation of the area as soon as possible. The original request for this decommissioning was dated July 30, 2008, and renovations in other parts of the building have already begun. We are requesting that our license (Docket 030-01179, License 50-02430-07) be amended to include the following decommissioning plan.

DECOMMISSIONING PLAN

1) INCINERATOR OPERATING HISTORY

The University of Alaska Fairbanks has a Type B broad-scope nuclear materials license (docket number 030-01179, license number 50-02430-07) that permitted use of the incinerator located in the Animal Facility of the Arctic Health Research Building (AHRB) for destruction of low-level radioactive wastes. The physical location of the facility and diagrams of the incinerator were provided in the original license application as Appendix F, Conditions for Incineration (attached).

The incinerator was used largely for the destruction of non-radioactive animal wastes (bedding, carcasses), and occasionally for destruction of low-level radioactive wastes. A summary of the totals incinerated over the 17-year operating span of the AHRB incinerator is provided in Table 1. These amounts do not include scintillation vial waste and animal carcasses that were incinerated according to the provisions of 10 CFR 20.2005. The first disposal of radioactive materials in the AHRB incinerator occurred in July 1989, and the last such disposal was in November 2006. During this 17 year time frame, approximately 19 mCi ^{3}H and 13 mCi ^{14}C were burned in the incinerator. The Conditions for Incineration (Appendix F of license 50-02430-07) allowed for the incineration of up to 30 mCi ^{3}H and 20 mCi ^{14}C per year.

Table 1. Summary of radioactive materials incinerated in the ARHB incinerator.

Year	^{3}H (mCi)	^{14}C (mCi)
1989	0.25	0.1
1990	1.78	0.1
1991	0	0
1992	0.1	0.02
1993	0	0
1994	0	0
1995	0	0
1996	1.09	0.39
1997	0	0
1998	0	0
1999	0	0
2000	1.92	1.8
2001	3.4	2.54
2002	0.009	0.872
2003	9.43	5.165
2004	0.243	0.9
2005	0.116	0.106
2006	0.506	0.234
Totals	**18.844**	**12.687**

The incinerator was mainly operated by the UAF Animal Facility for the purposes of destroying non-radioactive animal wastes, bedding, blood, and infectious wastes. These types of wastes were burned approximately once a week. In contrast, burns of radioactive material occurred no more than three times per year.

2) CURRENT USES OF THE AHRB

The AHRB houses research labs for the Institute of Arctic Biology, the Institute of Marine Science, and the School of Natural Resources and Agricultural Sciences. The IAB Animal Facility was formerly located in this building but has moved to a recently-constructed facility dedicated to this purpose (the BiRD building). Once the incinerator is removed, the room will be renovated and used for laboratory/research space.

3) SUMMARY OF CURRENT AND POTENTIAL USES OF LAND IN AND AROUND THE AHRB

The land immediately surrounding the AHRB belongs to the University of Alaska Fairbanks. Currently the land immediately to the west of AHRB is covered with grass, and there are parking lots to the east and west (Fig. 1A). To the north, there is a road and several other research buildings including the International Arctic Research Center, the Elvey Building, the O'Neill Building, Irving I, and Irving II. To the south, there is a road and the Butrovich Building, which houses the University of Alaska Statewide System Offices. Much of the land to the north and west of the AHRB is a designated natural area for research and recreation (heavily wooded, cross-country skiing/hiking trails, and two small lakes), and is referred to as the North Campus area (Fig. 1B).

Future plans for the open land to the west of the AHRB are unknown at this time. Recent proposals to erect a new Biosciences building in that location were rejected in favor of a different location (to the northeast, across from the BiRD Facility). It is extremely unlikely that any residence facilities would be constructed in this area, as those types of facilities are located elsewhere on campus. In addition, it is unlikely that additional buildings will be constructed in the North Campus area (Fig. 1B), as it is essential to the mission of the University that it remain a biological reserve.

5) SUMMARY OF METHODS THAT WILL BE USED TO REMOVE INCINERATOR FROM AHRB

The incinerator will be removed from AHRB by a contractor. The process will be as follows:

