DL-102494_01

GENICOM

GENICOM CORPORATION
1 GENICOM DRIVE WAYNESBORO VA 22980-1999
PHONE 703 949 1000 • TELEX II 710 839 0407

October 24, 1994

Nuclear Materials Licensing Section
U.S. Nuclear Regulatory Commission, Region II
101 Marietta Street NW, Suite 2900
Atlanta, Georgia 30323-0199

Dear Sir,

Attached is the NRC form 313, "Application for Material License", to renew license no. 45-06589-1. This license is for:

GENICOM Corporation
1 Genicom Drive
Waynesboro, VA 22980-1999

I ask that the following changes be noted:

- We request that the license for Krypton-85 gas be reduced from 450 curies to 50 curies. At no time, since the original license have there been more than 50 curies of Krypton-85 on-site.

- We have replaced the Consolidated Electrodynamic Corporation model C2D20 radiflo unit and the Radiflo Mark IV unit with a single Radiflo Radiflo Mark V unit for leak testing of parts and components.

I have sent the monies for renewal, $2,496.50 and one copy of the documentation to U.S. NRC P.O. Box 954514, St. Louis, MO.

I have sent the original application and one copy to the above address in Marietta, Georgia.

Sincerely,

G.F. Peltier
Director Relay Engr'g. & Q.A.
GENICOM Corporation
1 Genicom Drive
Waynesboro, VA 22980-1999
(703) 949-1162

256195

NRC FORM 313 (6-93)
10 CFR 30 32 33 34 35 36 39 and 40

U. S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0120
EXPIRES 6-30-96

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 9 HOURS. SUBMITTAL OF THE APPLICATION IS NECESSARY TO DETERMINE THAT THE APPLICANT IS QUALIFIED AND THAT ADEQUATE PROCEDURES EXIST TO PROTECT THE PUBLIC HEALTH AND SAFETY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0120), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

APPLICATION FOR MATERIAL LICENSE

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

LICENSING ASSISTANT SECTION
NUCLEAR MATERIALS SAFETY BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION II
101 MARIETTA STREET, NW, SUITE 2900
ATLANTA, GA 30323-0199

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
801 WARRENVILLE RD
LISLE, IL 60532-4351

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-8064

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

NUCLEAR MATERIALS SAFETY BRANCH
NUCLEAR REGULATORY COMMISSION, REGION V
1450 MARIA LANE
WALNUT CREEK, CA 94596-5368

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR (Check appropriate item)
   - [ ] A. NEW LICENSE
   - [ ] B. AMENDMENT TO LICENSE NUMBER
   - [x] C. RENEWAL OF LICENSE NUMBER 45-06589-1

2. NAME AND MAILING ADDRESS OF APPLICANT (Include ZIP code)
   GENICOM Corporation
   1 Genicom Drive
   Waynesboro, VA 22980-1499

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED
   GENICOM Corporation
   1 Genicom Drive
   Waynesboro, VA 22980-1999

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION
   Gary F. Peltier

   TELEPHONE NUMBER
   (703) 949-1162

SUBMIT ITEMS 5 THROUGH 11 ON SEPARATE PAPER. THE TOPIC AND ITEM NUMBER SHOULD BE INDICATED IN THE LICENSE APPLICATION GUIDE.

5	RADIOACTIVE MATERIAL a. Element and mass number; b. Chemical and physical form; c. Maximum amount which will be possessed at any one time	6	PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED
7	NAME(S) AND RESPONSIBILITIES OF RADIATION SAFETY OFFICER (RSO) AND TRAINING AND EXPERIENCE	8	TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS
9	FACILITIES AND EQUIPMENT	10	RADIATION SAFETY PROGRAM
11	WASTE MANAGEMENT	11	FEE CATEGORY: 3P AMOUNT ENCLOSED: $2,496.50

12. CERTIFICATION (Must be completed by the applicant) I understand that all statements and representations made in this application are binding upon the applicant.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 2 CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39, AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948, 62 STAT. 749, MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFYING OFFICER (Type/Print) NAME AND TITLE	SIGNATURE	DATE
Gary F. Peltier, Dir. Relay Engr'g. & Q.A.		

FOR NRC USE ONLY

TYPE OF FEE	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
		$		256195

APPROVED BY: DATE:

NRC FORM 313 (6-93)

PRINTED ON RECYCLED PAPER

5. Radioactive Material

A. Krypton 85, gas, 50 curies.

B. Krypton 85, gas, sealed sources in Pyrex < 1 mc/vial.

6. Purposes for which licensed material will be used.

A. For storage in D.O.T. approved shipping containers and for loading into, and use in a radiflo Mark V unit for leak testing of parts and components.

B. For use in the calibration of instruments.

7. Individual responsible for radiation safety program and their training experience.

D.R. Burnett trained at GENICOM by IsoVac Engineering on the following dates:

- Mar. 4, 1984 as an alternate Radiation Safety Officer and Light Maintenance Technician.

- May 7, 1993 as Assistant Radiflo Safety Officer and Light Maintenance Technician.

- Minimum of 10 years experience as an Assistant Radiation Safety Officer.

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8. Training for individuals working or frequenting restricted areas at GENICOM Corporation by IsoVac Engineering as follows:

Appendix D dated 10/24/94 Health Physics Operation Course Outline.

Radiflo Personnel Job Status, Qualifications and Training.

