70-854

Tulsa, Oklahoma
December 1, 1976

Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: William A. Nixon, Div. of Fuel Cycle and Material Safety

Gentlemen:

Request for amendment is hereby applied for to Special Nuclear Material License SNM 791 which was last applied for on January 16, 1976. The amendment requested is made due to changing the location of our laboratory facility.

The following information is submitted in sextuplicate in fullfillment of the requirements of Section 70.22, Title 10, Code of Federal Regulations, Part 70, "Special Nuclear Material".

1. Isotopic Analysis, Inc. was incorporated in the State of Oklahoma on December 24, 1975 by the Secretary of State.

   The office and laboratory of Isotopic Analysis, Inc. presently located at 10700 E. Independence St., Tulsa, Oklahoma 74115, will be relocated on or about December 15, 1976 to 8335 East 51st St., Tulsa, Oklahoma 74145. Our new mailing address will be P.O. Box 35622, Tulsa, Oklahoma 74135.

   The officers of the Corporation are:

Name and Title	Address	Citizenship
Thomas C. Westmoreland President and Operating Manager	5609 S. Yorktown Pl. Tulsa, Oklahoma 74105	USA
Jon W. Harrison Vice President & Chemist	5819 E. 21st Pl. Tulsa, Oklahoma 74114	USA
Richard W. Johnson Secretary-Treasurer & Mass Spectroscopist	4808 S. 267th E. Ave. Broken Arrow, Oklahoma 74012	USA

   Isotopic Analysis, Inc. is completely owned by the above three officers. No additional stock has been issued.

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No control is exercised over the applicant by any client, foreign corporation, or foreign government.

2. Activity to be Performed

This facility has been established to provide mass spectrographic analysis of nuclear materials. The special nuclear materials received under this license will consist of (1) samples of enriched uranium, Uranium-233, and plutonium from core manufacturers and from prime contractors engaged in monitoring military and civilian reactor programs. (2) a small quantity of U-233 for use as an internal standard in trace analyses, and (3) NBS uranium and plutonium standards of various enrichment levels. The processing of this material will consist of four steps: (1) chemical separation of the ruanium or plutonium from interfering elements by extraction or ion exchange techniques, (2) loading microgram quantities of the purified uranium or plutonium onto filaments for analysis on the mass spectrometer, (3) analysis of the material on the mass spectrometer, and (4) salvage of unused samples for return to the customer if recoverable or for burial if non-recoverable.

All processing of enriched uranium will be done in chemical hoods. All processing of U-233 and plutonium will be done in glove boxes up to the point where quantities less than 50 micrograms are to be handled. These quantities will then be handled in chemical hoods over absorbent paper.

This operational activity will be conducted at 8335 East 51st St., Tulsa, Oklahoma 74145.

3. Duration of License

The amended license is requested for a period of five (5) years.

4. Type and Quantity of Special Nuclear Material

Uranium enriched in the 235 isotope will be received in solid form as oxide, alloy or pure metal, and in solution as nitrate or sulfate with various impurities such as iron, chromium, nickel, and zirconium. The total quantity of enriched uranium possessed at any one time will not exceed 200 grams.

Uranium-233 will be received in solid form as oxide, alloy or pure metal, and in solution as nitrate or sulfate with various impurities such as iron, shromium, nickel, and zirconium. A maximum of 10 grams will be possessed at any one time.

Plutonium will be received as metal, oxide, alloy, and as sulfate, nitrate, or chloride solutions. The samples will contain various metallic impurities such as iron, nickel, chromium, and zirconium. A maximum of 3 grams will be possessed at any one time.

5. Qualifications of Supervisory and Technical Personnel

Mr. Thomas C. Westmoreland is designated Manager, Security Officer, and Alternate Radiation Safety Officer of the laboratory. Mr. Westmoreland possesses a B.S. degree in Chemistry and has twelve (12) years experience as an analytical chemist. He was employed at the Avco/Tulsa facility for four (4) years in the Mass Spectrographic Laboratory. During that time, he has been trained in managing the overall laboratory operation.

Mr. Richard W. Johnson, Lead Mass Spectroscopist, is designated Alternate Security Officer. Mr. Johnson has eleven (11) years experience in operating various functions of our laboratory.

Mr. Jon W. Harrison is Lead Chemist and the Radiation Safety Officer for the laboratory. Mr. Harrison had had eleven (11) years experience working with special nuclear materials at Kerr-McGee Corporation's Cimmaron Nuclear Facility and possesses a B.S. degree in Chemistry.

Messrs. Westmoreland, Johnson, and Harrison are designated qualified "Users" of the special nuclear material.

6. Facilities and Equipment

Plan and elevation drawings of the laboratory are attached as Drawings 1 and 2. These drawings indicate the location of the chemical hoods, glove boxes, ventilation system, airborne reaioactivity sampling stations, sample storage areas, firefighting equipment, holding tank, airlock, shower, laundry equipment, mass spectrometer, and personnel monitoring stations.

a. General Construction Details

The facility is divided into four areas as follows: (1) office area, (2) cold laboratory, (3) instrument room, and (4) the hot laboratory for radioactive material preparation. Outer walls in all areas are of windowless concrete construction (except for windows in office area) with sheet rock interior surfaces. Ceilings are of precast metal panels with caulked joints and asphalt and gravel outer surfaces. For security reasons, the Restricted Area

walls extend from floor to outer ceiling up through the acoustical ceiling drop on all four sides. This was also necessary in the hot laboratory because of it being a negative pressure area. The entire area is of fireproof construction. All services, ducts, and joints have been sealed with plaster or caulking with a phenolic sealing compound to render them dust and air tight. The floor of the hot laboratory and air lock is covered with a seamless phenolic coating which is scrubbed weekly. The floor of the instrument room is covered with vinyl tile, which is scrubbed weekly.

The walls of the hot laboratory are covered with two coats of oil base enamel paint for scrubbility. There are no floor drains in the hot laboratory. All water from the hot laboratory and washer laundry is transferred to a 350 gallon holding tank in the hot laboratory area. Sampling outlets are provided which permit analysis of all effluent before it is released into the sanitary sewer system. (Permissible dumping limits are discussed in Section 7.g.)

All cooling water for the hot laboratory analytical equipment is provided from a small, portable closed loop refrigeration unit. The water in this unit is drained into the sink when a change is necessary. The cooling water for the mass spectrometer is provided by a closed loop cooling system which cannot be contaminated by operation of the mass spectrometer. Any change in cooling water in the hot laboratory would be transferred to the holding tank.

b. Personnel Monitoring Stations and Clothes Changing

Personnel monitoring stations are located at the exit to the hot laboratory and at the exit to the instrument room as shown in Drawing 1. Personnel leaving these areas are required to monitor their clothing and person with the Technical Associates or Nuclear Chicago alpha survey meter described in Section 6.e. (2). Maximum permissible contamination is called out in Section 7.c..

Covered metal containers and plastic bags are provided for contaminated clothing. Section 7.c. calls out procedures and limits for changes and laundering or disposal of contaminated clothing.

c. Glove Boxes, Hoods and Ventilation

Two chemical fume hoods are located in the hot laboratory. These are Lab-Con-Co Advance 70 Fiberglas and epoxy units designed especially for handling radioactive materials. The hoods are of

constant volume minimum turbulence design and are operated at a minimum linear face velocity of 100 FPM.

A line of glove boxes is located in the preparation area. One of these boxes is operated without gloves as a minimum opening box. The glove boxes are operated at a negative pressure of 1/2 inch of water relative to the room and with an air change of 50 cfm per three-foot box. The minimum opening box is operated at a minimum linear face velocity of 100 FPM.

Details of the exhaust and supply system, as well as the filters used, are shown in Drawing 2. Intake air ducts supply 100% new air from the central air conditioning to all areas. The incoming air in the hot lab is filtered through absolute filters which prevent backstreaming in the event of an exhaust blower failure. The instrument room exhausts through the air lock into the hot lab. The door between the airlock and the hot lab is fitted with special gasketing and an absolute filter so that it may be sealed off to prevent backstreaming in the event of an exhaust blower failure. These rooms are balanced to maintain a negative pressure of 0.06 inches of wate in the airlock and 0.25 inches of water in the hot lab relative to the instrument room.

The hot lab exhausts through the hoods and glove boxes to pre-filters and an absolute filter to a separate duct and blower which serve only this area. Two emergency switches are located in the hot lab (one switch) and in the instrument room (one switch) to permit emergency shutdown of the exhaust blower. The pre-filters in the exhaust system are located at the exhaust vents of the individual hoods. The absolute filters are located just ahead of the exhaust blower and the glove boxes have the canister type absolute filter. The absolute filters discussed in this section are replaceable Cambridge filters capable of removing 99.95% of particulate matter 0.3 micron or larger. All filters have Underwriters Laboratory Class II fire resistance ratings. All pre-filters are the rough Fiberglas type used to prolong the useful life of the absolute filter.