1. All hydraulic systems, fuel oil systems, control and electrical systems will be dismantled and shrink-wrapped onto pallets. The pallets will be taken by truck to the UAF Central Receiving Warehouse (1855 Marika Road, Fairbanks, AK).
2. The conveyor box will be mechanically detached from the combustion chamber and hauled outside onto the loading dock adjacent to the incinerator room. The box will be transported to the warehouse on Marika Road.
3. The refractory brick will be removed from the primary (lower) and secondary (upper) burn chambers. During this procedure, workers will wear respiratory protection to guard against inhalation of refractory brick dust. Wetting techniques will be used to help keep dust levels down during the removal of the refractory brick.
4. The stack will be unbolted from the combustion chambers.
5. The combustion chambers will be unbolted from each other and lowered to the floor. They will be hauled to the loading dock adjacent to the incinerator room, loaded on a truck, and hauled to the warehouse on Marika Road.
6. The stack joint flanges will be unbolted and the welds will be ground off. The sections of the stack will be rigged and hoisted up through the roof opening by crane. As the stack is dismantled, the RSO will sample the interior and exterior surfaces of the pieces. Stack pieces will be wrapped in plastic, laid on a flat deck trailer, secured, and transported to the UAF Hazmat Facility until the results of the wipe tests are complete. Once test results have shown the stack to be free of radioactive contamination, the stack pieces will be taken to the warehouse on Marika Road.
7. In the event any of the stack pieces is found to be contaminated with ^{14}C or ^{3}H, the piece will be remediated by soaking in Count Off™ for 24 hours. The activity present in the contaminated Count Off™ solution will be assessed by liquid scintillation counting to ensure compliance with sanitary sewer disposal limits (10 CFR 20 Appendix B, Table 3).

6) SUMMARY OF RADIATION PROTECTION METHODS AND CONTROL PROCEDURES TO BE USED DURING SURVEY AND REMOVAL OF INCINERATOR AND STACK

In preparation for removal of the incinerator, we have surveyed and wipe sampled all surfaces in the incinerator room (floors, walls), as well as all accessible surfaces of the incinerator itself. These include all outer surfaces, the inside of the hopper, the doors, and the interiors of both the primary and secondary burn chambers. Surfaces were surveyed with a Ludlum Model 3-98 survey meter with an internal Geiger-Mueller detector and an external low-energy gamma probe (Ludlum Model 44-3). Several figures are provided to show the condition of the incinerator and the incinerator room (Fig 3).

Table 2. Survey readings taken from incinerator and room surfaces (at 0 m).

Location	Alpha/Beta (mR/h)	Low energy gamma (mR/h)
Outdoors	0.01-0.02	0.05-0.08
Walls of incinerator room	0.01-0.03	0.05-0.12[1]
Floors of incinerator room	0.01-0.03	0.05-0.08
Incinerator hopper	0.01-0.03	0.04-0.06
Incinerator primary chamber	0.01-0.07	0.5-0.7[2]
Incinerator secondary chamber	0.02-0.07	0.5-0.8[2]
Outer surfaces of incinerator	0.01-0.03	0.05-0.12[3]

[1] A reading of 0.12 mR/h occurred on the wall near the incinerator stack, which is lined with refractory brick that contains natural thorium.
[2] Higher readings are believed to be due to the presence of thorium in the refractory brick lining the incinerator.
[3] A reading of 0.12 mR/h occurred on the outer surface of the primary chamber of the incinerator, and is probably due to the refractory brick lining the interior.

Table 3. Wipe test results (mean and standard deviation) for incinerator surfaces and surfaces of the incinerator room. Values are the average of three distinct samples, taken over a 100 cm^2 area.

Location	^3H (dpm/100 cm^2)	^{14}C (dpm/100 cm^2)
Floor near hopper	41 ± 3.8	17.3 ± 2.2
Inside surfaces of hopper (Fig. 3F)	80.9 ± 63.3	19.3 ± 2.1
Outside surfaces of hopper	56 ± 29.1	16.2 ± 2.3
Drip tray below hopper	37.5 ± 0.5	17.3 ± 2.1
Inside surfaces of primary chamber (Fig. 3C)	40.4 ± 10.6	16.9 ± 1.7
Outside surfaces of primary chamber	38.3 ± 1.4	18.5 ± 2.8
Inside surfaces of lower portion of stack (Fig. 3D)	55.2 ± 11.5	19.7 ± 1.3
Floor by incinerator door	39.3 ± 6.4	16.8 ± 0.4
Wall by stack	40.2 ± 1.0	17.6 ± 0.7
Interior of secondary chamber (Fig. 3E)	36 ± 2.3	17.3 ± 2.2
Wall behind incinerator	38 ± 4.2	16.9 ± 1.3
Blank	38.5 ± 6.7	17.7 ± 1.0

The upper portion of the 36-foot tall stack was accessed using a fire truck ladder (Fig. 4). The outside of the stack was blackened, so we wipe-tested these surfaces as well as the surface of the spark arrester on top of the stack (Fig. 5). The interior of the stack could not be accessed at this time, however, it appeared to be clean (no black soot was visibly present; Fig. 5). Wipe samples from the base of the exhaust stack (on the roof) were also taken (Fig. 6).

Table 4. Wipe test results (mean and standard deviation) from the base of the exhaust stack and from the upper portion of exhaust stack (accessed via ladder). Values are the average of at least two distinct samples, taken from a 100 cm^2 area, with the exception of the blank, of which there was only one sample counted.