Name	Highest Position	Dates Trained	Trained By	Job Status
K. Cline	ARSO/Maintenance/CE	3/1/84 5/7/93	IsoVac	ARSO/Maintenance
B. Ketterer	Light Maintenance/CE	5/7/93	IsoVac	ARSO/Maintenance
D. Burnett	ARSO/Light Maintenance	3/1/84 5/7/93	IsoVac	ARSO/Maintenance
L. Byers	Light Maintenance Tech.	5/7/93	IsoVac	Maintenance Tech.
J. Corbett	Light Maintenance Tech.	5/7/93	IsoVac	Maintenance Tech.
J. Sensabaugh	Light Maintenance Tech.	5/7/93	IsoVac	Maintenance Tech.
S. Day	ARSO/CE	3/1/84	IsoVac	ARSO/Maintenance
L. Collie	Light Maintenance Tech.	1/20/89	IsoVac	Maintenance Tech.
R. Holbert	Light Maintenance Tech.	1/20/89	IsoVac	Maintenance Tech.
P. Via	Operator	1/20/89	IsoVac	Operator
P. Shipe	Operator	3/1/84	IsoVac	Operator

Radiflo Personnel duties, responsibilities, limitations, and qualifications described in Appendix F dated October 24, 1994.

9. Facilities and Equipment

- Radiflo Mark V Activation Unit
- GM Survey Meter - Nuclear Chicago
- IsoVac Mark V Rate Meter

10. Radiation Safety Program

- Appendix A dated 10/24/94 Rev. A - Radiation Protection Program for Control of By-Product Material.

- Appendix B dated 10/24/94 Rev. A - Emergency Procedure for an Uncontrolled Release of By-Product Material into the Radiflo Room.

11. Waste Management

- Appendix C dated 10/24/94 Rev. A - An Evaluation of Krypton 85 Concentration from Operation of a Radiflo Activation Unit.

- Appendix E dated 7/11/83 - An Evaluation of Krypton 85 Concentration in Occupiable Unrestricted Areas from the Operation of the Radiflo System.

APPENDIX A
REV. "A"

RADIATION PROTECTION PROGRAM

FOR

CONTROL OF BY-PRODUCT MATERIAL

COMPANY NAME GENICOM CORPORATION
ADDRESS 1 GENICOM DRIVE
WAYNESBORO
VA, 22980

OCTOBER 24, 1994

1. PURPOSE

1.1 The purpose of this procedure is to provide standard operating instruction concerning storage and use of radioactive material.

2. RECORDS AND SURVEYS

2.1 The following records and surveys shall be maintained,

2.1.1 A record of receipts, transfer or export of radioactive material. This record shall include: date received, activity (curies) date loaded into Radiflo Units, date transferred or exported and signature of person making the entry.

2.1.2 A report of loss of radioactive material will be given as soon as the occurrence of such loss is known.

2.1.3 Personnel radiation exposure records shall be recorded as required to comply with Title 10 Code of Federal Regulations, Part 20, Section 20.2102.

3. INSTRUCTIONS OF PERSONNEL

3.1 All persons working in the Radiflo room engaged in testing Radiflo activated components shall be instructed by the Radiation Safety Officer at that facility.

4. PERSONNEL MONITORING

4.1 All persons who operate, or maintain Radiflo Units must wear a personnel monitoring device (film badge, dosimeter). The exposure shown by these devices shall be recorded in compliance to Title 10, Code of Federal Regulations, Part 20, Section 20.2106.

5. DISPOSAL OF KRYPTON-85

5.1 Disposal of Krypton-85 will be accomplished by discharge to the ambient atmosphere via the Radiflo exhaust system.

5.2 To provide a continuous change of air in the Radiflo room and assure that any leakage of radioactive material to adjacent areas will not occur, the Radiflo exhaust system shall operate continuously.

5.2.1 In the event it is required to turn the Radiflo exhaust system off, the Radiation Safety Officer shall isolate all Krypton-85 possible in the storage tank by closing the hand valve provided on the storage tank.

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6. REPAIR AND SERVICE OF RADIFLO UNIT

6.1 Service and repair of the Radiflo Unit will be done by or under the direct supervision of IsoVac Engineering Inc. or K.E. Cline, D.R. Burnett, or B.G. Ketterer, all trained by IsoVac Engineering.

APPENDIX B
REV. "A"

EMERGENCY PROCEDURE FOR AN UNCONTROLLED RELEASE OF BY-PRODUCT MATERIAL INTO A RADIFLO ROOM

COMPANY NAME GENICOM CORPORATION
ADDRESS 1 GENICOM DRIVE
WAYNESBORO
VA, 22980

OCTOBER 24, 1994

1. Whenever it is suspected that Krypton-85 may have been discharged from the Radiflo Unit, evacuate the room as soon as possible and lock the door. DO NOT RE-ENTER the Radiflo room until it can be verified that the room was returned to normal using an operating G.M. survey meter that is properly calibrated.

2. The Radiation Safety Officer, or his alternate, should be notified as soon as possible if he is not already present.

3. Make a radiation survey of all possible areas inside and outside the building until the radiation level has returned to normal.

4. An evaluation of the uncontrolled release shall be made by the Radiation Safety Officer and notification of cognizant authority shall be made, if warranted.