The pre-filters are checked quarterly and changed if they appear to need so. In the past, our type of laboratory operation has found it necessary to change the absolute filters usually on an annual basis. The linear face velocity of the hoods and glove boxes is checked periodically to determine the effective operation of the filtering system.

d. Air Sampling Stations

Eight (8) permanent air sampling stations are located as shown in Drawing 1. These stations provide adjustable flow rates and are fitted with quick-change heads. In addition, a portable air sampler (Atomic Accessories Model HV-300) is available for evaluation of new operations and special hazards such as spills or glove failures. Air sampling schedules and maximum permissible levels are discussed in Section 7.d.

e. Radiation Instrumentation

(1) Personnel Monitoring Devices

Manufacturer:	Eberline
Type Instrument:	Thermoluminescent Badge
Sensitivity:	Beta-Gamma
When Checked:	Monthly (Eberline will continue to read badges and provide exposure reports)

Manufacturer:	Bendix Corporation
Type Instrument:	Model 862 Direct Reading Dosimeter
Sensitivity:	0-200 mr
When Checked:	Twice daily

(2) Radiation Protection Instruments

Description	Radiation Detected	Range
Technical Associates Frisker Monitor Model FM (2 ea.)	Alpha	0-30,000 in 6 ranges
Technical Associates Juno Survey Meter Model SRJ7 (1 ea.)	Alpha-Beta-Gamma	0-50, 0-500, 0-5000 mr/hr
Technical Associates Proportional Gas Flow Counter (1 ea.)	Alpha Beta	0 to 10^8 counts
Nuclear Chicago Portable and Survey Meters Model 2672 (3 ea.)	Alpha	0-150,000 c/m in 7 ranges

(2) Radiation Protection Instruments (Continued)

Description	Radiation Detected	Range
Atomic Accessories HV-300 Air Sampler (1 ea.)	Not Applicable	Not Applicable
Nuclear Chicago Model 2650 Portable Survey Meter	Beta-Gamma	0.1, 0.3, 1, 3, 10, 30, 100 mr/hr

Instruments are calibrated once each calendar quarter and after every replacement of components per manufacturer's instructions, using National Bureau of Standards Reference Standards. Operational check sources are affixed to each instrument for instantaneous check of operability.

f. Fire Fighting Equipment

Three (3) 15-pound carbon dioxide fire extinguishers are located as shown on Drawing 1. Because metal quantities will not exceed 0.3 grams per sample, it is felt that no metal extinguishers will be required as long as processing is limited.

g. Shielding

Lead bricks are provided for operations requiring shielding.

h. Protective Clothing

Laboratory coat, coveralls, surgeons caps, booties, respirators, and rubber gloves are provided for each individual. Use requirements and change schedules are discussed in Section 7.c.

i. Storage Area

Enriched uranium samples are stored in a locked metal NRC approved safe in the sample preparation area. This cabinet is fabricated of steel and has a baked enamel finish. All samples are stored in polyethylene bottles or glass ampules.

Plutonium samples are stored in glass or polyethylene bottles on a shelf in the glove line in the preparation area. U-233 is stored in glass or polyethylene bottles in the glove box in the uranium preparation room.

j. General Supplies

Absorbent paper, plastic bags, chemwipes, masking tape, metal cans, and laboratory trays are provided for use where necessary for contamination control.

7. Operational and Radiation Control Procedures

a. Receipt of Samples

Samples received will include uranium and plutonium as solids and as acid solutions. Samples will be individually contained in sealed glass or polyethylene bottles. Plutonium and U-233 samples will be further protected by a second sealed bottle. The individual samples will be packed together inside a metal container with vermiculite or other absorbing material separating them. The metal container will be plainly marked with appropriate radiation warning signs. This container will then be packed in an approved cardboard, wooden, or metal shipping container. The samples will be either material from fuel manufacturers which has no appreciable beta-gamma contamination or samples from post-irradiation studies from which the beta-gamma contamination has been removed. When received, the shipping container will be monitored and smeared (unless the package contains an exempt quantity of material as specified in paragraph 20.205 of Part 20) to assure that the beta-gamma rate does not exceed 200 mr/hr at the surface and that the fixed and removable alpha contamination does not exceed 500 DPM per 100 square centimeters. When the container is known to meet these criteria, it will be taken into the sample preparation room. The samples will then be placed in the previously described storage safe until ready for analysis. Plutonium and U-233 samples will be placed in the minimum opening box for removal from the shipping container and checking individual sample vials. If the contamination levels do not exceed those described above, the individual samples will be removed to the glove line for storage until ready for analysis. The shipping containers will be monitored inside and out and, if necessary, decontaminated to below 200 mr/hr beta-gamma and 10 DPM per 100 square centimeters alpha. Containers and packing material which cannot be decontaminated will be discarded as hot waste for burial at an approved burial site.

b. Processing of Material

Analyses involving four types of special nuclear materials will be carried out. These are (1) isotopic analysis of enriched uranium, (2) trace analysis for enriched uranium using U-233 as an internal standard, (3) isotopic analysis of U-233 fuel samples, and (4) isotopic analysis of plutonium. To avoid ambiguity, each procedure is discussed separately.

(1) Enriched Uranium

Laboratory coats will be worn for preparation of these samples. Respirators, coveralls, booties, surgeon caps, and rubber gloves will be available for use when cleaning up spills and other operations where air and surface contamination levels exceed those called out in Section 7.d. Samples in batches not to exceed ten (10) samples will be removed from the storage cabinet and taken to the chemical hood. (Individual samples as received will usually not exceed 0.3 gram contained uranium.) Appropriate aliquots (0.05 to 0.1 gram) will be weighed or pipetted into beakers for purification. The unused sample will be returned to the storage safe. The uranium in the sample aliquots will be purified by acid fuming, liquid-liquid extraction, ion exchange or electro-deposition. The end product will be a solution of pure uranyl nitrate. This solution will be transferred to the previously described minimum opening glove box where up to 100 micrograms of the uranyl nitrate will be evaporated to dryness on a tungsten filament. The loaded tungsten filament will be transferred to the loading hood in the mass spectrometer room in a closed disposable ice cream carton. The filament will be loaded into the mass spectrometer source for analysis. After the analysis is completed, the spent filament will be removed from the mass spectrometer and discarded in a covered container for eventual shipment to an approved burial site as non-recoverable waste. The unused sample will be salvaged into a polyethylene salvage bottle. When 50 grams of uranium have been accumulated, it will be returned to the customer for purification and recovery. The low level waste solutions will be discarded into a screw cap polyethylene salvage container within the hood. When full, the container will be analyzed. If the radioactivity level does not exceed the limits called out in Section 7.g., it

will be dumped in the sanitary sewer. If the level exceeds these limits, it will be concentrated and shipped to a licensed burial site. All solid waste, absorbent paper, and salvage will be placed in the proper containers and work surfaces decontaminated below the levels called out in Section 7.d. before proceeding with the next batch of samples.

(2) Trace Uranium

Protective clothing requirements for this operation are the same as those described for enriched uranium. The major difference in this process involves the preparation of the U-233 internal standard. The desired quantity of U-233 will be weighed out in the glove box in the uranium preparation room. It will then be dissolved in nitric acid and diluted to a solution concentration of 5 micrograms U-233 ml. Up to 10 aliquots containing 5 micrograms U-233 each will then be pipetted into 100 ml beakers. These beakers will be transferred to the chemical fume hood. Aliquots of unknown sample containing up to 50 micrograms of enriched uranium will be added to each beaker. From this point on, the processing is identical to the previously described enriched uranium. The total purified uranium is evaporated to dryness on the filament for analysis in the mass spectrometer. The remaining U-233 standard solution is retained for future use. At no time will the total U-233 content of the box exceed 10 grams.

(3) U-233 Fuel Samples

Protective clothing requirements for this operation will be the same as those described for enriched uranium. The major difference here involves the preparation of the fuel sample inside the glove box instead of in the open hood. Samples in batches not to exceed ten samples will be removed from the storage cabinet for reprocessing. Individual samples received will not exceed 0.1 gram contained Uranium-233. Appropriate aliquots of 0.01 gram contained U-233 will be weighed or pipetted into beakers inside the glove box. The unused samples will be returned to the storage cabinet. The uranium in the sample aliquot will be purified by acid fuming, liquid-liquid extraction, or ion exchange. The end product will be pure uranyl nitrate. This solution will be diluted to a concentration of 1 mg/ml. Fifty micrograms of this solution will be transferred to the minimum opening glove box where up to 10 micro-

grams of the uranyl nitrate will be loaded onto a tungsten or tantalum filament. The loaded filament will be transferred to the loading hood in the mass spectrometer room in a disposable ice cream carton.

The filament will be loaded into the mass spectrometer for analysis. After the analysis is completed, the spent filament will be removed from the mass spectrometer and discarded in a covered ice cream carton for eventual shipment to an approved burial site as nonrecoverable waste. The unused sample will be salvaged in a polyethylene salvage bottle for return to the customer. All unused U-233 samples will be returned to the customer within 90 days of receipt of the sample.

All low level waste solutions will be salvaged in a screw cap polyethylene salvage bottle within the glove box. When full, the solution in the container will be analyzed. If recoverable quantities are present, the material will be returned to the customer for reprocessing. - If the quantities are nonrecoverable, the material will be added to a container containing a gel to render it solid and packaged for shipment to an approved burial site. No material will be shipped for burial until permission is first obtained from the customer.

(4) Plutonium

Coveralls, surgeons caps, and booties are required for all operations involving plutonium. Respirators and rubber gloves are carried at all times and are worn whenever any plutonium is handled outside the glove box and whenever the possibility of accidental release of airborne contamination exists. It should be pointed out that all handling procedures are designed to maintain safe limits of airborne contamination at all times. Respirators are worn as an additional precaution, but are not used in lieu of maintaining proper airborne contamination levels. Transfer of filaments to the mass spectrometer, glove changes, salvage bag changes, opening the airlock on the glove line, hot spot cleanup, and mass spectrometer source changes are examples of operations where use of the respirator and gloves will be required.