Location	^{3}H (dpm/100 cm^2)	^{14}C (dpm/100 cm^2)
Exhaust stack base—east side	61.5 ± 9.5	24.2 ± 6
Exhaust stack base—north side	67 ± 10.8	20.2 ± 1.8
Exhaust stack base —south side	84.8 ± 3.7	24 ± 0
Exhaust stack base—west side	66 ± 3.7	20.9 ± 0.7
Flange of stack	65 ± 30.3	20.9 ± 2.1
Surface of spark arrester	63.2 ± 16.4	21.1 ± 6.8
Outside of stack	66.9 ± 34.6	22.1 ± 2.0
Rim of stack	59.3 ± 13.3	26.5 ± 17
Blank	80.7	21.4

Based on the history of the incinerator (as described in item #1, above), in conjunction with the survey and wipe test results, we find no indication that the incinerator or the room where it is located are contaminated with radioactive materials as a result of our incinerating licensed material. We only incinerated tritium and carbon-14 (a total of 19 mCi and 13 mCi, respectively, during the 17 years the incinerator was used to burn licensed material). All short-lived isotopes such as I-125, S-35, and P-32 were decayed-in-storage for at least 10 half-lives prior to incinerating.

7) COMMITMENT TO COMPLY WITH WRITTEN, APPROVED PROCEDURES

Removal of the incinerator from the AHRB will be done in accordance with this decommissioning plan, once approved by the NRC.

8) DESCRIPTION OF MANAGEMENT ORGANIZATION OVERSEEING REMOVAL OF THE INCINERATOR

Removal of the incinerator from the AHRB will be overseen by the UAF Radiation Safety Officer. The RSO is supervised by the Director of Environmental Health, Safety, and Risk Management within the University of Alaska Fairbanks, and has been delegated authority over all matters involving radiation safety at UAF by the UAF Chancellor. The RSO will work closely with the Senior Project Manager (from the UAF Department of Design and Construction) and the contractors to ensure the work is done according to this decommissioning plan.

9) CONTRACTOR SUPPORT OF DECOMMISSIONING ACTIVITIES

A contractor has been hired to dismantle and remove the incinerator from the AHRB (see item 5, above for a description of the process). The UAF RSO will provide an overview of the operating history of the incinerator to contractor personnel prior to the commencement of work, including an explanation of the hazards of ^{3}H and ^{14}C. The UAF RSO will be onsite to oversee the activities of contractor personnel during the dismantling and removal of the incinerator from the AHRB. Contractor personnel and the senior project manager (from UAF Department of Design and Construction) will be expected to comply with the directives of the RSO at all times during this process.

10) COMMITMENT TO ALARA

All activities associated with the dismantling and removal of the AHRB incinerator will be done in accordance with the principle of ALARA. Respirators will be worn when removing refractory brick and while handling the sections of the stack. Although all preliminary surveys indicate there is no residual ^{14}C or ^{3}H contamination of the stack, we will require, as per ALARA, the use of respiratory protection since we do not yet know if any contamination exists in the center portions of the stack. In addition, the interior of the stack appears to be lined with refractory brick, which may contain traces of thorium and uranium, and these should not be inhaled.

We do not anticipate that the removal of the AHRB incinerator will result in any release of radioactive materials to the environment. As described above (Section 6), survey data and wipe test results indicate that the incinerator is not contaminated with radioactive materials. The only radioactivity present in the incinerator comes from the refractory brick lining the incinerator and the stack. These materials will be removed from the incinerator prior to its removal from the building, and will be stored in metal drums until arrangements for disposal or recycling can be made (see section 14 below). Thus, environmental releases of radioactivity will also be ALARA.

11) SUMMARY OF QUALITY ASSURANCE PROGRAM

Quality assurance of the Radiation Safety Program at UAF is provided by the RSO. The organization of the Radiation Safety Program at UAF is shown in Figure 7.

