Standard Nuclear Consultants, Ltd.

Nuclear Medicine • Radiology • Industrial Specialists

STAN BUHR
JIM MIKOWSKI
(312) 344-7308

P.O. Box 362, Manhattan, IL 60442 □ 1340 Balmoral Avenue, Westchester, IL 60153

September 4, 1984

Bill Adam, Ph.D.
Materials Licensing Section
U.S. Nuclear Regulatory Section
Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Re: Amendment to NRC license no. 12-20362-01.

Dear Dr. Adam:

This is in request of amendment to the above referenced radioactive materials license for the following items:

1. We wish to add the names of the individuals listed below to our license, as authorized users:

Vincent J. Gallagher

William D. Stetter

Robert Basset

Supporting documentation of training and experience with radioactive materials is attached for V. Gallagher, K. Skinner, and W. Stetter. Please reference the ADCO Services, Inc. NRC license (no. 12-11286-01) application, for B. Basset's training and experience with radioactive materials. We request that B. Basset be listed as an authorized user on our license for all procedures that he is eligible.

We confirm that Stan Buhr or Jim Mikowski will not allow anyone to work on any assignment without supervision until that individual has demonstrated competence, or has experience in the duties assigned, including radiation detection instrument calibration procedures, and sealed source recovery operations. The above named individuals have all had formal radiation safety training, and on-the-job training experience. Attachment I summarizes the minimum radiation safety training to be given other SNCL personnel prior to there assisting in licensed procedures. The training session as defined in Attachment I will be of three hours duration and will be presented by Stan Buhr or Jim Mikowski. At the conclusion of the classroom training session, each participant will be given an examination consisting of about 50 questions. The passing grade will be 75%.

2. Please add the following sealed sources for use in instrument calibration procedures and for storage purposes incident to recovery operations, as described on Attachment II of this amendment application.

Please note, we request authorization to transport any of the sealed sources specified, for the purpose of performing radiation detection instrument calibrations, to temporary job sites. The sealed sources will be transported according to 10 CFR Part 71 regulations and procedures contained in our current NRC license application.

Sealed sources will be stored in the original containers provided by the manufacturer. Containers of equivalent specifications; thickness, metallic composition, etc. will be used in storing sealed souces obtained from recovery operations when the original container is unavailable for use. Necessary shielding calculations are made to ensure that the proper container is used for the job to maintain radiation exposure as low as reasonably achievable.

We have also evaluated the shielding requirements in our radiation storage area and have determined the present shielding will be augmented with the construction of a concrete storage well of dimensions; 4'x 4'x 3' with 8" thick walls. This storage well would be constructed prior to receiving any sealed sources that could possibly threaten our maintaining the 10 CFR 20.105 limits with the present shielding arrangements. We have also acquired various sizes and shapes of lead bricks for use in providing additional shielding before the concrete structure would be needed.

We have evaluated our shielding requirements based on the highest activity source that would be in storage at any one time, as follows:

Given: 45.0 Curies ^{60}Co; Emmissivity for ^{60}Co = 14.4 R/hr/Curie/foot

Therefore, 45.0 Ci of cobalt-60 x 14.4 R/hr/Ci/foot = 648 R/hr/foot. The Half-Value Layer for cobalt-60 in lead (Pb) is 1.2 cm (from NCRP booklet 34, Table 28). To reduce the radiation level of of a 45.0 Ci cobalt-60 source to below 2.0 mr/hr, approximately 19 HVL's, or about 24 cm of lead will be used to contain the source.

Our calculations show that the available lead shielding used for storing cobalt-60 at maximum activity requested is also sufficient for storing the maximum activities requested for iridium-192 and cesium-137.

Should the concrete shielding structure be needed, it would be located in a locked, commercial aluminum storage shed constructed inside the garage located on the premises of the licensee's address, 1340 Balmoral Avenue, Westchester, Illinois 60153. A detailed diagram showing the proposed storage facility is attached (Attachment II). We confirm radiation levels to unrestricted areas surrounding the aluminum shed will be maintained in accord with 10 CFR 20.105. The entrance door to the aluminum shed will be posted with the appropriate "Caution, Radioactive Materials" sign, and will remain locked at all times when the area is unattended by authorized personnel. The aluminum shed will be bolted to the concrete floor of the garage.

4. Following is a description of procedures to be followed in calibrating alpha and beta survey instruments:

Alpha Survey Instruments

Alpha survey instruments are to be calibrated using the Eberline, model S94-1, S94-4, DNS-5 or DNS-10 alpha emitting source sets described earlier in this letter. By use of a filter grid, levels of approximately 280 to 1.6 x 10^3 cpm (2 Pi) are detectable. Licensees will be advised of the need for instrument repair if readings are not within ± 20%. Response factors will be provided to interpret meter readings to within ± 10%.

Beta Survey Instruments

Instruments requiring beta calibration will be checked with various energy sources such as C-14, Ni-63, Sr-90, or Cs-137. The sources are to be placed at the detector surface to simulate 2 Pi geometry and the scale reading of the instrument is to be noted next to the source dpm. The licensee will be advised of the need for instrument repair if readings are not within ± 20%. Response factors will be provided to interpret meter readings to within ± 10%.

5. We request authorization to use the following method of assaying leak test samples taken from beta and alpha emitting sealed sources:

   a. Remove the end cap from the end-window g.m. probe (Ludlum model 44-7, or probe of equivalent sensitivity for beta samples, and a Ludlum model 43-2 alpha scintillation probe for alpha samples), and with the use of the appropriate radionuclide calibration standard calibrate the unit on the proper scale. Information on the above mentioned probes is attached.

   b. Place the leak test sample (swab) as close to the end-window of the g.m. tube as possible and read the results. The degree of removable contamination may be readily evaluated by the direct ratio method.

   The following procedure may be used for calculating removable activity using an end-window g.m. meter that has demonstrated ability to detect 0.005 uCi of the radioactive source being leak tested.

   a. Turn on the meter, and check the battery for function. Remove end cap from g.m. tube.

   b. Place selected certified standard source (traceable to the National Bureau of Standards), of radionuclide being assayed, directly on end of end-window g.m. tube and turn the range switch to proper position. Record observed reading (R1) in mr/hr or cpm.

   c. Perform wipes of sealed source with cotton swab.

   d. Place cotton swab over the face of the end-window g.m. tube carefully to prevent cross-contamination of the tube. Take a reading (R2) of cotton swab in mr/hr or cpm.

e. To determine the degree of contamination in microcurie units, a direct proportion equation is used:

$$\frac{A}{R1} = \frac{C}{R2}$$

Where: A= activity of radionuclide standard in uCi
C= amount of removable activity from sealed source (uCi)
R1= survey meter reading of radionuclide standard
R2= survey meter reading of cotton swab from source tested

R1 and R2 must be in the same units of mr/hr or cpm

Sample calculation:

$$\frac{0.001 \text{ uCi}}{1.2 \text{ mr/hr}} = \frac{C \text{ uCi}}{0.5 \text{ mr/hr}}$$

$$(1.2 \text{ mr/hr}) \times C = 0.001 \text{ uCi} \times 0.5 \text{ mr/hr}$$

$$C = 0.00416 \text{ uCi}$$

The leak test certificate would be completed in the same manner, with the same information as described in our current license application. NRC regulations for limits of removable activity from sealed sources will continue to be followed.

6. Standard Nuclear Consultants, Ltd. may occasionally be called upon to deal with sealed sources that may either be damaged or leaking, and recover such sources that may have been disconnected or dislodged from their housings. Our training and experience has included;

1. Methods and procedures to evaluate and prevent the spread of radioactive contamination, and

2. Methods and procedures to decontaminate radioactive contaminated items, containers, or areas, and return of the product to the manufacturer or for transfer to an NRC licensed carrier and/or site for disposal.

We therefore, request authorization for such decontamination procedures. The purpose of obtaining this authorization is for latitude in providing necessary health physics services under such circumstances without prior formal written NRC approval. Our emergency actions would first be discussed with and approved by NRC personnel from the Office of Inspections and Enforcement. Specifically, we request authorization to provide the following services to licensed facilities, as needed:

a. Relocate contaminated equipment incident to service of source housings and/or transport contaminated equipment to a licensed decontamination or disposal facility.

