J. G. Sylvester Associates, Incorporated
Metallurgical and Welding Consultants
Materials Testing

900 Hingham Street. · Post Office Box H. · Rockland, Massachusetts 02370-0607 · Telephone 617-878-9000

MS-12
F3

December 28, 1982

United States Nuclear Regulatory Commission
Region 1
631 Park Avenue
King of Prussia, PA 19406

Reference: (a) License No.: 20-17594.01
(b) Docket No.: 030-13024
(c) Control No.: 12155

Gentlemen:

This is in response to your correspondence dated September 9, 1982, concerning our application for license renewal. The numerical sequence of this reply shall follow that of your 9-9-82 letter.

1. The changes have been incorporated throughout the manual.
2. Changes were made on all pages.
3. Enclosed please find Mr. Clifford's resume.
4. Enclosed please find a copy of Mr. Clifford's license 06-12117-02 as amended

Should you desire any additional information, please contact us.

Sincerely,

Dennis C. Yeaton
Dennis C. Yeaton
General Manager

DCY/el

A-11

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RADIATION PROTECTION PROGRAM

General

The radiation protection program at J.G. Sylvester Associates, Inc. for the specific use of open source byproduct material for metallurgical, failure analysis, and non-destructive examination shall consist of four discrete sections.

Section I shall embody responsibility for control of byproduct material and personnel qualifications of the individuals charged with this control.

Section II shall consist of a course in Health Physics as related to our specific work requirements; and in direct compliance with Title 10, Chapter 1, Code of Federal Regulations; NRC, Parts 19, 20, 30, and 31.

Section III will consist of a detailed policy statement regarding all work performed in our Hot Lab, mandatory requirements for Hot Lab personnel, and emergency decontamination procedures, as well as a description of permanent Hot Lab facilities, Section III will also be explained and read by all personnel taking the Health Physics course.

Section IV will consist of our routine policy for Hot Lab inspection, air sampling, swipe testing and hood exhaust monitoring.

Section I

1. The following persons are directly responsible for overall radiation protection in the use of byproduct material by J.G. Sylvester Associates, Inc.

   (1) Dennis C. Yeaton, General Manager and Radiation Safety Officer.
   (2) Frank Clifford, Radiation Safety Consultant.

   Mr. Yeaton is the General Manager of the corporation and shall be responsible for the overall operation of the radiation protection program.

Mr. Frank Clifford has been retained to act as Radiation Safety Consultant for hot laboratory operations All hot lab operations will be conducted under the direct control and SURVEILLANCE of Mr. Clifford with the following exceptions:

(a) Materials may be received, surveyed and stored in our Hot Lab by the following person.

Dennis C. Yeaton

It shall be required, however, that these materials remain packaged and unopened until Mr. Clifford is physically on the premises, who can then supervise and control the opening, surveying and handling of these materials.

(b) After these materials have been packaged for shipment and properly surveyed by Mr. Clifford, they may be stored or shipped by Mr. Yeaton.

2. Authority to issue or change operating procedures involving safety and disposition of radioactive material is vested with Mr. Clifford.

Qualifications of Radiation Safety Officer

Mr. Yeaton has over nine years of experience as an industrial radiographer with J.G. Sylvester Associates, Inc. and he is presently General Manager of the corporation. He has also studied and been given radiation safety training pertinent to industrial radiography in excess of 120 hours. He has also studied and been given 40 hours of intensely specialized training in handling open source materials, radioactive waste disposition, health physics control procedures in a radiological environment, and mathematical calculations basic to the use and measurement of radioactivity.

Duties of Radiation Safety Officer

a. To ensure that the use of radioactive material is by or under the direct supervision of individuals specifically listed on your license.
b. To ensure that all users (where appropriate) wear personnel monitoring equipment when using radioactive materials.
c. To ensure that radioactive materials are properly secured against unauthorized removal at all times when not in use.
d. To perform routine inspections of all laboratories using or storing radioactive materials.
e. To ensure that the terms and conditions of the license are met, and that all required records are maintained.

Section II

Health Physics Course for Open Source Byproduct Material

The training required for the personnel who work in the Hot Lab shall consist of first, satisfactory completion of the health physics course for radiographers which is part of USNRC Materials License No. 20-00302-02 (included as attachment #1 of this document) and second, the satisfactory completion of the following training course:

I. Contamination Control

a. Surface contamination
b. Airborn contamination
c. Protective clothing
d. Frisking
e. Swipe tests and measurement
f. Airborn sampling and measurement
g. Removal of contamination
h. Control of spills
i. Waste disposal

II. Laboratory Operational and Emergency Procedures

a. Work permits
b. Air filteration
c. Alarms and instrumentation
d. Emergency instruments

Section III

Health Physics Regulations

The hot lab will be considered "hot" whenever any open byproduct material is in the lab. Once byproduct material has been opened, the lab shall be considered hot until the following surveys and operations are completed and audited by the Radiation Safety Consultant.