The following operations will be conducted in glove boxes. Samples in batches not to exceed 10 samples will be removed from the storage rack in the first box for processing. Individual samples will contain no more than 20 milligrams of plutonium each. Appropriate

quantities (not to exceed 10 milligrams plutonium) are weighed on an analytical balance in the first box. The unused sample is returned to the storage rack. The plutonium in the sample aliquot is purified by acid dissolution, liquid-liquid extraction, and ion exchange techniques. The end product will be a solution of pure plutonium nitrate or chloride. A maximum of 10 micrograms of this plutonium nitrate or chloride will be evaporated to dryness on a tungsten filament for analysis on the mass spectrometer. The loaded filament will be placed in a specially designed container which is partially inserted through a fitting in the wall of the glove box. The fitting and container are designed to permit insertion through the glove box wall, placement of the filament within the container, closing the container, and removal of the container, all without ever permitting a direct leak path from the glove box to the room atmosphere. As the container is removed, the outside surface of the container and inside surface of the fitting are monitored with a portable alpha survey meter to assure that no contamination to either surface has occurred. Respirators will be worn as a precautionary measure during this operation. The closed container will be taken to the mass spectrometer hood where the container will be opened and the loaded filament placed in the mass spectrometer source. Respirators and rubber gloves will be worn as a precautionary measure. Respirators are not considered to eliminate the need for maintaining proper air contamination levels. Rather they represent an added precaution in the event of an accidental release of material. After analysis, the spent filament will be removed from the mass spectrometer source and placed back in the container. The container will be closed, the outside surface will be monitored, and the container returned to the mass spectrometer preparation room. The container will be inserted into the fitting and the spent filament removed and salvaged in a covered stainless steel beaker for eventual shipment to a licensed burial site. The unused sample will be salvaged into a polyethylene salvage bottle. When 1 grams of plutonium have been accumulated, the material will be returned to the customer for purification and recovery. All low level solutions generated in the purification process will be concentrated, analyzed to determine radioactivity level, and shipped to a licensed burial site as nonrecoverable waste. All absorbent paper, contaminated glassware, and other contaminated solid waste will be placed in appropriate plastic bags or metal salvage containers for eventual shipment to a licensed burial site.

c. General Procedures

Protective laboratory coats for uranium processing will be changed on a weekly basis or whenever the Technical Associates Frisker Monitor indicates an alpha contamination level greater than 50 DPM per 100 square centimeters. These laboratory coats will never be worn outside the restricted area described in Section 7.h. Coveralls, booties, and caps for plutonium processing will be changed daily and whenever alpha contamination levels exceed 50 DPM per 100 square centimeters. Daily changes will be made just before the lunch period. These coveralls will not be worn outside the restricted area described in Section 7.h.

If, during personnel monitoring, protective clothing is found to be contaminated in excess of the above limits, the following procedures will be followed. If contamination is not in excess of 1000 CPM, the individual will proceed to the change area and change clothing, placing the contaminated clothing in the covered container provided. If contamination in excess of 1000 CPM is observed, a change of clothing will be brought to the individual in the sample preparation room. Clothing with contamination of less than 5000 CPM will be placed in a plastic bag for special laundering and monitoring. Clothing contaminated in excess of 5000 CPM will be placed in a plastic bag and sealed for eventual shipment to a licensed burial site. An immediate check of the preparation room will be performed to determine the source of the contamination whenever contaminated clothing in excess of 50 DPM per 100 square centimeters is observed.

Respirators will be changed on a weekly basis and whenever the daily or special air sample checks indicate an airborne radioactivity concentration above 2×10^{-12} microcuries/ml, the maximum permissible concentration for plutonium in Section 20.103 of 10 CFR 20, has occurred. Changes will include laundering of the face pieces and replacement of the filter cartridges.

Samples will be processed in batches as previously described. All salvage and cleanup operations will be completed for one batch before the next batch is started. A portable alpha survey meter will be placed in the plutonium preparation room, another in the uranium preparation room, and another in the mass spectrometer room to permit immediate checking of hands, gloves, equipment, and work surfaces when required. It is expected that plutonium samples will be received on only an occasional basis. When the plutonium line is not in use, the line will be cleaned up and glove port covers placed over all glove ports as additional precautionary measures.

d. Radiation Surveys

Eight (8) permanent air sampling stations are provided, as described in Section 6.d. The filter heads will be changed and counted daily when plutonium is being processed and weekly when only uranium is being processed. Maximum airborne radioactivity levels will not be permitted to exceed 2×10^{-12} microcuries per ml, the maximum permissible concentration for plutonium -239 in Section 20 of 10 CFR 20. Respirators will be required for any emergency, such as a spill where levels in excess of these limits are known to exist for short periods of time. Full face supplied air masks are available for use when cleaning up a spill which results in dangerous levels of airborne activity. Any operation such as a new operation, bag or glove change, which could result in exceeding these limits will be monitored with the portable air sampler. Permanent records of the results of these surveys will be maintained.

Air samples of the effluent air from the blower system will be taken once a week over an 8 hour work day when uranium is being processed and continuously when plutonium is being processed to assure that the airborne radioactivity in the effluent air does not exceed 6×10^{-14} microcuries per ml, the maximum permissible concentration for plutonium-239 in Section 20 of 10 CFR 20. Permanent records of the results of this survey will be maintained.

Weekly smears of all floors and working surfaces will be taken. Fixed and removable alpha contamination levels will be held to the lowest possible level, but will not be permitted to exceed 10 DPM per 100 square centimeters in any case. Smears will be scheduled so that they are taken just before the weekly scrubbing. All scrub water will be dumped into the hot lab sink for transfer to the holding tank to guarantee that no effluent will be released without first being analyzed. The scrub equipment used in this area will not be used for other areas of the facility.

In addition, a portable air sampler (Atomic Accessories Model HV-300) is available for evaluation of new operations and special hazards such as spills or glove failures.

Permanent records of the results of all radiation surveys will be maintained.

e. Personnel Monitoring

All personnel working in the Restricted Area will be required to wear film badges. These badges will be changed on a monthly basis. Bioassays will be performed for Restricted Area employees initially upon employment, quarterly thereafter, and upon termination of employment. Additional bioassays will be requested if there is reason to suspect high exposures. Examples of incidents requiring additional bioassays are spills, high air counts, and cuts while handling special nuclear materials. Permanent records of the results of these surveys will be maintained for each individual. Direct reading dosimeters are available and will be worn when processing irradiated fuel samples meeting the beta-gamma activity levels called out in Section 7.a.

Permanent monitoring meters are provided in the locations previously described in Section 6.b. Technical Associates Frisker or Nuclear Chicago Monitors are used at these stations. Personnel are required to monitor their protective clothing whenever leaving the sample preparation room for the change room or mass spectrometer room. Personnel are required to monitor their personal clothing whenever leaving the restricted area as designated in Section 7.h. for other areas of the building.

f. Decontamination of Equipment

No equipment or materials will be removed from the restricted area described in Section 7.h. unless monitored by the radiation control officer or his assistant and found to have less than 10 DPM per 100 square centimeters total fixed and removable alpha contamination. All waste material to be shipped to a licensed disposal site will be monitored and inspected by the radiation control officer or his assistant. No such materials will be removed from the restricted area unless accompanied by a signed statement from the radiation control officer or his assistant that the packaging and contamination levels conform to standards established by the Interstate Commerce Commission and Section 20 of 10 CFR.

g. Waste Disposal

As previously described, the laundry water and hot lab sink waste water are held in the holding tank. When full, the contents of the holding tank will be analyzed on the previously described gass proportional flow counter. If the total alpha activity of the holding tank does not exceed 1×10^{-4} microcuries per ml, the maximum permissible concentration for plutonium-239 in Section 20 of 10 CFR 20, the contents of the tank will be released into the sanitary sewer. This

material will be further diluted by a factor of 10 to 1 by the daily quantity of water released into the sewer by the applicant. A permanent record of the results of these analyses will be maintained.

All low level nonrecoverable waste which exceeds the contamination levels permissible for plutonium as established in 20.303 will be packaged and shipped to a licensed burial site for disposal per 20.304.

h. Restricted Areas

The instrument room and the hot lab area are designated as the "Restricted Area". The applicant limits access to this area to authorized personnel only. These areas are posted in accordance with Section 20 of 10 CFR 20.

i. Security Against Unauthorized Use of Special Nuclear Materials

All uranium samples are stored in the previously described storage safe. The cabinet is locked except when samples are being transferred. The sample preparation hot lab is locked except when under the surveillance of authorized laboratory personnel. Keys and combinations to the storage safe and sample preparation room are maintained only by laboratory supervision. The Restricted Area is also locked with NRC approved combination locks during off-shift hours to prevent unauthorized entry.

j. Indoctrination Procedures

Copies of the Isotopic Analysis, Inc., Standard Procedures for Radiation Safety (enclosed), individual processing procedures, fire fighting and emergency procedures, and selected reading topics describing general procedures for handling radioactivity are required reading for all new personnel assigned to this area. Annual reviews of all procedures assure periodic re-instruction of all personnel.

k. Fire and Emergency Procedures

To limit the likelihood of fires, all flammable organic solvents are stored in one specific metal storage cabinet. No combustible materials are stored in the chemical hoods or glove boxes. Most of

the material received will not be in metallic form. However, the following procedures have been established for handling metal. Total uranium metal content in a hood is limited to 3 grams in individual and separated aliquots of 0.3 gram. Total plutonium metal in a glove box is limited to 2 grams in individual and separated aliquots of 20 mg each. All metal will be handled in platinum crucibles which will contain the metal in the event of fire.

The following emergency procedures have been adopted in the event of a major spill or fire within the process area:

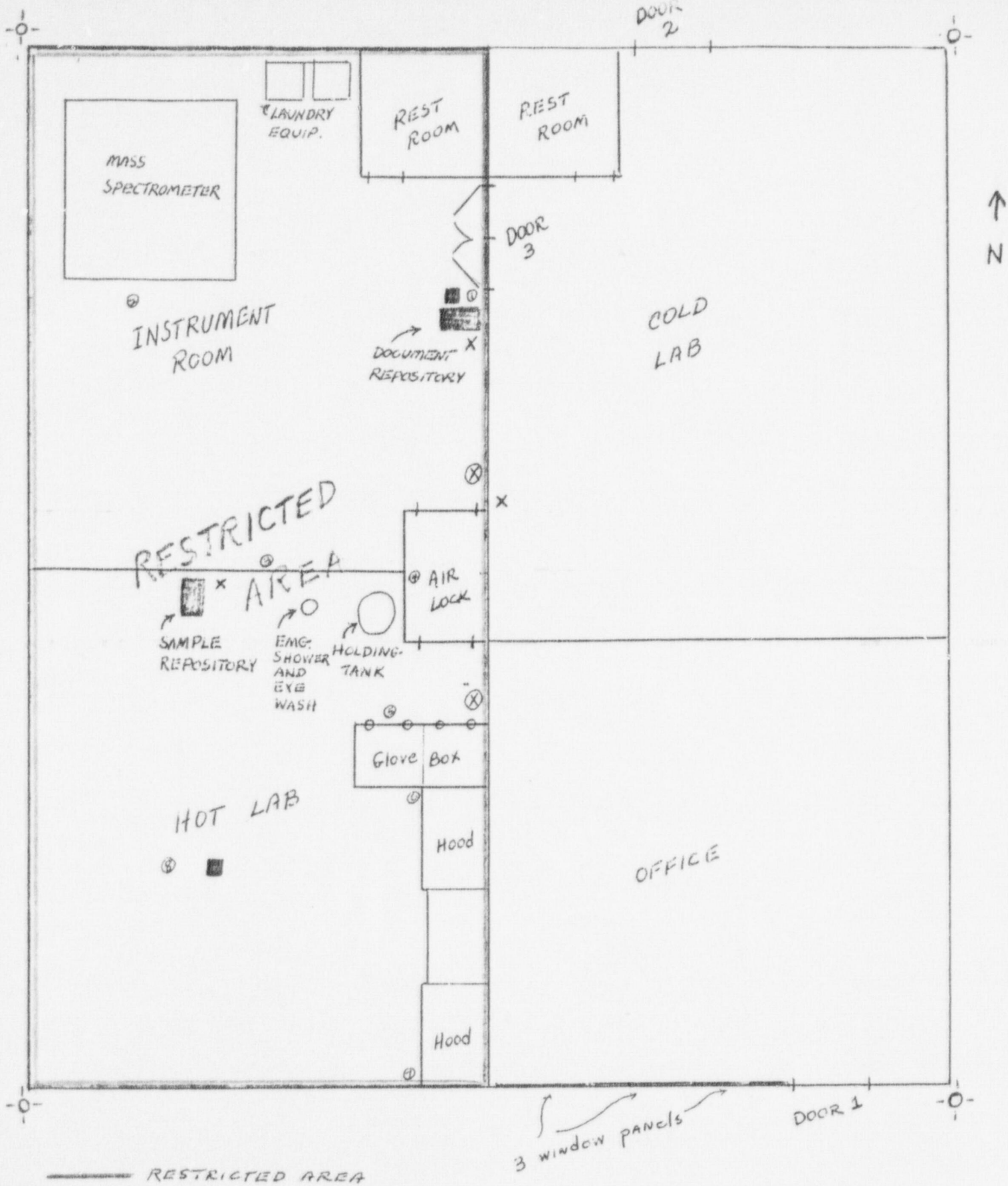
(1) Shut down all exhaust fans within the immediate laboratory area. (This is done with either of two master switches located within the area as shown on Drawing 1)

(2) Evacuate the preparation area.

(3) Notify the Radiation Safety Officer and seal off the area to prevent unauthorized entrance. (An emergency call list is posted on the door outside the restricted area and at the main switchboard. This list contains the names, addresses, and telephone numbers of the members of the damage control team and the order in which they are to be called.)

(4) A damage control team under the direction of the Radiation Safety Officer will re-enter the area, if safe, to combat the emergency. Personnel assigned to the damage control team have been instructed in the methods of fighting fires and warned of the dangers involved in pressurizing glove boxes and hoods with extinguishing agents. Because of the small quantities of metal involved, fire control efforts of metal fires will be directed primarily to isolating the material rather than extinguishing it.

Copies of the emergency procedure are conveniently posted throughout the facility and provided to local fire fighting units. Annual reviews of radiological and emergency procedures are held. Members of the local fire department and police rescue units have been guided through the facility and the potential hazards discussed with them.



— RESTRICTED AREA

○ AIR SAMPLING STATIONS (8)

X FIRE EXTINGUISHERS

■ PERSONNEL MONITOR STATION

⊗ EXHAUST SYSTEM SWITCH

isotopic analysis, inc.

8335 E. 51st St.
Tulsa, OK 74145

EAST 51st Street

Drawing 2, Page 1

isotopic analysis, inc.
8335 E. 51st St.
Tulsa, OK 74145

Drawing 2, page 2

isotopic analysis, inc.
8335 E. 51st St.
Tulsa, OK 74145

STANDARD POLICY AND PROCEDURE FOR

RADIATION SAFETY PROGRAM

Originally Issued: September 1, 1965
Revised: January 16, 1976
December 15, 1976

By: Isotopic Analysis, Inc.
8335 East 51st Street
Tulsa, OK 74145

Former address: 10700 East Independence
Tulsa, OK 74115

Jon W. Harrison

Jon W. Harrison
Radiation Safety Officer

Date 12-15-76

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POLICY AND PROCEDURE FOR RADIATION SAFETY PROGRAM

1. POLICY

To provide a clear understanding of the procedures and responsibilities with regard to the Radiation Safety Program at Isotopic Analysis, Inc., it is the policy of this Corporation that these procedures and responsibilities be understood by all personnel concerned in order to insure strict compliance with Nuclear Regulatory Commission (NRC) regulations and to insure the health and safety of employees.

2. RESPONSIBILITY

Mr. Jon W. Harrison is designated the Radiation Safety Officer (RSO) for Isotopic Analysis, Inc., and is responsible for seeing that all phases of the Radiation Safety Program are carried out in strict compliance with NRC regulations. Mr. T.C. Westmoreland is designated alternate RSO. Both Mr. Westmoreland and Mr. Harrison are capable and aware of the responsibilities of their duties under this program.

3. GENERAL REQUIREMENTS

3.1 Licensing

The NRC issues two types of licenses: general and specific. A general license is issued to all persons to receive, possess, use, and transport byproduct and source material in very limited quantities. These limits are shown in Table A of Appendix I to this manual. In addition, general licenses have been issued to receive, possess, and use certain devices which contain greater than general license quantities of radioactive material, providing such devices have been manufactured under the terms of a specific license and are installed by a person authorized for such installation under a specific license. These general licenses are described in full in Section 30 of Title 10 of the

Code of Federal Regulations.

In addition to the general licenses described above, the NRC issues specific licenses to persons, organizations, and corporations to receive, use and/or possess byproduct, source, and/or special nuclear material under specified conditions. In every case the specific license limits the type and quantity of material, the location where used, the use permitted, and the persons using the material. It is important that this be understood because a license to possess a given quantity of radioactive material does not permit additional quantities or uses without amending the license. Assumptions to the contrary are the most common cause of license violations.

At present we have one specific license at Isotopic Analysis, Inc. The Mass Spectrographic Laboratory is licensed for possession and use of plutonium and uranium up to specified limits.

3.2 Health Physics and Safety Requirements

Material received either under a general license or a specific license must be handled in accordance with the regulations of Section 20 of Title 10, Code of Federal Regulations. A brief abstract of these requirements is given in Appendix I to assist all personnel in evaluating their procedures. The actual procedures required to assure compliance with these regulations are detailed in the following section. Definitiions of terms used in this section are included in Appendix I of this manual.

4. PROCEDURES - GENERAL

4.1 Obtaining Licenses

The RSO or alternate RSO shall be solely responsible for obtaining all NRC licenses and no license application will be filed without their examination or without one of their signatures on the accompanying letter.

Any individual requiring a radioactive source or source material will contact the RSO and furnish all information requested by him in writing.

At least one employee who will be working with and responsible for radioactive materials will be named as a "User" in the application. This person must have had adequate experience in the handling of radioactive materials to be acceptable to the NRC as a "User."

In the event that the individual named as a "User" leaves the employ of the company, the RSO shall at that time designate a replacement unless other employees, who are named on the license as "Users," still remain in that particular group. The RSO will then file application for license amendment naming the new individual.

4.2 Ordering of Radioactive Material

All purchase requisitions for radioactive materials will be originated by the RSO. All materials ordered must be shipped to 8335 East 51st Street, Tulsa, Oklahoma 74145. Other individuals can write specifications, but these must be reviewed and accepted by the RSO. If correspondence must be by telephone, the call must be made by the RSO or with the RSO on conference line. This is to prevent statements being made which are in conflict with the terms of our license.

4.3 Receipts of Radioactive Materials

Only the RSO or alternate RSO will have the authority to inspect and accept incoming radioactive materials. The RSO or alternate RSO will oversee unpacking and removal of the material.

5. PROCEDURES -- SPECIFIC

5.1 Special Nuclear Material

5.1.1 Handling Procedures

All material received is subject to the handling procedures called out in the specific operating procedures of Appendix II.

5.1.2 Maximum airborne contamination and fixed contamination limits for plutonium will be used as limits for this laboratory.

5.1.3 Radiation surveys for fixed contamination, effluents, and airborne contamination will be conducted as called out in the specific operating procedures in Appendix II of this material.

5.1.4 All shipments of material from the laboratory must be approved by the RSO.

5.2 Area Postings

5.2.1 Radiation Areas

All areas in which there exists radiation sufficient to cause a whole body dose of 5 millirems per hour or 100 millirems in any period of 5 consecutive days shall be posted with a sign bearing the radiation symbol and the words "CAUTION - RADIATION AREA."

All areas in which there exists a radiation level sufficient to cause a whole body dose of 100 millirems per hour shall be posted with a sign bearing the radiation symbol and the words "CAUTION - HIGH RADIATION AREA."

All areas used for the storage of special nuclear materials shall be posted with a sign bearing the radiation symbol and

and the words "CAUTION - RADIOACTIVE MATERIALS."

All storage containers used to store a quantity of licensed material in excess of the limits called out in Table C of Appendix I of this manual shall have attached a label bearing the radiation symbol and the words "CAUTION - RADIOACTIVE MATERIAL." Additionally, the label shall identify the quantity and type of material. Permanent areas will be so posted by the RSO.

All permanent restricted areas will be posted with copies of "Notice to Employees." (See Appendix I, 1.5 b.) The RSO will be responsible to so post these areas.

5.3 Exposure Limits

5.3.1 Radiation Exposures

No personnel will be permitted to receive radiation in excess of the following limits:

a) Whole body, head and trunk, active blood-forming organs, lens of eyes, or gonads: 1.25 rem/calendar quarter.

b) Hands and forearms, feet and ankles: 18.75 rem/calendar quarter.

c) Skin of whole body: 7.5 rem/calendar quarter.