Under these circumstances, the radioactive items would remain under our continuous surveillance until properly disposed or transfered. We confirmtransfers of byproduct material will be in accord with 10 CFR 30.41 regulations. Transportation of radioactive materials will be done according to 10 CFR Part 71 regulations.

b. Remove air, water, soil, bioassay, or leak test samples for analysis at our licensed facility.

c. Engage in radioactive decontamination procedures of any facility not duly licensed by the NRC or Agreement State.

d. Use SNCL sealed sources at temporary job sites for instrument qua ity control checks and calibration procedures. All sealed sources used for such purposes will either be kept at the temporary job site in locked vehicles (according to the method described in our current license application), or under the personal supervision of the licensed user.

e. Perform radiation survey "shutter" checks of radiography sources or industrial gauges to ensure locking mechanisms are functioning properly.

f. Also, we request authorization to install, relocate, and perform initial radiation surveys of devices containing licensed material, and perform operations involving the installation, replacement, disposal and leak testing of sealed sources containing licensed material used in devices. Please refer to B. Basset's training and experience involving source installation and relocation described in the ADCO NRC radioactive materials license. The above procedures will not include servicing sources that are unencapsulated.

We confirm that client personnel will not be allowed to use licensed material, as described above, unless documentation of their training in the use of such sources is available. The above listed operations would be carried out only in the direct physical presence of SNCL licensed users, or employees who have received the training in Attachment I.

7. We request authorization to remove guages and other sealed sources from licensed facilities for temporary storage at our facilities until such time they may be transfered to a licensed disposal firm, or returned to the manufacturer for disposal. Operations of this nature will be carried out under the direct supervision of one of SNCL licensed users and the client's Radiation Safety Officer.

These operations will be performed according to the sealed source manufacturer's procedure manual, NRC regulations and client's license conditions.

We confirm all transporting of licensed material, or delivering of licensed material to a carrier for transport will be done in accord with 10 CFR Part 71 and all applicable Department of Transportation regulations.

Please refer to the attached detailed Radiation Safety Practice and Operating Procedure Manual to be followed by SNCL personnel in providing radiation safety services to radioactive material users.

8. Please update Item 10 of our original Form 313I to indicate the additional instrumentation shown on Attachment III.

Our check in the amount of $120.00, payable to the U.S. Nuclear Regulatory Commission, is enclosed for amendment processing fees. Thank you.

Sincerely,

Jim Mikowski

Jim Mikowski

Control No. 77430

STANDARD NUCLEAR CONSULTANTS, LTD.
1340 Balmoral Avenue
Westchester, Illinois 60153
(312) 344-7308

Radiation Safety and Operating Procedures Manual

Standard Nuclear Consultants, Ltd. operates according to the Nuclear Regulatory Commission's philosophy of maintaining radiation exposures as low as reasonably achievable (ALARA), and in accord with all applicable NRC and Agreement State regulations and/or license conditions.

It is essential that all authorized users under the Standard Nuclear Consultants, Ltd. radioactive materials licenses recognize the importance of maintaining the respective licensing agencies' regulations and license conditions in performing their duties. The reputation of SNCL depends upon the constant effort of each authorized user and employee to thoroughly understand his duties and execute them efficiently and safely.

This safety manual summarizes the responsibilities of authorized users to maintain safe work habits. It is provided to each employee for his review and reference in maintaining control over operations involving the use of radioactive materials.

This manual will be periodically updated to keep it current with revised NRC regulations and operational procedures.

Standard Nuclear Consultants, Ltd.

NRC License No. 12-20362-01
IDNS License No. IL-00565-01

August 31, 1984

Table of Contents

VIII.Radiation Safety Standards and Limits

8.1 Permissable Radiation Levels
- a. Restricted Areas
- b. Unrestricted Areas
- c. Contaminated Areas
  - 1. Unrestricted Areas
  - 2. Restricted Areas
  - 3. Removable Contamination for Restricted Areas

IX. Emergency Procedures

9.1 Responsibility of Employees
9.2 Evaluation and Control of Radiation Accidents
- a. Loss of Byproduct Material
- b. Malfunction of Radiography Device
- c. Servicing Guage Devicesa
- d. Damage to Radiography Device
- e. Highway Accident Involving Radioactive Material
- f. Radiation Overexposure
- g. Procedure for Controlling Radioactive Spills
- h. Decontamination Techniques

X. General Safety Procedures

I. Introduction

1.1 Purpose

This manual is provided to all SNCL personnel for the purpose of familiarizing them with practical information to develope safe working habits when handling radioactive materials. The procedures contained herein are essential for employees to maintian compliance with NRC and Illinois Department of Nuclear Safety regulations and SNCL license conditions.

1.2 Scope

Operating and Emergency procedures contained herein are applicable to all radiological operations conducted at SNCL facilities or at client facilities.

1.3 Responsibility

The ultimate responsibility for the safe use of licensed materials lies with the SNCL radiation safety officer. This individual has the authority to control all operations involving licensed materials. Judgements, with respect to matters concerning radiation safety, will be made by the RSO or his appointed delegate, in conjunction with authorities of the NRC and IDNS.

The RSO will appoint responsible personnel to perform the following duties when needed:

a. Preparation of NRC or IDNS reports, including license renewals or amendment applications.

b. Train company or client personnel

c. Maintain company records required for licensing agency compliance.

1.4 Changes in Procedures

Changes in this manual will be made by the RSO as needed to maintain compliance with NRC or IDNS regulations.

1.5 Organization and Operations

Standard Nuclear Consultants, Ltd. was organized December 1983 for the purpose of providing health physics management and radiation safety services for radioactive materials users throughout the U.S.

Specific services provided by SNCL include:

a. Management services; materials, instrumentation, for the performance of health physics concerning evaluation and control of radiation environmental hazards, and to prevent such hazards from occurring.

b. To repair, calibrate and maintain radiation detection instrumentation, and radiographic devices containing sealed sources.

c. To provide radiation decontamination services for the purpose of disposing potentially hazardous materials, including recovery, transport, storage, sale or transfer of materials.

d. To provide radiation safety training relating to radionuclide accountability systems, and technical training for the safe handling of radioactive materials.

Operations described above are carried out at company headquarters at 1340 Balmoral Avenue, Westchester, Illinois, as well as at temporary job sites throughout the U.S. SNCL health physics personnel are available on an emergency basis 24 hours a day.

1.6 Personnel Training

All SNCL personnel are trained relative to certain hazards associated with specific operations involving the handling of radioactive materials.

a. Each SNCL employee will receive training informing him of the general knowledge of radiation safety techniques required to safely perform his duties.

b. The training will be given by his immediate supervisor and/or the RSO.

c. In order to determine if employees understand and can competently perform basic radiation safety procedures, examination may be given, as deemed necessary by the RSO or his delegate.

d. Initial training will also include a review of the SNCL NRC and IDNS radioactive materials license, including all backup information (license amendments) contained therein.

II. Operating Procedures

2.1 General Instructions

All personnel working with radioactive materials must wear personnel monitoring devices (film badges). The SNCL authorized employee must also have available a properly functioning and calibrated radiation detection instrument for establishing radiation exposure controls during sealed source recovery, source device servicing and decontamination operations.

All employees will conduct operations involving the use of radioactive materials according to the rules and regulations of the individual Agreement States or the NRC, and within the limitations of the SNCL byproduct materials license.

Copies of the NRC rules and regulations and the SNCL regulatory agency licenses will be provided to each SNCL employee.

2.2 Radiological Operations

Radiological operations, instrument calibration procedures, radiation decontamination operations, etc., will be performed at our licensed facility or in the field at temporary job sites, as needed. In all cases, radiation exposure limits defined in 10 CFR 20.202 and 203 will be maintained by SNCL employees.

2.3 Receiving Radioactive Materials

All packages containing radioactive materials received at SNCL headquarters will be done so according to procedures set forth in NRC Regulatory Guide 10.8, Appendix F.

2.4 Procedures For Controlling Access to Radiation Areas

Wherever radiological operations are carried out, it may be necessary to establish restricted areas on all sides of the operation to prevent unecessary radiation exposure and to comply with NRC and Agreement State regulations. It is essential that SNCL employees limit the access of unauthorized personnel with the use of barricades or roping off of the area or providing continuous surveillance of the area. Title 10, Code of Federal Regulations, 10 CFR Part 20.202 and 203 must be maintained.

The RSO or authorized SNCL employee will be assisted by the NRC Regional Office personnel with methods of resolving radioactive contamination incidents and sealed source recovery operations, when necessary. National Council on Radiation Protection booklet #65 will be referenced for specific procedures for decontaimination operations.

2.5 Use of Radiation Warning Signs

Radiation warning signs will be posted to restrict and control areas. The 10 CFR 20.203 regulations will be followed for posting:

a. Caution- Radioactive Materials

b. Caution- Radiation Area

c. Caution- High Radiation Area

2.6 Securing Exposure Devices

1. Locking:

All radiological exposure devices and/or sealed sources that may be removed from its protective container must be locked at all times when not in use by an authorized user, to prevent accidental removal of the licensed material. This shall be done by SNCL employees in accord with 10 CFR 34.22.