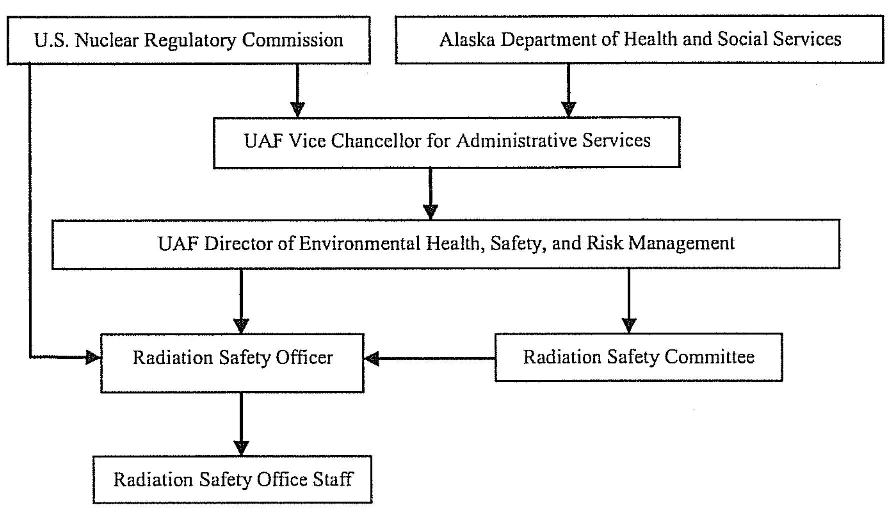

Fig. 7. Organizational chart of the Radiation Safety Program at UAF.

The U.S. NRC and Alaska Dept. of Health and Social Services are the regulatory agencies directly involved in radiation safety at UAF. As a non-agreement state, the role of the Alaska

Department of Health and Social Services at UAF primarily involves registration and inspection of x-ray sources. The Director of UAF Environmental Health, Safety, and Risk Management (EHS&RM) is responsible for appointing and evaluating the RSO, appoints members of the Radiation Safety Committee, and serves as chair of the Radiation Safety Committee. The Director of EHS&RM reports directly to the Vice Chancellor for Administrative Services. The RSO is responsible for the day-to-day management of the radiation safety program at UAF and is responsible for communicating directly to the NRC. The RSO is assisted by the Radiation Safety Office staff, which currently consists of the UAF Environmental Compliance Officer. For purposes of this decommissioning plan, the RSO will be responsible for direct oversight of the dismantling and removal of the incinerator from the AHRB. The RSO will report to the Director of EHS&RM and to the Vice Chancellor for Administrative Services, as well as to the NRC.

12) EQUIPMENT USED FOR MEASUREMENT

The RSO maintains all measurement equipment, and is in direct control of the equipment at all times. Calibration of survey meters is done annually by a third party, and calibration of the liquid scintillation counter is done at least annually by the RSO. Certificates of calibration for survey meters are maintained by the RSO. Survey meters are checked for proper functioning prior to each use, using check sources.

Survey measurements were taken using a Ludlum Model 3-98 survey meter equipped with an internal Geiger-Mueller detector and an external low-energy gamma probe (Model 44-3). The meter and probe were last calibrated on June 18, 2009, by Ludlum Measurements, Inc., Sweetwater, Texas. The serial number of the meter is 251072, and the serial number of the low-energy gamma probe is PR279390. This same meter will be used for measurements during the dismantlement process.

Wipe tests were counted on a Beckman LS 6000 SE liquid scintillation counter (serial number 7065966). The scintillation counter was last calibrated on March 31, 2009. A printout of the current calibration is attached to this decommissioning plan. This same instrument will be used for analyzing wipe tests of the stack after it is dismantled and taken down from the roof.

13) RELEASE CRITERIA FOR UNRESTRICTED USE

The incinerator will meet the criteria for release for unrestricted use if wipe test values do not exceed those given in Table 1 of the 63 FR 64132 (November 18, 1998). Table 1 of 63 FR 64132 lists the acceptable screening levels for ^{3}H and ^{14}C are 1.2×10^{8} dpm/100 cm^{2} and 3.7×10^{6} dpm/100 cm^{2}, respectively. Wipe tests taken from the surfaces of the incinerator, including the outside of the stack and the hopper, indicate that removable surface contamination is well-below the screening levels for ^{3}H and ^{14}C, and moreover, is not significantly different from background (Tables 3 and 4).

65 FR 37186 (June 13, 2000) clarifies the use of screening values for demonstrating compliance with 63 FR 64132 (November 18, 1998), and notes that buildings with surface contamination below those listed in Table 1 of 63 FR 64132 (November 18, 1998) will meet the release criteria for unrestricted use if there is no volumetric contamination. We believe it is unlikely that any ^{3}H or ^{14}C was absorbed into the walls or floors of the incinerator room, which are painted cinder block and concrete, respectively. Radioactive materials were not stored in this room, and were

always in bags or boxes when loaded into the incinerator. Similarly, we do not believe the structural components of the incinerator, which is made of solid metal, absorbed any ^{3}H or ^{14}C. The refractory brick lining the interior of the incinerator and stack may have absorbed some tritiated water vapor or $^{14}CO_2$ during the incineration process. When the brick is removed, we will take samples, extract them, and analyze by liquid scintillation counting to determine levels of ^{14}C and ^{3}H in the firebrick.