5. **DO NOT ATTEMPT TO OPERATE THE RADIATION UNIT AFTER A RELEASE OF ACTIVITY, IF THE CAUSE IS UNKNOWN. IF THE CAUSE OF THE RELEASE IS KNOWN AND IN THE JUDGMENT OF THE RADIATION SAFETY OFFICER, THE KRYPTON-85 CAN BE RETURNED TO THE STORAGE TANK WITHOUT A FURTHER RELEASE OF ACTIVITY, THIS SHOULD BE DONE AND THE HAND VALVE ON THE STORAGE TANK CLOSED.**

6. Contact NRC Operations Center for further information. In cases of suspected personnel exposure or loss of by-product material in excess of the limits specified in Title 10, code of Federal Regulations Part 20, telephone the above referenced concern immediately. Current telephone numbers and contacts are:

Personnel	Telephone
NRC Operations Center	(301) 951-0550

APPENDIX C
REV. "A"

AN EVALUATION OF KRYPTON-85 CONCENTRATION FROM OPERATION OF A RADIFLO ACTIVATION UNIT

COMPANY NAME GENICOM CORPORATION
ADDRESS 1 GENICOM DRIVE
WAYNESBORO
VA, 22980

OCTOBER 24, 1994

PURPOSE

The purpose of this report is to analyze the known and calculated parameters of the subject Radiflo installation to demonstrate that it will be unlikely that the operation of the unit will result in concentrations of radioactive material in occupiable unrestricted areas in excess of the limits established in Title 10 Code of Federal Regulations, Part 20.

It is further intended that the evaluation will serve in conjunction with a record of Krypton-85 discharges to completely fulfill the requirements of Title 10 Code of Federal Regulations, Part 20 for surveys with respect to concentrations of effluents to unrestricted areas, and exposure of individuals to concentrations of radioactive material in unrestricted areas.

ANTICIPATED ANNUAL DISCHARGES

From the Radiflo activation unit, radioactive material is discharged to the environs each time the equipment is cycled through a complete activation cycle. This discharge is the result of not returning all of the Kryoton-85 to the storage tank. The anticipated annual discharges are determined by calculating the loss per cycle, multiplying the figure obtained by the number of cycles per day, and multiplying the product by the number of working days per year.

The amount of gas lost per activation cycle is determined by the following formula:

$$La = (S)(Pas)(F_{va})$$

where:

La = loss of gas in activation tank per cycle (mc/cycle)

S = concentration of gas in the unit (μc/atm cc)

Pas = pressure in the activation tank after return of gas to the storage tank

F_{va} = volume of activation tank without fillers (cc)

At the GENICOM Corporation installation the values will approximate:

S	=	225 μc/atm cc
Pas	=	0.5 mm Hg or $\frac{.5}{760}$ atmospheres
F_{Va}	=	800 cc (assume 800 cc maximum free volume)

The anticipated gas loss is thus .119 mc/cycle. The annual release from non-recovery of gas, cycling the unit 66 times daily for 260 working days per year, would be 2.04 curies.

With the incorporation of a gross leak test which is more commonly being used in these machines, the equipment is being vented at 2 mm Hg.

Thus.

S	=	225 μc/atm cc
P	=	$\frac{2}{760}$ atmospheres
F	=	800 cc

The anticipated gas loss is thus .473 mc/cycle. The annual release from the non-recovery of gas cycling the unit as above would be 8.1 curies. It must also be noted that the devices which fail the test are consuming Krypton-85 gas which is normally vented through the same room air exhaust system. This consumed gas has been seen to increase the annual usage to 25-30 curies in high production applications.

The emission rate averaged over the year, based on the conservative gas loss figure of 30 curies would be obtained by dividing the calculated release (μc) by the number of seconds in a year. This maximum emission rate is therefore .95 μc/sec.

APPENDIX D

HEALTH PHYSICS AND RADIFLO® OPERATION COURSE OUTLINE

COMPANY NAME GENICOM CORPORATION
ADDRESS 1 GENICOM DRIVE
WAYNESBORO
VA. 22980

OCTOBER 24, 1994

RADIFLO CUSTOMER TRAINING PROGRAM

HEALTH PHYSICS AND RADIFLO OPERATION

TO BE PROVIDED BY ISOVAC ENGINEERING

HEALTH PHYSICS TRAINING COURSE OUTLINE

Introduction and Terminology

ATOMIC STRUCTURE

I. Atomic Components
II. Structure of Atoms
III. Electron Arrangement
IV. Ions and Ionization
V. Isotopes

RADIOACTIVITY- NATURAL AND ARTIFICIAL

I. Introduction
II. Nuclear Stability
III. Natural Radioactivity
    A. History
    B. Types of Radioactive Emissions
        1. Beta
        2. Gamma
        3. Other types of Emissions
    C. Decay Phenomena
    D. Radioactive Families
IV. Artificial Radioactivity
    A. Induced Radioactivity
    B. Fission Products

ABSORPTION OF RADIATION

I. Introduction
II. Beta Absorption
III. Gamma Absorption
    A. Photoelectric Effect
    B. Compton Effect
    C. Pair Production
IV. Summary

UNITS OF RADIOACTIVITY AND RADIATION

I. Introduction
II. Activity Measurement
    A. Curies
    B. Specific Activity
III. Dosage Measurement
    A. Roentgen
    B. Roentgen Equivalent Physical
    C. Radiation Absorbed Dose

IV. Biological Effect Measurement
  A. Relative Biological Effectiveness
  B. Roentgen Equivalent Man
V. High Energy Units
VI. Summary

BIOLOGICAL EFFECTS OF IONIZING RADIATION

I. Introduction
  A. Absorption of Radiation
  B. Relative Biological Effectiveness
II. Effects upon Biological Material
  A. Latent Period
  B. Effects on Tissues and Cells
  C. Stimulation
  D. Recovery
III. Determinants of Radiation Effects
  A. Amount Absorbed
  B. Rate of Absorption
  C. Area Exposed
  D. Relative Sensitivity of Cells and Tissues
IV. External vs. Internal Radiation Exposures
  A. External Radiation
  B. Internal Radiation
V. The Radiation Syndrome
  A. Acute Radiation Syndrome
  B. Chronic Radiation Exposure
    1. Carcinogenesis
    2. Genetic Effects
    3. Decreased Fertility
    4. Premature Aging
    5. Embryological and Developmental Effects
    6. Cataract Induction
    7. Cutaneous Effects
VI. Summary
VII. Quiz

LICENSING OF BY-PRODUCT MATERIALS

I. Introduction
II. Review of Title 10 Code of Federal Regulations, Part 30
III. Review of application for license for by-product material, and license issued by the Atomic Energy Commission pursuant to the use of by-product material in connection with the Radiflo Unit.