1. All open byproduct material resealed in plastic containers or drums.

2. All hot lab surfaces are cleaned and swipe surveys indicate no contamination levels in excess of .01 uCi/100cm^2.

3. No areas exist which if any individual were continuously present in the area, could result in his receiving a dose in excess of 2 millirems in any one hour or 100 millirems in any seven consecutive days.

4. Hood exhaust filters, both particulate and charcoal, are monitored individually and when a survey indicates a level of radiation greater than 100 cpm above background the filters will be replaced.

When the lab is hot, the following regulations shall be in force to prevent exposure or contamination of hot lab workers, the general public and the environment.

1. There will be no mouth operations, specifically no mouth pipetting, eating, smoking, drinking, or chewing gum or candy. None of these items will be permitted in the lab.

2. Personnel will change street clothing, as required by work permit before entering the hot lab.

3. Personnel monitoring devices may be worn under coveralls, except for wrist badges and finger rings which will be covered by gloves when specified by the work permit.

4. Before entering the hot lab, the exhaust blower for the hooded areas will be placed on the high speed.

5. Metallurgical examination of samples prepared in J.G. Sylvester Assoc., Hot Lab facility.
After preparing by cutting and polishing in the hot lab area, the samples are taken to the regular lab on trays covered with absorbent paper.
The samples are photographed, tested for hardness, mounted in clear plastic and photographed in the optical microscope and scanning electron microscope.
In some instances, specimens may be tensile tested, and in the case of non-contaminated radiation, samples may be tested by dye penetrant, magnaflux, or zyglo. Some samples are also radiographed.
The only test performed outside the sample preparation room are non-destructive. All handling is performed using gloves, gowns, etc.
Normally to only liquid waste generated are decontamination solutions.

6. Anyone who has an open wound of any kind must check with the Radiation Safety Consultant to determine whether any special precautions are necessary.

7. A radiation work permit must be obtained from the Radiation Safety Consultant before access to the hot lab is granted.

8. Any injury in the hot lab must be reported at once to the Radiation Safety Consultant. If the injury is of minor nature, work will be allowed to continue at the descretion of the Radiation Safety Consultant, however should it be serious in nature, written approval from the corporate physician must be obtained prior to returning to work. In the event of a serious injury, the co-worker will aid the injured to the access room and immediately summon assistance via the intercom, describing the nature and the extent of the injury. In such a case normal decontaminating procedures may be abandoned, the life of the injured will take priority; however a co-worker may institute decontamination procedures while awaiting the ambulance. After the injured has been removed, the co-worker shall monitor all equipment, floors, benches, himself as well as the access area for contamination. He will then write a detailed summary of the incident. No further work will be permitted in the hot lab until the cause of the accident is determined and eliminated.

9. Upon leaving the hot lab all personnel shall be monitored; hands, forearms, body and feet. All protective clothing shall be removed and put into hot waste drums. If after removing protective clothing, contamination is still present, the contamination areas will be washed and scrubbed until the contamination is removed.

10. Upon leaving the access area, all personnel will again be monitored as a double check paying particular attention to hands and feet.

11. When personnel have assured themselves that they are "cold", they will close and secure hot lab door. They will also return the hood exhaust blower to normal speed.

12. All monitors, alarm systems, and the exhaust blower shall be left on 24 hours per day, while cell is hot (open by-products in lab).

13. All liquid "hot" waste from decontamination shall be poured into 1 (one) gallon plastic bottles filled with "floor dry" or some other absorbent approved by the Radiation Safety Consultant. When these bottles are filled (the absorbent material is saturated) they will be caped off with their twist tight plastic top and placed individually inside a 3 mil. thick plastic bag whose top will then be secured. At this point they may be placed into the hot waste drum.

14. All hot waste drums must be lined with a 6 mil. thick plastic bag.

15. When a hot waste drum is full the liner will be sealed with wire and before the cover is locked on, the barrel must be swipe tested over its entire surface to check for removable contamination. Following this, a survey meter must be placed in contact with the sides and top of the barrel to check that it is no more than 2 mr/hr at these contact points. Should the level be in excess of 2 mr/hr the drum must be stored in a locked and posted storage area.

16. A yellow tag, indicating the isotope (s), amounts and date is then taped to the barrel top.

17. The barrel may now be removed from the hot lab to the storage area for pickup by Interex Corporation or other NRC licensed disposal services.

18. All hot lab personnel shall have their film badges changed monthly.

19. A Dosimeter log shall also be maintained in which all hot lab personnel shall record their dosimeter reading at the end of each work day. Dosimeters shall be recharged at the commercement of each work day.

