NRC FORM 313
(9-88)
10 CFR 30, 32, 33,
34, 35 and 40

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB
3150-0120
Expires: 6-30-90

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.

APPLICATIONS FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY, NMSS
WASHINGTON, DC 20555

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:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIALS SAFETY SECTION B
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
NUCLEAR MATERIALS SAFETY SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

IF YOU ARE LOCATED IN:

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
NUCLEAR MATERIALS SAFETY SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

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 JURISDICTION.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [X] C. RENEWAL OF LICENSE NUMBER 34-00054-05

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include Zip Code)*

GE-Lighting
Nela Park
Cleveland, OH 44112

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED.

See Attachment

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

A. M. Zielinski

TELEPHONE NUMBER: (216) 266-3349

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSEE FEES *(See 10 CFR 170 and Section 170.31)*
FEE CATEGORY: 3M
AMOUNT ENCLOSED: $ 460

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION 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, 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.

SIGNATURE—CERTIFYING OFFICER	TYPED/PRINTED NAME	TITLE	DATE
M Zielinski	A. M. Zielinski	Spec.-Industrial Hygiene	2/19/90

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS
Ren	Mar 13	3B	

AMOUNT RECEIVED	CHECK NUMBER
$460	607427

APPROVED BY: 3/6/90 — DATE:

NRC FORM 313 (9-88)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 7.5 HRS. COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE OFFICE OF INFORMATION AND REGULATORY AFFAIRS, OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

CONTROL NO. 8813

Attachment for Item 3.

GE Lighting
Nela Park
Cleveland, OH 44112

Licensed material will be used at the following locations:

Nela Park, Cleveland, OH
Tungsten Products Plant, 21800 Tungsten Road, Euclid, OH
Ravenna Lamp Plant, 6800 N. Chestnut Street, Ravenna, OH
Circleville Lamp Plant, East Ohio Street, Circleville, OH

Licensed material will be stored, incident to distribution, at the following locations:

Ravenna Master Distribution Center, Ravenna, OH
Kansas City Master Distribution Center, Kansas City, MO

Attachment for Item 5.

GE Lighting
Nela Park
Cleveland, OH 44112

The radioactive materials currently covered under this license are as follows:

Krypton-85, in starter bottles, containing no more than 25 nanocuries per starter bottle, total quantity in possession at any one time - 25 mCi.

Promethium-147, in starter bottles, containing no more than 0.5 microcuries per starter bottle, total quantity in possession at any one time - 100 mCi.

Krypton-85, as a gas, in arc tubes, containing no more than 48 nanocuries per arc tube, total quantity in possession at any one time - 0.5 mCi.

Promethium-147, as a solid, in zeolite pellets and introduced into arc tubes, containing no more than 0.5 microcuries per pellet/arc tube, total quantity in our possession at any one time - 36 mCi.

Tritium (H-3), as a gas, for storage only - 9 curies.

Krypton-85, as a gas, for storage only - 10 curies.

Attachment for Item 6.

GE Lighting
Nela Park
Cleveland, Ohio 44112

Promethium-147 Use in Glow Switches

Promethium-147 is contained in glow starter switches (electron tubes) that are purchased from Toshiba Corporation of Japan. The units are not manufactured by General Electric, but are incorporated into a fluorescent lamp at our Circleville Lamp Plant, which is then distributed by GE Lighting, as an item exempt from the regulations pursuant to 10CFR30.15 and 10CFR32.14.

The promethium-147 is present in the glow switch to promote starting under dark conditions. Each G4 glow switch (used in the 100/50 Circlite and Toshiba's Compax lamp) contains no more than 0.1 microcuries of Pm-147 in solid form. The attached drawing shows the details of the construction and design of the G4 glow switch. The promethium is plated onto one nickel electrode of the switch to a thickness of 3 microns and is then overplated with additional nickel. The promethium is thus tightly bound to the electrode, sandwiched between two layers of nickel. Radiation measurements indicate no increase in radiation emitted from the surface of the electrode even after being heated in an open flame (~1500 degrees C).

The electrodes are hermetically sealed in a glass envelope. The radiation level, measured at a distance of 1 centimeter from the surface as per 10CFR30.15 is less than 0.1 millirad per hour (same as background). This measurement was made though an end window probe with a window thickness of 1.4 mg/sq. cm. Tensile strength measurements on the glow switch indicate that the glass envelope can withstand up to 30 pounds of pressure, considerably more than it would be subjected to in normal use.

Every glow switch received from Toshiba Corporation is visually inspected for integrity of the glass envelope and is glow tested. Any switch that is not intact and completely sealed will not pass the test and consequently would not be used.

The design of the 100/50 Circlite lamp is such that the glow switch is encased in a plastic housing as shown in the attachment. For those lamps shipped as part of a package including an adapter, the notice concerning the radioactive material contents is included in the "Use and Care" booklet shipped in the package. For replacement lamps shipped in a standard cardboard sleeve, the notice is included in the package graphics. The specific statement used is "Starter within the base arm contains 0.1 microcuries Pm-147".

In addition to the use of this switch in the 100/50 Circlite lamp, it is also licensed for use in a version of our Compax lamp which may be imported as an intact unit from Toshiba. A copy of the lamp design drawing is attached indicating the location of the switch. A similar statement, "Starter bottle within lamp base contains 0.1 microCi Pm-147" is used on the packaging of the Toshiba Compax. Although we have not distributed this lamp, we would like to maintain it on our license as an alternate source for this product.

A slightly different version of the Compax is obtained from Matsushita of Japan which uses a similar glow switch also containing Pm-147, but using 0.33 uCi of the material. This product uses the statement "Starter bottle within lamp base contains 0.33 microCi Pm-147". This is the version of the Compax lamp that we are currently distributing, and have been since late 1986.

Finally, another Toshiba glow switch (G4A) which is identical in design to the G4 described above, but contains < 0.5 uCi Pm-147 is used in a version of our Double-BIAX (DBX) product which is just being introduced into the U.S. A design drawing and specification sheet of the G4A switch is attached, along with a drawing of the DBX lamp indicating the location of the switch. The packaging for the Toshiba DBX lamp includes the statement "Starter bottle within lamp contains < 0.5 uCi Pm-147".

Promethium-147 Use in Zeolite Pellets

In addition to the use of promethium-147 in glow switch starters as described above, it is also used in a zeolite pellet which is incorporated into an arc tube manufactured for export to a Japanese lamp manufacturer. The pellet is introduced, one pellet each, into two different types of arc tubes. These arc tubes are sent to the Japanese manufacturer who in turn assembles them into lamps. Neither the arc tubes containing the promethium-147 nor the lamps themselves are marketed in the U.S.

The pellets are either manually (using tweezers) or mechanically introduced into the arc tubes at our Ravenna Lamp Plant. A drawing of the arc tube exhaust machine showing the personnel locations is attached. Each completed arc tube is visually inspected and then operated for 15 minutes. Any arc tubes not successfully completing the 15 minute burn test would be saved for later disposal at an approved low-level waste disposal site.

The arc tubes passing our 100% inspection would be packaged in bulk packs of approximately 1000 arc tubes per box. Since these arc tubes are intended for incorporation into a lamp product, they will not be individually labeled. Instead, a statement of "Each arc tube contains 0.1 microCi Pm-147" is included either as an insert with each box or as a label on the box.

Krypton-85 Use in Glow Switches and Arc Tubes

Krypton-85 is contained in glow starter switches (electron tubes) that are purchased from several distributors of the same manufacturer. The units are not manufactured by General Electric, but are incorporated into a fluorescent lamp at our Circleville Lamp Plant, which is then distributed by GE Lighting, as an item exempt from the regulations pursuant to 10CFR30.15 and 10CFR32.14. Each glow switch contains < 25 nanocuries krypton-85 present as part of the fill gas of the switch.

Each glow switch is tested by the manufacturer prior to delivery to GE Lighting. Additionally, each is tested at the time of assembly into the lamp. I have attached testing information from the manufacturer. These starter bottles are used in our low-watt (currently 7-13 watt) BIAX lamps. A design drawing and specification sheet is attached, along with a drawing of the lamp indication the location of the switch.

Each individual lamp package contains the statement "Starter bottle in lamp contains < 25 nanocuries Kr-85".

Additionally, this glow switch is also used in one version of our Double-BIAX (DBX) lamp. A drawing of the DBX lamp indicating the location of the switch is attached. The packaging for this version of the DBX lamp uses the same statement as on our BIAX lamp, "Starter bottle in lamp contains < 25 nanocuries Kr-85".

Krypton-85 is also used in the fill gas of another lamp imported from Osram. This lamp (MQI/150) is a metal halide lamp manufactured from a quartz tube to provide significant structural strength. Each lamp contains <48 nanocuries of krypton-85. A drawing of the lamp is attached. Each lamp package contains the statement "Arc tube filling gas contains Kr-85".

Storage of Krypton-85 and Tritium

Previous activities under this license included the generation of krypton-85 and tritium-doped rare gas mixtures for use as fill gases in specific lamp types. The gas mixing operations were conducted at our Tungsten Products Plant. Although the operations had ceased a number of years ago, a small number of gas cylinders of Kr-85 and several ampoules of tritium are still stored at this location in the vault formerly used for for storage of larger quantities of the material. This vault is not used for any other purpose, and worker access to the area is not required for any reason. We have been unsuccessfully trying to dispose of the raw materials to other licensees, but are continuing to look for a means to transfer this material. Until such time as transfer or disposal occurs, on-site storage is a requirement.

GENERAL ELECTRIC

24A510148

REV NO. 1,2 | CONT ON SHEET 2 | SH NO. 1

TITLE

SWITCH, GLOW

CONT ON SHEET | SH NO.

FIRST MADE FOR

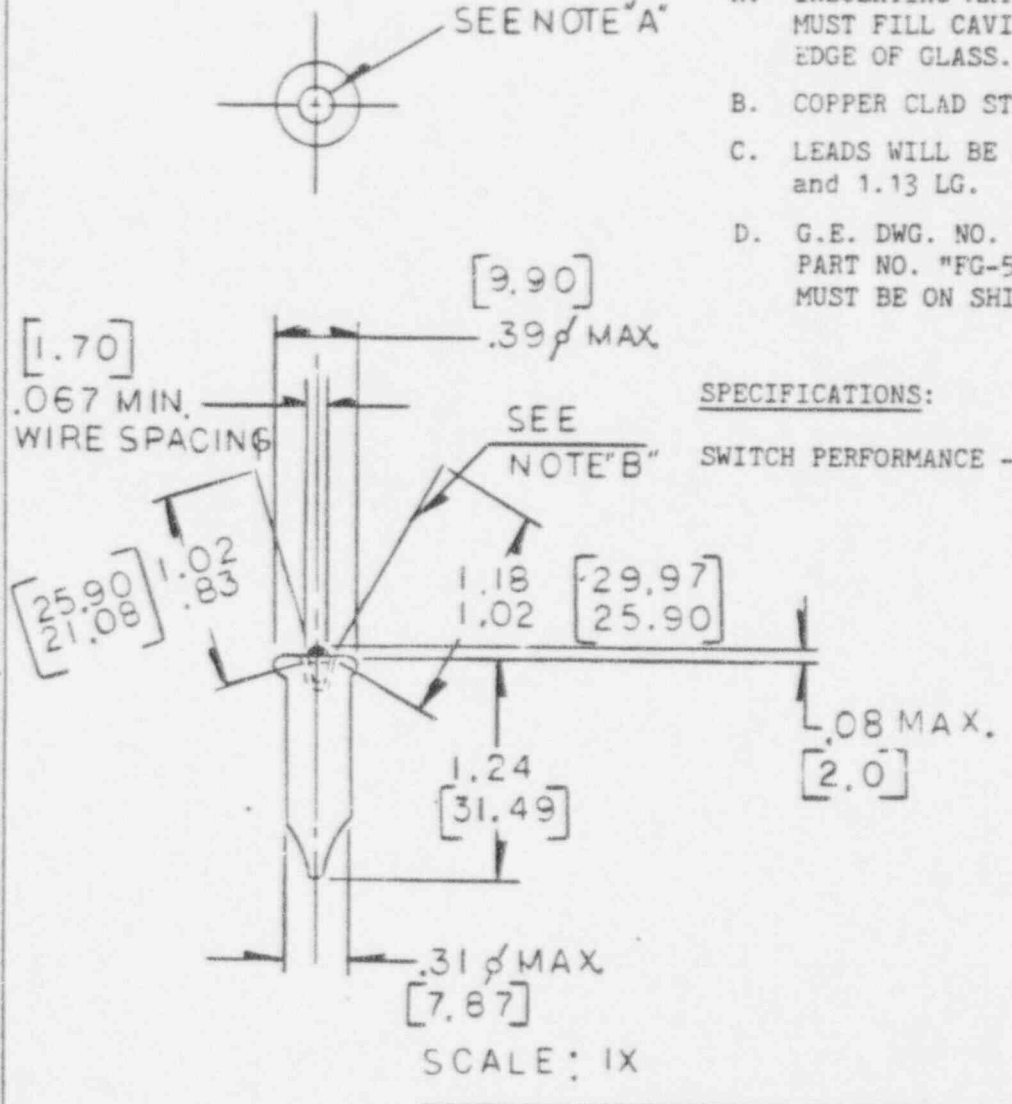
NOTES

A. INSULATING MATERIAL (SILICONE COMPOUND) MUST FILL CAVITY BUT NOT EXTEND BEYOND EDGE OF GLASS.

B. COPPER CLAD STEEL WIRE .016 Ø.

C. LEADS WILL BE RECEIVED WITH 1.25 LG and 1.13 LG.

D. G.E. DWG. NO. "24A510148" AND TOSHIBA PART NO. "FG-5P(W)-G4 (WITH PM 147)" MUST BE ON SHIPPING CONTAINER.



SPECIFICATIONS:

SWITCH PERFORMANCE --------- F32-05-012

for 100/50

UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS FRACTIONS	DECIMALS	ANGLES
		✓	±	±	±

REVISIONS

1	OCT 16, 1981	DLM	DIMS .98 MAX DELETED. ADD MILLIMETRE DIMS. ADD 1.0 MM & REF NOTE
2	OCT 16, 1981	DLM	SILICONE OVERFILL WAS .04 MAX [1.0]

PRINTS TO: CL

MADE BY YUHASZ-11-3-80

ISSUED NOV 24, 1980

APPROVALS

FLUOR — DIV OR DEPT

NELA PARK — LOCATION

24A510148 CONT ON SHEET 2 SH NO. 1

FF 803-F (4-78) PRINTED IN U.S.A.

5434

GENERAL ELECTRIC

24A510148

CONT ON SHEET – SH NO. 2

REV NO.

CONT ON SHEET SH NO.

TITLE

SWITCH, GLOW

FIRST MADE FOR

REVISIONS

CIRCLITE 100/50

Part No. 24A510148
Sheet 2 of 2

GLOW STARTER PERFORMANCE
AQL REQUIREMENTS

Ref: STD. Notice F32-05-012

	Limits	AQL or other Criteria
Dimensions	Per Dwg., Sheet 1	2.5%
Electrical Performance Tests:		
Dead Time @ 108 volts	0.2 to 3.5 sec.	2.5%
Dead Time @ 120 volts	0.2 to 1.5 sec.	2.5%
Breakdown Voltage	92 V rms min.	2.5%
Non Reclosure Voltage	92 V rms min.	2.5%
Starting Time:		
108V on High	15 sec. max.	1.5%
116V on Low	20 sec. max.	1.5%
Cumulative		1.5%
Mechanical		
Electrode-to-Wall Contact		4.0%
AQL Level II:		
Total Cumulative		4.0%
Endurance Test:		
No. Starts	6000	Sample of 10.
@ Line Volts	109 rms	Lot accept < 2 failures
Deactivated Lamp	5 hours	Lot reject 2 or more failures.
Deseasoning Test:	24 hr @ 65°C	Sample of 10 Lot Accept:
Dead Time @ 108V Average value	3.5 sec. max.	8 of 10
Dead Time @ 110V Maximum value	10 sec.	10 of 10
Radioactivity:	0.1 μ curies max.	
Material:	PM 147	
Emissivity - Intact Bottle	< 0.2 m rad/hr. max.	
Emissivity - Electrodes	> 1.0 rad/hr. max.	