STANDARDS FOR PROTECTION AGAINST IONIZING RADIATIOI

I. Introduction
II. Review of Title 10 Code of Federal Regulations, Part 20
III. Review of Standard Operational & Emergency Procedures to be followed in using by-product material in connection with the Radiflo Unit.

BASIC PRINCIPLES OF RADIATION PROTECTION

I. Introduction
II. External Radiation Hazards
    A. X-rays and Gamma rays
    B. Beta particles
III. Prevention of External Radiation Hazards
    A. Distance
    B. Shielding
    C. Exposure Time

SURVEY AND PERSONNEL MONITORING INSTRUMENTS

I. Introduction
II. Geiger-Mueller Instruments
    A. Theory
    B. Physical Description
    C. Operation
    D. Calibration
    E. Uses
III. Scintillation Survey Instruments
    A. Theory
    B. Physical Description
    C. Operation
    D. Calibration
    E. Uses
IV. Uses of Survey Meters
V. Photodosimetry
    A. General Description
    B. Theory of Operation
    C. Limitations

VI. Ionization Chamber Instruments
- A. Theory of Operation
- B. Types of Instruments
- C. Operation Characteristics

VII. Summary

VIII. Quiz

RADIFLO UNIT OPERATION

LECTURE

I. Basic Theory of Radiflo Leak Testing
   - A. Reject Point
   - B. Counting Efficiency
   - C. Gas Concentration
   - D. Pressure and Time
   - E. Test Sensitivity
   - F. Special Considerations

II. Radiflo Operation
   - A. Activation Unit
     1. Transfer System
     2. Operator's Control Panel
     3. Supervisor's Control Panel

LABORATORY

I. Demonstration of material covered in Item II above with Radiflo Unit. Familiarization of class members with unit.

LECTURE

I. Radiflo Operation (continued)
   - A. Normal Modes of Operation
     1. Automatic
     2. Manual
     3. Test

LABORATORY

I. Supervised operation of the Radiflo Unit by students in the normal modes of operation.

LECTURE

I. Radiflo Operation (continued)
   A. Interlocks, alarms, and alarm conditions
      1. Activation Unit Interlock
      2. Buzzer Alarms
      3. Bell Alarms
      4. Auxiliary Alarm Outlets
   B. Alarm Override Modes of Operation
      1. Manual Alarm Override
      2. TestAlarm Override
   C. Electronic System
      1. Control Chassis
      2. Dual Channel Ratemeter

LECTURE

I. Operation of Associated Equipment
   - A. Sampling System
     1. Uses of Gas Sampling System
        - a. Determination of Kr^{85} concentration
        - b. Determination of counting efficiency of parts to be tested.
   - B. Radiation Detection Equipment
     1. Use and Maintenance of Scintillation equipment
     2. Use and Maintenance of laboratory G. M. instruments

II. Record Keeping
   - A. Activation Log
   - B. Activity Log
   - C. Isotope Receipt Log
   - D. Radiation Survey Log
   - E. Film Badge Records

III. Review of procedures for admitting nitrogen and Krypton-85 into Radiflo Unit.

LECTURE

I. Special Considerations
   - A. Loss of Krypton-85 from Unit
   - B. Testing Painted Components
   - C. Gross Leakers

II. Calibration
   - A. Ratemeters
   - B. Survey Meters
   - C. Activation System

LECTURE

I. Supervising Maintenance of the Activation Unit
   A. Removal of Krypton-85 from transfer lines
      1. Radiological Protection Considerations
   B. Removal of Oil from Vacuum Pumps and Compressor

II. Supervising Maintenance of the Activation Unit (continued)
   A. Valves
   B. Plumbing, including: Hastings tube, transducers and pressure switches

III. Leak Testing of Radiflo Transfer System

LABORATORY

I. Supervised Maintenance of Radiflo Unit by class members demonstration of material covered in lecture.

LABORATORY

I. Charging of Nitrogen and Krypton-85 into Radiflo Unit
   A. Admission of Nitrogen
   B. Admission of Krypton-85
   C. Activity Determination

II. Complete review of operation and maintenance procedure

Report No. R3899

PURPOSE

The purpose of this report is to analyze the known and calculated parameters

IsoVac Engineering Inc.

APPENDIX E

An Evaluation of Krypton-85 Concentrations

in Occupiable Unrestricted Areas

From the Operation of the Radiflo System

Located At

COMPANY NAME GENICOM CORPORATION
ADDRESS 1 GENICOM DRIVE
WAYNESBORO
VA, 22980

REPORT NO. R3899

DATE JULY 11, 1983

Report No. R3819

PURPOSE

The purpose of this report is to analyze the known and calculated parameters of the subject Radiflo installation to demonstrate that it will be unlikely that the operation of the Unit will result in concentrations of radioactive material in unrestricted areas in excess of the limits established in Title 10 Code of Federal Regulations, Part 20.

It is further intended that the evaluation will serve in conjunction with a record of Krypton-85 discharges to completely fulfill the requirement of Title 10 Code of Federal Regulations Part 20 for surveys with respect to concentration in effluents to unrestricted areas, and exposures of individuals to concentrations of radioactive material in unrestricted areas.