20. All hot lab personnel are required to undergo physical examination as directed by the corporate physician.

21. The corporate physician may institute any additional tests and bio-assay procedures that he deems necessary and appropriate.

22. An air quality sampling log shall be maintained by the Radiation Safety Consultant, in which records of routine hood exhaust filter changes, and air quality particulate filter assays will be recorded as specified in Section IV.

23. Radiation work permits must be turned into the Radiation Safety Officer immediately upon completion of each analysis. Sample A2 "Radiation Work Permit" is on the following page.

24. In the event of a spill, spread of contamination, sounding of radiation or air flow alarm or any other emergency, secure and evacuate laboratory. Notify the R.S.O. who will assist the Consultant in evacuating the situation and correcting the problem area. Recovery and or clean up of the operation will be concluded as conditions warrant.

25. <u>Procedures for Receiving, Opening Packages, and Shipping Packages Containing Radioactive Materials</u>:

    A. Upon notification by the carrier, all incoming packages will be inspected as soon as practicable, but no later than three hours upon arrival from the carrier. Specifically the Radiation Safety Officer, or designated, will monitor all the surface of the package for leakage, furthermore, the package will be swipe surveyed over the surface of at least 100^2Cm to check for contamination. These monitoring procedures must be performed and entered in the Material Inventory Log within three hours after receipt of the package. If the package arrives after normal working hours the Radiation Safety Officer must be notified immediately and the monitoring procedures must be carried out within 18 hours after receipt.

If there should be removable contamination in excess of .01 microcuries (22,000 dpm) per 100 cm^2; or if the radiation levels are found on the external surface of the package in excess of 200 mr/hr or at three feet from the external surface of the package in excess of 10 mr/hr, the Radiation Safety Consultant shall immediately notify the final delivery carrier and by telephone, telegram or mailgram notifying the Nuclear Regulatory Commission Inspection and Enforcement Regional Office at 215-337-5000, daytime, nights, and holidays, address:

Region 1
USNRC Office of Inspection and Enforcement
631 Park Avenue
King Prussia, PA 19406

B. Once these initial surveys are made and logged in, the packaged may be brought into the hot lab where one individual will carefully remove the packed radioactive material, while a second individual will monitor both the radioactive material as well as the shipping containers for contamination. This procedure will be observed by the Radiation Safety Consultant to insure compliance with Health Physics Regulations. Any Contaminated packing material will be disposed of as radioactive waste.

C. In preparing radioactive material for shipment, it will be packaged in accordance with current D-O-T regulations. The shipping container will be sealed and monitored to insure there is no removable contamination in excess of .01 microcuries (22,000 dpm) per 100 Cm^2 or external radiation levels in excess of 200 mr/hr at contact and 10 mr/hr at a distance of 3 feet from any external surface. Required D-O-T labels will be affixed to each side of the shipping containers indicating the isotope, number of curies and transport index. Only after this information is recorded in the material inventory log may material be shipped.

RADIATION WORK PERMIT

A. Required Information:

1. Person (s) to Whom Issued: _____
2. Date: _____
3. J.G.S. Job Number: _____
4. Expected Duration of Analysis: _____
5. Approximate Level of Radioactivity to be Handled: _____
6. Expected Isotope (s) to be Handled: _____
7. Special Safety Precautions: _____
8. Type of Analysis Requested: _____
9. Special Equipment Needed if Any: _____

_____

_____
Radiation Safety Consultant

B. Operational Check List

1. Personnel Monitoring Devices Worn: _____
2. Personnel Protective Clothing Worn: _____
3. Hood Exhaust on High: _____
4. Air Sampling Devices Functioning: _____
5. Survey and Monitoring Instruments Functioning: _____
6. Dosimeters Logged in and Reset: _____
7. Closed Circuit Television Manned and Operational: _____
8. Intercom Functioning:

C. Special Conditions, Incidents or Remarks:

_____

BY-PRODUCT MATERIAL INVENTORY LOG

A. Current Material in House

1. Amount (s): _____
2. Isotope (s): _____
3. Date: _____
4. Client Corporation (s): _____
5. J.G.S. Job Number: _____
6. Status: check one _____ incoming _____ in process _____ outgoing
7. Status: check one _____ incoming _____ in process _____ outgoing

B. Incoming By-Product Material

1. Date: _____ J.G.S. Job Number _____
2. Time of Arrival _____
3. Name of Final Carrier and Telephone No. _____ # _____
4. Incoming Radiation Survey:
   below 200 mr/hr contact level _____
   below 10 mr/hr at 3 feet level _____
   below .01 uCi/100 cm _____
   Time of survey _____