The RSO will review all personnel exposure reports and inform personnel when they approach 25% of the permissible quarterly dose.

5.3.2. Airborne Radioactivity

Personnel will be permitted exposure to atmospheres containing more than 2×10^{-12} microcuries per day.

No personnel will be permitted to handle radioactive material in such manner to receive a maximum equilibrium body burden of 2×10^{-7} microcuries per day.

The RSO will review the results of the daily and/or weekly airhead samples and quarterly bioassay reports and immediately report excessive exposures to personnel concerned.

5.4 Personnel Monitoring

5.4.1 Radiation Areas

All personnel entering a radiation area are required to wear a film badge or pocket dosimeter at all times. Dosimeters will be read before entering the area and upon leaving the area. Readings are to be recorded in a permanent log book with date and user. Exposures in excess of 5 mr per hour should be reported immediately to the RSO. Film badges will be changed once each month.

The RSO will recommend proper personnel monitoring devices. The RSO will periodically check to determine that all personnel are complying with these requirements.

5.4.2. Radioactive Material Areas

All personnel working in an area where licensed quantities of radioactive materials are processed are required to wear a film badge at all times. Additionally, each person will monitor his hands, feet, and clothing each time he leaves the area to assure that no radioactive material is being carried on his person.

All persons working with licensed quantities of radioactive materials as unsealed sources are further required to submit

urine samples for bioassay on a quarterly basis.

The RSO will recommend appropriate monitoring devices and services.

5.5 Records

The RSO will maintain permanent records of the individual personnel exposure records from film badges and bioassay reports, as well as records of all disposals.

5.6 Reports

5.6.1 Report to Employees

Upon receipt of a request from any employee, the RSO will supply a written report of the individual's occupational exposure record on an annual basis.

5.6.2 Report to Former Employees

Upon receipt of a written request, the RSO will supply within 30 days a written report of the employee's occupational exposure record covering the period of his employment.

5.6.3 Reporting Incidents

The RSO shall be informed immediately of any incident involving licensed matter which indicates:

a) Loss or theft of licensed material

b) Whole body exposure in excess of 5 rem

c) Release of radioactive material in excess of the limits called out in Table B of Appendix 1 of this manual

d) Loss of one day's operation of the affected facilities.

e) Damage to facilities of $1,000 or more.

5.7 Waste Disposal

5.7.1 Special Nuclear Materials

No liquid effluents shall be disposed of into the sanitary sewage system until the effluent has been analyzed and shown to contain less than 1×10^{-4} microcuries per milliliter.

Airborne effluents may not contain activity in excess of 6×10^{-14} microcuries per ml of air.

Management will assure that sufficient surveys are conducted to show compliance with these requirements. The RSO will periodically review these surveys.

No waste may be shipped for disposal without the approval of the RSO.

5.8 Instruction of Personnel

5.8.1 Instruction Aids

All personnel shall be provided with and required to read pertinent parts of the following material:

a) Part 20, Title 10, Code of Federal Regulations

b) Isotopic Analysis, Inc., Radiation Safety Policy and Procedures

c) Specific operating procedures for the licensed activity in which he is engaged.

5.8.2 Responsibilities

The RSO will provide copies of Part 20, Title 10, Code of Federal Regulations, Isotopic Analysis, Inc., radiation manual and specific operating procedures as requested by the cognizant group leader. Additionally, he will provide any guidance or clarification of regulations as requested by any individual.

The cognizant group leader will assure himself that each individual engaged in the licensed activity under his direction has read all required instructional material before he is permitted to engage in licensed activities.

APPENDIX I

Abstract of Part 20, Title 10, Code of Federal Regulations

1. Standards for Protection Against Radiation

1.1 Exposure Limits (Radiation)

(a) Restricted Area - No licensee shall possess, use, or transfer licensed material in such a manner as to cause any individual in a restricted area to receive a dose in excess of the following:

(1) Whole body, trunk and head, active blood-forming organs, lens of eyes, or gonads: 1.25 rems/calendar quarter

(2) Hands and forearms, feet and ankles: 18.75 rems/calendar quarter

(3) Skin of whole body: 7.5 rems/calendar quarter

(b) Unrestricted Area - The radiation limits for an unrestricted area must be such that no individual will receive a whole body dose in excess of 0.5 rem per calendar year. Compliance is assured when the radiation level is kept below 2 millirems for any one-hour period and below 100 millirems for any five consecutive days.

1.2 Exposure Limits - Radioactive Material

(a) Restricted Area - No licensee shall use, possess, or transfer licensed material in such a manner as to expose any individual in a restricted area to airborne radioactivity

in excess of the limits shown in Table B. Expose in this instance is taken to mean that the individual is present in this airborne concentration. No allowance shall be made for protective clothing or equipment.

(b) Unrestricted Areas - No licensee may use, possess, or transfer restricted material in such a manner as to release to an unrestricted area concentrations of radioactive materials in excess of the limits listed in Table B.

1.3 Personnel Monitoring Equipment

Each licensee must supply and require the use of appropriate personnel monitoring equipment to each individual who enters a restricted area under such circumstances that he may receive a dose in any calendar quarter in excess of 25% of the applicable limits as called out in paragraph 1.1 of this Appendix, and to minors who may receive a dose in excess of 5% of those limits and to all individuals entering a "high radiation area."

1.4 Caution Signs, Labels and Signals

(a) Radiation Area - Each area in which there exists radiation in sufficient quantity to cause a whole body dose of 5 millirems per hour or 100 millirems per any consecutive five-day period shall be posted with a sign bearing the radiation symbol and the words "CAUTION - RADIATION AREA."

(b) High Radiation Area - Each area in which there exists radiation in sufficient quantity to cause a whole body dose of 100 millirems/hr shall be posted with a sign bearing the radiation symbol and the words "CAUTION - HIGH RADIATION AREA."

(c) Airborne Radioactivity Area - Any area in which the concentration of airborne radioactivity exceeds the limits

in Table B shall be posted with a sign bearing the radiation symbol and the words "CAUTION - AIRBORNE RADIOACTIVITY AREA."

(d) Radioactive Materials - Any area used for the storage of special nuclear materials, natural uranium or thorium shall be posted with a sign bearing the radiation symbol and the words "CAUTION - RADIOACTIVE MATERIALS."

(e) Containers - Any container in which is stored a quantity of licensed material in excess of limits called out in Table C shall have attached a durable, clearly visible label bearing the radiation symbol and the words "CAUTION - RADIOACTIVE MATERIAL." In addition, the quantity and type of material shall be shown.

(f) Exceptions to Posting Requirements

Caution signs need not be posted in rooms containing radioactive materials for periods of less than eight (8) hours, provided the materials are constantly attended by an individual who will take all required precautions to assure against excessive exposure.

1.5 Instruction of Personnel

(a) All individuals frequenting any portion of a restricted area shall be informed of the occurrence of radioactive materials or radiation and shall be instructed in the safety problems associated with exposure to such materials or radiation and in the proper procedures for minimizing exposure. All personnel shall be further instructed in the applicable regulations and licenses governing handling of such materials and shall be advised of reports of radiation exposure which employees may request pursuant to these regulations.

(b) A "Notice to Employees" shall be posted where employees engaged in licensed work may observe a copy on the way to or from their place of employment. The notice will inform workers that the following documents are available for their inspection:

(1) The regulations in Part 19 and in Part 20, Title 10, Chapter 1, Code of Federal Regulations;

(2) The license, license conditions, or documents incorporated into a license by reference, and amendments thereto; and

(3) The operating procedures applicable to licensed activities.

1.6 Disposal of Waste

No licensee shall dispose of licensed material except by:

(a) Transfer to an authorized recipient as provided by regulations CFR Part 30, 40, or 70,

or (b) As provided by specific authorization of the NRC,

or (c) As provided in Part 20, Title 10, Code of Federal Regulations.

1.7 Records

(a) Each licensee is required to maintain records of the radiation exposures of all individuals for whom personnel monitoring is required pursuant to Part 20, Title 10, Code of Federal Regulations.

(b) Each licensee must maintain permanent records of all surveys and disposals made in fulfillment of these regulations.

1.8 Reports

(a) Each licensee must report by telephone and telegraph to the Director of the appropriate Regional Inspection and Enforcement Office immediately any known loss or theft of licensed material in such quantities and under such circumstances that it seems likely that a substantial hazard may exist to persons in unrestricted areas.

(b) Each licensee must immediately notify the appropriate Director of Regional Inspection and Enforcement by telephone and telegraph of any incident which may have caused (1) a whole body exposure of 25 rems or more, (2) a whole skin exposure of 150 rems, (3) a hands and forearm, or feet and ankle exposure of 375 rems, (4) the release of radioactive material which, averaged over a 25-hour period, would result in concentrations in excess of 5000 times the amount in Table B, (5) a loss of one working week of operation of the facilities affected, or (6) damage to property in excess of $100,000.

(c) Each licensee shall within 24 hours notify the Director of the appropriate Regional Inspection and Enforcement Office of any incident which results in (1) whole body exposure of 5 rems or more, (2) whole skin exposure of 30 rems or more, (3) hand, forearm, feet and ankle exposure of 75 rems, (4) release of radioactive material which, when averaged over a 24-hour period, results in concentrations in excess of 500 times the limits specified in Table B, (5) loss of one day operation of the facilities affected, or (6) damage of property in excess of $1000.

(d) Each licensee must at the request of a former employee furnish a report of the former employee's exposure to

radiation within thirty days of the request.

(e) Each licensee must make a report in writing within 30 days to the Director, Division of Licensing, of (1) all exposures in excess of the applicable limits in this section, (2) all incidents requiring immediate or 24-hour notification of the Regional Inspection and Enforcement Office, and (3) all levels of radiation or concentrations of radioactive materials in unrestricted areas in excess of 10 times the applicable limits shown in this part or the employee's license.

(f) At the request of any employee, each licensee shall advise said employee of the employee's exposure on an annual basis.

1.9 Violations

An injunction or court order may be obtained prohibiting any violation of any provision of these regulations. Any person who willfully violates these regulations may be guilty of a crime and upon conviction may be punished by fine or imprisonment or both as provided by law.