1 APR 20, 1981 RD
Delete Preheat Time.
Add mechanical AQL.

CL

PRINTS

MADE BY Donald E. Hagan

ISSUED NOV 24, 1980

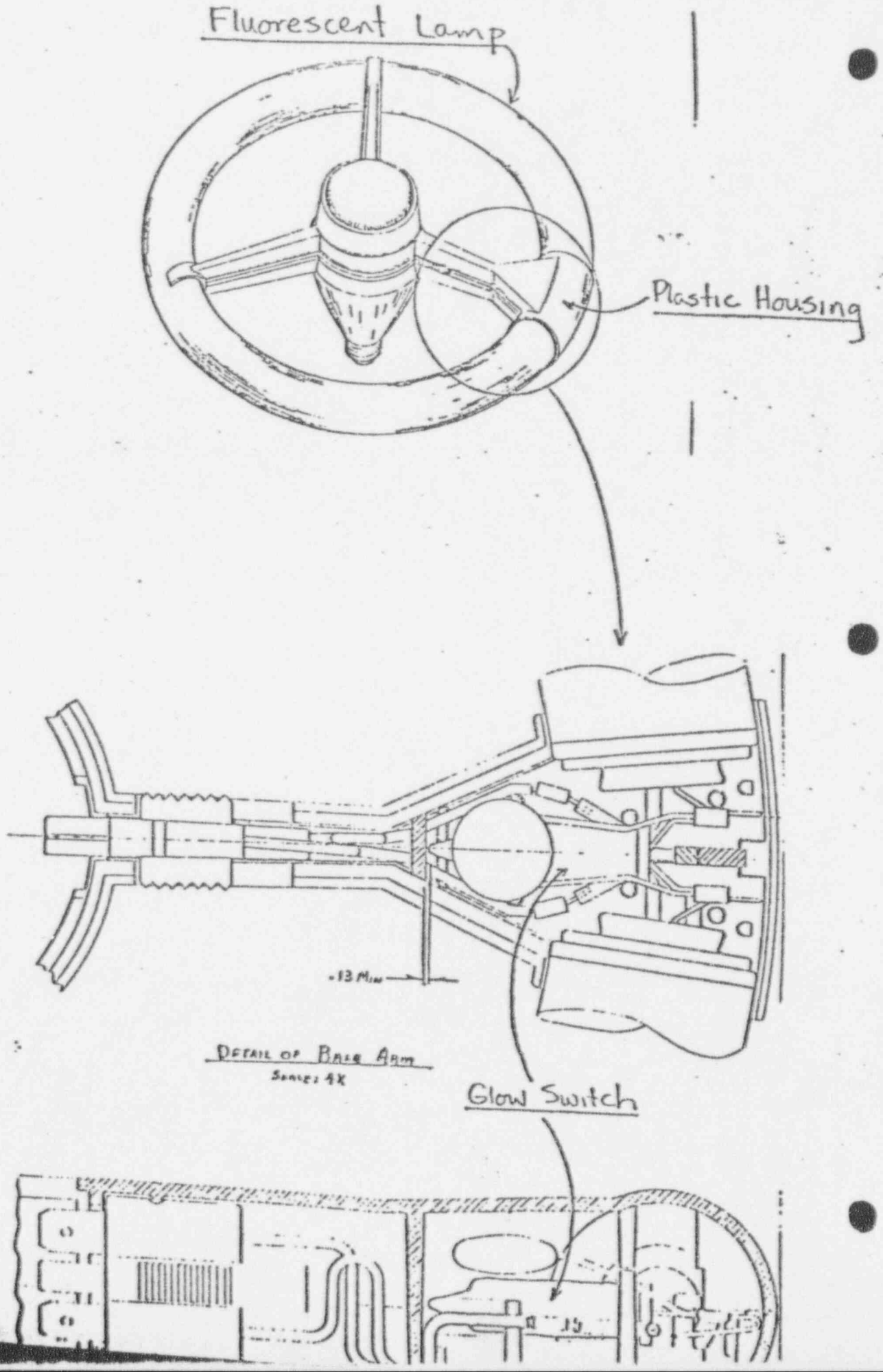
APPROVALS RD

FLUORESCENT DIV OR DEPT.

NELA PARK LOCATION

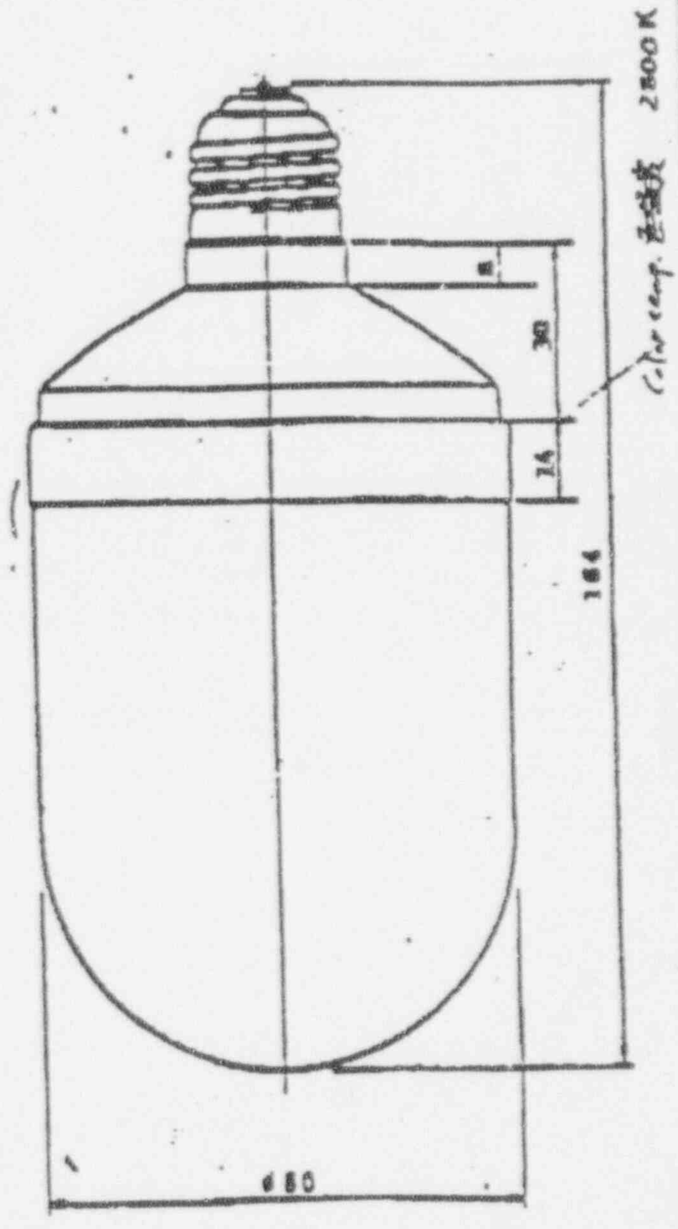
24A510148

CONT ON SHEET – SH NO. 2



DETAIL OF BALL ARM
SCALE: 4X

TOSHIBA



Color	Outer Diameter (mm)	Over All Length (mm)	Base	Supply Voltage (V)	Frequency (Hz)	Lamp Wattage (W)
Warm White	80	164	E26	120	60	16

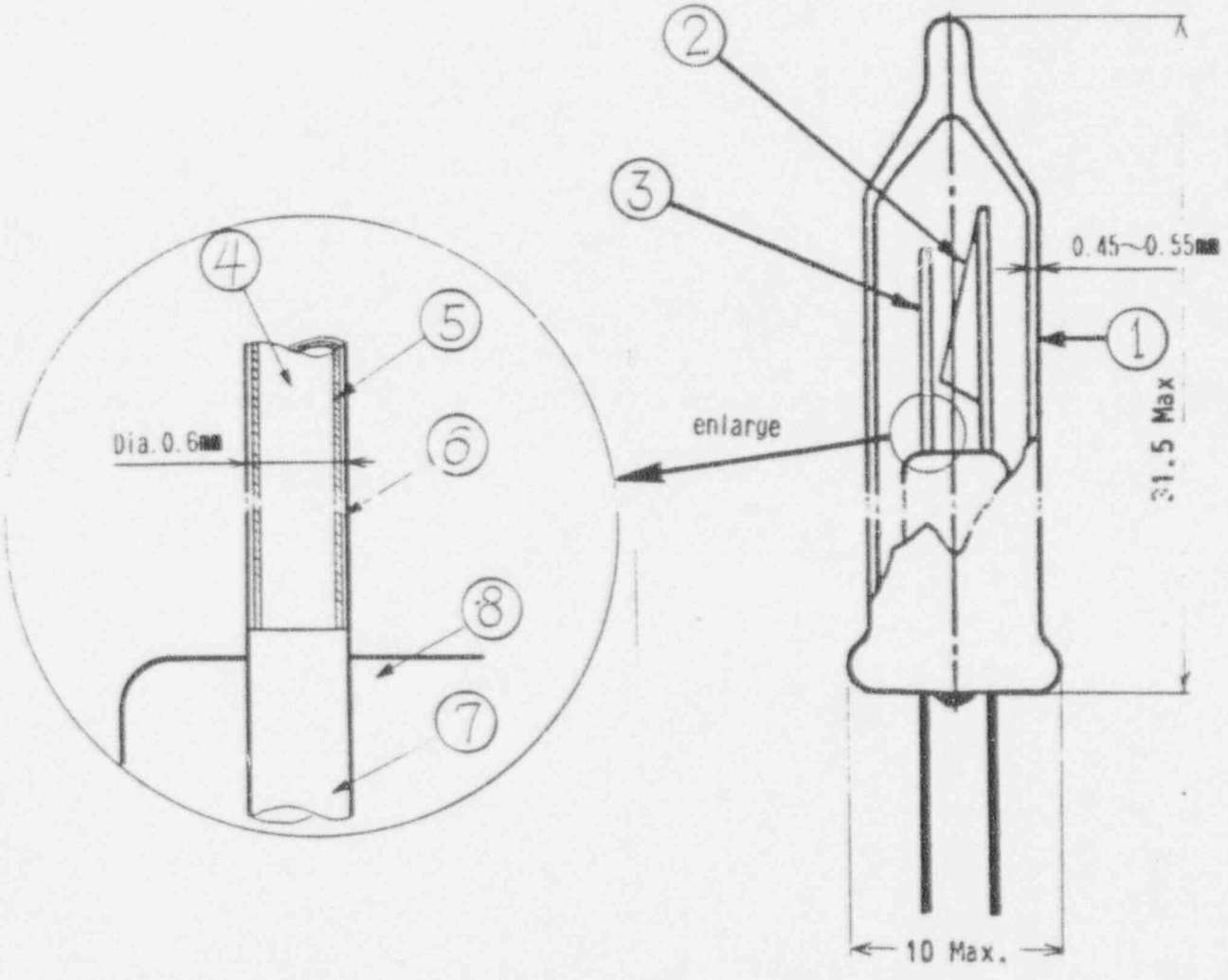
Lamp Current (A)	Luminous Output (lm)	Luminous Efficacy (lm/W)	Weight (g)	Average Life (hrs)	Globe
~~0.30~~ 0.27	750	46.9	480	9000	Opal

NOTE (CATALOG NO.)	DESCRIPTION
EFT120V16WW.OPE/E	TOSHIBA FLUORESCENT LAMP " NEO BALL "

DESIGNED BY	CHECKED BY	APPROVED BY	DRAWING NO.
K. Mizuno	O. Ohsawa	M. Aida	EFT16-001E/E
3rd ANGLE	SCALE:	UNIT: mm	DATE ~~1995-11-15~~ 1996-2-5

LAMP DIVISION
TOSHIBA CORPORATION

GLOW STARTER BOTTLE CONSTRUCTION



No.	PART NAME
1.	Glow starter bottle
2.	Bi-metal electrode (non-radioactive)
3.	Radioactive electrode
4.	Fe-Ni alloy wire (non-radioactive)
5.	Pm147 (Radioactive, Electroplating)
6.	Ni58 (non-radioactive, Electroplating)
7.	Dumet wire (non-radioactive)
8.	Glass stem

Glow Starter Bottle Specification

Fill Gass	Argon 22Torr
Bimetal	
Gap	0.3mm
Pre-stress	60grams
Flexure Characteristics	
Young coeff.	1.3×10^{4} (Kg/mm^2)
Flexure coeff.	20.0×10^{-6}/℃
Radioactive Material	
Isotope	Promethium-147
Radioactivity	less 0.5μCi
Absorbed Dose Rate	0.0mrad/h
(Acuracy	± 0.05mrad/h)
Activator	Barium

Capacitor Specification

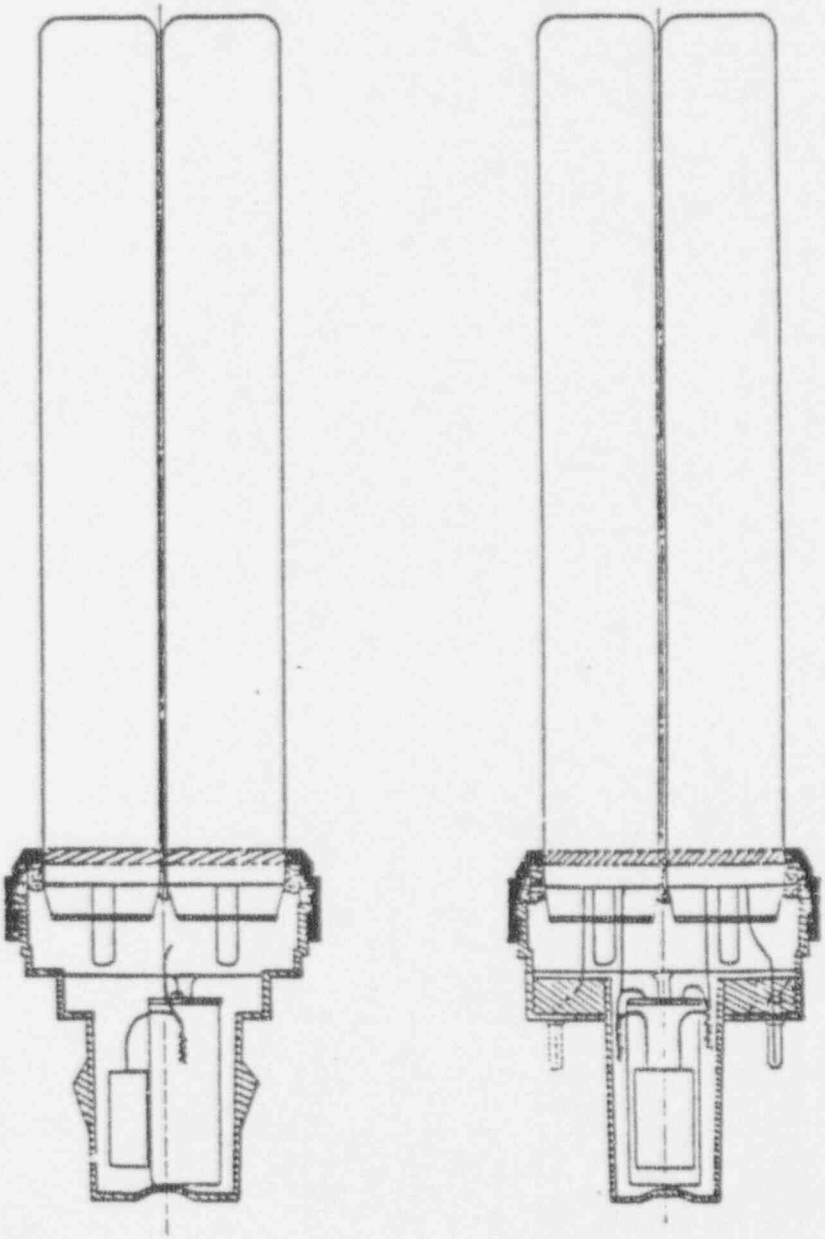
Material	Polyester film
	Aluminium foil
Capacitance	0.006μF(±20%)
Approved Temperature	120℃

DRX glo starter.

CONTROL NO. 088818

EXHIBIT III

Lamp Construction



Attachment I

Promethium Pellet, Toshiba designation # RMZ-24B

Description: Zeolite sphere, impregnated with promethium-147, coated with sintered alumina/silica ceramic, insoluble.