14) RADIOACTIVE WASTE MANAGEMENT PROGRAM

At this time, we do not anticipate generating any radioactive waste as a result of our efforts to remove the incinerator. All surveys to date indicate that the incinerator is not contaminated with licensed material (^{3}H and ^{14}C). As the incinerator is dismantled, and becomes more accessible to sampling, additional measurements will be taken to ensure that the incinerator and stack are not contaminated. These will be submitted to the NRC in a final status survey.

The refractory bricks lining the incinerator contain small amounts of naturally-occurring thorium (0.0055%) and uranium (0.00119%). There is some brick residue in the secondary burn chamber that we have tested and found to contain the same levels of thorium and uranium as the intact brick lining the burn chambers. At this time, we are investigating disposal or recycling options for the refractory brick.

Appendix F

Conditions for Incineration

The incinerator has main and secondary burning chambers and uses No. 2 fuel oil. The capacity of the incinerator is approximately 250 pounds per hour on the basis of an eight hour per day operation. The incinerator is equipped with a semi-automatic hydraulic loader with a hopper capacity of 1 cubic meter. Figure 2 is a diagram of the AHRB, which houses the incinerator. The air intakes for the building are on the north side of the building below the roof level, whereas the incinerator exhaust chimney is on the south side of the building and extends 12 feet above the roof of the building. The rated airflow of the incinerator is approximately 1 cubic meter per second at a normal burning rate.

The AHRB is located on an east-west ridge with an elevation of 600 feet above sea level (MSL). The surrounding area, including Fairbanks which is 5 miles to the west, has an elevation of 440 feet MSL. The chimney (18 inch I.D. Van Packer) extends to an elevation of 640.5 feet MSL. The AHRB is a two story building; thus the 36.5 foot exhaust chimney extends 12 feet above the roof of the building. The nearest building to the AHRB building and the exhaust chimney is approximately 200 feet to the south. The nearest non-campus residential area is located approximately 1 mile to the south at an elevation of 440 feet MSL.

Specific conditions concerning the incineration of radioactive material waste are as follows:

(1) Radioactive Materials and Quantities - The radioactive materials to be disposed by incineration are listed in the following table. Also given are the maximum quantity per year, maximum permissible concentration limits, the resulting concentrations in stack effluent if the maximum quantity was incinerated, and the latter concentrations expressed as a fraction of the permissible limits.

Radioactive Material	Maximum Quantity Disposed per year µCi	Maximum* Permissible Limits µCi/ml	Average ** Concentration in Stack Effluent µCi/ml	Fraction *** Permissible Limit 24 h	year
H-3	30000	1×10^{-7}	6.9×10^{-9}	.35	.069
C-14	20000	3×10^{-7}	4.6×10^{-9}	.08	.015
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total	50000			.43	.084

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* Maximum permissible concentrations in effluents to unrestricted areas (revised 10CFR20, Appendix B, Table 2, Column 1 for tritiated water vapor and carbon dioxide).

** Calculations based on an incinerator air flow of 1 m^3/sec for 12 h/d for 100 d/y or a total exhaust discharge of 4.3×10^{12} ml/y.

*** The calculated average concentration in stack effluent as a fraction of the maximum permissible limit:

24 h - averaged over a 24 hour burn period and 10 burns per year (exhaust discharge of 8.6×10^{11} ml/y)

year - averaged over a year (exhaust discharge of 4.3×10^{12} ml/y)

If the maximum quantity of radioactive material waste (50,000 microcuries) was incinerated during one year, the concentrations in the stack effluent averaged over one year would be less than 9% of the concentrations as allowed for release into unrestricted areas (10CFR20.1302(b)(2)). When averaged over the actual radioactive material waste burn period, the average concentrations would be 43% of the concentrations allowed for release into unrestricted areas. It should be noted that these calculations assume the incineration of waste containing the maximum quantities of both requested radioactive materials in a given year; therefore, the estimates are inherently high.

The ^{3}H and ^{14}C waste incinerated includes the chemical and physical forms listed below. Note that UAF also incinerates some licensed material as if it were not radioactive in accordance with 10CFR20.2005. That material is not included in the list.