Remarks: _____

_____

_____
Radiation Safety Consultant

C. Outgoing By-Product Material

1. Date: _____ Time: _____ J.G.S. Job Number _____
2. Destination: _____
3. Pick-up Carrier: _____
4. Exit and Packing Inspection:
   below 200 mr/hr contact level _____
   below 10 mr/hr at 3 feet level _____
   packing inspection correct _____
   DOT Lable _____
   Exit Survey _____

D. Radioactive Waste

1. Amount: _____
2. Date of Pick-up: _____
3. Isotope (s): _____
4. J.G.S. Job No.: _____
5. Weight: _____
6. Client Corporation: _____
7. D-O-T Class 7 Level III Labels Affixed: _____
8. "Radioactive" Stenciled on properly: _____
9. Barrel Monitored and Radioation Level at Contact Below 2 mr/hr: _____
10. No removable contamination on surface: _____
11. Liner and locking collar secured: _____
12. Name of NRC Licensed Disposal Service _____
    (If different than Interex Corporation)
13. License on File: _____

Air Quality Sampling Log

Date_____ Time_____ Background cpm_____

Note: Net cpm=gross cpm - bkg cpm

Particulate Filter #1 (daily) Gross cpm_____ Net cpm_____

Particulate Filter #2 (daily) Gross cpm_____ Net cpm_____

Roof Final Hood Exhaust Particulate Filter (weekly) Gross cpm_____ Net cpm_____

Interior Charcoal Exhaust Filter (weekly) Gross cpm_____ Net cpm_____

Interior High Efficiency Exhaust Filter (weekly) Gross cpm_____ Net cpm_____

Interior Hood Exhaust Total Filters last changed on date:_____

_____
Radiation Safety Consultant

Section III-2

Exposure of Individuals in Restricted Areas

1. Maximum Permissible Dose per Calender Quarter

Condition of Exposure	mrems/Quarter
Whole Body	1,250
Head and Trunk	1,250
Active blood forming organs	1,250
Lens of eye	1,250
Gonads	1,250
Hands and Forearms: feet; ankles	18,750
Skin of whole body	7,500

Note: Any dose in excess of the above limits shall be considered unacceptable and indicative of poor health physics hygiene and neglect in using proper shielding.

2. Special Operating Conditions

a. An individual may be allowed to received a dose to the whole body greater than the above table provided:

(1) During any calendar quarter the whole body dose shall not exceed 3000 mrems.

(2) The whole body dose, when added to the accumulated occupational dose to the whole body shall not exceed, 5 (N-18) Rems where N= individuals age at last birthday

(3) The accumulated occupational whole body dose shall be calculated on Form NRC-4.*

(4) Permission to operate up to this level is received from both the Radiation Safety Officer, President of the corporation, and Corporate Physician.

Note: Determination of accumulated dose shall be in accordance with CFR Title 10, Chapter 1, Part 20, Paragraph 20.102.

Section III-3

Description of permanently established Hot Lab and Access Area

1. J. G. Sylvester Associates, is located at 900 Hingham St., in Rockland, Massachusetts. The firm leases approximately three acres of land upon which a one story combination concrete and concrete block building stands. This building is centrally located and has approximately 7500 square feet of floor space of which approximately 200 square feet is built and shielded for the use of radioactive by-product open source material.

   The radioactive by-product open source material area described on Sketch 1 as the "Hot Lab" shall be considered a high radiation area, it's adjacent "Access Room" shall be considered a Radiation area.

   The hot lab has a concrete floor poured directly on the earth beneath, and all the walls are 12" thick solid concrete block which stand 12 foot high. The roof is of conventional wood and tar construction. No access is possible to the roof except by use of an outside ladder. The door to the hot lab is constructed of 1 1/2" standard solid steel.

   The door is equipped with a coded simplex locking mechanism on the outside to prevent unauthorized entrance. The hot lab is equipped with a ventilation exhaust system described as follows: A two speed high volume exhaust blower is mounted on the roof, from this blower a 12" duct runs perpendicularly into the hot lab. At 90° from this 12" master duct, twenty-one feet of 12 inch duct are laid across the hot lab interior ceiling in an "L" shape. From this horizontal ducting six 6" 90° feeder ducts are located at equal distances to provide uniform suction throughout the hooded enclosures. Before the horizontal ducting meets the master duct a 24" x 24" filter-box assembly is located; which contains charcoal, high efficiency and perspex particulate filters to assure complete removal of any possible contaminates.

   The hot lab is equipped with a victoreen Model 808D monitor alarm. The alarm housing is mounted on the exterior access wall, while the probe assembly is mounted on the interior of the hot lab. The present alarm level is fixed on 25 mr/hr. The victoreen Vamp 808D allows visual metered determination (up to 1R) from the outside of the laboratory.