Size: 1 mm diameter average, 1.5 mm maximum

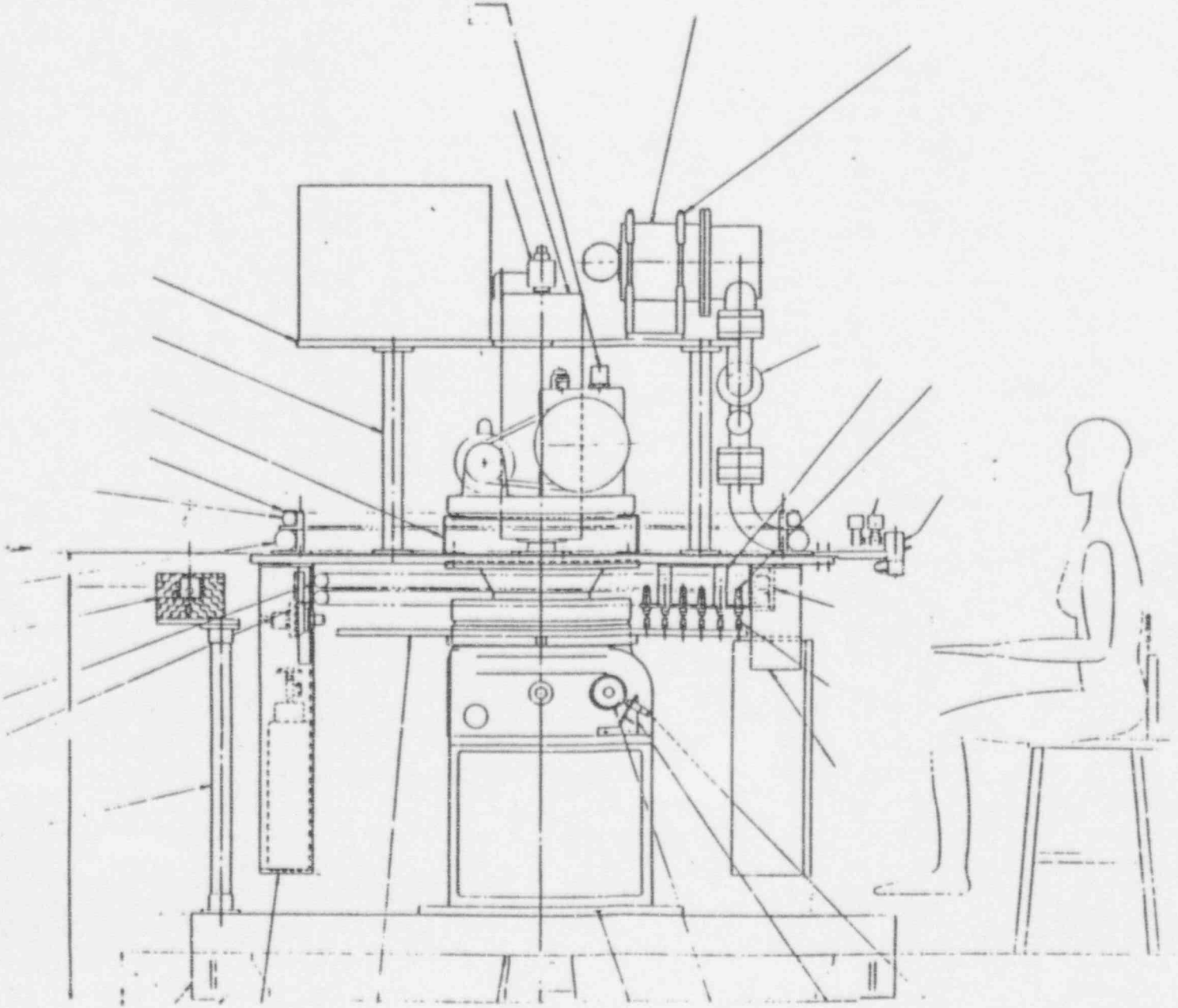
Weight: 1.0 gram per 1000 pieces (+/- 20%)

Main components: Zeolite core with coating of alumina/silica ceramic

Radioactivity: 0.1 microcuries per pellet (+/- 20%)

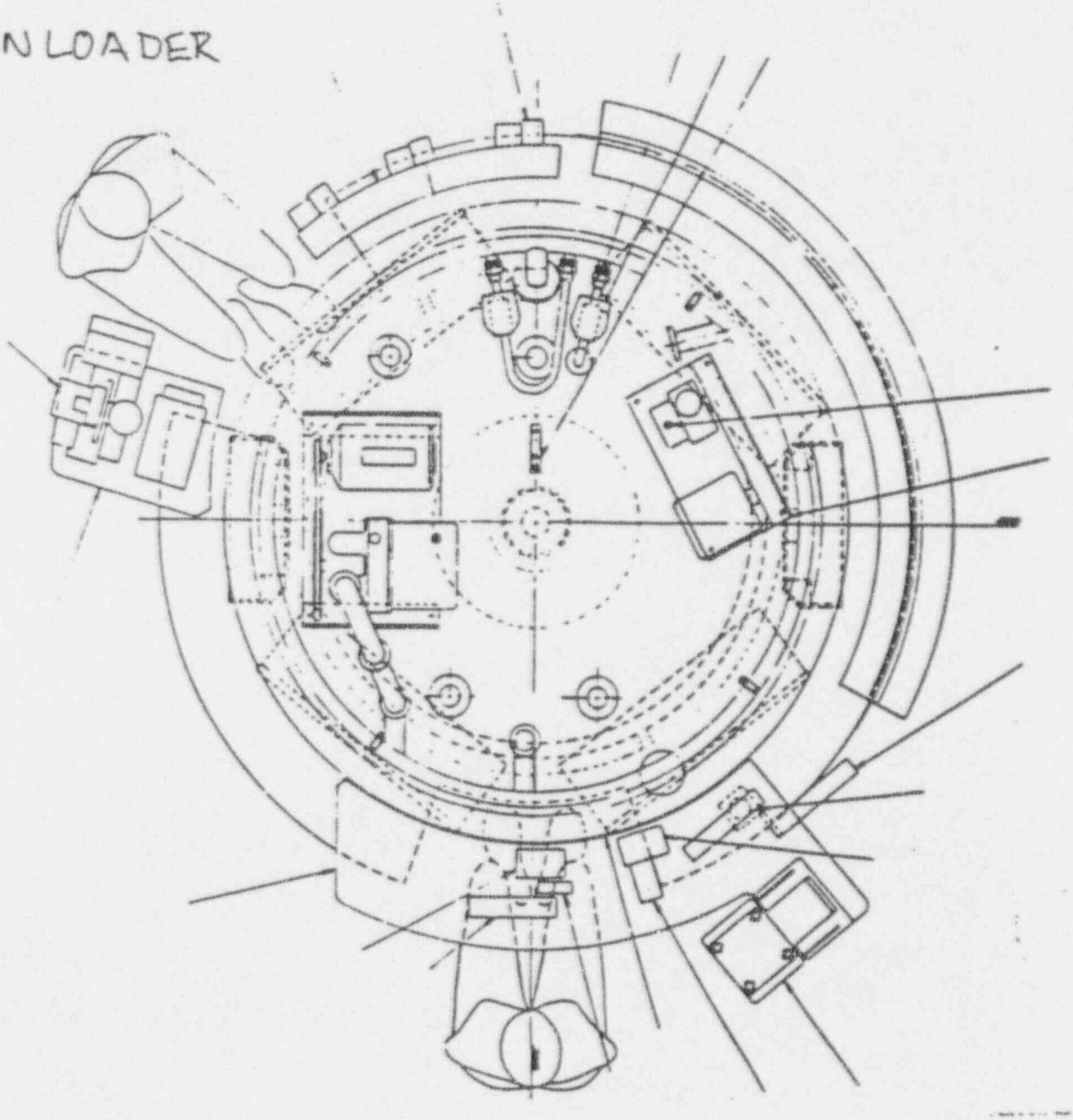
Smear test: < 1.0 E -4 microcuries per pellet

LOADER
STATION



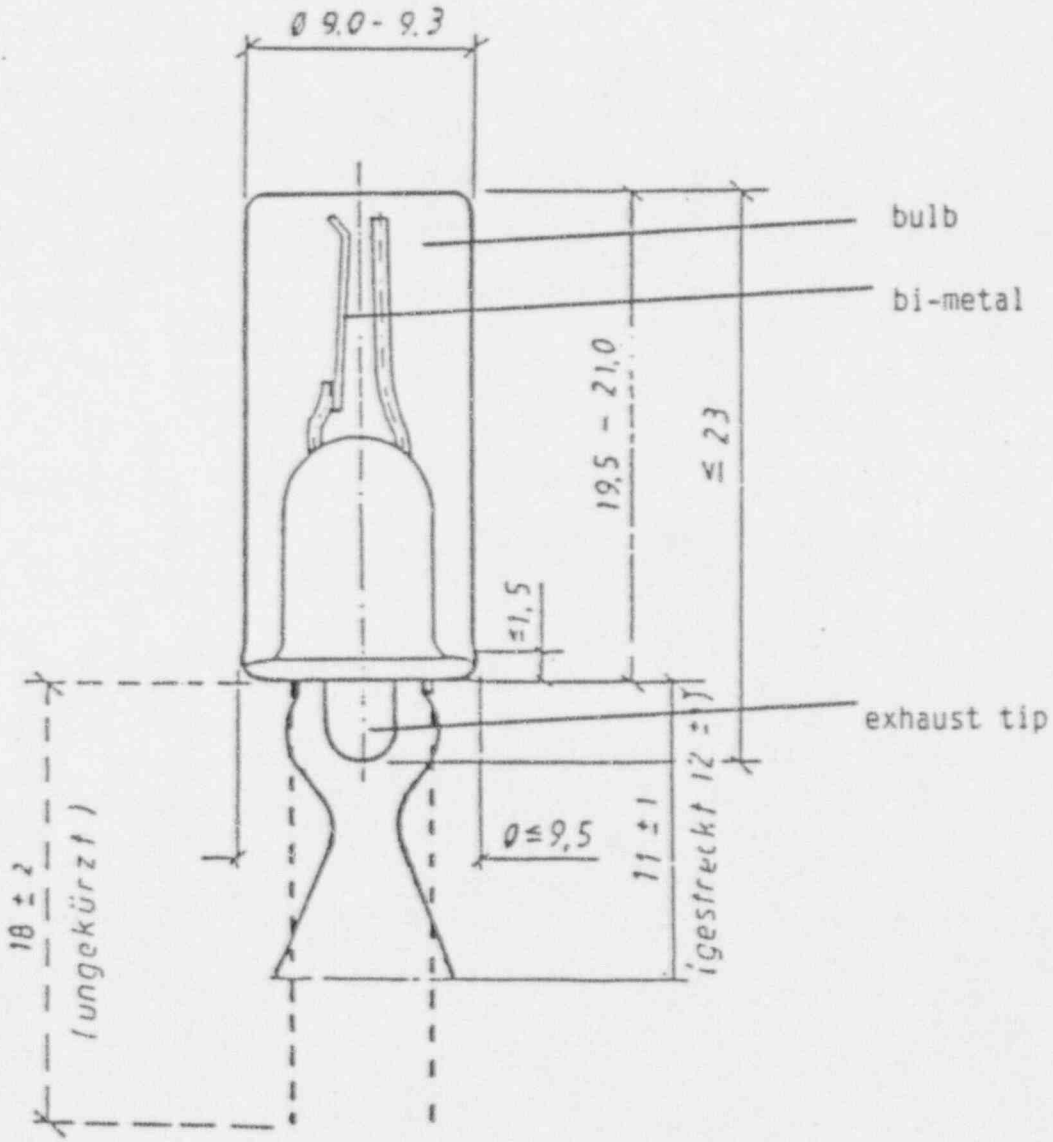
E520 EXHAUST MACHINE LAYOUT

UNLOADER



LOADER

design spez.	glow switch	Type: GZ 115 GZ 115/3
	Datum: 10/88 Blatt: /	



Technical data for glow-switch

1. Type: GZ 115

1.1 Material: Glass
1.2 Wall thickness in millimeters: 0,5
1.3 Tube volume in cm^3: 1,0 ± 0,1
1.4 Filling gas: 60% Ar + 28% Ne + 12% He with traces of Krypton 85
1.5 Specific activity in MBq/liter: 18,5
1.6 Filling pressure in millibars: 19 ± 1
1.7 Quantity of Kr85 per tube in Bq: 347 ± 42

2. Radiation level:

Max. energy dose rate of an individual glow switch measured at 1 cm distance from the glow switch surface in millirads per hour: less than 0,001

3. Application: DULUX D 10W; DULUX D 13W

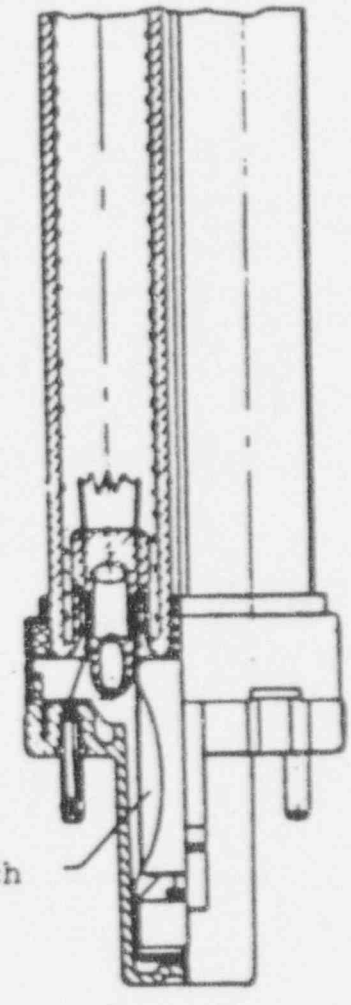
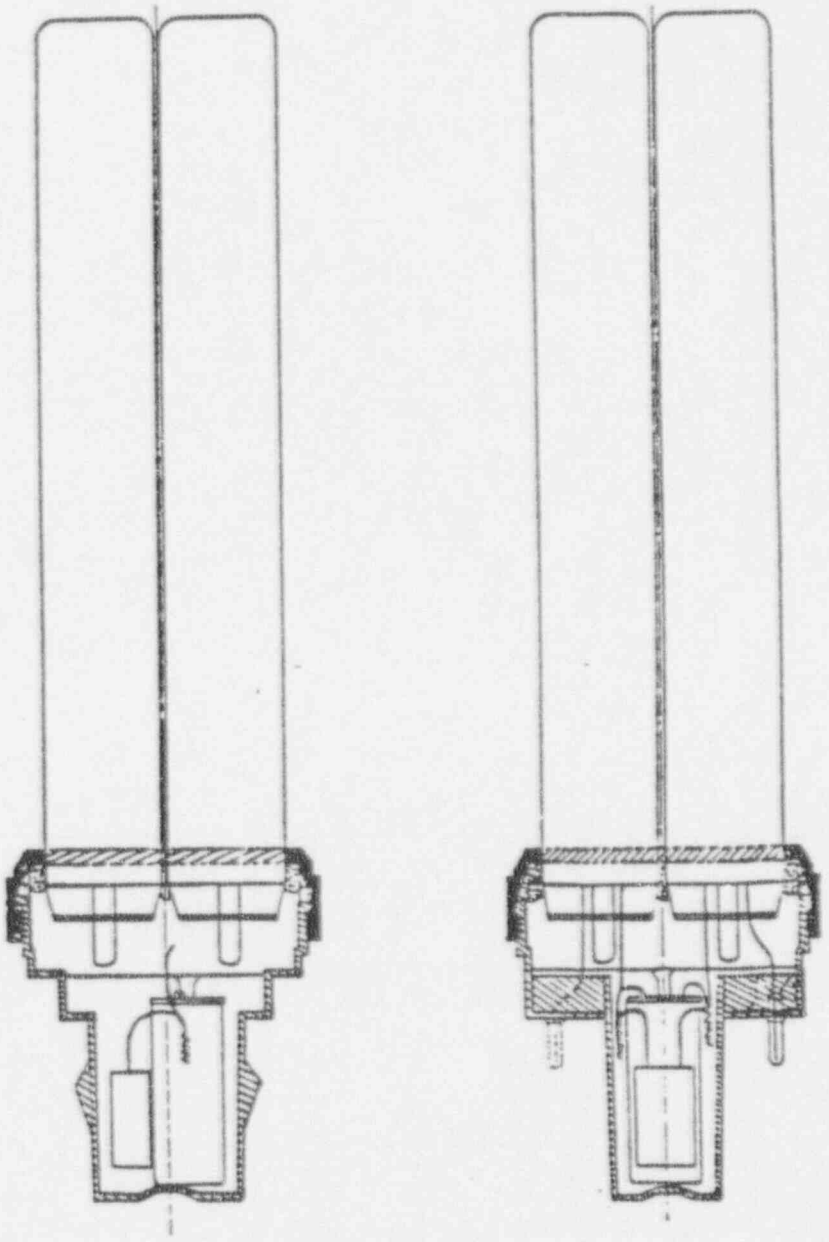