2. Storage of Sealed Sources:

Licensed material normally used for instrument calibration procedures is to be returned by the authorized user to the SNCL storage facility indicated on the enclosed diagram. This area, posted with a Caution-Radioactive Material sign, is to remain locked at all times when unattended by authorized personnel. When used for field work, instrument calibration sources may be kept locked in the authorized user's transport vehicle trunk.

Sealed sources obtained from recovery operations are brought to the SNCL facilities garage storage area and secured in the concrete well that is located inside the aluminum shed in the garage. The shed is posted with a Caution-Radioactive Materials sign and locked at all times. A radiation survey will be made of the unrestricted areas surrounding the shed to ensure radiation levels are in accord with 10 CFR 20.105.

2.7 Transporting Radioactive Materials

Refer to 10 CFR Part 71 and the attached excerpts from U.S. Department of Transportation regulations for transporting radioactive materials.

III. Radiation Survey Instrument Operating Procedures

3.1 General Instructions

The use of a properly calibrated and functioning radiation survey instrument shall be used by SNCL personnel when participating in operations involving potential exposure to radiation.

3.2 Radiation Survey Procedures

1. Check the radiation survey instrument to ensure that it is functioning properly. Perform a day-of-use constancy check on the instrument with a long lived radionuclide (Cs-137) and compare with previous reading.

2. Perform dose rate measurements

Radiation measurements should be made at the position of the workers body and extremities. Dose rate measurements are made to establish maximum allowable working times at the worker's body position.

3. Perform necessary contamination smears and obtain water, air, or soil for use in determining other limiting factors for working in the contaminated area.

4. Use time, distance and shielding to maintain radiation exposure ALARA.

5. Post area with the appropriate radiation sign as determined by survey results. Establish perimeter where the 2.0 mr/hr is determined.

6. Both removable and stationary objects that are found contaminated ()0.05 mr/hr, or with removable activity-see specific limits in Section VII), will be tagged. The tag will contain information describing the item, dose rate, contamination level, and distance at which 2.0 mr/hr exists. The name of the individual who monitored the item/area and applicable remarks should be included.

7. The radiation exposure limit is 1.25 Rem/person. As a rule of thumb, radiation exposures should be kept below 1.25 R in emergency situations. 1.25 R is equivalent to a 1.0 minute exposure in a 75.0 R/hr radiation field. Other time intervals may be calculated based on this relationship. If it is apparent that the above radiation dose limits for workers is being exceed, stop operations set up restricted area (posted), and immediately contact the RSO for orders on further action.

3.3 Radiation Detection Instrument Calibration Procedures

Radiation detection instruments are calibrated according to NRC Reg. Guide 10.8, Appendix C procedure (gamma and x-ray), and specific procedures outlined in the SNCL NRC radioactive materials license application for beta and alpha detectors.

IV. Radiation Survey Monitoring Techniques

4.1 Alpha

Analysis is accomplished by use of a ZnS(Ag) scintillation probe capable of detecting alpha contamination.
probes. Wipe smears are field checked with this alpha probe, which is carried to the facility where needed.

The alpha monitoring equipment is initially checked against an NBS traceable standard to determine its efficiency for the radionuclide being monitored.

4.2 Beta

Beta radiation analysis is accomplished in a similar manner as above in that the beta sensitive instrumentation is first checked against an NBS traceable standard equal in energy to the radiation being monitored. Beta radiation is always monitored with the probe shield in the open position.

4.3 Gamma

Gamma radiation analysis is determined by either a g.m. probe and survey instrument calibrated with cesium-137. Relative efficiencies for other gamma emitting radionuclides are also determined for comparison purposes. Analysis of test samples is made in the scintillation well counter that has been calibrated with cesium-137. Relative counting efficiencies will also have been determined on the well counter for other radionuclides encountered.

V. Personnel Monitoring

5.1 All SNCL personnel involved in radiological operations will be provided personnel monitoring devices-film or TLD whole body badges. Under no circumstances shall any SNCL employee work with radioactive materials unless he is wearing the personnel monitoring device assigned to him .

5.2 Film Badges

Prior to beginning work with radioactive materials, each employee will be issued a film or TLD badge. This badge will be worn only by the individual to whom it is assigned.

Film badges will be worn on the worker's body in the direction from which the radiation is emanating.

Film badges will be exchanged on a quarterly basis.

Ring TLD badges will be provided to workers involved in handling millicurie quantities of strontium-90 used in instrument calibration procedures.

5.3 Personnel Pocket Dosimeters

All SNCL employees involved in operations that may result in radiation exposure may also be provided personnel pocket dosimeters, in addition to film badges, if necessary.

Only dosimeters that read from 0-200 mR will be used for radiological operations. Periodic checks will be made by the employee to make certain the dosimeter is operating properly. Dosimeter readings should not vary by more than 2% of full scale in 24 hours when zeroed or left at end reading following semi-annual calibration. Drift checks will be made in an area away from x or gamma radiation.

No employee shall continue to work in any radiation field after it has been determined that his dosimeter has gone off-scale. In the event of an off-scale exposure, the employee's film badge is to be sent in for immediate processing.

5.4 Radiation Exposure Records

Quarterly film badge results will be retained in the SNCL files for immediate review by any employee. Pocket dosimeter results will be documented on NRC Forms 4 and 5.

VI. Instructions for Use of Uncontained, "Free" Sealed Sources

6.1 General Instructions

When sealed sources are used in "Free" or open air position, such as in calibration procedures, the user must employ time and distance as the most effective means of reducing radiation exposure.

6.2 Safety Equipment Required

Before removing a radioactive source from its storage location or protective container, the following equipment and instrumentation must be available:

a. A calibrated radiation survey meter in proper working order

b. Remote handling device

c. Radiation warning signs appropriate for the level of radiation

6.3 Procedures for Handling "Free" Sources

a. Position the source in a low traffic area to prevent unnecessary radiation exposure to unauthorized personnel, or set up a restricted area zone based on radiation exposure levels.

b. Post radiation warning signs as needed per 10 CFR 20.202 and 203.

Determine the maximum allowable radiation level to unrestricted areas for posting warning signs:

External Exposure:

$$\text{max. allowable radiation level} = \frac{60}{(\text{total exp. time-min.})} \times (2.0 \text{ mr/hr})$$

In the event of particulate airborne radioactive contamination, exposures will be limited to 520 MPC hours per calendar quarter, according to 10 CFR 20.

c. Maintain constant surveillance of the area to ensure that unauthorized persons do not enter the area.

d. Following use of the radioactive material in the "Free" state, it is returned to the container which is then relocked and returned to the radioactive materials storage area.

e. A radiation survey is then conducted around the container to ensure the source is properly secured.

VII. Leak Testing Sealed Sources

7.1 Use of SNCL Leak Test Kit-1

See enclosed leak test kit with instructions and leak test certificate.

VIII. Radiation Safety Standards and Limits

8.1 Permissable Radiation Levels

The use of all radiation sources is controlled by the NRC and individual Agreement States.

Specific radiation limits have been established for the protection of radiation workers and public.

These limits are set forth in 10 CFR 20.101, 102, 103, 104 and 105. All operations involving radioactive materials are governed by the following exposure limits:

Occupational Radiation Workers

External Exposures in Millirems

Area	Annual	Quarterly
Whole Body	5,000	1,250
Hands & Forearms	75,000	18,750
Feet & Ankles	75,000	18,750
Skin of Whole Body	30,000	7,500

Exposure limits of radiation workers whose occupational radiation history has been determined and documented on NRC Form-4 may be evaluated with respect to 10 CFR 20.102(b)(2).

8.1 Restricted Areas

Air

The maximum permissable concentration for all radioisotopes in air shall not exceed levels of 10 CFR 20 Appendix B, Table 1, Column 1.

b. Unrestricted Areas

Air

The maximum concentrations for all radionuclides in air released to unrestricted areas are detailed in 10 CFR 20 Appendix B, Table II. The concentrations units are in microcuries/ml of air.