   Should the radiation level within the hot lab rise over 25 mr/hr, both an audible and visual alarm are tripped and remain so until the reset switch is activated. In addition, above the Model 808D is a Fisher "Lab-Larm" hood exhaust monitor alarm consisting of both audible and visual alarm signals which are accuated if the hood exhaust velocity drops more than 10% of it's present value. Specifically the exhaust hoods in the Hot Lab pull 300 linear feet per minute (LFM); if the valve dropped to 270 LFM the alarm system would be triggered and the working personnel in this area would be made immediately aware of the potential hazard and be able to suspend their operations until the problem was corrected.

Both laboratory benches are designed (see sketch #1) with sliding plexiglass panels 48" x 48" so that both ease of access to equipment and maximum shielding and containment is afforded. The benches are all sealed and painted with acrylic coatings to aid in decontamination procedure. The sample preparation bench is equipped with accordian gloves and sleeves.

For shielding purposes twenty-five, 8" x 4" x 2" lead bricks are available as well as 200, 8" x 4" x 2" solid high density concrete bricks which can be arranged in any configuration necessary to provide maximum shielding capability. Furthermore, two 12" high, 9" diameter, 1/2" thick lead pigs are also available for storage purposes.

For sets of 24" grip tongs are provided for close-in handling of small objects, while for materials of greater size a five foot master remote handling tool is present, along with six assorted interchangeable jaws capable of lifting up to eighty pounds of handling a 10 ml. beaker adroitly.

Section IV

Facility, Equipment and Environment Inspections

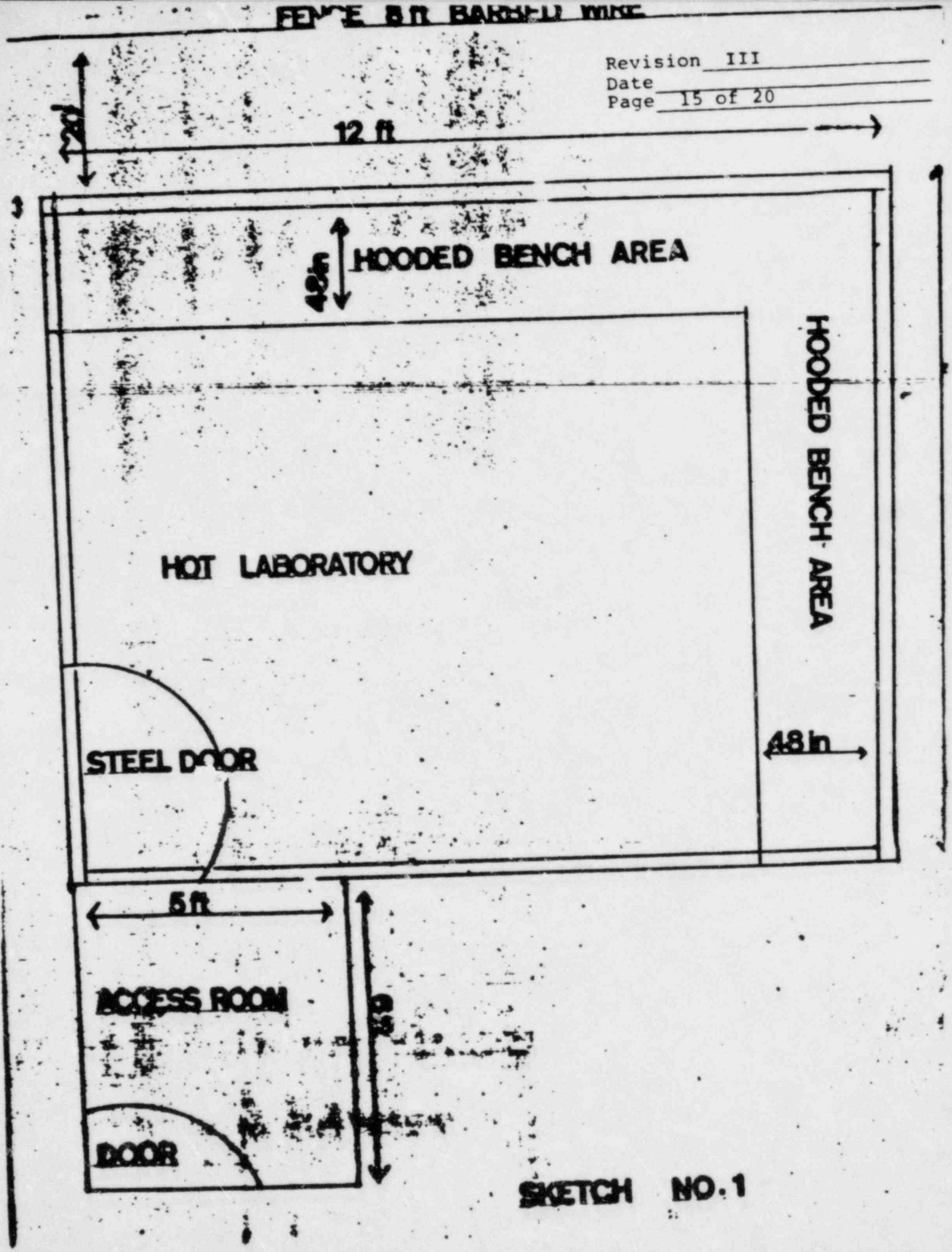
1. Hot Lab inspections will be conducted by the Radiation Safety Consultant upon completion of every analysis. The inspection will consist of an area survey and swipe survey. Any contaminated surfaces will then be deconaminated if possible. If it is not possible or practicable the contaminated surface shall be considered radioactive and permanently marked with a yellow circular tag or disposed in accordance with these procedures.