Glow Switch

EXHIBIT III

DBX

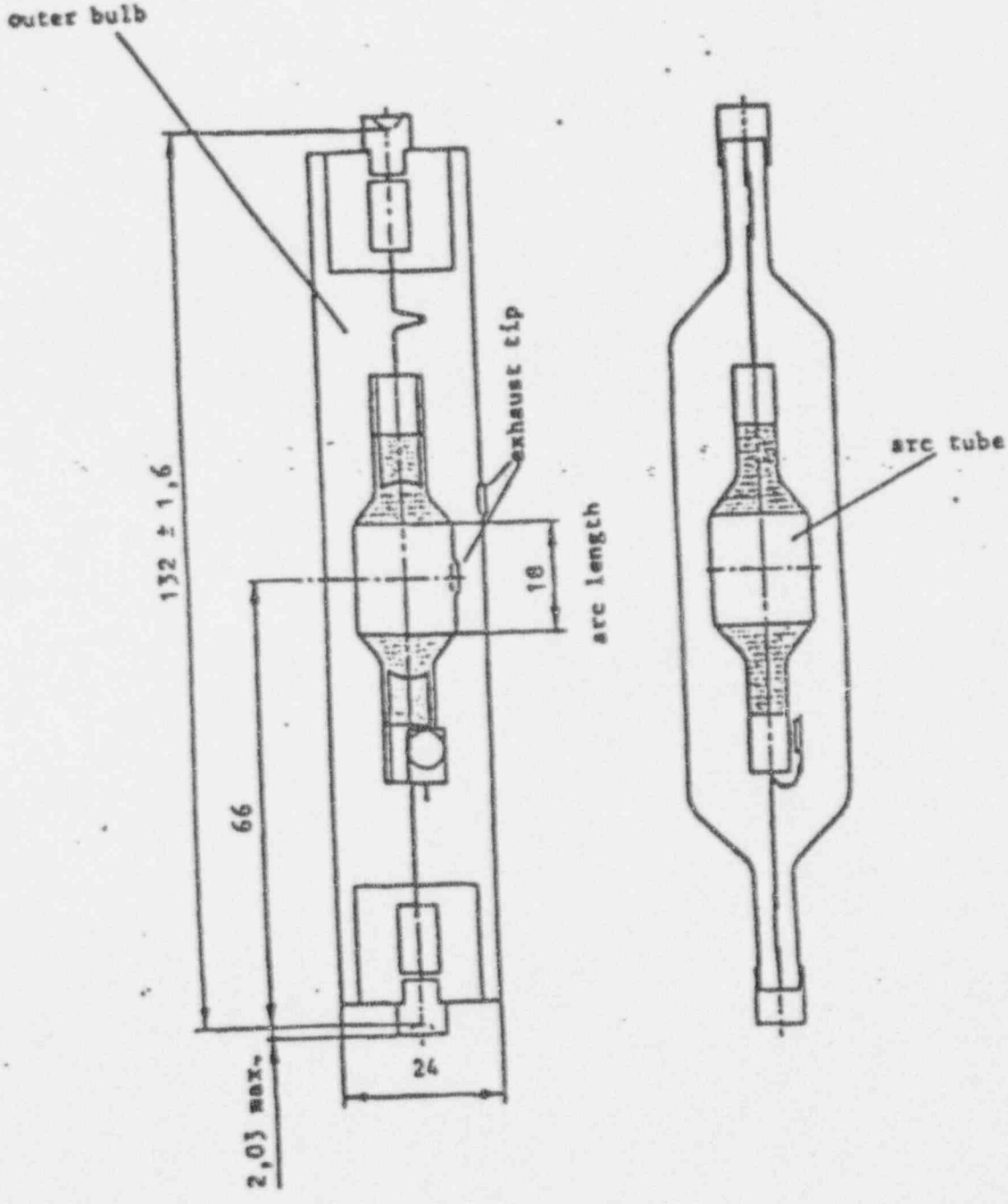
Lamp Construction



OSRAM Design Spec.	Metal Halide Lamps	Lamp type: MQI-TS 150W/NDL
	Date: 19.3.85 page: 1	

not on scale

all dimensions in mm



Attachment to Item 7.

GE Lighting
Nela Park
Cleveland, Ohio 44112

Qualifications Resume for A. M. Zielinski

1. Industrial Hygienist, General Electric Company, Lighting Business Group Cleveland, Ohio; 1981 - Present.

2. Industrial Hygiene Chemist, General Electric Company, Lighting Business Group, Cleveland, Ohio; 1976 - 1981.

3. Education:

   * BS, Chemistry; Cleveland State University, Cleveland, Ohio 1976.

   * Graduate course in Radiological Health Physics, University of Lowell, Lowell, Mass. 1983.

4. Thirteen years experience in the collection and analysis of radioactive isotope samples. Eight years experience in the administration of the radiation protection program of GE Lighting.

5. Certified in Comprehensive Practice by the American Board of Industrial Hygiene (1986).

Attachment for Item 8.

GE Lighting
Nela Park
Cleveland, OH 44112

Training for personnel in restricted areas

Because of the very low level of radiation from the devices covered under this license, restricted areas to control worker exposure to the radioactive material are not needed. However, all personnel involved in the handling of the glow switches and the zeolite pellets as described in attachment 6 are informed as to the proper procedures for handling these items as well as what to do in case of damage to either the lamps or the starter bottles.

A copy of the Safe Handling Procedures for Lamps Containing Byproduct Materials is attached. It is also incorporated into the Radiation Safety Manual for Byproduct Materials as Appendix C.

SAFE HANDLING PROCEDURES FOR LAMPS CONTAINING BYPRODUCT MATERIAL

1.0. PURPOSE

The purpose of this notice is to instruct GE employees who handle lamps containing small quantities of radioactive material, either in manufacturing or distribution activities, regarding applicable Government regulations.

1.1. BACKGROUND

Several models of lamps manufactured and/or distributed by GE Lighting are designed to include a very small amount of radioactive material in each lamp. This radioactive material is contained either as a solid material in a sealed glow switch starter-bottle or as a fill gas in the glow switch or in the arc tube.

The 100/50 Circlite and the Compax lamp both use a starter bottle in which is sealed a glow switch. This glow switch has a small amount of promethium-147 plated onto one of its electrodes. The radiation (beta rays) cannot penetrate the glass walls of the glow switch and therefore pose no radiation risk in storage or use.

The Toshiba #RMZ-24B pellets used in the Toshiba arc tubes also contain a small amount of promethium-147. In this case, it is in a zeolite sphere, which is then coated with sintered alumina/silica ceramic. Again, these spheres pose no radiation risk in storage or use.

The glow switch in low-wattage BIAX lamps (7, 9, & 13 watt) and the MQI-150 lamp arc tube contains a very small amount of krypton-85 as a part of its fill gas. The krypton-85 is also a low-energy radiation emitter and poses no risk in storage or use.

Double-BIAX uses either a promethium-147 glow switch or one using krypton-85, depending on the lamp type. All of the T5 lamps (13, 18, & 27 watt) incorporate a promethium-147 glow switch while the T4 lamps (13, 18, & 26 watt) use a krypton-85 glow switch.

Appropriate notice of the presence of the radioactive material is required with all of these lamps. In the case of the 100/50 Circlite, the notice is included in the "Use and Care" booklet for the lamp system and on the package sleeve for the replacement lamps. For the other lamps, the appropriate notice is located on the packaging.

All GE Lighting employees who handle these products should be aware of these contents and avoid any situation which could result in breakage of the glow switches and/or arc tubes.

2.0. SAFETY PROCEDURES

2.1. CIRCLITE AND COMPAX LAMPS

For the 100/50 Circlite and the Compax lamps, the following applies:

- If the lamp is damaged so that the starter bottle is broken and the glow switch is exposed, handle the switch gently with a set of tweezers and store the switch in a glass bottle with a cover. SUCH HANDLING PROCEDURES MUST BE EMPLOYED, TO PREVENT CHRONIC EXPOSURE OF ANYONE TO THE LOW-LEVEL BETA RADIATION EMITTED BY THE RADIOACTIVE PROMETHIUM-147 ON THE GLOW SWITCH.

- OUR LICENSE REQUIRES THAT DAMAGED AND DEFECTIVE 100/50 CIRCLITE AND COMPAX LAMPS NOT BE DISCARDED IN THE REGULAR TRASH. Therefore, do not discard any part of the damaged lamp. Call me (8*346-3349) or Art Kaplan (8*346-8618) for appropriate instructions concerning the shipment of the damaged lamp (parts) to Lighting Environmental Operation for appropriate disposal.

2.2. Toshiba pellets and arc tubes

For the Toshiba arc tubes and the pellets used in the arc tubes, the following applies:

- If the arc tube is damaged so that the tube is broken and the pellet is exposed, handle the pellet gently with a set of tweezers and store the pellet in a glass bottle with a cover. SUCH HANDLING PROCEDURES MUST BE EMPLOYED, TO PREVENT CHRONIC EXPOSURE OF ANYONE TO THE LOW-LEVEL BETA RADIATION EMITTED BY THE RADIOACTIVE PROMETHIUM-147 IN THE PELLET.

- OUR LICENSE REQUIRES THAT DAMAGED AND DEFECTIVE ARC TUBES CONTAINING THE TOSHIBA PELLETS NOT BE DISCARDED IN THE REGULAR TRASH. Therefore, do not discard any part of the damaged lamp. Call me (8*346-3349) or Art Kaplan (8*346-8618) for appropriate instructions concerning the shipment of the damaged lamp (parts) to Lighting Environmental Operation for appropriate disposal.

2.3. LOW WATTAGE BIAX AND MQI-150 LAMPS

For the low wattage BIAX lamps (7, 9, and 13 watt) and MQI-150 lamps, the following applies:

- If the lamp is damaged such that the low watt BIAX glow switch or the MQI-150 arc tube is broken, the small amount of gas present would immediately dissipate into the air resulting in an insignificant concentration, posing no risk to anyone.

- OUR LICENSE REQUIRES THAT DAMAGED AND DEFECTIVE LOW WATT BIAX AND MQI-150 LAMPS NOT BE DISCARDED IN THE REGULAR TRASH. The low watt BIAX glow switch must be removed and saved for proper disposal. Once this has been done, the remaining lamp parts may be discarded in the normal manner. Scrap, intact MQI-150 lamps must also be saved for proper disposal. Call me (8*346-3349) or Art Kaplan (8*346-8618) for appropriate instructions concerning the shipment of the damaged lamp (parts) to Lighting Environmental Operation for appropriate disposal.

2.4 DOUBLE-BIAX LAMPS

For the T5 Double-BIAX lamps, the safety procedures described above for use with the 100/50 Circlites and Compax lamps should be followed. For the T4 Double-BIAX lamps, the safety procedures described above for the BIAX lamps should be followed.

- o OUR LICENSE REQUIRES THAT DAMAGED AND DEFECTIVE DOUBLE-BIAX LAMPS NOT BE DISCARDED IN THE REGULAR TRASH. The Double-BIAX glow switch must be removed and saved for proper disposal. Once this has been done, the remaining lamp parts may be discarded in the normal manner. Call me (8*346-3349) or Art Kaplan (8*346-8618) for appropriate instructions concerning the shipment of the damaged lamp (parts) to Lighting Environmental Operation for appropriate disposal.

The procedures outlined above are mandatory as a condition of our licenses with the U.S. Nuclear Regulatory Commission and with various individual State agencies. Customers are exempt from any such requirements.

If you have any questions related to this matter, please contact me.

A. M. Zielinski
Lighting Environmental, Health
and Safety Department

Attachment for Item 9.

GE Lighting
Nela Park
Cleveland, Ohio 44112

Radiation Detection Instruments

Type of Instrument	Number Available	Radiation Detected	Sensitivity Range	Use
Victoreen Survey Meter Model 493	1		0-30,000 cpm	
w/491-40	1	beta,gamma		general survey
& 489-35 probes	1	alpha,beta, gamma		general survey
Victoreen Survey Meter Model 440	1	alpha,beta, gamma	0-300 mR/h	general survey
Eberline Survey Meter Model ESP-2	2			
with AC-3	2	alpha	0-50 K cts/sec	alpha survey
& HP-270 probes	2	beta,gamma	Bkg - 3 K mR/h	general survey
Eberline Survey Meter Model ESP-1	6			
with AC-3 probe	6	alpha	0-50 K cts/sec	alpha survey
Eberline Model MS-2 Scalar & Voltage Supply (used with FC-2)	1			
Eberline Model FC-2 Gas Flow Proportional Counter (used with MS-2 Scalar)	1	alpha,beta	0-1,000,000 cts.	Leak test & sample analysis
Ludlum Model 2929 Dual Chan. Scaler	2	alpha,beta, gamma	0-1,000,000 cts	Leak test & sample analysis
Eberline Model MP-2 Mini-Pulser	1			Calibration of meters
Pocket Dosimeters	4	gamma	0-200 mR	general use

GE Lighting
Nela Park
Cleveland, Ohio 44112

Radiation Detection Instruments (Cont.)

The Eberline Mini-Pulser is used to checkout, troubleshoot and calibrate both the ESP-2 survey meter and the Mini-Scaler. As a pulse generator, it can both verify the operation of the meter, and if there is a problem, help to identify either the meter or the probe as a possible source of trouble.

G-M Survey meters are calibrated with a Victoreen Gamma Survey Instrument Calibrator (Model 773) either annually, or at a minimum, prior to use. This calibrator is a sealed source containing 141 millicuries Cesium-137 and is specifically designed for the calibration of survey meters. The manufacturer's instructions are followed in performing the calibrations. Also available is a pocket dosimeter calibrator containing an 8 uCi Cesium-137 source.

In addition, a number of small calibration sources (Cobalt-60, Bismuth-210, Promethium-147, Strontium-90, Nickel-63, Cesium-137, Americium-241) are maintained. These calibration sources are accurate to +/- 5% and are traceable to NBS, with the exception of the Nickel-63. A set of 3 Thorium-230 calibration sources are used to determine the efficiency of the Ludlum 2929 and also that of the alpha survey instruments.

Where used, air sampling instruments are calibrated before and after each use.

Attachment for Item 11.

GE Lighting
Nela Park
Cleveland, OH 44112

Waste management

Waste disposal of scrap material is done by transfer of the waste material to the Chem-Nuclear Systems, Inc site at Barnwell, South Carolina. Waste material is generally produced only in very small quantities since all of the individual starter bottles are individually tested by both the manufacturer and during assembly into lamps. The small numbers of defective starter bottles are saved in boxes and later consolidated into DOT spec 17H drums. All such waste transfers to Barnwell are coordinated through Nela Park and are done under the direction of the RSO.

Scrap lamps that fail for reasons other than the starter bottles are disassembled to recover and reuse the starter.

Arc tubes containing promethium-147 that fail the 15 minute burn test are collected intact in boxes and saved for disposal at Barnwell in a manner similar to that for scrap starter bottles.

Additional information on waste disposal can be found in Chapter 8 of the Radiation Safety Manual for Byproduct Material.

GE LIGHTING

RADIATION SAFETY MANUAL

for

BYPRODUCT MATERIAL

Prepared:

Approved:

Issued:

CONTENTS

CHAPTER 1

INTRODUCTION

GE Lighting currently uses radioactive materials in a number of different applications including sealed source level controls, as an emission mix in several lamp types, as a component in its NF and 2TH wire, and in starter bottles in several of its lamps.