Water

The maximum permissable concentrations for all radionuclides in water released to unrestricted areas are detailed in 10 CFR 20, Appendix B, Table II, Column II. The limits are in units of microcuries/ml of water.

c. Contaminated Areas

1. Unrestricted Areas

Area	Beta-Gamma (mr/hr)	Alpha (cpm)
Skin	0.05 mr/hr	10
Clothing	0.05 mr/hr	10
Shoes	0.05 mr/hr	10
Vehicles	0.05 mr/hr	10
Other Surace Areas	0.05 mr/hr	10

2. Contamination Levels for Restricted Areas

Areas	Beta-Gammma (mr/hr)	Alpha (cpm)
Shoes	0.05 mr/hr	50
Protective Clothing	0.05 mr/hr	500
Respirators (Ext)	0.05 mr/hr	50
Respirator (Int)	NDA	NDA
Bench Tops	0.50 mr/hr	2000
Floors	0.05 mr/hr	500
Equipment/Tools	0.5 mr/hr	2000

3. Removable Contamination Limits for Restricted Areas

Area	Beta-Gamma (dpm/100cm^2)	Alpha (cpm)
Bench Tops	3500	200
Floors	500	100
Equipment/Tools	1000	50

Table 1

SURVEY FREQUENCIES

1. All elution, preparation, and injection areas should be surveyed daily with a survey meter and decontaminated if necessary.

2. Laboratory areas where only small quantities of radioactive material (less than 200 μCi at any one time) are used should be surveyed monthly.

3. All other laboratory areas should be surveyed weekly.

4. The weekly and monthly surveys should consist of the following:

   a. A measurement of radiation levels with a survey meter sufficiently sensitive to detect 0.1 mR/h.

   b. A series of smear tests to measure contamination levels. The method for performing smear tests should be sufficiently sensitive to detect the limits in Table 2 to one significant digit.

   c. Any air sample measurements necessary to determine compliance with § 20.103 of 10 CFR Part 20 in cases where calculations alone are not sufficient.

Table 2

RECOMMENDED ACTION LEVELS FOR REMOVABLE SURFACE CONTAMINATION IN MEDICAL INSTITUTIONS*

		Type of Radioactive Material**					
		Alpha Emitters		Beta or X-Ray Emitters		Low-Risk Beta or X-Ray Emitters	
	Type of Surface	($\mu Ci/cm^2$)	($dpm/100cm^2$)	($\mu Ci/cm^2$)	($dpm/100cm^2$)	($\mu Ci/cm^2$)	($dpm/100cm^2$)
1.	Unrestricted areas	10^{-7}	22	10^{-6}	220	10^{-5}	2,200
2.	Restricted areas	10^{-6}	220	10^{-5}	2,200	10^{-4}	22,000
3.	Personal clothing worn outside restricted areas	10^{-7}	22	10^{-6}	220	10^{-5}	2,200
4.	Protective clothing worn only in restricted areas	10^{-6}	220	10^{-5}	2,200	10^{-4}	22,000
5.	Skin	10^{-6}	220	10^{-6}	220	10^{-5}	2,200

* As adapted from Table I of Reference 10. Averaging is acceptable over nonliving areas of up to 300 cm^2 or, for floors, walls, and ceiling, 100 cm^2. Averaging is also acceptable over 100 cm^2 for skin or, for the hands, over the whole area of the hand, nominally 300 cm^2.

** Beta- or x-ray emitter values are applicable for all beta- or x-ray emitters other than those considered low risk. Low-risk nuclides include C-14, H-3, S-35, Tc-99m, and others whose beta energies are less than 0.2 MeV maximum, whose gamma- or x-ray emission is less than 0.1 R/h at 1 meter per curie, and whose permissible concentration in air (see 10 CFR Part 20, Appendix B, Table I) is greater than 10^{-6} μCi/ml.

Table 3*

ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONTROLLED RELEASE OF EQUIPMENT

Nuclide[a]	Average[b,c]	Maximum[b,d]	Removable[b,c]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm^2	3,000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1,000 dpm $\beta\gamma$/100 cm^2

*Adapted from Regulatory Guide 1.86 (Ref. 30).

[a]Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c]Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d]The maximum contamination level applies to an area of not more than 100 cm^2.

[e]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionately and the entire surface should be wiped.

Table 4*

CONVERSION FACTORS FROM OLD TO NEW RADIATION UNITS

Quantity	Old Unit	Symbol	New Unit	Symbol	Conversion Factor
Activity	curie	Ci	becquerel	Bq	1 Ci = 3.7×10^{10} Bq
Absorbed dose	rad	rad	gray	Gy	1 rad = 1cGy = 10^{-2} Gy = 10^{-2} J/kg
Dose Equivalent	rem	rem	sievert	Sv	1 rem = 1cSv = 10^{-2} Sv
Exposure	roentgen	R	-	-	1 R = 2.58×10^{-4} C/kg

*Conversion to the new SI units provided in this table will now be considered in compliance with this guidance.

TABLE 2

RECOMMENDED ACTION LEVELS FOR REMOVABLE SURFACE CONTAMINATION IN MANUFACTURING PLANTS

Type of Surface	Type of Radioactive Material[a]			
	Alpha Emitters		Beta or X-Ray Emitters ($\mu Ci/cm^2$)	Low-Risk Beta or X-Ray Emitters ($\mu Ci/cm^2$)
	High Toxicity ($\mu Ci/cm^2$)	Lower Toxicity ($\mu Ci/cm^2$)		
1. Unrestricted areas[b]	10^{-7}	10^{-7}	10^{-6}	10^{-6}
2. Restricted areas[c]	10^{-4}	10^{-3}	10^{-3}	10^{-2}
3. Personal clothing worn outside of restricted areas	10^{-7}	10^{-7}	10^{-6}	10^{-6}
4. Protective clothing worn only in restricted areas	10^{-5}	10^{-5}	10^{-4}	10^{-4}

[a] High toxicity alpha emitters include Am-243, Am-241, Np-237, Ac-227, Th-230, Pu-242, Pu-238, Pu-240, Pu-239, Th-228, and Cf-252. Lower toxicity alpha emitters include those having permissible concentrations in air greater than that for Ra-226 (s) in 10 CFR Part 20, Appendix B, Table I, Column 1. Beta or x-ray emitter values are applicable for all beta or x-ray emitters other than those considered low risk. Low-risk nuclides include those whose beta energies are less than 0.2 MeV, whose gamma or x-ray emission is less than 0.1 R/h at 1 meter per curie, and whose permissible concentration in air in 10 CFR Part 20, Appendix B, Table I, is greater than 10^{-6} $\mu Ci/ml$.

[b] Contamination limits for unrestricted (non-contamination-controlled) areas in this table are considered to be compatible in level of safety with those for release of facilities and equipment for unrestricted use, as given in Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors," and in "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," which is available from the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

[c] As adapted from Table I of Reference 4. Averaging is acceptable over inanimate areas of up to 300 cm^2 or, for floors, walls, and ceiling, 100 cm^2. These limits are allowed only in those restricted areas where appropriate protective clothing is worn.

Note on Units: The above units of $\mu Ci/cm^2$ have been used in this table since they are consistent with units adopted as national standards in several other nations and the IAEA (see Reference 6); the units of μCi and cm are already used to express concentration in 10 CFR Part 20, and they are readily convertible to SI units by the well-known relation; 1 $\mu Ci = 3.7 \times 10^4$ dis/sec $= 3.7 \times 10^4$ Becquerels (Bq). They may also be easily converted to other frequently used units of radiation protection practice, i.e., disintegrations/minute per 100 $cm^2 = 2.22 \times 10^6 \times$ (activity expressed in $\mu Ci/cm^2$).

Note on Skin Contamination: Skin contamination should always be kept ALARA. Exposed areas of the body of persons working with unsealed radioactive materials should always be monitored and should be washed when any contamination is detected. It is important, however, that contaminated skin should not be so treated or scrubbed that the chance of intake of radioactivity into the body is increased. See Section 1.6 of this guide.

APPENDIX F

PROCEDURES FOR SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIAL

1. Special requirements will be followed for packages containing quantities of radioactive material in excess of the Type A quantity limits as specified in paragraphs 20.205(a)(1) and (c)(1) of 10 CFR Part 20 (more than 20 Ci for Mo-99 and Tc-99m). They will be monitored for surface contamination and external radiation levels within 3 hours after receipt if received during working hours or within 18 hours if received after working hours, in accordance with the requirements of paragraphs 20.205(a) through (c). All shipments of liquids greater than exempt quantities will be tested for leakage. The NRC Regional Office will be notified in accordance with the regulations if removable contamination exceeds 0.01 μCi/100 cm^2 or if external radiation levels exceed 200 mR/hr at the package surface or 10 mR/hr at 3 feet (or 1 m).

2. For all packages, the following additional procedures for opening packages will be carried out:

   a. Put on gloves to prevent hand contamination.

   b. Visually inspect package for any sign of damage (e.g., wetness, crushed). If damage is noted, stop procedure and notify Radiation Safety Officer.

   c. Measure exposure rate at 3 feet (or 1 m) from package surface and record. If >10 mR/hr, stop procedure and notify Radiation Safety Officer.

   d. Measure surface exposure rate and record. If >200 mR/hr, stop procedure and notify Radiation Safety Officer.

   e. Open the package with the following precautionary steps:

      (1) Open the outer package (following manufacturer's directions, if supplied) and remove packing slip.