SUMMARY

Assuming a mean wind velocity of 8 miles per hour, a moderate inversion, and based on the calculated values for the effective stack height, the calculated annual discharge rate, and the distance in meters from the point of release to the point of maximum concentration, and obtaining the diffusion coefficient from the prepared table, an evaluation of maximum concentrations in occupiable unrestricted areas is performed by utilizing formula (4.50), found on page 47 of the publication entitled, "Meteorology and Atomic Energy", AECU 3066, prepared by the U.S. Department of Commerce Weather Bureau for the United States Atomic Energy Commission. This formula is known as Sutton's Isotropic, Continuous Point Source Formula. Concentration at air inlets and other points of interest above ground level are determined by the use of equation (8.35), found on page 239 of, "MICROMETEOROLOGY", by O.G. Sutton, published by McGraw-Hill Book Co., 1958. The results of these computations indicate that maximum concentration at ground level as a result of the anticipated emission rates at the subject installation would be 2.5×10^{-10} µc/cc averaged over a period of one year. Maximum concentration on the roof and at other points of interest above ground level are less than 1×10^{-9} µc/cc averaged over a period of one year. Concentration at the point of discharge from the stack is calculated to be slightly higher than the allowable 3×10^{-7} µc/cc averaged over a period of one year. However, since the rooftop is a restricted area and only authorized personnel are permitted in this locale, the 3×10^{-7} µc/cc maximum is not applicable.

ATMOSPHERIC CONDITIONS

The averaged wind velocity over a period of years reported by the U.S. Weather Bureau at the RICHMOND, Va of 8 miles per hour will be use in this report. A moderate inversion will also be considered in the report.

ATMOSPHERIC CONDITIONS (continued)

These conditions will be referred to as atmospheric condition 1. The stability parameter and mean wind velocity are tabulated below.

Atmos. Condition	n	$\bar{u}$
1	0.33	3.58

where:

n = nondimensional parameter associated with stability

$\bar{u}$ = mean wind speed (meters/sec.)

EFFECTIVE STACK HEIGHT

The effective height of the stack is the sum of the height of the building upon which the stack is constructed, the height of the stack proper and the height of the plume rise above the stack. It is calculated by using formula (5.6) on page 72, of the AECU 3066 mentioned above, known as the "Bryant-Davidson" expression which reads:

$$\Delta h = d\left(\frac{V_s}{u}\right)^{1.4}\left(1 + \frac{T}{T_s}\right)$$

where:

Δh = plume rise above stack (feet)

d = diameter of stack (feet)

V_s = stack discharge velocity (ft/sec.)

u = wind speed (ft/sec.)

ΔT = stack gas temperature, excess over ambient (°C)

T_s = stack gas temperature

Since the worst possible conditions are being considered, it will be assumed that ΔT is zero.

The formula then reduces to:

$$\Delta h = d\left(\frac{V_s}{u}\right)^{1.4}$$

EFFECTIVE STACK HEIGHT (continued)

An average height of 22 ft. for the building plus the exhaust will be used. A nominal exhaust capacity of 2,200 cfm, (at point of discharge), and an 0° temperature rise will be used.

A tabulation of the effective stack height considering the above mentioned atmospheric condition is recorded below.

Atmos. Condition	Hgt. of stack+Bldg. (ft)	d(ft)	V_s(ft/sec)	Plume rise(ft) Δh	Effective Hgt. (ft)	Effective Hgt. (mtrs.
1	30	0.67	104	21.3	51.3	15.64

ANTICIPATED ANNUAL DISCHARGES

In the RADIFLO Unit, byproduct material is discharged to the environs each time the equipment is cycled through a complete activation cycle. This discharge is the result of not returning all of the Krypton-85 to the Storage tank. The anticipated annual discharges are determined by calculating the loss per cycle, multiplying the figure obtained by the number of cycles per day, and multiplying the sum by the number of working days per year. The amount of gas lost per activation cycle is determined by the following formula:

$$La = (S)\ (Pas)\ (F_{Va})$$

where:

L_a = loss of gas in Activation tank per cycle (mc/cycle)

S = concentration of gas in the Unit (μc/atmos cc)

P_{as} = pressure in Activation tank after return of gas to Storage tank (atm)

F_{Va} = volume of Activation tank with filler (cc)

The values will be:

$S \simeq 225$ μc/atmos cc.

$P_{as} \simeq \frac{.5}{760}$ atmospheres

$F_{Va} \simeq 800$ cc.

ANTICIPATED ANNUAL DISCHARGES (continued)

The anticipated gas loss is thus .119 mc/cycle. The annual release from non-recovery of gas cycling the unit 66 time daily for 260 working days per year would be 2.04 curies/year.

With the incorporation of a gross leak test which is more commonly being used in these machines, the equipment is being vented at 2 mm Hg.
Thus:

S	≃	225	μc/atm cc
P	=	$\frac{2}{760}$	atmospheres
F	≃	800	cc

The anticipated gas loss is thus .473 mc/cycle. The annual release from the non-recovery of gas cycling the unit as above would be 8.1 curies. It must also be noted that the devices which fail the test are consuming Krypton-85 gas which is normally vented through the same room air exhaust system. This consumed gas has been seen to increase the annual usage to 25-30 curies in high production applications.

The emission rate averaged over the year, based on the conservative gas loss figure of 30 curies would be obtained by dividing the calculated release (μc) by the number of seconds in a year. This maximum emission rate is therefore .95 μc/sec.