This Radiation Safety Manual is designed as a guide to the plant or Master Warehouse Radiation Safety Officer. It is intended to provide information and procedures which are to be used in the normal conduct of his responsibilities. The specific instructions included in this Manual are based on the regulations of the Nuclear Regulatory Commission, information submitted as part of our license applications, or current good practice guides.

1.1 SEALED SOURCE BYPRODUCT MATERIALS PROGRAM

Currently, many of our glass plants as well as several other locations operate under a byproduct materials license which regulates our use of sealed sources, typically cesium-137 or cobalt-60. Under this license, the plants are permitted to use sealed sources from manufacturers licensed to distribute such devices to specific or general licensees. These sources are used to measure or control either the level of glass in the furnace or the thickness of material in other processes. Also, under this license, are several other sealed sources containing either tritium or nickel-63, that are used as detectors in gas chromatography equipment. All these operations are governed by our Byproduct Materials License 34-00054-06.

Another, different use of sealed source byproduct material is the use of starter bottles containing radioactive material. These starter bottles are used as a component part of certain lamp products, notably our 100/50 Circlite, BIAX, Double-BIAX, Compax and MQI/150 lamps. The 100/50 Circlite starter bottle contains a small amount (0.1 uCi) of promethium-147 (Pm-147) plated onto one of its wires and then over-plated with nickel. The BIAX lamps (7, 9, 11, and 13 W) have a starter bottle that contains krypton-85 (Kr-85) as part of the fill gas (< 25 nCi). The

Compax lamps are currently sourced and contain a starter bottle similar to that in the Circlite but with slightly more radioactive material (0.33 uCi). The MQI/150 lamps contain krypton-85 (< 48 nCi) as part of the fill gas mixture. Double-BIAX (DBX) lamps contain either promethium-147 (< 0.5 uCi) or krypton-85 (< 25 nCi), depending on source. The T4 DBX lamps, sourced from Osram, contains the same starter bottle as that used in the low-watt BIAX lamps and uses krypton-85. The T5 DBX lamp, sourced from Toshiba, contains a starter bottle similar to that used in the 100/50 Circlite and the Compax and uses promethium-147. The possession and use of these starter bottles and lamps is governed by our Byproduct Materials License 34-00054-05. Distribution of these materials to the general public is governed under Byproduct Materials License 34-00054-07E.

In addition to these federal licenses, several plants and Master Warehouses located in what are called "Agreement States" operate under local licensing programs (California, Georgia, Illinois, Kentucky, Maryland, and Texas).

1.2 SOURCE MATERIALS PROGRAM

We also use naturally occurring source material, thorium, in several of our processes. Two of our wire products NF and 2TH wire contain respectively 1 or 2% thorium. These wires are used either as electrodes or shanks in several of our lamp products. In addition, one of our emission mixes that is used as a coating on our mercury discharge lamp electrodes contains thorium. Thorium may also be used in some of the arc tube doses. The manufacturing of the wire, emission mix, and the lamps are governed under our Source Materials License SMB-191.

A companion Radiation Safety Manual for Thorium Use covers the RSO's responsibilities under this license.

1.3 GROUP-LEVEL RESPONSIBILITIES

The Lighting Environmental Operation (LEO) at Nela Park is responsible for the overall direction and guidance under these licenses. Contacts with the Nuclear Regulatory Commission concerning the program, our licenses, and applications for renewal or modification of these licenses will be done by LEO. For those licenses where the licensee is the Group and which operate under NRC jurisdiction, the Radiation Safety Officer (RSO) will be the Group Industrial Hygienist. Licenses for those plants in Agreement States will have the industrial hygienist listed as RSO with the plant's RSO listed as the authorized user of the material.

The Group Hygienist will be responsible for the maintenance of this Manual and for assuring that it reflects the current authorizations and restrictions of our licenses, as well as the application of current good practice in maintaining exposures to levels as low as reasonably achievable.

All waste shipments, purchase of new gauges, and transfers of gauges between facilities must be coordinated with LEO. Specific contracts for waste disposal with the low-level disposal site have been arranged and the appropriate transport permits have been obtained. Because of the detailed disposal and transportation regulations covering these activities, as well as the stiff penalties involved, these operations are best handled at the Group level.

The analysis of all leak tests, air samples, and surface contamination wipe tests will be done at Nela Park, under the direction of the Group Industrial Hygienist. In addition to the necessary analytical equipment and calibration standards, a selection of appropriate field testing equipment, such as Gieger-Mueller meters, ionization chamber meters, alpha survey meters and pocket dosimeters will be maintained at LEO, along with the appropriate calibration devices and sources.

1.4 PLANT RESPONSIBILITIES

The plant Radiation Safety Officer, as appointed by the plant manager, has the overall responsibility for the radiation safety program at the plant. The later chapters in this manual provide a detailed description of these duties, including the training of local plant personnel, the maintenance of the plant inventory of radioactive materials, leak testing and limited servicing of gauges, and disposal of radioactive materials.

1.5 RESPONSIBILITIES OF MASTER WAREHOUSES

The on-site Radiation Safety Officer (RSO) has overall responsibility for the radiation safety program at the Master Warehouse. Later chapters in this manual provide a detailed description of these duties including the training of personnel, control of the lamps containing radioactive materials, and the disposal of broken lamps.

1.6 ADMINISTRATIVE RESPONSIBILITIES

Regardless of whether the plant or warehouse is regulated under the NRC or an Agreement State, copies of the pertinent regulations must be maintained at the site. Additionally, the

NRC and most states require that a posting be permanently displayed in an area available to plant personnel, notifying them that the site operates under a license, that copies of that license, applications, and regulations are available for review, and who at the state or NRC may be contacted for complaints.

Sample copies of the appropriate notice and the posting form used by the NRC are included in Appendix A. Copies of the NRC regulation 10 CFR Parts 19, 20, 21, 30, and 32 are included in Appendix B. Copies of the applicable Agreement State regulations should by obtained by the plant RSO.

1.7 ENFORCEMENT

Should an area of non-compliance with licensing requirements be identified at the facility, both the plant RSO and the Lighting Environmental Operation shall independently have the authority to halt or suspend any and all activities involving the use of radioactive materials until such time as the non-compliance has been corrected and appropriate actions taken to assure continued compliance.

Personnel working with radioactive materials or having assigned responsibilities concerning the material shall be subject to normal company disciplinary procedures. Non-conmpliance with their duties shall result in diciplinary actions ranging from written warnings through dismissal.

CHAPTER 2

TRAINING

2.1 TRAINING REQUIREMENTS - GAUGE LICENSE RSO'S

Nuclear Regulatory Commission regulations specify that Radiation Safety Officers must be qualified by training and experience to use the material for the purposes covered under the license in such a manner as to protect health and minimize hazard to life and property. For those locations where operations such as installation, gauge relocation, and radiation surveys are performed, the plant RSO who will be responsible for such activities must have received training in the following areas:

1. The principles and fundamentals of radiation protection and good safety practices related to the use of radioactive materials.

2. Radioactivity measurements, the use of radiation detection instruments, and monitoring techniques.

3. Biological effects of radiation.

4. Procedures for performing services.

5. Actual practice in performing the services.

6. NRC regulations pertinent to the safe use of devices, including the maintenance of records of receipt, surveys, leak and shutter tests, and training.

7. Required notices and signs such as "Notice to Employees" (Form NRC-3).

8. Training of plant employees.

9. Safety practices applicable to protection from radiation.

Because of the strictly limited scope of the servicing operations allowed under our license, this training need not be formal nor conducted in a classroom setting. The training of plant RSO's will be done by the Lighting Environmental Operation, prior to or

in conjunction with the installation of the first gauge at the facility. Training specific to each individual gauge will be provided by the manufacturer of the gauge. Typically, the training will be conducted over a period of 1-2 days, covering 8-16 hours. The competency of the plant RSO to carry out his duties under our license will be determined by direct observation of the RSO during the training and by periodic checks throughout the future, conducted by the Group RSO. Training must be accompanied by the use of up-to-date manuals and instruction sheets provided by the source and device manufacturers.

For facilities where there will be no servicing done, such as those where the material is part of a gas chromatograph, the training required is similar to that given above, with the exception that it will not cover the servicing of the device.

Typically, the servicing operations are performed only during repair of the furnace. Because of the non-routine and infrequent nature of these operations, the Group RSO will be available to the plants for assistance during the servicing.

2.2 TRAINING REQUIREMENTS - GAUGE LICENSE PLANT PERSONNEL

Typically, a number of employees will be working under the direction of the plant RSO either routinely or during servicing operations. As a minimum, these employees should receive training and instructions in the operation and use of the gauges at the plant. If a gauge installation is being done by the supplier, these employees should attend the training and instruction given by the supplier at the time of the installation. Alternatively, these employees must be trained either by the plant or Group RSO.

This training should cover, in addition to the above information provided by the supplier, the following topics:

1. The basic principles of radiation safety and good safety practices related to the plant's use of radioactive materials

2. The purpose for which radiation detection instruments will be used

3. A review of the appropriate emergency and operating procedures, including safety procedures, use of the shutter mechanism, shutter lock procedures during maintenance, control of access

4. Specific instructions in procedures to be used to minimize exposure to radiation

In addition to employees working under the direction of the plant RSO during servicing of the gauges, other plant personnel will normally be working in the same general area as the gauges, but will have no actual or potential exposure to the radiation. These employees might, for example, be operators of the glass furnace on which the gauge has been located. Although not required by NRC regulations, some training in basic radiation safety should be provided to these employees along with information on the plant's radiation program. This will help to acquaint the employees with the materials used and provide accurate information on the potential for exposure to the radiation.

Records of the training provided to the employees working under the direction of the plant RSO or to other plant employees must be maintained for possible review by the NRC or by LEO. Such records must include the topics covered during the training, the date, and information on who received the training and by whom the training was provided.

Training materials and outlines, as well as the training itself is available from the Lighting Environmental Operation. Many manufacturers and suppliers of gauges also provide training courses.

2.3 TRAINING REQUIREMENTS - NON-GAUGE LICENSES

Training requirements for non-gauge licensees are basically similar to that for gauge licensees with the obvious deletion of the information pertaining to the use and servicing of the gauges. The training required for the RSO includes:

1. The principles and fundamentals of radiation protection and good safety practices related to the use of radioactive materials.

2. Radioactivity measurements, the use of radiation detection instruments, and monitoring techniques.

3. Biological effects of radiation.

4. Required notices and signs such as "Notice to Employees" (Form NRC-3).

5. Training of plant employees.

Training for plant personnel working directly with the licensed material shall include the following topics:

1. The basic principles of radiation safety and good safety practices related to the plant's use of radioactive materials

2. The purpose for which radiation detection instruments will be used

3. Specific instructions in procedures to be used to minimize exposure to radiation

In addition to the employees working directly with the licensed material, other plant personnel will normally be working in the same area, but will have no actual or potential exposure to the radiation. Although not required by the NRC regulations, some training in basic radiation protection may be provided to these employees at the plant's discretion. This will help to acquaint the employees with the materials used and provide accurate information on the potential for exposure to the radiation.

Specific handling procedures have been developed concerning the lamps and starter bottles which contain byproduct material. All personnel handling either the starter bottles or the finished lamps should be instructed in these handling procedures, and the specific instructions should be carefully followed. A copy of the handling procedures is included in Appendix C.

Records of the training provided to the employees working under the direction of the plant RSO or to other plant employees must be maintained for possible review by the NRC or by LEO. Such records must include the topics covered during the training, the date, and information on who received the training and by whom the training was provided.

Training materials and outlines, as well as the training itself is available from the Lighting Environmental Operation. Many manufacturers and suppliers of gauges also provide training courses.

2.4 TRAINING REQUIREMENTS - MASTER WAREHOUSE RSO'S

Because of the limited scope of the operations at our Master Warehouses, the training requirements for the RSO's are also limited. RSO's should be knowledgeable about which lamps contain licensed radioactive material, the regulations of their particular state that apply to their operations, and the location of the licensed lamps within their warehouse.

Specific handling procedures have been developed concerning the lamps and the starter bottles which contain byproduct material. All personnel handling either the starter bottles or the finished lamps should be instructed in these handling procedures, and the specific instructions should be carefully followed. A copy of

the handling procedures is included in Appendix C.

CHAPTER 3

FACILITIES AND EQUIPMENT

In order to safely use, operate, and service sealed source gauges containing radioactive materials, there are certain required items that must be either on-site or available. Primarily these are concerned with having adequate facilities and equipment to assure the integrity of the device and the measurement equipment to determine the operational characteristics of the device.

Because of the specific isotopes involved (Promethium-147 and Krypton-85), the non-gauge licensees, with the exception of the Toshiba Pm-147 arc tube manufacturin, do not require G-M type devices for area monitoring. The main facility requirements are for appropriate storage of the material and any waste.

The Pm-147 zeolite pellets used in the manufacture of the Toshiba arc tubes requires monitoring for control of potential contamination, using either a thin end-window or pancake detector sensitive to low-energy beta particles.

3.1 FACILITIES

Any radioactive device not under immediate supervision, must be secured to prevent unauthorized removal of the device from the facility. In the case of a level or thickness gauge, during normal use, this is accomplished by securely attaching the device to the furnace or other equipment. Other portable devices are secure in that they are under the direct supervision of a responsible individual, or when not in use, are locked in a secure area. In either case, the gauge must be used in such a way that exposure to the radiation from the gauge, under normal conditions, is minimized to the extent feasible. While a device is in storage, such as when it has been removed from the furnace while the furnace is being rebuilt, it must still be secured to prevent removal from the facility. This must be done by physically securing the device in such a way that it cannot be removed, either by storing it in a locked room or by chaining the device to an immovable object such as an I-beam.

Because the physical containment of the radioactive material depends on the structural integrity of the device, all devices must be used only in areas where the temperature does not exceed the maximum operating temperature as specified by the manufacturer of the device.

3.2 MAINTENANCE OF GAUGES

Although no actual repair of the sealed source gauges at our facilities is to be done by plant personnel, a number of routine operational checks need to be done periodically. Typically, these can be done at the time of the leak test (every 6 months). The gauge must be checked to ensure the proper operation of the shutter mechanism, whether it is a mechanical or an electrical shutter. Also, all labels as to the identity of the gauge and the type and quantity of the radioactive material present in the gauge must be visible and legible. The integrity of the gauge should also be checked to ensure that no corrosion or other damage has occurred as a result of high temperatures or other ambient conditions. Should any of these checks identify a possible problem, the Group RSO should be notified immediately.

3.3 EQUIPMENT

Because of the nature of radioactive materials, special equipment is needed on-site to effectively monitor the ezposure to the material as well as to monitor for possible contamination.

3.3.1 Survey Meters

Survey meters capable of measuring the radiation from the radioactive material must either be on-hand routinely at the facility, or alternatively, borrowed from another facility or from LEO for use during the removal and re-installation of the gauge. These meters must be properly calibrated, prior to use, either by an outside company or by LEO. In the event that the facility does not have a meter, arrange to borrow one from LEO. This should be done sufficiently far enough in advance so that scheduling difficulties do not interfere.

3.3.1.1 G-M Meters -

The G-M type survey meters must be calibrated either annually or, at a minimum, if the meter is not used routinely, prior to use. A record of the calibration shall be kept at the plant, and a copy of the calibration sent to LEO. This calibration is a

requirement of the NRC and records of the calibration are reviewed during their periodic inspections of GE Lighting operations. LEO has a device for calibration of survey meters should you want to have your meter calibrated in-house. Repair of survey meters should be done by the manufacturer.

Specific recommendations for gauges can be made by LEO. Typically, a unit similar to a Victoreen Model 493 is acceptable. Such a meter should have several switch-selectable scales ranging from 1 to 50 mR/hr full scale and be equipped with an appropriate probe. For a gauge licensee, a probe such as the 491-40 beta-gamma probe is acceptable. For the Ravenna promethium-147 pellet operations, a more sensitive, pancake probe for contamination monitoring, such as the Eberline HP-260 is required. This probe is compatible with the ESP-2 scaler already at the plant.

Also, it may be necessary to have some type of material handling equipment available, such as a crane, forklift, etc. available at locations using gauges, due to the weight of the gauge.