      (2) Open inner package and verify that contents agree with those on packing slip. Compare requisition,* packing slip, and label on bottle.

      (3) Check integrity of final source container (i.e., inspect for breakage of seals or vials, loss of liquid, and discoloration of packaging material).

      (4) Check also that shipment does not exceed possession limits.

   f. Wipe external surface of final source container and remove wipe to low background area. Assay the wipe and record amount of removable radioactivity (e.g., μCi/100 cm^2, etc.). Check wipes with a thin-end-window G-M survey meter, and take precautions against the spread of contamination as necessary.

   g. Monitor the packing material and packages for contamination before discarding.

      (1) If contaminated, treat as radioactive waste.

      (2) If not contaminated, obliterate radiation labels before discarding in regular trash.

3. Maintain records of the results of checking each package, using "Radioactive Shipment Receipt Record" (see next page) or a form containing the same information.

---

*In the case of special orders (e.g., therapy doses), also compare with physician's written request.

Control No. 77430

Note: Beta-Gamma levels as measured at contact by end-window g.m. probe ($1.4\ mg/cm^2$).

Alpha cpm as measured at contact with alpha scintillation probe at surface.

NDA refers to No Detectable Activity.

Other recommended action levels for removable surface contamination as specified in NRC Reg. Guides 8.21 and 8.23 may be followed.

IX. Emergency Procedures

9.1 An emergency situation may arise at any time when transporting or handling radioactive materials. The purpose of the following information is is to prepare SNCL employees for such emergency situations that occur when least expected.

It is the responsibility of the radioactive material user to know:

1. What procedures to follow when dealing with an emergency situation involving radioactive materials.

2. Who to contact immediately to evaluate the situation and correct it.

3. How to contain the area and immediately reduce radiation exposures.

9.2 Evaluation and Control of Radiation Accidents

a. Loss or Theft of Radioactive Materials

The Radiation Safety Officer is to be notified immediately of any loss or theft of radioactive material. The RSO will in turn notify the proper authorities according to the regulations set forth in 10 CFR 20.403. The RSO will also notify personnel at the job site of the incident, if applicable.

It is the responsibility of the authorized user to obtain necessary facts concerning the identity of the personnel that were on hand at the area where the radioactive material was last used or seen. Both RSO and/or other designated personnel will immediately begin searching for the missing material using the most sensitve survey meter available.

b. Malfunction of Radiography Device

When involved with malfunctioning radiography devices, the SNCL authorized user will attempt to retract the radioactive source if possible. If the source cannot be retracted, then immediately resurvey the work area and adjust the perimeter of the restricted area to ensure the 2.0 mr/hr unrestricted area radiation limits are

maintained. Post the area with Caution-Radiation Area, where applicable.

Have someone notify the RSO immediately. Do not attempt to repair the equipment or retrieve a loose source.

The following steps are to be taken only by the RSO or delegate with experience in such recovery operations:

1. Locate the position of the source of the sealed source with the aid of a survey meter.

2. Develop a recovery plan and calculate radiation exposures relative to the time involved in the recovery operation.

3. Ensure all individuals involved in the recovery operation have properly calibrated, zeroed and functioning pocket dosimeters that read in the 0-200 mR range. Also, personnel involved in the recovery operation must wear whole body film badges, positioned on the body area most likely to receive maximum exposure.

4. The following method is to be used in recovering sources in radiography exposure devices when the source tube is not damaged, thereby preventing retrieval by reverse method:

   a. Lock the exposure device.

   b. Remove source tube tip from the end of the source tube, provided the source is not positioned at this point. If the source is positioned at this point, elevate the source tubing using remote handling device (rod) and shake the tube to allow the source to move down the tube as far from the end of the tip as possible.

   c. Remove the control cables from the exposure device.

   d. Position the control cables in the source tube end which is not open and crank the control cable out slowly to push the source back into the shielded position. Cranking must be done slowly so as not to override the source and jam it in the tube with the cable.

   e. Unlock the exposure device and crank the cable slowly to allow the source to enter the lock box. Lock source when properly positioned.

   f. Throughout the operation, it is necessary that pocket dosimeters be periodically checked to ensure they have not gone off-scale.

   g. Complete a detailed report of the incident. If the incident is considered reportable, the RSO will notify the NRC per 10 CFR 20.403 regulations.

c. Servicing Guage Devices

1. Guage servicing will be performed at client facilities or SNCL headquarters. Prior to performing any operations, access to the work area will be controlled by establishing restricted area zones. The sources being serviced will be kept under constant surveillance by SNCL personnel.

2. Radiation surveys will be performed prior to and following installation of sources. The service area will be posted with the appropriate radiation warning singns. The results of the radiation surveys will be documented. The source container will be posted with the appropriate radiation warning signs per 10 CFR 20.203.

3. The removed source will be leak tested according to the attached procedures with the SNCL Leak Test Kit-I. The results of the leak test will be reported in microcurie units as indicated on the leak test sample analysis procedures contained in the SNCL license application.

4. Sealed sources will be handled with remote handling tools to avoid unnecessary radiation exposure.

5. Following removal of source from holder (outside guage), adequate shielding will be available for its temporary on-site storage to maintain radiation exposures within 10 CFR 20.105 limits. Personnel involved in source service operations will be required to wear a pocket dosimeter (0-200 mR range). The pocket dosimeter will be checked frequently to ensure no off-scale exposure has occured.

6. Shutter checks- radiation surveys, will be performed to ensure proper function.

7. The removed source will be transported to the SNCL storage facility or disposed as described earlier in this manual.

8. Placarding and transporting of the source will be done according to 10 CFR Part 71 regulations, by SNCL personnel.

9. Repair of sources will not be attempted by SNCL personnel, unless specifically licensed to do so.

d. Damage to Radiography Device or Source Disconnect

The RSO or delegate with specific training in source recovery operations will evaluate the extent of damage and plan the recovery operation. Under no circumstances can any repair of equipment be made to the actual radioactive source or source housing. Repairs may be made only to accessories.

A restricted area must be established as determined with survey meter readings, and posted according to NRC regulations described in Section 9.2 b above. The restricted area must be kept under constant sur-

veillance until the condition of the damaged device is corrected and radiation exposure levels have been reduced to unrestricted limits.

Recovery operations of this nature may require the use of special handling and retrieval equipment as determined by the RSO or his delegatep

e. Highway Accidents Involving Radioactive Material

In the event of an accident involving radioactive material occurs on the highway, the same procedures in establishing a perimeter of a restricted area apply. The restricted area perimeter can be determined through calculation and radiation exposure charts relative to the type of radioactive material involved, if a radiation survey meter is not available.

Establishing the restricted area is not applicable if the radioactive material has not escaped its protective containers and upon survey the radiation levels are deemed safe.

f. Radiation Overexposure

The Radiation Safety Officer is to be notified immediately of any suspected incident involving a possible radiation overexposure. The RSO will notify the proper agencies if an overexposure has occured.

The RSO will suspend all radiological operations that may have have produced the overexposure and will reassign any individual who is determined to have been overexposed. The RSO will have the radiation workers film badge immediately processed and will have the exposed individual examined medically.

In the event the radiation exposure was to unauthorized personnel, it will be necessary to obtain the person's name address and social security number. Other persons who are suspected of having been over-exposed are to be tracked down and advised of the situation.

The RSO will prepare a detailed report and determine the course of action based on the facts gathered.

g. Procedure for Controlling Radioactive Spills

Emergeny procedures for handling radioactive contamination incidents are adapted from NCRP booklet 65 and NBS Handbook 48 are to be used as a guide in developing specific decontamination plans. Since these procedures are general, modification must be made when dealing with unique contamination situations.

NRC Reg. Guide 10.8, Appendix H procedures will be considered the core of any management plan for decontaminating areas.

h. Decontamination Techniques

In cleaning objects or areas, the most important preoperative determination to be made is whether the contaminant is in powdered (dry) or liquid form. If the contaminant is powder or of dry form (solid), the most valuable technique for cleaning the area is by vacuuming. A method of filtering the effluent vacuum air must be availabele to prevent further spread of contamination. The use of wet mops and detergents is also useful. Detergents of neutral pH should be used soaps which tend to fix certain nuclides to the surface rather than remove them. Complexing agents such as chelators or citric acid in combination with soaps increase the cleaning efficiency.

Predecontamination:

1. Plan the decontamination operation thoroughly and obtain adequate supplies.

2. Provide adequate protection for all personnel involved in the decontamination process. Develop contingency plans to allow for the rotation of personnel to maintain radiation exposures within regulatory limits.