TABLE A

Exempt Quantities Not Requiring Licenses

Byproduct material	Column No. 1 Not as a sealed source (microcuries)	Column No. II As a sealed source (microcuries)
Antimony (Sb 124)	1	10
Arsenic 7[illegible] (As 76)	10	10
Arsenic 77 (As 77)	10	10
Barium 140—Lanthanum 140 (BaLa 140)	1	10
Beryllium (Be 7)	80	80
Cadmium 109—Silver 109 (CdAg 109)	10	10
Calcium 45 (Ca 45)	10	10
Carbon 14 (C14)	80	80
Cerium 144—Praseodymium (CePr 144)	1	10
* Cesium—Barium 137 (CsBa 137)	1	10
Chlorine 36 (Cl 36)	1	10
Chromium 51 (Cr 51)	80	80
Cobalt 60 (Co 60)	1	10
Copper 64 (Cu 64)	80	80
Europium 154 (Eu 154)	1	10
Fluorine 18	80	80
Gallium 72 (Ga 72)	10	10
Germanium 71 (Ge 71)	80	80
Gold 198 (Au 198)	10	10
Gold 199 (Au 199)	10	10
Hydrogen 3 (Tritium) (H 3)	260	260
Indium 114 (In 114)	1	10
Iodine 131 (I 131)	10	10
Iridium 192 (Ir 192)	10	10
Iron 55 (Fe 55)	80	80
Iron 59 (Fe 59)	1	10
Lanthanum 140 (La 140)	10	10
Manganese 52 (Mn 52)	1	10
Manganese 56 (Mn 56)	80	80
Molybdenum 99 (Mo 99)	10	10
Nickel 59 (Ni 59)	1	10
Nickel 63 (Ni 63)	1	10
Niobium 95 (Nb 95)	10	10
Palladium 109 (Pd 109)	10	10
Palladium 103—Rhodium 103 (PdRh 103)	80	80
Phosphorus 32 (P 32)	10	10
Polonium 210 (Po 210)	0.1	1
Potassium 42 (K-42)	10	10
Praseodymium 143 (Pr 143)	10	10
Promethium 147 (Pm 147)	10	10
Rhenium 186 (Re 186)	10	10
Rhodium 105 (Rh 105)	10	10
Rubidium 86 (Rb 86)	10	10
Ruthenium 106—Rhodium 106 (RuRh 106)	1	10
Samarium 153 (Sm 153)	10	10
Scandium 46 (Sc 46)	1	10
Silver 105 (Ag 105)	1	10
Silver 111 (Ag 111)	10	10
Sodium 22 (Na 22)	10	10
Sodium 24 (Na 24)	10	10
Strontium 89 (Sr 89)	1	10
Strontium 90—Yttrium 90 (SrY)	0.1	1
Sulfur 35 (S 35)	80	80
Tantalum 182 (Ta 182)	10	10
Technetium 96 (Te 96)	1	10
Technetium 99 (Te 99)	1	10
Tellurium 127 (Te 127)	10	10
Tellurium 129 (Te 129)	1	10
Thallium 204 (Tl 204)	80	80
Tin 113 (Sn 113)	10	10
Tungsten 185 (W 185)	10	10
Vanadium 48 (V 48)	1	10
Yttrium 90 (Y 90)	1	10
Yttrium 91 (Y 91)	1	10
Zinc 65 (Zn 65)	10	10
Beta and/or Gamma emitting byproduct material not listed above **	1	10

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TABLE B

Maximum Permissible Concentrations of Material

Table I - Restricted Areas

Table II - Unrestricted Areas

PART 20 - STANDARDS FOR PROTECTION AGAINST RADIATION

Appendix B

Concentrations in Air and Water Above Natural Background

Element (atomic number)	Isotope*		Table I Column 1 Air (μCi/ml)	Table I Column 2 Water (μCi/ml)	Table II Column 1 Air (μCi/ml)	Table II Column 2 Water (μCi/ml)
Uranium (92)	U 230	S	$3X10^{-10}$	$1X10^{-4}$	$1X10^{-11}$	$5X10^{-6}$
		I	$1X10^{-10}$	$1X10^{-4}$	$4X10^{-12}$	$5X10^{-6}$
	U 232	S	$1X10^{-10}$	$8X10^{-4}$	$3X10^{-12}$	$3X10^{-5}$
		I	$3X10^{-11}$	$8X10^{-4}$	$9X10^{-13}$	$3X10^{-5}$
	U 233	S	$5X10^{-10}$	$9X10^{-4}$	$2X10^{-11}$	$3X10^{-5}$
		I	$1X10^{-10}$	$9X10^{-4}$	$4X10^{-12}$	$3X10^{-5}$
	U 234	S	$6X10^{-10}$	$9X10^{-4}$	$2X10^{-11}$	$3X10^{-5}$
		I	$1X10^{-10}$	$9X10^{-4}$	$4X10^{-12}$	$3X10^{-5}$
	U 235	S	$5X10^{-10}$	$3X10^{-4}$	$2X10^{-11}$	$3X10^{-5}$
		I	$1X10^{-10}$	$8X10^{-4}$	$4X10^{-12}$	$3X10^{-5}$
	U 236	S	$6X10^{-10}$	$1X10^{-3}$	$2X10^{-11}$	$3X10^{-5}$
		I	$1X10^{-10}$	$1X10^{-3}$	$4X10^{-12}$	$3X10^{-5}$
	U 238	S	$7X10^{-11}$	$1X10^{-3}$	$3X10^{-12}$	$4X10^{-5}$
		I	$1X10^{-10}$	$1X10^{-3}$	$5X10^{-12}$	$4X10^{-5}$
	U-natural	S	$1X10^{-10}$	$1X10^{-3}$	$5X10^{-12}$	$3X10^{-5}$
		I	$1X10^{-10}$	$1X10^{-3}$	$5X10^{-12}$	$3X10^{-5}$
Plutonium (94)	Pu 238	S	$2X10^{-12}$	$1X10^{-4}$	$7X10^{-14}$	$5X10^{-6}$
		I	$3X10^{-11}$	$8X10^{-4}$	$1X10^{-12}$	$3X10^{-5}$
	Pu 239	S	$2X10^{-12}$	$1X10^{-4}$	$6X10^{-14}$	$5X10^{-6}$
		I	$4X10^{-11}$	$8X10^{-4}$	$1X10^{-12}$	$3X10^{-5}$
	Pu 240	S	$2X10^{-12}$	$1X10^{-4}$	$6X10^{-14}$	$5X10^{-6}$
		I	$4X10^{-11}$	$8X10^{-4}$	$1X10^{-12}$	$3X10^{-5}$
	Pu 241	S	$9X10^{-11}$	$7X10^{-3}$	$3X10^{-12}$	$2X10^{-4}$
		I	$4X10^{-8}$	$4X10^{-2}$	$1X10^{-9}$	$1X10^{-3}$
	Pu 242	S	$2X10^{-12}$	$1X10^{-4}$	$6X10^{-14}$	$5X10^{-6}$
		I	$4X10^{-11}$	$9X10^{-4}$	$1X10^{-12}$	$3X10^{-5}$

* Soluble (s); Insoluble (I)

TABLE C

Quantities Exempt From Labeling Requirements

Material	Microcuries
Ag^{105}	1
Ag^{111}	10
As^{76}, As^{77}	10
Au^{196}	10
Au^{199}	10
$Ba^{140}+La^{140}$	1
Be^{7}	50
C^{14}	5
Ca^{45}	10
$Cd^{109}+Ag^{109}$	10
$Ce^{144}+Pr^{144}$	1
Cl^{36}	1
Co^{60}	1
Cr^{51}	50
$Cs^{137}+Ba^{137}$	1
Cu^{64}	50
Eu^{152}	1
F^{18}	50
Fe^{55}	50
Fe^{59}	1
Ga^{72}	10
Ge^{71}	50
H^{3}(HTO or H_2O)	250
I^{131}	10
In^{114}	1
Ir^{192}	10
K^{42}	10
La^{140}	10
Mn^{52}	1
Mn^{54}	50
Mo^{99}	10
Na^{22}	10
Na^{24}	10
Nb^{95}	10
Ni^{59}	1
Ni^{63}	1
P^{32}	10
$Pd^{103}+Rh^{103}$	50
Pd^{109}	10
Pm^{147}	10
Po^{210}	0.1
Pr^{143}	10
Pu^{239}	1
Ra^{226}	0.1
Rb^{86}	10
Re^{186}	10
Rh^{105}	10
$Ru^{106}+Rh^{106}$	1
S^{35}	50
Sb^{124}	1
Sc^{46}	1
Sm^{153}	10
Sn^{113}	10
Sr^{89}	1
$Sr^{90}+Y^{90}$	0.1
Ta^{182}	10
Tc^{96}	1
Tc^{96}	1
Te^{127}	10
Te^{129}	1
Th (natural)	50
Tl^{204}	50
Tritium. See H^3	250
U (natural)	50
U^{232}	1
U^{234}-U^{238}	50
V^{48}	1
W^{181}	10
Y^{88}	1
Y^{91}	1
Zn^{65}	10
Unidentified radioactive materials or any of the above in unknown mixtures	0.1

NOTE: For purposes of §§ 20.203 and 20.304, where there is involved a combination of isotopes in known amounts the limit for the combination should be derived as follows: Determine, for each isotope in the combination, the ratio between the quantity present in the combination and the limit otherwise established for the specific isotope when not in combination. The sum of such ratios for all the isotopes in the combination may not exceed "1" (i.e., "unity").

EXAMPLE: For purposes of § 20.304, if a particular batch contains 2,000 μc of Au^{196} and 25,000 μc of C^{14}, it may also include not more than 3,000 μc of I^{131}. This limit was determined as follows:

$$\frac{2{,}000\ \mu c\ Au^{196}}{10{,}000\ \mu c} + \frac{25{,}000\ \mu c\ C^{14}}{50{,}000\ \mu c} + \frac{3{,}000\ \mu c\ I^{131}}{10{,}000\ \mu c} = 1$$

The denominator in each of the above ratios was obtained by multiplying the figure in this table for 1 μc as prescribed in § 20.304

DEFINITIONS

1. "Airborne radioactive material" means any radioactive material dispersed in the air in the form of dusts, fumes, mists, vapors, or gases.