Although not required because of the low level and short duration of the exposures during removal, relocation, and reinstallation of the gauges, should the plant wish, it may borrow several pocket dosimeters from LEO for use during the operations. These devices can be worn to measure the individual's exposure to the radiation. Instructions on the use of these dosimeters are available from LEO.

3.4 MAINTENANCE ACTIVITIES

Any maintenance work which is done on the arc tube dosing equipment while the promethium-147 pellets are being used must be done under detailsed standard operating procedures designed to properly evaluate and limit personnel exposure.

Appropriate protective equipment shall be used whenever maintenance is done. For those activities involving potential dust exposure where the extent of the exposure is unknown, protective coveralls coveralls and gloves shall be used.

The use of respirators should not be needed since the pellets do not readily generate significant amounts of dust. However, air sampling shall be conducted to allow for the measurement of actual exposure.

All equipment and protective clothing used in the maintenance activity shall be decontaminated after use or saved for appropriate later disposal. No equipment shall be removed from the site until inspected for proper decontamination. Any equipment which cannot be decontaminated shall be saved for later disposal.

CHAPTER 4

SERVICE OPERATIONS

The possible service operations permitted under our license are strictly limited. No dismantling or repair of the sealed source gauges which may involve the potential release of the radioactive material is permitted. The only service operations that may be done are the periodic leak testing and inspections of the gauges, and the installation, removal, relocation and reinstallation of the entire gauge.

Specific step-by-step operating procedures must be written, specific to the plant site. At a minimum the procedures must include the items in the following model operating procedures. In addition, any instructions for the installation, removal, relocation, and reinstallation of the gauges that may be available from the gauge supplier should be included in the procedures.

4.1 MODEL OPERATING PROCEDURES

1. The plant RSO is to be the sole possessor of the keys to the shutter padlock and will be the only individual authorized to turn the shutter to the "on" position. (In the event that the plant RSO will be absent from the plant, he may designate one other individual on a temporary basis only.)

2. The shutter mechanism must be kept padlocked in the closed position at all times when the process is to be down for an extended length of time, or when repairs are to be done in the vicinity of the gauge or the detector.

3. The gauge may not be removed without the express consent of the plant RSO, nor may it be relocated within the plant (to another tank, etc.) or shipped from the plant without the prior consent of the Lighting Environmental Operation.

4. Prior to any installation, removal, relocation, or reinstallation of the gauge, the gauge must be locked in the "store" or "off" position. After the shutter has been closed

and locked in place, the gauge must be surveyed with a meter to verify that the shutter is indeed in the off position. The survey must be done on all accessible sides of the gauge and must meet the manufacturer's specifications or the information provided at the time of the installation. Any significant deviation from these conditions must be reported to LEO prior to moving the gauge.

5. While wearing gloves, remove the gauge from the furnace by un-bolting any restraining bolts or other means of attachment. Since the gauge is heavy, you may need the use of a crane or other lifting equipment. Be sure to keep your hands away from the beam area of the gauge.

6. If it is necessary to store the device while work is being done, it must be placed in a lockable area not frequented by personnel. If a lockable area is not available, the gauge must be secured from unauthorized removal by chaining the gauge to an immovable object such as an I-beam. Post the area with a "Caution Radiation Area" sign.

7. Once the work had been completed or the new location prepared, the gauge may be installed. First verify that the shutter is still in the closed position and locked in place. While wearing gloves, mount the gauge on the furnace by means of bolts or other devices. Be sure to keep your hands away from the beam area of the gauge.

8. Once the gauge has been mounted, survey the meter in a manner similar to that done previously. The results of the survey, with the shutter still in the closed position, must agree with those of the manufacturer's specifications.

9. After visually ensuring that the gauge has been properly installed, the plant RSO may unlock the gauge and place the shutter in the "open" position. The gauge must again be surveyed, this time with the shutter in the open position. The results of the survey must agree with those of the manufacturer's specifications.

10. The results of the above surveys must be kept on file for possible inspection by the NRC.

Typically, the surveys mentioned above are done at a distance of 12 inches in all directions from the gauge. The readings at this point should be < 5 mR/hr. The manufacturer or supplier of the gauge should be able to supply the plant RSO with a diagram of the gauge and their recommended profile readings.

Because of the potential for severe injury in the event of an exposure to the radiation beam from the open shutter of the gauge, the gauge MUST NOT be on the furnace at any time when work is done inside the furnace (such as re-bricking or rebuilding).

To provide for the safe repair of the furnace, the removal of the gauge must be the first operation done, and must be completed prior to the beginning of any furnace repair. Also, the reinstallation of the gauge must be the last thing done, and begun only after the repairs are completed and no possibility exists for exposure to the beam.

CHAPTER 5

PERSONNEL MONITORING

Personnel monitoring is required by the NRC whenever employees may receive or are likely to receive an exposure in excess of 25% of the dose specified in 10 CFR 20.101(a). The specified doses per calendar quarter are 1-1/4 rems to the whole body, head and trunk, active blood forming organs, or gonads; 18-3/4 rems to the hands and forearms or feet and ankles; and 7-1/2 rems to the skin of the whole body. Individuals under the age of 18 years of age need such personnel monitoring equipment if their exposure may reach 5% of these doses.

The radiation level at the surface of a 4000 millicurie gauge, at any point, would not be in excess of 10 millirem per hour (mR/hr). If an individual was in contact with the gauge for an hour each for removal from the furnace and for reinstallation, his exposure to the hands would not exceed 20 mrem. This is approximately 1/1000 of the permitted calendar quarter limit of 18-3/4 and well below the 25% of that limit which would require the use of personnel monitoring. Similarly, the 20 mrems is also well below the limit for the whole body (1-1/4) and its 25% level of approximately 300 mrem. Even if the individual were in contact with the gauge for a full eight-hour shift, his exposure would not require monitoring.

Because of the very small quantity of radioactive material present in our lamp products, no personnel monitoring is required at the Master Warehouses or at the manufacturing locations using Pm-147 or Kr-85.

5.1 POCKET DOSIMETER USAGE

Although not required due to the low exposure involved, pocket dosimeters can be used to measure the actual exposure of the individuals during servicing of the gauges. These dosimeters are available for loan from the Lighting Environmental Operation. The pocket dosimeters are preferred since they can be read at the end of the operations and provide immediate information.

The proper procedures must be used to ensure accurate information from the dosimeters. The dosimeters to be used should cover the range from 0-200 mR. Loan of the dosimeters should be requested in advance to allow for the calibration of the units at LEO. These units are calibrated either annually or prior to use to an accuracy of +/- 30% using a calibrator containing a cesium-137 source of approximately 10 uCi. The calibration includes a test for both accuracy and drift per the calibrator manufacturer's recommendation.

The dosimeters are used as follows:

1. First recharge the dosimeter using the charger, and adjust the reading to zero.

2. Clip the dosimeter to the shirt pocket and wear it during all operations with the gauge.

3. At the end of the day or at the end of the job (whichever comes first) read the dosimeter by looking through the dosimeter at a bright light or by using the light in the charger.

4. Record the reading and keep the results with the results of the gauge survey.

Because the dosimeters are sensitive to physical shock or damage, they may read incorrectly if they are dropped or subject to abuse.

The results of any personnel monitoring must be reviewed with LEO at the end of the servicing.

CHAPTER 6

LEAK TESTING

Periodic leak testing of sealed sources is a requirement of our NRC and Agreement State licenses. This leak testing must be conducted every six months to ensure that the gauges in use are intact and not contaminating the surrounding areas or personnel. Unless otherwise specified by the gauge manufacturer, leak tests must be conducted every six months.

Leak test kits will be supplied on a regular basis by Lighting Environmental Operation. These kits will include a series of adhesive-backed wipes that are to be used to wipe the gauge. Also included in the kit is a form indicating the gauge to be wiped and the areas of the gauge covered by each wipe.

6.1 LEAK TEST PROCEDURES

The following operating procedures should be followed when conducting a leak test:

1. If there has been any apparent damage to the gauge, either through impact or through temperature, the gauge must be surveyed using a survey meter to determine if there has been any gross contamination of the area. Contact LEO immediately with the results of the survey before proceeding with the test. Depending on the extent of the damage, further steps may be delayed until such time as appropriate personnel (such as the manufacturer's representative) can get to the plant.

2. If there has been no apparent damage, turn the shutter to the "off" or "closed" position.

3. While holding the wipe, rub the listed areas of the gauge with the non-adhesive side of the wipe per the included form using moderate pressure.

4. Be sure to complete the identification information required on the wipe.

5. When all wipes on the gauge have been taken, return the shutter to the "on" or "open" position.

6. Mail the complete leak test kit to LEO.

The cover letter included with the kits will contain a time frame in which the leak testing must be completed. Included with this manual is a copy of the leak test form for the plant as an example of a typical kit.

A leaking gauge is one in which > 0.005 microcuries is found on the leak test wipes. In the event that a gauge is found to be leaking, the spread of the contamination must be prevented and controlled. If such a gauge is found, it will be necessary to restrict access to the area of the gauge. The gauge manufacturer must be contacted for advice on specific actions to be taken. Since the analysis of the leak test kits is being done by LEO, there is no need to notify them, LEO will contact the plant RSO in the event such leakage is found. LEO will, if necessary, notify the NRC. Any handling, packaging for shipment, or repair of the gauge must be done by the gauge manufacturer's representative or under his direction.

6.2 TRAINING

Leak testing of the gauges must be done by personnel who have received at least some minimal training in the basic principles and practices of radiation protection. Typically this can be accomplished either by the manufacturer of the gauges at the time of the initial installation, or by training such as that provided by either LEO or the plant RSO. Specifically, the individual must be trained in the proper procedures to be used to take the test, including that the gauge must be in the "off" or "closed" position, and what steps to take to prevent or minimize exposure during the tests.

Typically, either the plant RSO or someone working under his direction will take the tests and return them to LEO. Regardless of who actually takes the test, the plant RSO is responsible for seeing that the tests are taken correctly, on time, and that the individual taking them is properly trained.

CHAPTER 7

LOCK AND TAG PROCEDURES

In those cases where there is sufficient distance between the gauge source and the detector to allow the entry of a part of the human body, the plant shall have written lock and tag procedures which must be used whenever there is to be any work done which may involve possible exposure to the radiation beam. Maintenance employees and others working in the area of the gauge must be informed of and use these procedures. The plant RSO is responsible for ensuring that the appropriate lock-out procedures are used regarding the gauges.

The following information on the use of tags and locks may be used as a guide in developing the plant procedure. If a Group-wide policy and procedure on lock and tag is implemented, the Group-level procedure should be used as a model.

The use of red and yellow tags, along with locks are to be used to control the operation of gauges during repair or maintenance operations where it is possible to intercept the radiation beam.

7.1 LOCK AND TAG DESCRIPTION

The use of a RED tag always means that a worker is actively working on the equipment, and may be injured if the device is operated. The gauge must be red-tagged whenever it is possible for any part of the body to intercept the radiation beam during the maintenance activity. The tag must be removed if the employee is leaving the job, whether the work is completed or not.

The use of a YELLOW tag means that the equipment must not be operated. Even though maintenance on the equipment is not actively being done, if the potential exists for entry of a part of the body into the radiation beam, the equipment must be tagged. Yellow tags are left on the equipment until the equipment is authorized to be operated.

LOCKS are always used with red or yellow tags on sealed source gauges.

NOTE

ANY EMPLOYEE ACTING CONTRARY TO RED AND YELLOW LOCK AND TAG PROCEDURES IN A MANNER WHICH TENDS TO DEFEAT THE PURPOSE OF THESE SAFETY DEVICES WILL BE SUBJECT TO DISCHARGE.

7.2 RED TAG USE

Red tags are to be used only for personal protection when an employee is required to work on or near equipment which, if operated, might cause an injury. Locks must be used in every case, and the name of the individual working on the equipment must be written on the tag.

Only the person placing the red tag and lock is allowed to remove it. In case of the absolute inability of a person to remove a tag he has attached, the plant RSO will fully investigate the situation and remove the lock and tag only when it can be done with full knowledge of the intent of the tagger, and that the lock and tag may be removed without danger to either personnel or equipment.

NOTE

A DEVICE BEARING A RED TAG MUST NOT BE OPERATED BY ANYONE AT ANYTIME. ANY EMPLOYEE OPERATING EQUIPMENT TO WHICH A RED TAG AND LOCK IS ATTACHED WILL BE SUBJECT TO DISCHARGE.

7.3 YELLOW TAG USE

Yellow tags are to be used to restrict the operation of equipment for any reason other than when a red tag is required. Yellow tags are not to be used for tagging equipment which is not to be turned off. Tags of a different color should be used for this purpose.

Yellow tags may be placed on the gauge only when authorized by the RSO, and may be removed only by his authority. Yellow tags can be used at the same time as red tags if the circumstances require it.

A device bearing a yellow tag must not be operated without the authority of the RSO.

NOTE

ANY EMPLOYEE, WHO WITHOUT PROPER AUTHORIZATION, OPERATES EQUIPMENT TO WHICH A YELLOW TAG HAS BEEN ATTACHED WILL BE SUBJECT TO DISCHARGE.

7.4 LOCKS

Good quality, key-type locks which are keyed differently and cannot be master-keyed are to be used by maintenance personnel. The plant RSO may have a series of identically-keyed locks for his own use on the gauges. The use of these identically-keyed locks is limited to the plant RSO only. All locks used by the maintenance personnel are to have only one key; any additional keys are to be destroyed.

The person placing the lock will be identified by attaching a tag with his name inscribed on it on the hasp of the lock before closing the lock. If preferred, the name may be permanently stamped on the body of the lock.

A training program for all employees involved in placing and removing tags and locks shall be conducted, and close supervision of all tag and lock placement and removal shall be maintained.

CHAPTER 8

WASTE DISPOSAL

8.1 GAUGES

Because of the radioactive content of the sealed source gauges, waste disposal is strictly controlled. The electronics and detector parts which do not contain radioactive material may be disposed of with no specific precautions. The gauge containing the radioactive material may only be disposed of by either:

1. transferring the gauge to another holder of an appropriate specific license,

2. returning the gauge to the manufacturer, or

3. transferring the gauge to an approved low-level waste disposal site.

Whichever manner of disposal is intended, all such transfers may only be done after obtaining permission and direction from the Lighting Environmental Operation. Such disposals must be coordinated in such a way that none of the license conditions for any of the involved parties are violated.

If the gauge is to be returned to the manufacturer, it is preferred that a representative from the manufacturer visit the site and arrange for the packaging and shipment of the gauge. Shipments to another licensee or to a disposal site will be arranged by LEO after consulting with the receiving site.

8.2 MANUFACTURING

Waste disposal for either byproduct or source material from our other operations (BIAX and Circlite manufacturing, and arc tubes manufacturing) will also be coordinated by LEO. All such waste is to be collected in DOT type 17H drums. Neither the drums nor the lids to the drums are permitted to have bungs. The drums must be in good condition and have no rust or other damage. The lids must be secured with a bolt-type locking ring. Leverlock

lids are not permitted. Specific instructions on how to handle the waste and what materials are to be included as waste shall be written by the plant with direction and advice from LEO.

For instructions on the shipping of radioactive material or radioactive waste, see Chapter 11.

8.3 LAMPS

Disposal of defective or damaged lamps containing radioactive material must be done in a controlled manner. Although our customers may dispose of our products without regard to its radioactive content, as the manufacturer or initial U.S. distributor, GE Lighting must dispose of these lamps in an approved landfill.

Any defective or damaged lamp containing a starter bottle which in turn contains radioactive material, should be disassembled and the starter bottle saved. When a sufficient number of these starter bottles has been collected, they should be shipped to LEO for later disposal. Contact LEO for proper shipping instructions.

MQI/150 lamps contain radioactive material in the arc tube. For these lamps, the intact arc tubes should be saved for shipment to LEO. In the event the arc tube has been broken, the very small amount of krypton-85 present in the arc tube will quickly disperse into the air, presenting no hazard.

Any defective or damaged mercury or metal halide lamps should be disassembled and the arc tube saves. When a sufficient number of arc tube drums have been generated, they will be consolidated with our routine waste shipment to the licensed low-level waste disposal site.