3. Provide for the safe storage of radioactive contaminated items waste products.

Decontamination:

1. Work towards the center of the contaminated area.

2. Provide covering to uncontaminated areas to prevent the spread of contamination.

3. Frequently monitor the area to determine the effectiveness of the decontamination process.

4. Monitor personnel prior to allowing them to move to uncontaminated areas.

Postdecontamination:

1. Reserve all potentially contaminated articles in plastic bags until they are surveyed.

X. General Safety Procedures

1. Each employee is to make a concerted effort to maintain his radiation exposure as low as reasonably achievable-specifically below 3.0 Rem calendar quarter, as set forth in 10 CFR 20.101.

2. Employees assigned to radiological operations must wear their film, and/or ring TLD badge, and a pocket dosimeter, if necessary. These personnel monitoring devices are to be turned in to the RSO quarterly or as directed.

3. Contamination surveys are to be performed on all radiation workers, including personal articles, prior to leaving a radioactive contaminated area. Personnel must wash their hands thoroughly prior to eating, smoking, or leaving radioactive contaminated areas.

4. If radioactive contamination is found in excess of aforementioned levels, it must be reduced prior to leaving the contaminated area.

5. Protective clothing such as gloves, coveralls, masks, booties, etc., shall be used when performing decontamination procedures involving possible contamination from unencapsulated sealed sources. OPEN OR UNENCAPSULATED SOURCES ARE TO BE TREATED AS CONTAMINATED UNLESS PROVEN OTHERWISE. When the extent of radioactive contamination is unknown, assume the contamination is everywhere and don appropriate protective clothing described above.

6. Wear protective masks when particulate alpha or beta radiation is suspected.

7. SITUATIONS BEYOND SCOPE OF SNCL LICENSE

   When confronted with exposed sealed sources or contamination incidents that elicit radiation levels in excess of 1.25/hr external, or 520 MPC hours for airborne, according to 10 CFR Part 20, stop recovery or decontamination procedures and set up restricted area boundries and immediately contact the Radiation Safety Officer.

6. All radioactive materials will be handled, transported and stored according to NRC license application procedures. Remote handling tongs, shielding, gloves, etc. will be routinely used.

7. Pipetting by mouth is PROHIBITED.

8. Air samples must be taken whenever airborne contamination is suspected. Until analysis of those samples is completed, only persons wearing respirators approved by the RSO will be allowed in that area.

9. ALL SNCL EMPLOYEES WILL BE GIVEN THE OPPORTUNITY TO REVIEW THE NRC AND ILLINOIS DEPARTMENT OF NUCLEAR SAFETY LICENSE APPLICATIONS, LICENSE DOCUMENTS, AND RESPECTIVE AGENCIES' REGULATIONS PRIOR TO WORKING WITH RADIOACTIVE MATERIAL.

Attachment I

Standard Nuclear Consultants, Ltd.
1340 Balmoral Avenue
Westchester, Illinois 60153

I. Principles and Practices of Radiation Protection

A. Basic Radiation Physics

1. Atom, Ionization
2. Types of Radiation; alpha, beta, gamma
3. Radiation Interaction with Matter
4. Radionuclides
5. Curie and Derivation
6. DPM's, RAD, REM
7. Physical Half-Life

B. Radioactive Contamination Control

1. Protective Clothing
2. Radiation Surveys
3. Establishing boundaries and Radiation Warning Signs
4. Wipe Test Sampling and Evaluation
5. Environmental and Bioassay Sampling
6. Use of Respirators

II. Instrumentation

1. G.M. Meter
2. Gas Proportional Counter
3. Scintillation Detertor; Probe and Well Counter
4. Ion Chamber

III. Personnel Monitoring

1. Film Badge
2. TLD
3. Pocket Dosimeter

IV. Mathematics and Calculations

1. Exponential Notation
2. Time, Distance, Shielding
3. Dose and Dose Rate Calculation
4. Contamination Sample Analysis
5. Leak Testing Procedures
6. Half-Value Layer

V. Biological Effects of Radiation

1. REM
2. Critical Organ
3. Chronic Exposure

4. Body Burden
5. Genetic Effects
6. Somatic Effects
7. Biologic Half-Life

VI. Regulations-Licensing

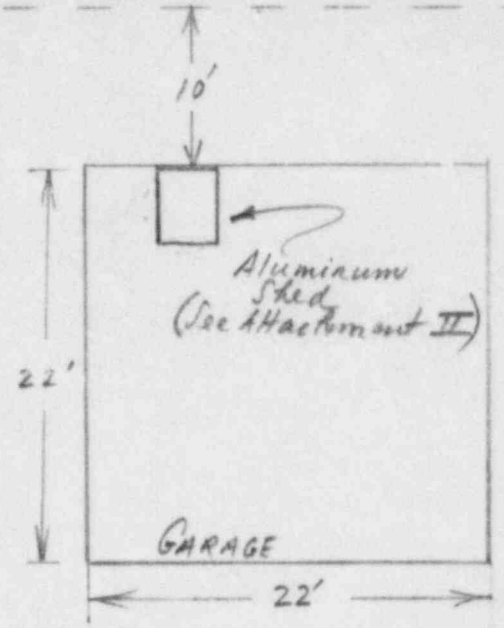
1. 10 CFR Parts 19, 20, 30, 34, and 71
2. SNCL License and Pertinent Regulatory Documents
3. Operating Procedures
4. Limitations

VII. Guage and Exposure Device Servicing Procedures

1. Radiation Surveys
2. Establishing Resticted Areas
3. Lock-Out Procedures
4. Source Handling Procedures-Remote Handling Tools
5. Shielding Requirements
6. Leak Testing Sealed Sources
7. Shutter Checks/Area Surveys
8. Transport and Disposal of Sources
9. Limitations of Device Servicing Procedures

The above 8 hour training program will be given to all SNCL employees whose training and experience with radioactive materials does not include the subject matter contained herein. The program will also include a minimum 1 hour hands-on instrumentation work shop to familiarize personnel with the proper use of radiation detection instrumentation.

Attachment II



Yard

STANDARD NUCLEAR CONSULTANTS

RESIDENCE

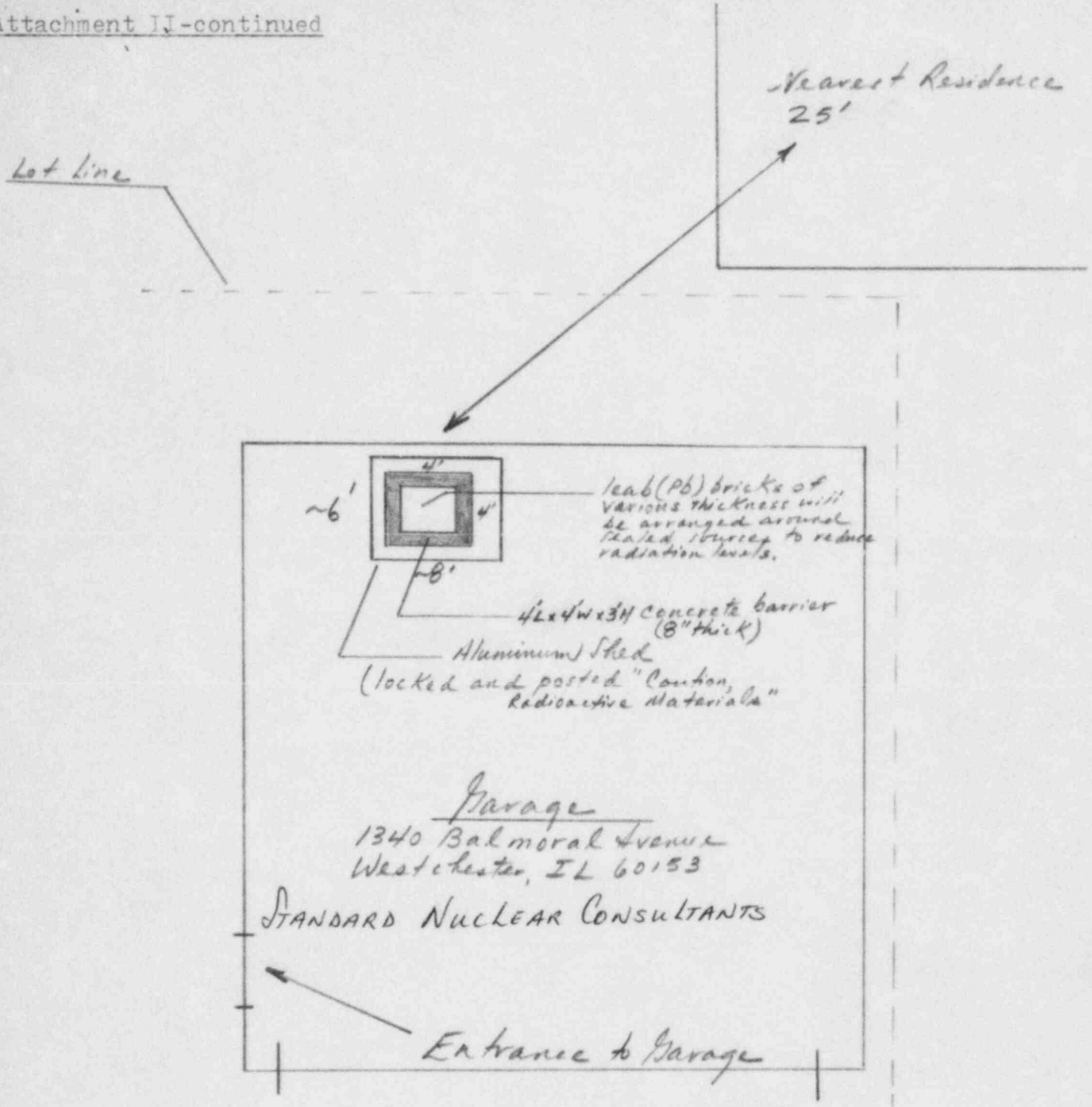
1340 BALMORAL AVENUE
WESTCHESTER, IL 60153