(10)

During hot lab major work operation, air sampling will be performed in the lab and the discharge of the hood exhaust filter assembly for radioactivity. Major work operations are considered to be opening sealed containers, machining, sawing, cleaning and any decontamination procedures. This will be accomplished using a low volume air sampling which draws air through a filter paper. The consentrations shall be based on 10 CFR 20.103 and 20.106. The results of these tests will be recorded in an air quality sampling log maintained in and by the Radiation Safety Officer.

(8)

Periodically, hood exhaust filters, both particulate and charcoal will be monitored individually and when a survey indicates any level of radiation greater than 100 cpm, the filters will be replaced. The old filters will be considered radioactive waste and disposed accordingly. If within a twelve month period no radioactivity is detected, all filters will be considered radioactive waste and disposed of as radioactive waste. A recorded entry of such a change will be made and maintained in the air quality sampling log.


12 ft
12 ft
42 in
HOODED BENCH AREA
HOT LABORATORY
HOODED BENCH AREA
48 in
STEEL DOOR
5 ft
ACCESS ROOM
DOOR

SKETCH NO. 1

RADIATION SAFETY TRAINING PROGRAM

Subject	Assistant Radiographer	Radio-Grapher	Recurrent Training
I. Introduction			
A. "Introduction" Film Strips	1/2 hr.	0	0
B. General Principles of Penetrating Radiation	1/4 hr.	1/4 hr.	0
C. Relationship of Penetrating, Radiation, Radiography and Radiometry	1/4 hr.	0	0
D. Areas of Application	1/2 hr.	0	0
II. Principles and Characteristics of Xray and Gamma Radiation			
A. "Origin of Penetrating Radiation" Film Strip	1/2 hr.	0	0
B. Nature of Penetrating Radiation (all types briefly, Xray, and Gamma detailed)	1 hr.	1 hr.	1/4 hr.
1. Particles			
2. Wave properties			
3. Electromagnetic waves			
4. Electrical theory of matter			
5. Fundamentals of radiation physics			
6. Sources of radiation:			
a. Electronic			
b. Isotope			
C. Interaction between penetrating radiation and matter.	2 hr.	1 hr.	1/2 hr.
1. "Radiation Characteristics and Interactions with Matter" Film Strip			
2. Absorption			
3. Scatter			
4. Pair production			
5. Photoelectric effect			
6. Other secondary emission			
D. Radiography	1/4 hr.	1/4 hr.	0
1. Imaging by film			
2. Imaging by flourescent materials			
3. Imaging by electronic devices			

Subject	Assistant Radiographer	Radio-Grapher	Recurrent Training
III. Radiation Sources			
A. Electronic Sources	2 hr.	1 hr.	1 hr.
1. "Xray Equipment and Generation of Xrays" Film Strip 2. Xray sources: a. Generators and tubes as an intergrated system b. Electron sources: Cold cathode Hot cathode Beam focusing Field emission Other c. Targets: Material Configuration Heat dissapation d. Equipment design consideration Generating wave shape Window design Duty cycle R. output Tube shielding			
B. Isotopic Sources	4 hr.	1 hr.	1/2 hr.
1. "Gamma Ray Sources and Equipment" Film Strip 2. Gamma a. Types b. Spectra c. Activity including self absorption d. Handling 3. Beta 4. Brehmstralung 5. Neutron 6. Practical demonstration of equip.			
IV. Units of Radiation	1 hr.	1/2 hr.	1/4 hr.
A. Radiation dose (MREM) 1. Discussion of cumulative effect 2. Discussion of units of measurement			