CHAPTER 9

EMERGENCY PROCEDURES

Each plant must have written emergency procedures which must be followed in the event of any damage to the sealed source gauge which may potentially result in the release of radioactive materials. These procedures must include the work and home phone number of the plant RSO and that for LEO (work - 8*346-3349/2439, home -( ). Those plant personnel who work in the area of the gauge must be trained in these emergency procedures. The procedures must be included as an attachment to this manual and also kept in the gauge area and be accessible to employees.

At a minimum, the emergency procedures must include the following items:

1. In the event of an emergency involving radioactive materials, the area must be vacated. All personnel must be kept away from the material.

2. If a survey meter is on hand, the area must be surveyed and a rope line established at the point where the exposure is 2 mR/hr. If a survey meter is not routinely available at the site, the rope line shall be set at a point where conservative judgment dictates. This should be specific for each plant area and identified previously by the plant RSO.

3. Call for help (phone numbers for plant RSO and LEO).

4. Follow such advice given by the above individuals, and then contact the gauge manufacturer.

These emergency procedures must be revised as required by changes in operations at the plant, location of the gauges, increases in the number of gauges or changes in the regulations.

CHAPTER 10

INVENTORY CONTROL

One of the requirements of our NRC licenses for the use of byproduct material, whether in gauges, as source material, or in lamps, is a strict limit on the amount of material that we may have on site at any one time. In order to comply with these requirements, it is necessary that an ongoing inventory be kept of all such materials, either in storage, in products, as waste, or in use.

Because of the limited number of gauges handled and the requirements of our licenses, any purchase, transfer, or disposal of a gauge must be done with the prior knowledge and consent of the Lighting Environmental Operation. Those plants having radioactive gauges must maintain a record for each gauge containing the following items:

1. The specific location of the gauge,

2. The manufacturer of the gauge,

3. The isotope and amount of radioactive material in the gauge,

4. The model and serial number of the gauge.

Since these items are on the form accompanying the leak test kits, copies of the form will be acceptable for inventory purposes provided that the information is accurate.

Responsibility for the inventory control of the starter bottles and thorium operations shall rest with the plant or Master Warehouse RSO.

For Master Warehouses, the number of lamps on hand should never exceed the license limitation. The maximum licensed quantity has been intentionally selected high enough so that no problem is anticipated.

10.1 RECEIPT OF PACKAGES

When a package containing radioactive materials is received, it must be properly inspected to determine whether any of the material may have been lost or damaged in transit. This shall be done in the following manner when receiving gauges:

1. Visually inspect the package for any sign of damage. If damage is found, stop and notify the plant RSO.

2. Measure the exposure rate at a distance of 3 feet from the package. If the rate is > 10 mR/hr, stop and notify the RSO.

3. Measure the exposure rate at the surface of the package. If > 200 mR/hr, stop and notify the RSO.

4. Carefully open the package and check for any visible damage. If there is no visible damage, place the package in a secure, locked area for storage. If there is any damage, do not move the package and notify the plant RSO.

The inspection of a package arriving during normal working hours shall be done within 3 hours of receipt of the package. If a package is received after normal working hours, it shall be inspected within 18 hours.

A record of the inspection (package received in good condition, exposure @ 3 ft, @ surface, etc.) should be noted on the packing slip and a copy given to the RSO. All such records of receipt must be kept for possible review by the NRC.

For those locations where the material is present as a gas (Kr-85 starter bottles) the packages need only be visibly inspected. However a record of the inspection must still be maintained.

LEO must be informed of the receipt of thorium from an outside supplier. Information concerning the shipment must be submitted by LEO to the NRC. The plant RSO shall contact LEO whenever thorium is received as a raw material.

CHAPTER 11

SHIPPING OF RADIOACTIVE MATERIAL

Radioactive materials are considered a hazardous material under the regulations of the Department of Transportation. As such, they may only be shipped according to the hazardous materials regulations. Any radioactive material shipped from the plant must comply with both the regulations of the DOT and those of the NRC in 10 CFR Part 71.

11.1 SHIPPING GAUGES

Gauges must be shipped in packages approved for the transportation of large quantities of radioactive material. Such packages should be obtained from the manufacturer of the gauge. The appropriate shipping papers and hazardous materials manifest, properly completed, will be supplied by the Lighting Environmental Operation. It will also be necessary to inspect and leak test the gauge prior to packaging it, as well as monitoring the radiation exposure rate at the package surface and at a distance of three feet.

Records of these tests and copies of the shipping papers shall be maintained for possible inspection.

Detailed specific instructions will be provided by LEO for each shipment when contacted by the plant RSO.

11.2 SHIPPING WASTE RADIOACTIVE MATERIAL

Waste shipments of radioactive material require extensive coordination and documentation. These shipments typically will be done as part of a Group-wide "milk-run" in which a truck will stop at several plants to collect the waste drums. Because of the documentation necessary to ensure compliance with both our licenses and those of the disposal site, all of the paperwork, hazardous materials manifests, disposal site forms, etc. will be completed by LEO. The labeling and marking of the drums will also be done by LEO with the assistance of the plant personnel.

Absolutely no radioactive waste is to be shipped from the plant except under the above conditions.

CHAPTER 12

AUDITS

In order to evaluate the effectiveness of the overall radiation safety program conducted under our licenses, audits of the Group operations are routinely conducted by the Nuclear Regulatory Commission. In a similar manner, audits of plant operation will be routinely conducted by both the Lighting Environmental Operation and the plant RSO.

12.1 AUDITS CONDUCTED BY LEO

These audits will be conducted on a frequency that varies from annually to once every three years, depending on the level of activity at the plant and other demands on staff personnel. These audits may be combined with the comprehensive Industrial Hygiene Surveys that are also conducted by the Group. The audits will cover the following topics:

1. Inventory of radioactive materials at the plant
2. Posting and labeling of the materials and areas
3. Storage of the materials
4. Emergency procedures
    a. Training of employees
    b. Leak test procedures
    c. Lock-out procedures
    d. Surveys and audits

A written report will be sent to the plant RSO noting any deficiencies which must be corrected. The RSO will respond with a corrective action plan, detailing the actions to be taken to correct any deficiencies and their expected completion dates.

Copies of the audit report and the plant action plan will be forwarded to the VP, Production. A copy of the LEO audit checklist is included in Appendix D.

12.2 AUDITS CONDUCTED BY THE PLANT RSO

In addition to those audits conducted by the Group, the plant RSO shall also conduct an annual review of the plants activities. Topics to be included in this review are as follows:

1. Sealed source inventory
2. Records of
    1. leak tests,
    2. receipt of gauges,
    3. installations,
    4. relocations,
    5. removals and reinstallations,
    6. disposal of gauges, and
    7. calibration of G-M meters
3. Lock-out procedures
4. Training of personnel
5. Emergency procedures.

The plant RSO shall maintain records of his audits and of actions taken to correct any issues that are found. These audits can be conducted as part of the Company-wide PULSE program which is done annually.

APPENDIX A

POSTING AND NOTICE

Attached is a copy of a suggested bulletin board posting concerning the licenses and a copy of the NRC required form.

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NOTICE

THIS NOTICE, POSTED PURSUANT TO TITLE 10, PART 19.11(A) AND (B) OF THE U. S. NUCLEAR REGULATORY COMMISSION, REFERS TO THE LICENSES AND REGULATORY DOCUMENTS APPLICABLE TO OPERATIONS IN THIS PLANT INVOLVING MATERIALS LICENSED BY THE NRC. THESE DOCUMENTS ARE AS FOLLOWS:

* 10 CFR 19: NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS.
* 10 CFR 20: STANDARDS FOR THE PROTECTION AGAINST RADIATION.
* 10 CFR 21: REPORTING OF DEFECTS AND NONCOMPLIANCE.
* NRC LICENSE NO. SMB-191 AND ITS APPLICATIONS FOR RENEWAL AND AMENDMENT (IF APPLICABLE).
* NRC LICENSE NO. 34-00054-04, -05, -06, -07E AND THEIR APPLICATIONS FOR RENEWAL AND AMENDMENT (AS APPLICABLE).

THESE DOCUMENTS ARE AVAILABLE AT THE FOLLOWING LOCATION:

APPENDIX B

NRC REGULATIONS

Attached is a copy of the NRC regulations in 10 CFR Parts 19, 20, 21, 30, and 32 which pertain to radiation safety in general and the licensing of byproduct material.

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APPENDIX C

HANDLING PROCEDURES

Attached is a copy of the handling procedures to be used with lamps and starter bottles containing byproduct material.

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SAFE HANDLING PROCEDURES FOR LAMPS CONTAINING BYPRODUCT MATERIAL

1.0. PURPOSE

The purpose of this notice is to instruct GE employees who handle lamps containing small quantities of radioactive material, either in manufacturing or distribution activities, regarding applicable Government regulations.

1.1. BACKGROUND

Several models of lamps manufactured and/or distributed by GE Lighting are designed to include a very small amount of radioactive material in each lamp. This radioactive material is contained either as a solid material in a sealed glow switch starter-bottle or as a fill gas in the glow switch or in the arc tube.

The 100/50 Circlite and the Compax lamp both use a starter bottle in which is sealed a glow switch. This glow switch has a small amount of promethium-147 plated onto one of its electrodes. The radiation (beta rays) cannot penetrate the glass walls of the glow switch and therefore pose no radiation risk in storage or use.

The Toshiba #RMZ-24B pellets used in the Toshiba arc tubes also contain a small amount of promethium-147. In this case, it is in a zeolite sphere, which is then coated with sintered alumina/silica ceramic. Again, these spheres pose no radiation risk in storage or use.

The glow switch in low-wattage BIAX lamps (7, 9, & 13 watt) and the MQI-150 lamp arc tube contains a very small amount of krypton-85 as a part of its fill gas. The krypton-85 is also a low-energy radiation emitter and poses no risk in storage or use.

Double-BIAX uses either a promethium-147 glow switch or one using krypton-85, depending on the lamp type. All of the T5 lamps (13, 18, & 27 watt) incorporate a promethium-147 glow switch while the T4 lamps (13, 18, & 26 watt) use a krypton-85 glow switch.

Appropriate notice of the presence of the radioactive material is required with all of these lamps. In the case of the 100/50 Circlite, the notice is included in the "Use and Care" booklet for the lamp system and on the package sleeve for the replacement lamps. For the other lamps, the appropriate notice is located on the packaging.

All GE Lighting employees who handle these products should be aware of these contents and avoid any situation which could result in breakage of the glow switches and/or arc tubes.

2.0. SAFETY PROCEDURES

2.1. CIRCLITE AND COMPAX LAMPS

For the 100/50 Circlite and the Compax lamps, the following applies:

- If the lamp is damaged so that the starter bottle is broken and the glow switch is exposed, handle the switch gently with a set of tweezers and store the switch in a glass bottle with a cover. SUCH HANDLING PROCEDURES MUST BE EMPLOYED, TO PREVENT CHRONIC EXPOSURE OF ANYONE TO THE LOW-LEVEL BETA RADIATION EMITTED BY THE RADIOACTIVE PROMETHIUM-147 ON THE GLOW SWITCH.

- OUR LICENSE REQUIRES THAT DAMAGED AND DEFECTIVE 100/50 CIRCLITE AND COMPAX LAMPS NOT BE DISCARDED IN THE REGULAR TRASH. Therefore, do not discard any part of the damaged lamp. Call me (8*346-3349) or Art Kaplan (8*346-8618) for appropriate instructions concerning the shipment of the damaged lamp (parts) to Lighting Environmental Operation for appropriate disposal.

2.2. Toshiba pellets and arc tubes

For the Toshiba arc tubes and the pellets used in the arc tubes, the following applies:

- If the arc tube is damaged so that the tube is broken and the pellet is exposed, handle the pellet gently with a set of tweezers and store the pellet in a glass bottle with a cover. SUCH HANDLING PROCEDURES MUST BE EMPLOYED, TO PREVENT CHRONIC EXPOSURE OF ANYONE TO THE LOW-LEVEL BETA RADIATION EMITTED BY THE RADIOACTIVE PROMETHIUM-147 IN THE PELLET.

- OUR LICENSE REQUIRES THAT DAMAGED AND DEFECTIVE ARC TUBES CONTAINING THE TOSHIBA PELLETS NOT BE DISCARDED IN THE REGULAR TRASH. Therefore, do not discard any part of the damaged lamp. Call me (8*346-3349) or Art Kaplan (8*346-8618) for appropriate instructions concerning the shipment of the damaged lamp (parts) to Lighting Environmental Operation for appropriate disposal.

2.3. LOW WATTAGE BIAX AND MQI-150 LAMPS

For the low wattage BIAX lamps (7, 9, and 13 watt) and MQI-150 lamps, the following applies:

- If the lamp is damaged such that the low watt BIAX glow switch or the MQI-150 arc tube is broken, the small amount of gas present would immediately dissipate into the air resulting in an insignificant concentration, posing no risk to anyone.

- OUR LICENSE REQUIRES THAT DAMAGED AND DEFECTIVE LOW WATT BIAX AND MQI-150 LAMPS NOT BE DISCARDED IN THE REGULAR TRASH. The low watt BIAX glow switch must be removed and saved for proper disposal. Once this has been done, the remaining lamp parts may be discarded in the normal manner. Scrap, intact MQI-150 lamps must also be saved for proper disposal. Call me (8*346-3349) or Art Kaplan (8*346-8618) for appropriate instructions concerning the shipment of the damaged lamp (parts) to Lighting Environmental Operation for appropriate disposal.

2.4 DOUBLE-BIAX LAMPS

For the T5 Double-BIAX lamps, the safety procedures described above for use with the 100/50 Circlites and Compax lamps should be followed. For the T4 Double-BIAX lamps, the safety procedures described above for the BIAX lamps should be followed.

- o OUR LICENSE REQUIRES THAT DAMAGED AND DEFECTIVE DOUBLE-BIAX LAMPS NOT BE DISCARDED IN THE REGULAR TRASH. The Double-BIAX glow switch must be removed and saved for proper disposal. Once this has been done, the remaining lamp parts may be discarded in the normal manner. Call me (8*346-3349) or Art Kaplan (8*346-8618) for appropriate instructions concerning the shipment of the damaged lamp (parts) to Lighting Environmental Operation for appropriate disposal.

The procedures outlined above are mandatory as a condition of our licenses with the U.S. Nuclear Regulatory Commission and with various individual State agencies. Customers are exempt from any such requirements.

If you have any questions related to this matter, please contact me.

A. M. Zielinski
Lighting Environmental, Health
and Safety Department

APPENDIX D

LEO AUDIT PLAN

Attached is a copy of the LEO Audit Plan to be used in the review of plant activities covering gauges, starter bottles and zeolite pellets containing byproduct material.

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Date

To:

SUBJECT: Report of Monthly Audit of Byproduct Material Use at
Plant, Conducted

Attached is a report of my audit of your byproduct materials operations conducted on.

The following corrective actions are required as a result of this audit:

The following concerns were noted:

Please respond to me by concerning your schedule for taking these actions. Thank you for your attention related to this matter. Should you have any questions, please contact me.

A. M. Zielinski
Lighting Environmental, Health
and Safety Department

xc: R.P. Mozgala #3000
R. Cotman #1350
Plant RSO

RADIATION SAFETY AUDIT PLAN

FOR PLANT

On a comprehensive audit of the use of byproduct material was conducted at the Plant. The following is a report of this audit.