125'

(— — —) = lot lines

50'

Attachment II-continued



LEAK TEST REPORT
FOR RADIOACTIVE SOURCES

Standard
Nuclear
Consultants, Ltd. (312) 344-7308

P.O. Box 362, Manhattan, IL 60442 □ 1340 Balmoral Avenue, Westchester, IL 60153

DATE: _____

LICENSEE: _____

ADDRESS: _____

LICENSE #: _____

RADIOACTIVE SOURCE INFORMATION

SOURCE: _____
ACTIVITY: _____
As Of: _____
MANUFACTURER: _____
MODEL #: _____
SERIAL #: _____
LEAK SAMPLE DATE: _____
COLLECTED BY: _____

RESULTS:

Gross cpm: _____
Background cpm: _____
Net cpm: _____
μCi removable: _____

NOTE: Sensitivity of counting instrument is <0.0005 μCi.

CONCLUSION: Radioactive leakage from source is less than the 0.005 μCi limit.

ANALYZED BY: _____ on _____

STANDARD NUCLEAR CONSULTANTS, LTD.
LEAK TEST KIT-1
(gamma/beta sources)

Instructions:

This kit is to be used in accord with NRC and/or Agreement State principles when handling sealed sources to be leak tested. The use of time, distance and shielding are extremely important to reduce radiation exposure when leak testing sealed sources.

1. Disposable gloves and handling tongs used when removing or accessing sources can significantly reduce radiation exposure.
2. Choose a shielded location for leak testing the exposed source to prevent unnecessary radiation exposure.
3. Remove cotton-tipped applicator from plastic bag and saturate with water or alcohol.
4. Thoroughly smear the source and its container (where accessible).
5. If a g.m. meter or other radiation detection instument is available, survey the used swab for any detectable radiation. If radiation levels are above background, immediately call Standard Nuclear Consultants, Ltd. at (312) 344-7308 for assistance.
6. Return used swab to plastic bag stapled to bottom portion of kit.
7. Remove protective strip from tape, fold bottom portion of kit as marked and press firmly to secure swab.
8. Secure prefolded kit by peeling protective covering on tape tabs.
9. Return to Standard Nuclear Consultants, Ltd. Documentation of assay results in microcurie quantities will be returned for your records.

Please provide the following information:

Name & Address of Facility: _____

_____

NRC or Agreement State License #: _____
Name of Person Performing Test: _____
Date of Test: _____
Radionuclide: _____
Activity & Date: _____ mCi/μCi as of _____
Manufacturer: _____
Model: _____ Serial #: _____

PEEL SIDE TAPES AND SECURE OVER BOTTOM FLAP

FROM:_____

_____

_____

STANDARD NUCLEAR CONSULTANTS, LTD.
1340 Balmoral Ave.
Westchester, Illinois 60153

Supplement to Item 8

Element and Mass Number	Chemical and/or Physical Form	Manufacturer and Model Number	Maximum Number of Millicuries	Maximum Activity Per Source
Any byproduct, source, or special nuclear material	Any form incident to leak testing and analysis of environmental samples, including leak test, bioassay and soil, water, or air samples	Any	Not to exceed 5.0 mCi per radionuclide	----------
Any byproduct material with atomic numbers between 3 and 83, inclusive	Sealed Sources	Any NRC approved source	5,000 mCi	1,500 mCi
Technetium-99	Sealed Sources	Eberline, model DNS-19 (set of three sources)	10^2 to 10^5 cpm	----------
Strontium-90	Sealed Sources	Eberline, model DNS-14	0.001-0.01 uCi	0.01 uCi
Thorium-230 Technetium-99 Cesium-137 (set)	Sealed Sources	Eberline, model DNS-9	0.01-1.0 uCi	1.0 uCi
Plutonium-239	Sealed Sources	Any NRC approved source	25 uCi	5.0 uCi
Nickel-63	Sealed Sources	Any NRC approved source	15 mCi	15 mCi
Cobalt-60	Sealed Sources	Any NRC approved radiography devices or guages	45,000 mCi	45, 000 mCi
Iridium-192	Sealed Sources	Any NRC approved radiography devices or guages	100,000 mCi	50,000 mCi
Cesium-137	Sealed Sources	Any NRC approved radiography devices or guages	500 mCi	500 mCi
Strontium-90	Sealed Sources	ICN model BS or cat. no. 75125-751291, or Tracerlab model no. RA-2	500 mCi	100 mCi

Supplement to Item 8-continued

Description of Use of Licensed Material

1. For possession incident to the collection and analysis of test samples including; leak tests, bioassays, soil, water, or air.

2. For testing, calibration, storage and/or protective maintenance of sealed sources.

3. Calibration of radiation detection instruments and health physics instruction.

4. Same as no. 3 above.

5. Same as no. 3 above.

6. Same as no. 3 above.

7. Same as no. 3 above.

8. For possession incident to the emergency recovery of, storage, repackaging and transfer to a duly licensed user or waste disposal firm, in accord with 10 CFR 30.41.

9. Same as no. 8 above.

10. Same as no. 8 above.

11. Same as nos. 3 and 8 above.

Attachment III

Supplement to Item 10

Type of Instrument	Manufacturer	Model No.	Number Available	Radiation Detected	Sensitivity Range
GM Detector	Ludlum	14C	2	Beta-Gamma	0-2000 mr/hr
GM Detector	Victoreen	CDV-700	1	Beta-Gamma	0-50 mr/hr
Ionization	Victoreem	740F	1	Beta-Gamma	1.0-2.5 R
Scintillation	Ludlum	3	1	alpha-Beta	0-50,000 cpm
GM Detector	Texas Nuclear	2652	1	alpha,beta,gamma	0-150,000 cpm

CURRICULUM VITAE

PERSONAL

William D. Stetter CNMT
1534 Blocki Court
Sheboygan,Wisconsin 53081

Phone: 414-457-0934

United States citizen-born in La Crosse, Wisconsin 6/22/53

Married/2 children

EDUCATION

UNIVERSITY OF WISCONSIN-LA CROSSE
1971-1976; Bachelor of Science Degree.
Major-Biology Minor-Chemistry

JOHN COCHRAN VETERAN'S ADMINISTRATION HOSPITAL
St. Louis, Missouri
1976-1977 Clinical Internship in Nuclear Medicine

EMPLOYMENT

HIGHLAND PARK HOSPITAL-Highland Park, Illinois
1977-1981 two years as staff technologist; eighteen months as senior technologist.
Responsibilities as senior technologist included: scheduling, development of new procedures, personnel scheduling, and development of departmental goals.
During my last 18 months at Highland Park, my primary scanning responsibilities were Nuclear Cardiology procedures.

SHEBOYGAN MEMORIAL HOSPITAL-Sheboygan, Wisconsin
1981-Present as Department Head of Nuclear Medicine
Responsibilities include:
Capital equipment and operating budgets
Purchasing for the department
Quality assurance
Inservices
Policy and procedure manual
Procedure development
Radioimmunoassay and scan procedures
Member of Radiation Safety Committee

CERTIFICATION

Certified Nuclear Medicine Technologist-ARRT

PROFESSIONAL AFFILIATION

Full member-Society of Nuclear Medicine.