Subject	Assistant Radiographer	Radio-Grapher	Recurrent Training
B. Radiation Activity (curies)	1 hr.	1/2 hr.	1/4 hr.
1. Discussion and contrast of energy and activity 2. Units of measurement			
C. Measurement of MREM and curies	2 hr.	1 hr.	1/2 hr.
1. Show film strip #5 "Radiation Safety"			
2. Discussion of principles of operation of survey meters a. Demonstrate operation of survey meter b. Discuss the units of radiation (MR) measured c. Calibration procedures d. Limitations of survey meters			
3. Discussion of use of film badges a. How to wear b. When to replace c. Units measured	1/2 hr.	1/4 hr.	1/4 hr.
4. Discussion of dosimeters and pocket chambers a. Principle of operation b. Where to wear c. How to read d. Units of information (MR) e. When to recharge f. Required records g. Note, when off scale, film badge to be developed	1 1/2 hr.	3/4 hr.	1/4 hr.
5. Discussion of accidental exposure to film badge or dosimeter while not actually exposing individual a. Required written report	1/4 hr.	1/4 hr.	1/4 hr.
V. Health Hazards of Radiation	1/2 hr.	1/4 hr.	1/4 hr.
A. Discussion of normal absorbed radiation from the sun			
B. Over exposure of radiation to the individual			
1. Effects a. No immediate sensations b. Genetic ramifications			

Subject	Assistant Radiographer	Radio-Grapher	Recurrent Training

c. Radiation burns, internal & external
d. Unknown effects-dicussion
e. Discussion of cumulative effects

C. Protection from radiation (time, distance, shielding) — 3 hr. — 3 hr. — 1 1/4 hr.

1. Distance

a. Discuss inverse square law and do problems

2. Time

a. Discussion and work out formulas

3. Shielding

a. Density characteristics of material
b. Half value layer of materials
c. Natural barriers such as earth, buildings, water
d. Geometric principles
e. Radiation is emitted in all directions-discussion
f. Collimators-discussion

4. Discussion of combination of methods with examples and open class discussion and solving problems

VI. Radiation Surveys — 2 hr. — 1 hr. — 1/2 hr.

A. Discussion of how to perform surveys
B. When surveys are required

1. Entering vault
2. receiving source containers and projectors
3. During each exposure
4. After each exposure

a. Emphasis on correct technique

5. After locking up source
6. Before and after transit
7. Records required

	Subject	Assistant Radiographer	Radio-Grapher	Recurrent Training
	C. Leak test surveys	1 1/2 hr.	1 hr.	1/2 hr.
	1. Use of equipment 2. How to perform 3. Required frequency 4. Required records			
VII.	Review, Discuss and Study Federal Regulations 10 CFR Parts 19, 20, and 34	6 hr.	3 hr.	2 hr.
VIII.	Review, Discuss and Study J.G. Sylvester Associates "Administrative Control and Radiological Protection Procedures" latest revision	4 hr.	2 hr.	1 hr.
IX.	Give Written, Oral, Practical Demonstration Exam			
	TOTAL HOURS	34.5	18	9.5

Frank L. Clifford Associates
Niantic, Connecticut

1. Title: President: Part Time 1966 to 1972 : Full Time: 1972 to date.

2. Nature and extent of Responsibilites

A. (1) Radiation Training and safety consultant services to numerous clients.

(2) Conduct NRC approved training courses and certify personnel in safety requirements for users of byproduct material and radiation producing equipment.

(3) Previously possessed USAEC Byproduct Material License 06-12117-01.

(4) Presently posseses USNRC Byproduct Material License 06-12117-02.

B. Radiation Detection Instrument Repair and Calibration.

(1) Repairs, adjustments and calibrations of most radiation detection instrumentation for numerous clients.

C. Radiographic equipment inspection and maintanence.

Gamma Industries, Inc.
Baton Rouge, LA.

1. Title: Regional Manager January 1970 to October 1972.

2. Nature and extent of Responsibilites

A. Supervision of sales, service an engineering in a 14 state area.
(1) Duties included equipment repair, source exchanges, source recovery and equipment maintainence.

Frank L. Clifford

General Dynamics/Electric Boat
Groton, Connecticut

Title: Chief Radiation Protection Officer
September 1961 to February 1970

Nature and extent of Responsibilites

A. Supervise the radiation protection program for 220 Certified Radiographers and responsible for the following:

(1) Serve as the Licensee's liaison officer with the Atomic Energy Commission on license matters.
(2) Supervise control of procurment and disposal of licensed byproduct material.
(3) Develop and maintain up-to-date operating and emergency procedures. Ensure compliance with these procedures.
(4) Establish and supervise personnel monitoring program.
(5) Procure and maintain adequate radiation survey instruments.
(6) Supervise the AEC training program for radiographers and radiographers' assistants.
(7) Establish and Maintain adequate storage facilities.
(8) Supervise maintanence of exposure devices, radiography facilities and associated equipment.
(9) Coordinate the leak testing program.
(10) Supervise the internal inspection program both at GD/EB, Groton and at all field sites.
(11) Ensure proper source tagging operations.
(12) Conduct quarterly inventories and maintain utilization logs.
(13) Supervise survey instrument calibration program.
(14) Assume control and institute corrective action in emergency situations.
(15) Investigate cause of incidents and determine necessary preventive action.
(16) Act in advisory capacity to licensee's management and radiography personnel.