Physical and Chemical Form	Approx. % of total waste by volume
(1) Dry, solid laboratory waste including: vinyl, rubber, and polyethylene gloves; disposable aprons or coveralls; absorbent paper; disposable glass pipets; paper wipes, polypropylene or polyethylene pipet tips and syringes; syringe needles; centrifuge tubes petri dishes, and other disposable containers made of a variety of plastics, including polyethylene, polypropylene, polystyrene, polycarbonate, and polymethypentene, or glass; and occasionally other types of dry, solid lab waste. These items are contaminated on average with less than 0.01 microcurie of ^{14}C and/or ^{3}H per gram of waste. The chemical form of the ^{14}C or ^{3}H can be any of those in unsealed inventory, including carbonate and bicarbonate, tritiated water, and a variety of organic compounds.	60%
(2) Animal wastes mixed with animal bedding material, usually straw, wood chips, or absorbent paper products. The chemical form of the ^{14}C or ^{3}H can be any of those in unsealed inventory, including carbonate and bicarbonate, tritiated water, and a variety of organic compounds, as well as undetermined biochemicals. These materials are typically a byproduct of physiological studies in which the exact chemical form of the tracer at the end of the experiment is not determined. This material averages less than 0.1 microCurie of ^{3}H and/or ^{14}C per gram.	20%
(3) Terrestrial plants and soils, sediments microorganisms or other particles on filters, or sediments from lakes or the ocean. The chemical form of the ^{14}C or ^{3}H can be any of those in unsealed inventory, including carbonate and bicarbonate, tritiated water, and a variety of organic compounds, as well as undetermined biochemicals. These materials are typically residues of metabolic studies in which the exact chemical form of the tracer at the end of the experiment is not determined. This material averages less than 0.1 microCurie of ^{3}H and/or ^{14}C per gram.	20%

Authorized Users and their supervised users are required to segregate waste according to the ultimate disposal method to be used, i.e., 10CRF20.2005 waste; aqueous liquid waste for sanitary sewerage disposal; incinerable waste containing ^{14}C and ^{3}H only; short-lived waste for decay-in-storage; wastes for shipment to a LLRW disposal site; and other wastes (e.g., mixed hazardous/radioactive wastes). The last category has not been much used in recent years since RSC policy forbids Authorized Users to generate mixed wastes without prior written authorization of the RSO, and this is not granted unless the AU has a legal disposal plan and the means to pay for it. All wastes are packaged in leakproof containers, typically cardboard boxes or drums with plastic bag liners or plastic buckets with liquid tight covers ("pickle buckets"). Some lightweight dry waste with very low levels of radioactivity (see 1 above) is packaged in plastic bags only, provided it does not contain sharp items, to minimize the volume for incineration. All waste packages, including those destined for incineration, must be labeled with the name of the originating Authorized User; the name of the person delivering the waste to the RSO (if not the AU); the quantity and type of radioisotopes in the waste material; the nature and quantity of any hazardous materials in the package (such materials are not incinerated) or agreement with the statement that no hazardous materials are in the package; and the date the waste delivered to the RSO. A detailed description of waste segregation, packaging and labeling requirements is given in Appendix D (Redbook). The RSO logs the waste and adds an identifying number label to the package to correspond to the logbook entry.

(2) Concentrations of Radioactive Materials Released - The concentrations of radioactive materials released will be calculated by dividing the total incinerator flow for the burn period into the quantity of each radionuclide present in the waste. The fractional concentration will be calculated by dividing the above calculated concentration by the permissible concentration as given in the revised 10CFR20, Appendix B, Table 2, Column 1. If both tritium and carbon-14 are present in the waste, the overall fractional concentration will be the sum of the individual fractional concentrations. The overall fractional concentration of the incinerator stack effluent will be less than 0.5 when averaged over any burn period and less than 0.1 when averaged over any yearly period.

The quantity of a radioactive material in proposed incinerator waste will be determined by the 1% contamination rule, i.e., for a particular radionuclide handling procedure, 1% of the total quantity of the handled radionuclide will be assumed to contaminate the resulting waste. If a higher contamination rate is suspected then the higher contamination rate will be used. If a lower contamination rate is known then that rate will be used. Such a procedure is necessary for estimating contamination since it is difficult to accurately quantify weak beta emitting radionuclides which contaminate articles such as absorbent paper, wipes, syringes, disposable pipettes, etc.

(3) Frequency of Burns - Radioactive material waste will be disposed by incineration during a maximum of 10 burn periods per year. A burn period will be no longer than 3 days. The RSO will conduct or directly supervise all incineration of radioactive waste under this license to ensure that all aspects of the operation are conducted consistent with the NRC license and applicable regulations.

(4) Ash Residue Handling - Before cleaning the incinerator, the ash is surveyed with a G-M type survey meter. If radioactivity above normal background for the incinerator (up to 0.2 mR/hour) is detected, the RSO or another member of the Radiation Safety committee is consulted before the ash is removed, to determine whether the levels detected warrant more stringent personnel protection and containment than described below. The background radiation within the incinerator can be slightly above usual environmental levels because of natural thorium isotopes in the firebrick, fallout radionuclides that are bioaccumulated by some of the animals burned in the incinerator, and natural radionuclides in local soils. The incinerator background radioactivity has been the subject of previous correspondence with the NRC.