CALCULATION OF CONCENTRATION AT POINT OF DISCHARGE FROM THE STACK

Concentrations at the point of discharge from the stack are calculated by dividing the anticipated discharge rate "Q" (μc/sec) by the exhaust flow rate (cc/sec). Based on a stack flow of 2200 c.f.m., operating continuously, concentration at the point of discharge averaged over a period of one (1) year would be 9.5×10^{-7} μc/cc.

POINT OF MAXIMUM CONCENTRATION

To determine the distance downwind at which ground concentrations will be maximum, formula (4.65) found on page 49, of "Meteorology and Atomic Energy" is used, this is a simplification of Sutton's basic formula.

It reads: $d_{max} = \left(\frac{h^2}{c^2}\right)^{\frac{1}{2-n}}$

POINT OF MAXIMUM CONCENTRATION (continued)

In order to keep designations uniform and thus avoid confusion, "d" will be written "x". The formula then reads:

$$x_{max} = \left(\frac{h^2}{c^2}\right)^{\frac{1}{2-n}}$$

where:

x = point of maximum concentration (meters)

h = effective stack height (meters)

C = diffusion coefficient (meters) $^{n}/2$

n = nondimensional parameter associated with stability

Listed below is a tabulation of the values used in the equation and the results obtained.

Atmos. Condition	h (meters)	C (meters) $^{n}/2$	n	x (meters)
1	15.64	0.087	0.33	500.2

MAXIMUM GROUND LEVEL CONCENTRATION

Maximum ground level concentrations are calculated by applying the aforementioned parameters to Sutton's Isotropic, continuous Point Source Formula, which reads:

$$\chi(xy) = \frac{2Q}{\pi C^2 \bar{u} x^{2-n}} \exp\left(-\frac{y^2 + h^2}{C^2 x^{2-n}}\right)$$

where:

χ = concentration at "x" distance downwind and "y" distance crosswind (μc/cc)

Q = emission rate from stack (μc/sec.)

x = horizontal distance downwind from the point of discharge (meters)

MAXIMUM GROUND LEVEL CONCENTRATION (continued)

y = horizontal distance crosswind from the point of discharge (meters)

h = effective plume height above point at which concentration is being calculated (meters)

C = diffusion coefficient (meters) $^{n}/2$

n = nondimensional parameter associated with stability

$\bar{u}$ = mean wind speed (meters/sec.)

to avoid confusion χ will be called K. The formula then reads:

$$K(xy) = \frac{2Q}{\pi C^2 \bar{u} x^{2-n}} \exp\left(-\frac{y^2 + h^2}{C^2 x^{2-n}}\right)$$

Since for the purpose of this evaluation it is assumed that the wind will be blowing continually directly toward the point of calculation, "y" equals zero. The formula then reads:

$$K(x) = \frac{2Q}{\pi C^2 \bar{u} x^{2-n}} \exp\left(-\frac{h^2}{C^2 x^{2-n}}\right)$$

Tabulated below are the values used in the calculation, their units, and the results obtained.

Atmos. Conditions	Q (uc/sec)	$\bar{u}$(meters/sec)	h(meters)	n	C(mtrs)$^{n}/2$	X(mtrs)	K_x (μc/cc
1	0.95	3.58	15.64	0.33	0.087	500.2	2.5×10^{-10}

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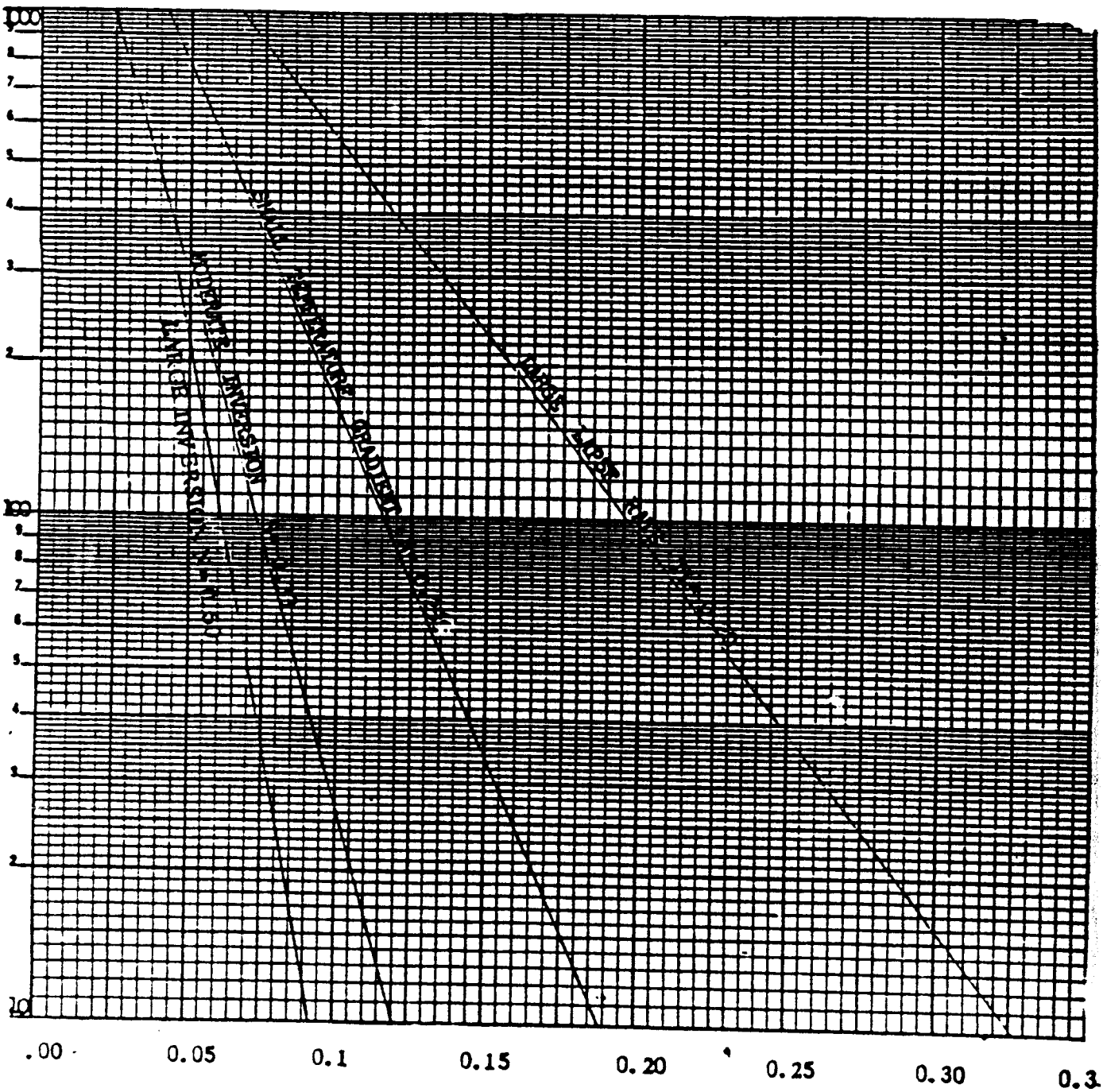
DIFFUSION COEFFICIENT.