2. "Byproduct material" means any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material.

3. "Calendar quarter" means any period determined according to either of the following subdivisions:

   (i) The first period of any year may begin on any date in January; provided that the second, third, and fourth periods accordingly begin on the same date in April, July, and October, respectively, and that the fourth period extend into January of the succeeding year, if necessary to complete a three-month quarter. During the first year of use of this method of determination by a licensee, the first period for that year shall also include any additional days in January preceding the starting date for the first period.

   (ii) The first period in a calendar year of 13 complete, consecutive calendar weeks; the second period in a calendar year of 13 complete, consecutive calendar weeks; the third period in a calendar year of 13 complete, consecutive calendar weeks; the fourth period in a calendar year of 13 complete, consecutive calendar weeks.

   *Alternatively, the four periods may consist of the first 14 complete, consecutive calendar weeks; the next 12 complete, consecutive calendar weeks; the next 14 complete, consecutive calendar weeks; and the last 12 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included (for purposes of this part) within the last complete calendar week of that year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included (for purposes of this part) within the last complete calendar week of the previous year.

   No licensee shall change the method observed by him of determining calendar quarters for purposes of this part except at the beginning of a calendar year.

4. "Commission" means the Nuclear Regulatory Commission or its duly authorized representatives.

5. "Curie" means that amount of radioactive material which disintegrates at the rate of 37 billion atoms per second.

6. "Dose" as used in this part is the quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body. When the regulations in this part specify a dose during a period of time, the dose means the total quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body during such period of time. Several different units of dose are in current use. Definitions of units as used in this part are set forth in paragraphs (b) and (c) of this section.

7. "License" means a license issued under the regulations in Part 30, 40, or 70 of Title 10, Code of Federal Regulations. "Licensee" means the holder of such license.

8. "Licensed material" means source material, special nuclear material, or byproduct material received, possessed, used, or transferred under a general or specific license issued by the Commission pursuant to the regulations in Title 10, Code of Federal Regulations.

9. "Microcurie" means that amount of radioactive material which disintegrates at the rate of 37 thousand atoms per second.

10. "Natural uranium and natural thorium."

(1) For purposes of the regulations in this part, one curie of natural uranium (U-natural in Appendix B or C) means the sum of 3.7×10^{10} disintegrations per second from U-238 plus 3.7×10^{10} dis/sec from U-234 plus 9×10^{8} dis/sec from U-235. Also, a curie of natural thorium (thorium-natural in Appendix B or C) means the sum of 3.7×10^{10} dis/sec from Th^{232} plus 3.7×10^{10} dis/sec from Th^{228}.

(2) For the purpose of the regulations in this part, one curie of natural uranium (U-natural in Appendix B or C) is equivalent to 3,000 kilograms, or 6,615 pounds of natural uranium; and one curie of natural thorium (thorium-natural in Appendix B or C) is equivalent to 9,000 kilograms or 19,850 pounds of natural thorium.

11. "Occupational dose" includes exposure of an individual to radiation (i) in a restricted area; or (ii) in the course of employment in which the individual's duties involve exposure to radiation; provided, that "occupational dose" shall not be deemed to include any exposure of an

individual to radiation for the purpose of medical diagnosis or medical therapy of such individual.

12. The rad, as used in this part, is a measure of the dose of any ionizing radiation to body tissues in terms of the energy absorbed per unit mass of the tissue. One rad is the dose corresponding to the absorption of 100 ergs per gram of tissue. (One millirad (mrad) = 0.001 rad.)

13. Radioactivity is commonly, and for purposes of the regulations in this part shall be, measured in terms of disintegrations per unit time or in curies. One curie (c) = 3.7×10^{10} disintegrations per second (dps) = 2.2×10^{12} disintegrations per minute (dpm). A commonly used sub-multiple of the curie is the microcurie (μc). One μc = 0.000001 c = 3.7×10^{4} dps - 2.2×10^{6} dpm.

14. "Radioactive material" includes any such material whether or not subject to licensing control by the Commission.

15. "Radiation" means any or all of the following: alpha rays, beta rays, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other atomic particles; but not sound or radio waves, or visible, infrared, or ultraviolet light.

16. The rem, as used in this part, is a measure of the dose of any ionizing radiation to body tissue in terms of its estimated biological effect relative to a dose of one roentgen (r) of X-rays. (One millirem (mrem) = 0.001 rem.) The relation of the rem to other dose units depends upon the biological effect under consideration and upon the conditions of irradiation. For the purpose of the regulations in this part, any of the following is considered to be equivalent to a dose of one rem:

    (1) A dose of 1 r due to X - or gamma radiation;

    (2) A dose of 1 rad due to X - , gamma, or beta radiation;

    (3) A dose of 0.1 rad due to neutrons or high energy protons;

    (4) A dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye;

    If it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron dose in rads, as provided in subparagraph (3) of this paragraph, one rem of neutron radiation may, for purposes of the regulations in this part, be assumed to be equivalent to 14 million

neutrons per square centimeter incident upon the body; or, if there exists sufficient information to estimate with reasonable accuracy the approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to one rem may be estimated from the following table:

Neutron Flux Dose Equivalents

Neutron Energy (Mev)	Number of neutrons per square centimeter equivalent to a dose of 1 rem (neutrons/cm^2)	Average flux to deliver 100 millirem in 40 hours (neutrons/cm^2 per sec.)
Thermal	970×10^6	670
0.0001	720×10^6	500
0.005	820×10^6	570
0.02	400×10^6	280
0.1	120×10^6	80
0.5	43×10^6	30
1.0	26×10^6	18
2.5	29×10^6	20
5.0	26×10^6	18
7.5	24×10^6	17
10	24×10^6	17
10 to 30	14×10^6	10

17. "Restricted area" means any area access to which is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials. "Restricted area" shall not include any areas used as residential quarters, although a separate room or rooms in a residential building may be set apart as a restricted area.

18. "Sealed source" means any byproduct material that is encased in a capsule designed to prevent leakage or escape of the byproduct material.

19. "Source material" means (i) uranium or thorium, or any combination thereof, in any physical or chemical form; or (ii) ores which contain by weight one-twentieth of one percent (0.05%) or more of a. uranium b. thorium or c. any combination thereof. Source material does not include special nuclear material.

20. "Special nuclear material" means (i) plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51 of the act, determines to be special nuclear material, but does not include source material; or (ii) any material artificially enriched by any of the foregoing but does not include source material.

21. "Unrestricted area" means any area access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, and any area used for residential quarters.

APPENDIX II

REQUIRED RADIATION SURVEYS

AND

MONITORING PROCEDURES

Required Radiation Surveys and Monitoring Procedures

I Introduction

In the handling of special nuclear materials, Section 20 of Title 10, Code of Federal Regulations, requires that radioactivity levels of working surfaces in the laboratory, airborne contamination in the laboratory, air and water contamination of laboratory effluents, and personnel exposure to radiation and radioactive materials be controlled within specified limits. This manual abstracts those portions of the Code which apply to the operation of the Mass Spectrographic Laboratory at Isotopic Analysis, Inc. A program for demonstrating compliance with these regulations is outlined.

II Permissible Limits

The following table lists the maximum permissible limits for radioactivity with which we must be concerned. These limits are based upon the limits for Pu-239 because this is the most active isotope with which we will be concerned. By adhering to these limits, the analytical problems associated with differentiating between plutonium and uranium are eliminated.

Type of Contamination	Maximum Permissible Limits
Total radiation exposure per individual	1-1/4 rem/calendar quarter
Maximum permissible equilibrium body burden determined by bioassay	2×10^{-7} microcurie/day
Airborne radioactivity in restricted laboratory area	2×10^{-12} microcuries/ml. of air
Airborne radioactivity in exhaust effluent into unrestricted area	6×10^{-14} microcuries/ml. of air
Total radioactivity in waste water to be dumped into sanitary sewer	1×10^{-4} microcuries/ml. solution
Total fixed and removable alpha contamination on floors and bench tops and equipment removed from restricted area	10 dpm/100 sq. cm.
Total alpha contamination on protective clothing before clothing change is required	50 dpm/100 sq. cm.
Total beta-gamma radiation dose from shipping container	200 mr/hr. at surface 1 mr/hr. at 1 meter from surface
Total alpha contamination permissible on shipping container	500 dpm/100 sq. cm.
Total amount of material buried at one time	Less than ten (10) microcuries U233, 234, 235, and/or Pu 239.

III Compliance Surveys and Records

The following surveys and records are required to demonstrate compliance with the previously described regulations and limits.

Survey	Scheduled Interval	Records Required
1. Personnel Exposure:		
a. Film Badge	Monthly	Permanent for each individual
b. Bioassay	Upon initial employment, quarterly thereafter, and upon termination.	Permanent for each individual
2. Airborne radioactivity in restricted area	Daily when handling Pu, Weekly when handling U only.	Permanent Permanent
3. Airborne radioactivity in effluent	Continuous when handling Pu, Weekly 8 hr. working period when handling U only.	Permanent
4. Total radioactivity in waste water	Before dumping any holding tank	Permanent
5. Total fixed and removable alpha in work area	Weekly smears of area.	Permanent

In addition to the above routine surveys, there are certain specific operations which require on-the-spot surveys to assure that no exposures in excess of the previously described limits occur. These are described under general operating procedures in the following section.

IV Specific Operating Procedures

It is the intent of this section to outline procedures for conducting surveys and maintaining records which will assure compliance with Section 20, Title 10 of the Code of Federal Regulations.

A. Personnel Monitoring

Film badges are to be worn by all personnel working in the restricted area to obtain a measure of total radiation dosage. Visitors to the area will not be required to wear film badges unless initial surveys indicate significant beta-gamma dosages are present. Badges will be monitored on a monthly basis.