B. Conduct courses of instruction for reactor test Engineers in the following subjects:

(1) Radiological control for naval nuclear propulsion plants.
(2) Radiochemical controls for naval nuclear propulsion plants.

C. Member of the Radiological Guidance Committee. This committee in an advisory capacity of management in establishing policy for handling radiation and contamination problems.

Frank L. Clifford

U.S.N. Nuclear Power School
U.S.N. Submarine Base, New London, Connecticut

1. Title — Nucleonics Laboratory Instructor
September 1959 to August 1961

2. Nature and Extent of Responsibilities

A. As a principal user of A.E.C. byproduct license, I was responsible for overall control, movement, storage, and disposition of all radioactive material in the laboratory. I made up suitable samples for training of Medical Officers and other Medical Personnel in techniques of Radiochemistry, Health Physics and Photodosimetry.

B. Taught Basic Radiological Control course of Medical Officers and USN Line Officers.

C. The following is a list of experiments supervised by me as part of the training program:

(1) G-M counter scaler check, 60 cycle test, high voltage test, and G-M tube operation.
(2) Counting statistics. Demonstrating the statistical variation in counting.
(3) Geometry factors of Beta and window counters.
(4) Backscatter. Effect of "z" number and thickness of backscatter and source energy on sample count rate.
(5) Efficiency vs endpoint energy.
(6) Photodosimetric film calibration.
(7) Beta absorption, P-32. Plot a Beta absorption curve and determine the true zero count rate.
(8) Radioactive Air sampling techniques, portable equipment.
(9) Sample preparation and decay study of Iodine -131.
(10) Radioassay of I-131.
(11) Feather analysis. Determination of beta particle range and energy by the use of a net beta absorption and the feather analyser.
(12) Potable water activity. Determination of potable water activity, technique and calculations.
(13) Portable alpha water survey instruments. Operation, maintenance and calibration procedures.
(14) Portable Beta-gamma survey instruments. Operation maintenance and calibration procedure.
(15) Radioisotope sample preparation. Decay curve plot and half-life determination of mixed isotopes. Separation of the two independent decay curves and determination of the half-lives.
(16) Photodosimeteric film practice. Developing techniques.
(17) Photodosimeteric film practice. Reading and interpreting.

Frank L. Clifford

USS Nautilus
And
USS Skipjack
Fleet Post Office
New York, New York

1. Title January 1957 to March 1958 Nautilus, Health Physics Dept.
March 1958 to September 1959 Skipjack, Health Physics Dept

2. Nature and Extent of Responsibilities

A. Qualified in the following tests and procedures

(1) Reactor primary coolant radiochemistry
(2) Boiler water gross activity
(3) Reactor fresh water gross activity
(4) Potable water samples for gross activity
(5) Enviromental Monitoring
(6) Personnel Monitoring
(7) Instrument Calibration
(8) Decontamination
(9) Photodosimetry

B. From March 1958 to September 1959, I performed the following duties:

(1) Directed the training and work of a staff of 3 Hospital Corpsmen in their duties in connection with the tests and procedures listed above.
(2) Verified the results of all radiochemical analyses necessary for the operation of the reactor.
(3) Established and administered a training program in Radiological Health Theory and Techniques for monitors and radiation casualty teams.
(4) Conducted inspections and supervised monitoring of all areas concerned with nuclear repair and maintenance.
(5) Supervised the photodosimetry program.
(6) Calibrated radiac equipment, dosimeters and film badges.
(7) Supervised Health Physics of Handling, processing, packaging and disposal of radioactive waste.
(8) Established radiological controls during reactor maintenance operations.

Frank L. Clifford

Educational Background

1. U.S.N. V-12 Program
   Harvard University
   1943 and 1944
   Major-Physics

2. U.S.N. Submarine Medicine School
   New London, Connecticut
   1951
   Subjects:
   A. Medical Administration
   B. Medical Diagnostics
   C. Anatomy & Physiology
   D. Materia Medica
   E. Minor Surgery
   F. Diving Physiology

3. U.S.N. Medical School
   Bethesda, Md.
   1955 to 1956
   Subjects:
   A. Radioisotope Therapy
   B. Chemistry
   C. Math
   D. Physics
   E. Radiochemistry
   F. Radiobiology
   G. Radiation Therapy

4. U.S.N. Nuclear Engineering School
   New London, Connecticut
   1956 to 1957
   Subjects:
   A. Radiological Controls
   B. Nuclear Plant Systems
   C. Nuclear Physics
   D. Mathmatics
   E. Reactor Principles
   F. Health Physics
   G. Radiochemistry
   H. Radiobiology
   I. Radiochemical Laboratory Technique

5. Various extension and correspondence courses.