If the survey indicates that radioactivity is equal to normal background, then the incinerator operator, wearing disposable coveralls, neoprene-coated work gloves, and respiratory protection required for the dust hazard, removes the ash with a shovel and places it in plastic-lined metal trash cans. When the cans are full (or reach a maximum weight of about 100 lbs.) the plastic bag liner is closed and the can covered with its metal lid. The can is then removed to the AHRB Bunker storage area, until analysis of the ash, described below, is completed. All are labeled with "Incinerator ash residue; do not dispose without authorization of the Radiation Safety Officer;" and the date when placed in the bunker. The coveralls, gloves, and respirator cartridges are bagged, labeled, and stored in the AHRB bunker radioactive waste storage area.

The concentration of radioactive material remaining in the ash residue of incineration is measured on five randomly selected subsamples of at least 100 g each from each waste incineration period. (This would normally include the residue from several incinerator loads of waste; the ash usually does not need to be removed until several loads have been burned unless there is a large amount of non-combustible material. The subsamples are removed from the incinerator before or during cleaning, or from the ash waste cans). The five subsamples are homogenized separately, and at least 0.5 g of each is placed directly in liquid scintillation cocktail for liquid scintillation counting. The liquid scintillation counter used has a >90% efficiency for ^{14}C in the absence of particulate matter, though the efficiency is less for the ash. The counting efficiency is estimated by standard addition of ^{14}C. If the efficiency is unacceptably low (<20%), at least 5 g of the ash will be extracted with 0.1 N HCl (1 part ash to 10 parts acid) and methylene chloride (1 part ash to 10 parts solvent), and the extracts counted by liquid scintillation counting.

Also, at least 1 g from each subsample are spread in a thin layer on a plastic dish (such as a petri dish) and counted using a gamma spectrometer.

In addition, at least 5 incinerator loads of ash from disposals of **nonradioactive** waste will be subsampled before and/or after the radioactive waste incineration. The nonradioactive waste consists of animal bedding, animal carcasses, potentially infectious laboratory waste from the Alaska State Virology Laboratory and biology research laboratories, and on occasion ordinary trash that is added as a combustion aid. If soils and/or vegetation containing radioactive materials are being disposed, a comparison incineration of the same quantity of soils and/or vegetation from the same area (but with no radioactive materials added) will be conducted if levels of natural radioactivity in the soil seem to be above normal ash background. This provision is necessary because there is appreciable natural radioactivity in some soils due to uranium-bearing rocks in the Fairbanks area. These subsamples will be assayed as described above for the residue of radioactive waste incineration. The mean of the radioactivity detected in each assay type for the ash from the non-radioactive incineration will be compared to the mean radioactivity in each assay type for the ash from the incineration of radioactive waste using standard statistical techniques (Student's t-test) and if the means for all assays do not differ at the 99% confidence level, then the ash from the radioactive waste incineration will be discarded as ordinary refuse in the Fairbanks North Star Borough Landfill. If the means of any assay do differ significantly, and the mean for the ash from the radioactive waste incineration is greater, then the ash from the radioactive waste incineration will be labeled with a "Waste transfer form" and stored in the AHRB Bunker until disposal in an approved LLRW disposal site.

If the preliminary survey of the ash, before removal from the incinerator, indicates levels of radioactivity above background, the ash removal will be halted until the situation can be evaluated by the RSO or a member of the Radiation Safety Committee. The first step will be a check that the survey meter is functioning properly and a resurvey. If the levels are still above background, then the measurements described above will be done in an attempt to ascertain the nature of the radioisotope(s) present. The Authorized users and laboratory personnel supplying the incinerated waste will also be questioned to determine if there are any known circumstances that could have led to improper disposal. If the results of the measurements or questioning indicate that the radioactivity is due to improper disposal, then the required reports will be made to the NRC. Depending on the nature and levels of the radioactivity detected, precautions will be taken to keep personnel exposure while removing the ash ALARA and in any case less than 10% of the applicable limits in 10CFR20. These would include waiting for decay of short-lived radionuclides before ash removal, personal dosimetry for workers, use of enhanced respiratory protection, limiting individual worker time near the ash, or any other necessary measures.

We note that UAF possesses almost nothing in unsealed inventory that could pose a significant personnel or public hazard if incinerated; the only improper disposal scenario that seems even remotely possible is incineration of less than 1 mCi of ^{32}P, which might be mistakenly disposed with ^{14}C or ^{3}H-containing waste in laboratories where both are used. The hazard posed by this amount of ^{32}P is small, especially since it should form non-volatile oxides in the incinerator. However, incineration of ^{32}P is improbable because these wastes are carefully segregated, or clearly marked if mixed. If mixed short-lived and ^{3}H or ^{14}C waste is received for disposal, it is held through 10 half-lives of the short-lived radionuclide before incineration. The other unsealed inventory items that can have relatively high levels of radioactivity are rock powders that have been subjected to neutron activation. However, these originate in a laboratory that has no ^{3}H or ^{14}C, are stored in a separate area of the AHRB waste storage building than the waste destined for the incinerator, and of course are clearly labeled.