From Table 4.3, Page 53 and Figure 4.5, Page 55 of Meteorlogy and Atomic Energy Sutton's values for "h" and "C" under varying atmospheric conditions and effective plume heights are excerpted in the graph below:



IsoVac Engineering Inc.

APPENDIX F

RADIFLO PERSONNEL

DUTIES, RESPONSIBILITIES, LIMITATIONS

AND QUALIFIACTIONS

REPORT NO. R-3848-B

OCTOBER 24, 1994

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RADIFLO PERSONNEL

DUTIES, RESPONSIBILITIES, LIMITATIONS

AND QUALIFICATIONS

INTRODUCTION

Once installed in a facility, the Radiflo equipment and process requires a variety of activities for the proper operation, maintenance, safety and calibration of the system. These activities are most conveniently described under certain job titles which are frequently assigned to other people in an organization.

It is recognized that some employees can "wear several hats" and discharge their various responsibilities without help from others. However, for the purpose of this report, the duties and responsibilities have been grouped under separate occupational titles. Additionally, the prerequisite knowledge and background for each of these positions requires satisfactory completion of a training program administered by IsoVac Engineering. The only exception applies to the Technician/Operator classification. These individuals may operate the Radiflo equipment after instruction from the R.S.O. and/or the supervising engineer who have been previously trained by IsoVac.

I-RADIFLO SAFETY OFFICER (or Assistant R.S.O.)

Duties and responsibilities:

The person designated as the Radiflo Safety Officer is responsible for the radiation protection program for the organization (as it applies to the Radiflo process), organizes and directs the safety operations, and is responsible for the program to assure satisfactory compliance. The duties performed by this individual are generally listed, but not limited to the following:

1. Responsible for the formulation and implementation of all policies regarding Radiflo radiation safety. Responsible to see that all personnel or contractors are properly trained, certified and licensed for any involvement with the Radiflo. Maintain file of certifications or licenses.

2. Controls the film badge program for all persons who regularly come in contact with the Radiflo equipment. Reviews all film badge reports for radiation dosages. Reports to the responsible supervisor on the limits of individuals who wear film badges, and takes action if limits are exceeded. Responsible for the accounting for all film badges. Monitors the film badge program for proper operation and performance.

3. Conducts, or supervises monthly radiation room surveys, maintains permanent record, and initiates appropriate action if limits are exceeded.

4. Instructs all personnel associated with the Radiflo equipment, in radiation safely including emergency procedures. May be required to instruct operators in the functional operation of the machine.

5. Maintains the log book for all incoming Krypton gas, and is responsible for the proper identification and storage of the gas. Instructs maintenance personnel and supervises the charging of the Radiflo activation console with Krypton.

6. Oversees the sampling for specific activity of the gas in the activation console. Monitors the specific activity logs for proper recording and maintenance. Maintains records of curie content and usage of Krypton per machine.

Limitations:

Only those created by company policies.

Qualifications:

Requires some technical background, preferably a college degree in a technical discipline. Ability to understand and apply elementary radiation health physics is necessary. Supervisory experience is beneficial.

II-SUPERVISING OR COGNIZANT ENGINEER

Duties and responsibilities

This occupational title includes overall responsibility for the day-to-day operation of the Radiflo process. It signifies supervisory duties to oversee the Radiflo operators in the performance of their work. The general duties are as follows:

1. See that all operators have been trained and qualified to operate the Radiflo equipment. This engineer has the responsibility to instruct new employees in the proper operation of the activation console and the counting station.

2. Calculates the activation pressures and soak times for all parts tested, and records all calculations.

3. Estimates K-factors for all parts tested.

4. Performs the sampling to determine specific activity of the gas in the activation unit. Calculates the curie content of the machine, reports data to R.S.O., and records the results in a log book.

5. Has a thorough understanding of the mechanical and electronic functions of the machine, as well as the theory and application of the Radiflo process.

6. Has complete knowledge of all emergency procedures, experience and capability in the operation of all switches and controls in the supervisor's panel of the activation console. Is responsible for making any direct "line" contacts with IsoVac for advice and telephone instruction.