Each person working in the restricted area will be required to submit urine specimens periodically for bioassay. A specimen is required initially on hire, quarterly thereafter, and upon termination. In addition, specimens will be required whenever conditions such as cuts from contaminated equipment, high airborne contamination, or major spills warrant rechecking.

The results from these two surveys will be entered on the individual's permanent exposure record. (See Form MS-1) Records will be maintained for a period of five (5) years after termination of employment for each individual.

B. Calibration of Gas Proportional Counter

Whenever in use, the gas proportional counter must be re-calibrated over its expected operating range. This is done as follows: Using a certified standard, determine the geometry factor for the instrument-

$$F = \frac{\text{Certified Count Rate}}{\text{Observed Count Rate}}$$

All results must be multiplied by this factor when determining total radioactivity of a sample.

C. Airborne Radioactivity

1. Permanent Sampling Stations

Eight (8) continuous air sampling heads are operated in the restricted area. When plutonium is being processed in the area, these air heads are to be changed on a daily basis. When only uranium is being handled, the air heads are to be changed on a weekly basis. The step-wise procedure is as follows:

a. Duplicate sample heads containing new filters are obtained from the counting area in a closed carrying case.	a. Duplicate filter heads are available for each sampling station to permit counting of one set while the other set is in place in the samplers. Fresh filter papers are inserted when the contaminated filter is removed. The clean filter heads are then stored in a carrying case until installed.
b. Each filter head is replaced with a clean unit. The contaminated head is placed in the carrying case for future analyses.	b. Each filter station is adjusted to a flow of 2 cubic feet per min.. The flow is read through a clean filter.
c. After changing filter heads, return the contaminated heads to the counting room, remove the filter paper and count for five minutes or until a good statistical count is obtained.	c.
d. From the observed count rate, calculate the airborne radioactivity as follows:	d.
microcuries per ml. of air =	$\frac{C \times F}{T \times V \times 2.2 \times 10^{12}}$

F = Counting efficiency factor

where C = The observed total count

T = Counting time in minutes

V = Volume of air through the filter in cubic meters

1 microcurie = 2.2×10^6 disintegrations per minute

1 cubic meter = 10^6 ml.

1 cubic meter = 35.32 cubic feet

e. Log the calcultated results for each airhead in the appropriate space on Form MS-2. If the Observed value exceeds 2×10^{-12} microcuries per ml, notify laboratory supervision immediately.	e. In general, airheads will sample at the rate of 2 cubic feet / min . Therefore, for a 24-hour sampling period, C x F should not exceed 1056 dpm. A week's sample would be 7 times this, or 7392 dpm. Actual volume through the air sampling system is to be checked at various intervals, adjusting each airhead to 2 cubic feet / min. with clean filter papers in all heads.
f. The completed survey sheet (Form MS-2) is to be turned over to the secretary for filing. These sheets are to be retained permanently as required by law.	f.

2. Effluent from Exhaust Blower

During at least one 8 hr. working period each week, we are required to sample the effluent from the exhaust blower if we are processing uranium. If plutonium is being processed, continuous effluent sampling is required. This is accomplished by use of a special air sampling unit installed in an area beyond the final absolute filtering system where maximum mixing of air is taking place. Data required during sampling are (1) flow rate

and (2) total collection time. The sample is counted and calculated as in section C. 1. The results are entered on Form MS-2 and given to the secretary for filing. This sheet is retained as a permanent record as required by law.

3. Other Air Samples

Certain special operations require that the atmosphere in the area of the special operation be sampled. Examples of such operations are glove changes, bag changes, new operations, and spill cleanups. For these situations, the portable U. S. Nuclear air sampler is to be used. A minimum of 20 cubic meters of air must be sampled. The sample is counted and calculated as in section C. 1. The results are entered on Form MS-2. If the calculated results exceed 2×10^{-12} microcuries per ml., notify laboratory supervision immediately.

D. Surface Contamination

1. Weekly Survey

We are required by law to survey floors and working surfaces once each week for surface contamination. This is accomplished by taking smears of selected locations to determine the removable contamination. The maximum permissible level here is 10 dpm per 100 square centimeters. Each smear should be taken over an area 12" x 12". This is equivalent to 929 sq. cm. The maximum permissible count per square is then 92.9 dpm. Smears are taken with 2" diameter filter papers. They may then be counted in exactly the same manner as the air samples. Smears are always to be taken before scrubbing rather than after.

a. On Form MS-3 enter the required data for identification of date, operator, etc.	a. This form is a scale drawing of the laboratory which is marked off in numbered squares. These numbers indicate the location of the smears.
b. Using a disposable sample collection book, collect the required smears.	b. Smears will be collected alternately from odd and even numbered squares on a weekly basis. In this way every square will be sampled on a bi-weekly basis.
c. Count each sample for 5 minutes.	c.
d. Enter the counts per minute on Form MS-3 and give to laboratory supervision for inspection. If any hot areas are found, immediately notify personnel working within the area.	d.

e. Laboratory supervision will give the work sheet to the secretary for filing. The results of these surveys are to be maintained as permanent records. e.

2. Spot Surveys

Whenever a major spill occurs or a group of hot airheads are observed, a complete survey of the affected area will be conducted immediately to determine the extent of the contamination. Results are to be recorded and filed in exactly the same manner as in section C.1.

3. Survey of Equipment to be Removed from Restricted Area

No equipment may be removed from the restricted area unless it has been monitored and found to have no more than 10 dpm of fixed and removable contamination. In checking such equipment, the surface should first be checked with the portable alpha survey meter. All interior surfaces and hard to monitor exterior surfaces should then be smeared and counted in the gas proportional flow counter. If fixed and removable contamination is below 10 dpm, an approval for release tag signed by the monitor and laboratory supervisor is attached to the equipment before removal. If contamination levels are in excess of these limits, the equipment must be further decontaminated before release.

E. Liquid Waste Disposal

Before any liquid waste is released for disposal into the sanitary sewer it must be shown to contain less than 1×10^{-4} microcuries per ml. of total radioactivity. To accomplish this, two separate holding tanks are provided. The larger of these two tanks retains the water waste from the shower room and laundry. The smaller of these tanks retains water from the sink in the hot room. An automatic alarm will sound indicating when the tanks are full. The procedure to be followed is described below.

1. Close the waste dump valve. on the tank.	1.
2. Open the recirculating valve.	2.
3. Turn on the pump and circulate the tank contents for 1 hour.	3.
4. Open the sampling valve and withdraw approximately 30 ml. of the sample solution.	4.
5. Pipette two 10-ml. aliquots into clean beakers.	5.
6. To one aliquot add 1 ml. of spike standard solution containing 1×10^{-4} microcuries/ml. of uranium.	6. This spike solution is used to calculate self adsorbtion by salts in the waste solution.
7. Add 5 ml. of conc HNO_3 to each beaker and evaporate the solution to near dryness under an infrared lamp.	7.
8. Transfer the solution to a counting planchette with a minimum quantity of distilled water and evaporate to dryness.	8. Care should be taken to distribute the film as evenly as possible over the surface of the planchette.

9. When dry, heat to dull red heat over a bunsen burner for 15 seconds. | 9.

10. Cool and count in the gas proportional counter after first checking the counter efficiency factor with a reference standard. | 10.

11. Calculate recovery factors by the following formula: | 11.

$$K = \frac{C_s - Cu}{C_T}$$

where K = recovery factor

C_s = counts for spiked sample

Cu = counts unspiked sample

C_T = theoretical counts from spike (This is the theoretical count rate multiplied by counter efficiency.)

12. Calculate microcuries/ml. as follows: | 12.

$$\mu c/ml. = \frac{Cu}{V \times K \times E \times 2.2 \times 10^6}$$

where Cu = observed counts of unknown

V = volume of sample

K = recovery factor

E = counting efficiency

13. Enter the results of this calculation on Form MS-4 together with all pertinent data and sign the form. | 13.

14. Give the form to laboratory supervision for a decision as to whether the salvage may be dumped.	14.
15. Supervision will sign the form and return to the secretary for filing. This form will be retained as part of our permanent records.	15.

V General Operating Procedures

In addition to the specific surveys previously discussed, there are several general operating procedures which must be adhered to by all operating personnel. These are described in the following section.

A. Protective Clothing

When handling radioactive materials, certain minimum protective clothing standards must be adhered to. These standards are as follows:

Uranium - Under normal conditions a laboratory coat is considered sufficient. A respirator must be kept available. In the event of a major spill, converalls, surgeons cap and gloves, booties, and a respirator are required.

Plutonium - When handling plutonium, coveralls, surgeons cap and booties are to be worn. A respirator and surgeons gloves are to be carried at all times. Respirators and gloves must be worn for transferring samples, cutting salvage bags, changing gloves on the boxes, and for any other operation where the uncontrolled release of plutonium could occur. Clothing to be changed daily just before lunch.

B. Monitoring Protective Clothing

Each person is required to monitor his clothing and person each time he leaves the hot area for the mass spectrometer room or the shower room. Each person is required to monitor his clothing before leaving the mass spectrometer room for other areas of the plant.

If in checking protective clothing a hot spot is observed, the following procedures are to be followed:

1.	0-50 dpm	Clothing is considered cold and may be used.
2.	50-1000 dpm	Proceed to the change room and change clothing. Place hot clothing in the covered containers provided.
3.	1000-5000 dpm	A change of clothing will be brought to the individual in the hot area. The contaminated clothing will be placed in a plastic bag and marked for special laundering.
4.	>5000 dpm	A change of clothing will be brought to the hot area. The contaminated clothing will be sealed in a plastic bag and placed in a salvage drum for offsite burial.

C. Instrument Operability Checks

Each survey meter must be checked daily to determine if it is operable. The procedure is as follows:

1. Using a calibrated source, obtain a reading from the instrument under test.	1.
2. If the two counts differ by more than 20%, the meter must be recalibrated.	2.
3. During each quarter, each meter must be recalibrated using certified standards and manufacturer's suggested procedures.	3.

APPROVED:

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