(5) Instructions to Personnel - All phases of radioactive waste disposal by incineration will be conducted by or under the direct supervision of the Radiation Safety Officer (RSO). Personnel assisting in waste disposal will be informed as to the purpose and function of protective devices and equipment used to evaluate exposure. Personnel will be instructed by the RSO in the health protection problems associated with exposure to such radioactive materials and in precautions and procedures to minimize exposure. Instructions will be consistent with 10CFR19.12.

(6) State and Local Authorization - State and local departments that have jurisdiction over the release of hazardous materials into the environment include the State Department of Environmental Conservation and the local Borough Department of Environmental Quality. These departments have approved incineration as a method for disposing of radioactive material waste under this license.

(7) Records - Records will be maintained by the RSO as to the date of incineration, the total quantity of radioactive materials disposed, the calculated concentrations of radioactive materials in the stack effluent, the results from the analysis of the ash residue and the specifics concerning the disposal of the ash residue.

31 MAR 2009 11:20

C A L I B R A T I O N

Calibrating both

LEFT		RIGHT		BOTH TUBES		
Gain	H#	Gain	H#	Left gain	Right gain	H#
2141	85.5	2288	85.3	2136	2277	1.7
2119	89.0	2265	87.4	2148	2289	1.0
2151	85.0	2297	84.3	2160	2301	0.5
2183	81.2	2329	81.4	2172	2313	-1.9
				2184	2325	-3.1
				2156	2297	-0.2

Calibration successful

Variance = 0.24

A C T I V E K E Y S

C	HelpC			Reset
PrevC	Print			

Press [PREV] after viewing results

Calibration of Beckman LS6000SE

472323

Designer and Manufacturer of Scientific and Industrial Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CERTIFICATE OF CALIBRATION

CUSTOMER UNIV OF ALASKA FAIRBANKS ORDER NO. 20134477

Mfg. Ludlum Measurements, Inc. Model 3-98 Serial No. 251072

Mfg. Ludlum Measurements, Inc. Model 44-3 Serial No. PR279390

Cal. Date 18-Jun-09 Cal Due Date 18-Jun-10 Cal. Interval 1 Year Meterface 202-608

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 35 % Alt 699.8 mm Hg

☑ New Instrument Instrument Received ☐ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☑ F/S Resp. ck ☑ Reset ck. ☐ Window Operation ☑ Geotropism
☑ Audio ck. ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC

☐ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☑ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set Comments V Input Sens. 30 mV Det. Oper. Comments V at 30 mV Threshold Dial Ratio ____ = ____ mV

☐ HV Readout (2 points) Ref./Inst. ____ / ____ V Ref./Inst. ____ / ____ V

COMMENTS:

Internal H.V.: 900V
External H.V.: 700V

Calibrated with internal pancake detector.

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
X 100	150 mR/hr		1.5
X 100	50 mR/hr		0.5
X 10	15 mR/hr		1.5
X 10	5 mR/hr		0.5
X 1	1.5 mR/hr= 4900 cpm		1.5
X 1	1.0 mR/hr		1.0
X 0.1	490 cpm		1.5
X 0.1	163 cpm		0.5

*Uncertainty within ± 10% C.F. within ± 20% X0.1 Range(s) Calibrated Electronically

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*		REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout				Log Scale			

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: ☐ S-394/1122 ☐ 1131 ☐ 781 ☐ 059 ☐ 280 ☐ 60646
Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ 720 ☐ 734 ☑ 1616 ☐ Neutron Am-241 Be S/N T-304

☐ Alpha S/N ____ ☐ Beta S/N ____ ☑ Other I-129 168,720 dpm s/n 071387

☑ m 500 S/N 189494 ☐ Oscilloscope S/N ____ ☑ Multimeter S/N 93580171

Calibrated By: Britt Glover Date 18-Jun-09

Reviewed By: Diana de Baca Date 18 Jun 09

FORM C22A 10/15/2008

☐ AC Inst. Passed Dielectric (Hi-Pot) and Continuity Test

Designer and Manufacturer
of
Scientific and Industrial
Instruments

LU' 'M MEASUREMENTS, INC.
POS, OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 44-3 Serial No. PR279390

Customer UNIV OF ALASKA FAIRBANKS Order #. 20134477

Counter 3-98 Serial No. 251077 Counter Input Sensitivity 30 mV

Count Time CPM Distance Source to Detector Surface

Other

High Voltage	Background	Isotope I-129 Size 168,720 dpm	Isotope Size	Isotope Size	Isotope Size
500	100	150			
550	100	30000			
600	130	31000			
650	130	32500			
700	140	33000			
750	180	33500			
800	400	36000			

Signature Britt Glover Date 18-Jun-09

FORM C4A 04/09/2003