7. Makes periodic checks of such machine functions as pump-down times, crosscut of electrical pressure gauges with mechanical pressure gauge and initiates requests for preventive maintenance. Maintains proper maintenance schedules, and monitors all maintenance work.

8. Notifies R.S.O. in writing of any involvement by personnel and/or contractors including their qualifications by certification or license. Provides copies of certifications or licenses.

Limitations:

Should fully understand light maintenance, but should not attempt Radiflo machine repairs of any kind unless trained for light maintenance by IsoVac Engineering.

Qualifications:

Requires mechanical and electrical aptitude. Should be able to understand simple mechanics and pneumatic systems. Training in a technical discipline is a definite asset. Supervisory and leadership experience essential.

III-TECHNICIAN/OPERATOR (Should be trained by R.S.O. and Cog. Eng.)

Duties and Responsibilities:

The routine operation of The Radiflo equipment is very straight forward and requires a minimum of training. An operator should be capable of:

1. Understanding the complete operation and functional cycles of the activation console and the counting station.

2. Be familiar with the handling and precautions for the devices to be tested.

3. Capable of reading all gauges, meters and instrumentation, and understand their relationship to the Radiflo process.

4. Have an understanding of basic radiation health physics as it applies to Krypton-85 and the Radiflo system.

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Limitations:

Should not attempt to operate the machine by using the switches in the supervisor's panel. Complete restrictions on attempts of any kind to repair the equipment.

Qualifications:

Requires manual dexterity and ability to perform simple arithmetic. Legible handwriting and ability to follow written instructions. High school education preferre'.

IV-LIGHT MAINTENANCE TECHNICIAN:

Duties and Responsibilities:

The person (s) responsible for routine light maintenance, calibration and troubleshooting of the Radiflo equipment must:

1. Have a complete understanding of the electro-mechanical, pneumatic and electronic operations of the Radiflo system.

2. Be thoroughly familiar with all operational, troubleshooting and emergency procedures, as well as capable of applying them for calibration and repair.

3. Coordinate all calibrations and repair with the cognizant engineer.

4. Be capable of charging the Radiflo with Krypton-85 under the supervision of the cognizant engineer or R.S.O.

Limitations:

The light maintenance technician is limited to the following areas:

1. All electronics control and operational sections of the equipment, including the use of the toggle switches to operate the equipment.

2. All mechanical areas which do not contain Krypton-85 gas in any significant concentrations such as:
V1, V5, V10, V11, V12, V15, V16, V17, Vac I bypass valve; changing oil or shaft seal in Vac I.

Excluded are:

The lead hot box area components which contain radiation such as the compressor oils, Vac II oils, oil separator system, valve numbers V2, V3, V4, V6, V7, V8, V9, compressor bypass valve and Vac II bypass valve.

EMERGENCY REQUIREMENTS

In the event that an emergency condition exists due to a suspected failure in the equipment, the problem should be evaluated carefully. If the problem appears to be in the "hot zones" of the machine, IsoVac Engineering should be contacted immediately.

IsoVac personnel will determine both the nature of the problem and the ability of the person contacting IsoVac to handle the problem under direct telephone supervision by IsoVac. If the nature of the problem is serious enough to justify it, IsoVac personnel may, at their discretion, proceed to talk the technician through the repair and correction of the problem, even though it is within the "excluded area" of the equipment.

SPECIAL NOTES:

1. The above limitations are intended to provide proper safety for maintenance personnel as well as others who work in the Radiflo area. Radiation licenses limit individuals to the above mentioned conditions and limits. Individuals who violate these restrictions are subject to citations by state and federal regulatory authorities.

2. It is illegal to modify, change, or alter the Radiflo equipment in ANY manner without prior written permission from the Federal Licensing Agency Representative responsible for approval of the equipment design as registered in the Official Cataiog sheets.

V-OPERATOR TRAINER

Duties and Responsibilities

This occupational title pertains to in-house training in the operation of the Radiflo Activation System and the use of various types of counting stations. The training program must be coordinated with the supervising or cognizant engineer to insure that the latest process parameters are being utilized properly. The general duties are as follows:

1. See that all new operators attend a radiation safety program established by the Radiflo safety officer.

2. See that all operators are familiar with proper use and handling of their personal film badges, dosimeters or survey meter, (or any other radiation protection instrumentation selected by the Radiflo safety officer).

3. Have a thorough knowledge of the operation of the Radiflo Activation System in the automatic mode. Have complete knowledge of the front panel indicators, preset conditions and interlocks. Must establish and insure complete recordation of the Radiflo cycle log.

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4. Must establish good cyclic, daily and/or weekly operator housekeeping methods for consistent, safe operation of the Radiflo such as: care and cleanliness of the tank "O" ring and the tank interior.

5. Have thorough knowledge and demonstrate effective operator responsibility and safety consideration in the event of a radiation alarm.

6. Have complete knowledge of the operation of the counting station (manual or automatic). Perform calibration checks using reference sources, every shift, as required by military standards, and recorded in the calibration log. Understand "K" factor philosophy as applied to proper detection of various devices. Understand limits on handling tested components for minimal damage.

7. Establish periodic recertification schedules for documented assurance of proper process application.

Limitations: Never attempt any operation of the Radiflo by means of the supervisor panel unless trained and certified to do so. Never attempt training of other individuals to use the supervisor panel or any operation other than the automatic mode.

Qualifications:

Technical aptitude and experience is required. Should be able to understand simple mechanics and pneumatics. Supervisory and leadership qualities essential.