PERSONAL INTERESTS

Camping, boating, skiing, golf, softball, fishing, hunting, traveling, bowling, remodeling old houses.

REFERENCES

Available upon request.

AVAILABILITY

Prefer not to relocate, but will if necessary.

VINCENT J. GALLAGHER

Address
1635 South Michigan #204
Villa Park, Illinois 60181

Telephone
Home: 495-9740
Work: 232-0771, Ext. 257

CAREER OBJECTIVE: Seeking a position in the field of health care administration that will enable me to utilize my education, experience, and interest in the field of health care, and allow for professional growth.

EDUCATION:

June 1984 - Masters Degree in Business Administration.
Concentration in Health Care and Finance.
Rosary College, River Forest, Illinois.

June 1982 - Bachelors Degree in Health Care and Management.
Sangamon State University, Springfield, Illinois.

June 1977 - Associate of Science
Nuclear Medicine Technology
Triton College, River Grove, Illinois.

May 1977 - Passed the Nuclear Medicine Registry exam given by the American Registry of Radiological Technologists.

WORK EXPERIENCE:

1982 to Present: Department Director, Nuclear Medicine, Community Hospital of Geneva, Geneva, Illinois. Manage daily functions of the department while directing a local program for teenagers interested in health care professions. Served as a designer and advisor for the College of Du Page Nuclear Medicine technology program as well as a Program Planner for Community Hospital.

1980 - 1982 - Staff Technologist, Nuclear Medicine, St.John's Hospital, Springfield, Illinois. Developed the protocol for new exams, while being responsible for the department billing, as well as staff duties.

1978 - 1980: Staff Ultrasound Technologist, B & W Diagnostics, Inc., Lombard, Illinois. Worked with approximately forty Chicago area hospitals, performing a variety of diagnostic imaging procedures, while teaching trainees, diagnostic ultrasound.

1977 - 1978: Staff Technologist, Nuclear Medicine, Lutheran General Hospital, Park Ridge, Illinois. Gained professional experience in Nuclear Medicine, along with being responsible for equipment evaluation of prototypes.

INTERESTS: Travel, Sports, Gourmet Cooking and Music.

REFERENCES: Available upon request.

THE AMERICAN REGISTRY OF RADIOLOGIC TECHNOLOGISTS

Representative of
The American College of Radiology and
The American Society of Radiologic Technologists

HEREBY CERTIFIES THAT

Vincent J. Gallagher

has pursued an approved educational program in Nuclear Medicine Technology, has met certain standards and qualifications and has passed the examinations conducted under authority of this Registry, and is thus qualified as a

Registered Technologist
Nuclear Medicine Technology

and by virtue of this certificate is authorized to use the title Registered Technologist and its abbreviation R.T. (ARRT) as long as this certificate is in force as is indicated by the current date appearing on the seal hereon attached.

Barbara M. Curtis R.T.
PRESIDENT

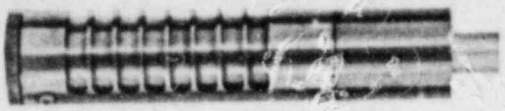
Dante DiLella R.T.
SECRETARY

N- 136257

1977

Control No. 774 30

Ludlum BETA-GAMMA DETECTORS

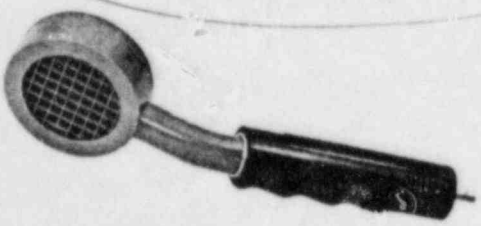


MODEL 44-6
THIN WALL GEIGER-MUELLER PROBE

The detector holder features a rotary beta shield with 1,000 mg/cm² stainless steel wall thickness.
OPERATING POINT: 900 volts.
DIMENSIONS: 1-3/16" diameter by 6½" long.
WEIGHT: 12 ozs.
WALL THICKNESS: 30 mg/cm² stainless steel.
EFFICIENCY FOR RADIUM 226: 1,700 counts per min. per MR/Hr.
QUENCH: Halogen.

MODEL 44-7
END WINDOW GEIGER-MUELLER PROBE

WINDOW: 1.4 to 2.0 mg/cm² mica.
WINDOW DIAMETER: 1-3/32" diameter.
WALL: 0.046 inches stainless steel, plus 0.062 aluminum holder.
MOUNTING: Aluminum holder.
DIMENSIONS: 1⅜" diameter by 5½" long.
WEIGHT: 10 oz.
Replaceable GM tube
Removable protective wire screen.



MODEL 44-9
PANCAKE GEIGER-MUELLER PROBE

WINDOW: 1.5 to 2 mg/cm² mica
WINDOW DIAMETER: 1.75"
MOUNTING: Aluminum holder, handle and window protector.
DIMENSIONS: 2¾" wide, 11" long 1.050" dia. Handle.
WEIGHT: 12 oz.

MODEL 44-1
BETA SCINTILLATOR

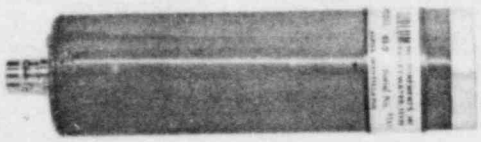
The beta scintillator is similar in performance to a 1.5 mg/cm² end window G. M. detector with the added advantage of lower gamma background and the ability to utilize discrimination. Carbon 14 detection is possible with reasonable gamma rejection.
DETECTOR: NE/102 plastic crystal, 0.01 thick. (thinner crystals on request)
WINDOW: 1 mg/cm² aluminized mylar.
EFFICIENCY: Function of discrimination setting.
DIMENSIONS: 6½" long by 2" diameter.
WEIGHT: 12 oz.

LUDLUM MEASUREMENTS, INC.
501 Oak Street • Sweetwater, Texas 79556 • Telephone (915) 235-5494
Printed in U.S.A.
12-1-80

Ludlum ALPHA DETECTORS

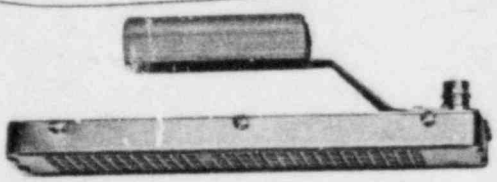
MODEL 43-1
ALPHA SCINTILLATION PROBE

SCINTILLATOR: ZnS(Ag)
WINDOW: 1 mg/cm² aluminized mylar.
COUNTING AREA: 4" diameter, approximately 75 cm² active area.
EFFICIENCY: At source spacing of 1/16" from window (PU239). 2 mg/cm² 30% of 2 pi emission; 1 mg/cm² 50% of 2 pi emission.
DIMENSIONS: 9½" long by 4½" diameter
WEIGHT: 1 lb. 12 oz.



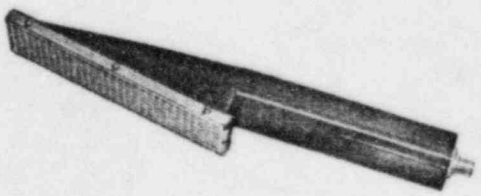
MODEL 43-2
ALPHA SCINTILLATION PROBE

SCINTILLATOR: ZnS(Ag)
WINDOW: 1 mg/cm² aluminized mylar.
COUNTING AREA: 1½" diameter (11.6 cm²).
EFFICIENCY: At source spacing of 1/16" from window (PU-239)50% of two pi emission.
DIMENSIONS: 6½" long by 2" diameter.
WEIGHT: 12 oz.



MODEL 43-4
AIR PROPORTIONAL ALPHA PROBE

WINDOW: 0.5 mg/cm² aluminized mylar.
ELECTRODES: 0.001" diameter platinum-tungsten alloy.
EFFICIENCY: 30% of 2 pi emission with source in contact with grill.
OPERATING POINT: 1.5 to 2.0 millivolt discriminator setting.
Voltage as follows: sea level—2100 volts; 3,500 feet—2000 volts; 7,000 feet—1900 volts.
SIZE: 2 inches by 9 inches by 5/8 inches thick.
WEIGHT: 9 ozs.



MODEL 43-5
ALPHA SCINTILLATION PROBE

SCINTILLATOR: ZnS(Ag)
WINDOW: 1 mg/cm² aluminized mylar.
COUNTING AREA: 50 cm² active area.
DIMENSIONS: Outside window 7¾" X 2¼" Length including handle 15"
WEIGHT: 2 pounds.

LUDLUM MEASUREMENTS, INC.
501 Oak Street • Sweetwater, Texas 79556 • Telephone (915) 235-5494
Printed in U.S.A.
12-1-80