1.0. TOUR

1.1. Visual survey

The following are results of visual survey of use and storage areas:

ITEM	OBSERVATIONS	VISIBLY CLEAN? YES	VISIBLY CLEAN? NO	FOLLOWUP DATE	FOLLOWUP CORRECTED? YES	FOLLOWUP CORRECTED? NO
GAUGE PLANTS						
Furnace areas						
Posting areas						
Storage areas						
Circleville						
LW BIAX manufacturing						
Circlite						
Storage areas						
Ravenna						
Toshiba arc tube manufacturing						
Storage areas						
Distribution Centers						
Storage areas						

1.2. Posting

All areas were observed to be in compliance with posting requirements:

YES ___ NO ___ (See below)

Posting of the following areas was observed not to be in compliance:

AREA	LOCATION	CORRECTION REQUIRED	FOLLOWUP DATE	FOLLOWUP CORRECTED? YES	FOLLOWUP CORRECTED? NO

1.3. Labeling of materials

Labeling of materials was in compliance with requirements:

YES ___ NO ___ (See below)

ITEM	LOCATION	CORRECTION REQUIRED	FOLLOWUP DATE	FOLLOWUP CORRECTED? YES	FOLLOWUP CORRECTED? NO

1.4. Storage of materials

All storage of materials was in compliance with requirements:

YES ___ NO ___ (See below)

ITEM	LOCATION	CORRECTION REQUIRED	FOLLOWUP DATE	FOLLOWUP CORRECTED? YES	FOLLOWUP CORRECTED? NO

2.0. TRAINING OF EMPLOYEES

A review of employee training was conducted, with the following results:

ITEM	LOCATION	CORRECTION REQUIRED	FOLLOWUP DATE	FOLLOWUP CORRECTED? YES	FOLLOWUP CORRECTED? NO

3.0. SURVEYS AND CHECK LISTS

A review of surveys and check lists (where required) was conducted, with the following results:

ITEM	OBSERVATION	CORRECTION REQUIRED	FOLLOWUP DATE	FOLLOWUP CORRECTED? YES	FOLLOWUP CORRECTED? NO
Gauge plants					
Gauge relocation surveys					
Wipe tests					
Shutter tests					
Package receipts					
Ravenna					
Plant manager checklist					
Plant RSO checklist					

4.0. RESULTS OF CORRECTIVE ACTIONS TAKEN BY PLANT PERSONNEL

ITEM	OBSERVATION	CORRECTION REQUIRED	FOLLOWUP DATE	FOLLOWUP CORRECTED? YES	FOLLOWUP CORRECTED? NO

5.0. REVIEW OF EMERGENCY PLANS (where required)

ITEM	OBSERVATION	CORRECTION REQUIRED	FOLLOWUP DATE	FOLLOWUP CORRECTED? YES	FOLLOWUP CORRECTED? NO

6.0 OTHER ITEMS

ITEM	OBSERVATION	CORRECTION REQUIRED	FOLLOWUP DATE	FOLLOWUP CORRECTED? YES	FOLLOWUP CORRECTED? NO

7. SUMMARY

INDEX

(13)

Form AEC-591
(11-62)

UNITED STATES ATOMIC ENERGY COMMISSION
DIVISION OF COMPLIANCE

-4, I-C(2), II. B#4
-5, I-C(1), I. B#3

INSPECTION FINDINGS AND LICENSEE ACKNOWLEDGMENT

1. LICENSEE	2. REGIONAL OFFICE
GENERAL ELECTRIC COMPANY LAMP DIVISION NELA PARK CLEVELAND 12, OHIO	REGION III, DIV. OF COMPLIANCE OAKBROOK PROFESSIONAL BLDG. OAK BROOK, ILLINOIS 60523
3. LICENSE NUMBER(S)	**4. DATE OF INSPECTION**
34-54-4 AND 34-54-5 ✓	JANUARY 19 AND 20, 1965

5. INSPECTION FINDINGS

☒ A. No item of noncompliance was found.

☐ B. Rooms or areas were not properly posted to indicate the presence of a RADIATION AREA. 10 CFR 20.203(b) or 31.302

☐ C. Rooms or areas were not properly posted to indicate the presence of a HIGH RADIATION AREA. 10 CFR 20.203(c) (1) or 31.302

☐ D. Rooms or areas were not properly posted to indicate the presence of an AIRBORNE RADIOACTIVITY AREA. 10 CFR 20.203(d)

☐ E. Rooms or areas were not properly posted to indicate the presence of RADIOACTIVE MATERIAL. 10 CFR 20.203(e)

☐ F. Containers were not properly labeled to indicate the presence of RADIOACTIVE MATERIAL. 10 CFR 20.203(f) (1) or (f) (2)

☐ G. Storage containers were not properly labeled to show the quantity, date of measurement, or kind of radioactive material in the containers. 10 CFR 20.203(f) (4)

☐ H. A current copy of 10 CFR 20, a copy of the license, or a copy of the operating procedures was not properly posted or made available. 10 CFR 20.206(b)

☐ I. Form AEC-3 was not properly posted. 10 CFR 20.206(c)

☐ J. Records of the radiation exposure of individuals were not properly maintained. 10 CFR 20.401(a) or 31.205(b)

☐ K. Records of surveys or disposals were not properly maintained. 10 CFR 20.401(b) or 31.303(d)

☐ L. Records of receipt, transfer, disposal, export or inventory of licensed material were not properly maintained. 10 CFR 30.41, 40.61 or 70.51

☐ M. Records of leak tests were not maintained as prescribed in your license, or 10 CFR 31.105(c).

☐ N. Records of inventories were not maintained. 10 CFR 31.106

☐ O. Utilization logs were not maintained. 10 CFR 31.107

Edgar G. Ashley
(AEC Compliance Inspector)

6. LICENSEE'S ACKNOWLEDGMENT

The AEC Compliance Inspector has explained and I understand the items of noncompliance listed above. The items of noncompliance will be corrected within the next 30 days.

(Date) _____ (Licensee Representative – Title or Position) _____

COPIES: ☐ LICENSEE; ✓ COMPLIANCE REGION; ☐ DIV. OF LIC. & REG.; ☐ DIV. OF COMPLIANCE

Mailed 1-26-65

REPORT COMPILED SHEET

Indentifying Information

Type report (circle) (591) 592

1. Licensee GENERAL ELECTRIC COMPANY
2. Address LAMP DIVISION
   NELA PARK
   CLEVELAND 12, OHIO
3. License No(s) 34-54-4 and 34-54-5
4. Date of Inspection JANUARY 19 AND 20, 1965
5. Inspector EDGAR C. ASHLEY
6. Status of Compliance CLEAR

Items of Noncompliance

7.

Section of Regulation or License Condition		Details Paragraph	
A		A	
B		B	
C		C	
D		D	
E		E	
F		F	
G		G	

Classified Information

8. This report contains classified or business confidential information. (Yes)

Edgar C. Ashley — Inspector — 2-11-65 — Date

Reviewer — 2-12-65 — Date

GENERAL ELECTR COMPANY
CLEVELAND, OHIO
LICENSES NO. 34-54-4 and -5

GENERAL INFORMATION

9. This was an announced reinspection conducted on January 19 and 20, 1965. Mr. I. Matelsky, Head of Industrial Hygiene Activity, was notified of this forthcoming inspection by telephone on January 6, 1965.

10. Mr. James Wynd of the State of Ohio Department of Public Health was notified of this forthcoming inspection by telephone on January 13, 1965. The AEC representative was unaccompanied during this inspection.

11. The following persons were interviewed during this inspection and provided the information contained in this report:

Mr. Issac Matelsky, Industrial Hygienist & Head of Industrial Hygiene activity, Chairman of the Isotope Committee
Dr. David H. Green, Radiophysicist
Mr. Robert Volland, Technician (in charge of gas mixing facility at the Wire Plant)
Mr. Joseph Franco, Supervisor, Glow Lamp Area, of the Lamp Plant

INSPECTION HISTORY

12. The initial inspection of License No. 34-54-4 was conducted on September 23, 1959. Two items of noncompliance were noted at that time. The initial inspection of License No. 34-54-5 and Reinspection No. 1 of License No. 34-54-4 was conducted on September 29, 1960. No items of noncompliance were noted. Reinspection No. 1 of License No. 34-54-5 and Reinspection No. 2 of License No. 34-54-4 was conducted on August 22 and 23, 1961. No items of noncompliance were noted at that time. Reinspection No. 2 of License No. 34-54-5 and Reinspection No. 3 of License No. 34-54-4 were conducted on October 21 and 22, 1963. No items of noncompliance were noted at that time. Reinspection No. 3 of the License No. 34-54-5 and Reinspection No. 4 of the -4 license were conducted on January 19 and 20, 1965 and is the subject of this report.

PROGRAM

13. License No. 34-54-4 is a broad license for research and development which authorizes receipt and possession up to 500 millicuries of any byproduct material between atomic numbers 3 and 83, plus additional amounts of Krypton 85, Hydrogen 3, Argon 39, Promethium 147 and Strontium 90. Those interviewed stated that all the basic research and development work is carried out by Dr. D. H. Green in his laboratory at the Lamp Division in Nela Park. If a certain process appears to the feasible in the production area, this operation will be set up in pilot plant at Nela Park, also under the supervision of Dr. Green. If the Pilot Plant tests shows the operations to be feasible on the production line the authorization to do this on a production basis is then requested by the licensee under their -5 license. At the time of this inspection, Dr. Green gave examples of some of the experiments which he has been doing and is doing now in his laboratory. Dr. Green explained that in the past, tritium gas has been mixed with other gases before the combination of material was added to glow lamps and switches. He stated that he has been doing experimental work such that the tritium could be added to lamps by means of a paladium leak. In this system, regular gas is put into the lamps and the tritium leaks into the sealed lamps by means of a traversing through the paladium. He stated that approximately 0.02 microcuries of tritium is used per each device. Other research and development work in progress now involves Iodine 131 used in the testing of the "Quartzline" lamps. This study involves distribution of Iodine (containing Iodine 131) in the lamps as a function of the various lamp parameters. This has been one of the major research projects during the past 6 months. Dr. Green stated that approximately 50 to 400 microcuries of Iodine 131 is used in each lamp test.

13. (continued)

The licensee stated that previous research and development work which have been conducted using byproduct materials under the -4 license are now relatively inactive. A physical inventory of Dr. Green's laboratory and dated October 1964 is attached to the field notes of this report.

15. As stated previously, in the research program Dr. Green developed various processes in which he checks in the Pilot Plant to assure that these will work within an operation. After this, these procedures involving radioactive materials may be used on a production schedule. Most of the radioactive gases are handled initially in a gas mixing plant which is part of the Cleveland wire plant. Mr. Coates is responsible for radioactive materials which come in and out of the gas mixing plant. Mr. R. Volland is the individual who does the actual mixing of the radioactive gases.

ORGANIZATION

16. The Lamp Division of the General Electric Company has its Headquarters in Nela Park, Cleveland, Ohio. Mr. D. Scarff is the Vice-President of General Electric and the General Manager of the Lamp Division. Under the general manager, there are a number of different organizations which are parallel in the division. These include the Lighting Research Laboratory, formerly called the Lighting Research and Development Operations, the Large Lamp Department, the Minature Lamp Department, the Photolamp Department, the Lamp Metals and Component Parts Department, Lamp Glass Department, Outdoor Lighting Section, and the Legal Department. The Lighting Research Laboratory is basically a service organization which provides service to the various operations within the Lamp Division. Mr. Carl Olson was the former General Manager of the Lighting Research Laboratory and retired in March 1964. This position is to be filled by Dr. Henry Marvin in February 1965. In the absence of a General Manager, Mr. Matelsky has been reporting to Mr. Scarff, and will report to Dr. Marvin. Within the Lighting Research Laboratory, Mr. Matelsky is the Head of the Industrial Hygiene activity. Mr. Matelsky is also the Chairman of the Isotope Committe. Dr. D. H. Green, who was interviewed, is in the Radiophysical Division of the Lamp Engineering Research. Mr. George Shernit is within the Finance and Administrative Operations which is part of the Lighting Research Laboratory. Mr. R. Volland was interviewed and works in the gas mixing operation which is located within the Cleveland wire plant and which is a part of the Lamps Metals and Components Department. The licensee has a Radioisotope Committee whose members are: Mr. I. Matelsky, Chairman; Dr. D. H. Green, and Mr. George Shernit. This committee has the overall authority and responsibility for the entire radioactive materials program. In fact, they have the responsibility for all sources of ionizing radiation whether they be licensable or not. Mr. Matelsky, the Committee Chairman, who is also the Head of the Initial Hygiene Activity has the overall responsibility for seeing that radioactive materials need to be used, for coordinating the application, for license to procure, and use such material, for seeing that personnel monitoring devices are available and that surveys are made to evaluate the hazards involved in each operation. The technical decisions necessary in this program are made by Dr. D. H. Green. Mr. Shernit coordinates the activities from an administrative viewpoint, and signs applications for the business representative. Mr. Matelsky is also listed on previous license applications as the Radiological Safety Officer. He has the responsibility for seeing that all radioactive materials are handled in a safe manner within the Lamp Division of General Electric.

ADMINISTRATIVE CONTROL

17. The control of the entire isotope program has been given to the Radioisotope Committee. Mr. George Shernit is the Business Representative on this Committee and speaks for the administration on this Committee. There is no other review of the Committee, RSO or individual users by anyone in management. As Committee Chairman, Mr. Matelsky shares administrative responsibilities which Mr. Shernit.

RADIATION SAFETY PROCEDURES

18. At the time of this inspection, Mr. Matelsky maintained copies of all the byproduct material and source material licenses issued to the Lamp Division of General Electric Company, 10 CFR 20, 10 CFR 30 and 10 CFR 40.

19. There are no general instructions which have been written concerning the safe handling of radioactive materials. For each specific instance letters are written from Mr. Matelsky to the responsible user in a specific area. The responsible user in each area is also designated in writing from the Isotope Committee. Responsible users in each area are the only ones who can acknowledge receipt of byproduct material, and they are responsible for maintaining a correct inventory for the material in their area. Beginning on February 1, 1965, a new monthly inventory form is to be put into use. This new monthly inventory form will replace the older isotope inventory; that is, receiver and user forms. The new monthly inventory form includes all information on the previous two forms. Each responsible person will fill in this new monthly inventory form and submit it to Mr. Matelsky for his and the Committee's review. A copy of this new radioisotope monthly inventory form is attached to the field notes of this inspection report.

FACILITIES

20. The research and development work involving isotopes is carried out within the radioisotope laboratory of Dr. D. H. Green. This laboratory is located on the third floor of Building 336 at Nela Park. Dr. Green is the only person who works in this laboratoy. The laboratory remains locked at all times when he is not working there. The outer door to the laboratory coming from the hallway leads into an area where Dr. Green has his desk. There is also a work bench located here but no radioactive materials are used in this area. The entire laboratory is divided into three separate sections. The one area has been described above. To the right as one enters the door, there is a low level counting room which contains the various types of GM, scintillation and gas proportional counters which Dr. Green uses. The far southeast corner there is a hot laboratory which again has another locked door leading to it. On the east wall of this laboratory there is a storage cabinet in which the majority of radioactive materials are stored. There is a Kewaunee scientific equipment hood located in one corner and a California hood also in this room. Low level materials are sometimes stored in these hood areas. Stainless steel sinks and work benches are located in this hot lab also. Dr. Green stated that the walls of this laboratory are constructed of high density concrete with concrete blocks swaged in place. The entire laboratory is covered with a pealable paint covering such that contamination can be easily removed. There are large green and red lights in this laboratory near the hoods. Dr. Green explained that the green bulbs are on if the power is onto the room and the red bulbs are on if the fans are on exhausting air from the room. The room is designed such that the air in the room is changed approximately every 2 minutes. All byproduct material was properly stored in containers such that no radiation level in excess of 8 mr/hr could be found in this room.

21. All Krypton 85 and tritium gases are received in the gas mixing area of the Cleveland wire plant. A single room having dimensions of approximately 10 x 10 x 10 feet is used for the mixing of all gases. A small area off to the side of this room is used for the storage of radioactive gases. A heavy metal door slides up and down over the storage area. The gas mixing room has an exhaust system which operates such that the air in this mixing room is changed each minute. The radioactive materials are mixed with other gases to desired levels for lamps usage and then they are shipped from the wire plant to other plants within the division with most of the material going to the Cleveland Lamp Plant. Occasionally some of these gases are shipped to other licensee's. In the past, these have always been in different divisions of General Electric.

EQUIPMENT

22. Health physics survey instruments possessed by the licensee include a Nuclear Chicago Model 2612 instrument utilizing a thin end window GM tube and a Jordon Rad Gun, both of which were used and stored in Dr. Green's laboratory. It was also noted that a Tracerlab "cutie pie" having ranges from 0 to 25, 250 and 2500 mr/hr was located in a gas mixing plant and used by Mr. Volland to conduct surveys in that area. Dr. Green stated that these instruments were not calibrated at any preset time intervals. He stated that he regularly checks the Nuclear-Chicago meter by use of the incorporated Carbon 14 check source. He said that occasionally he will calibrate the instruments using Cobalt 60 or Cesium 137 sources. At these times he stated he will calibrate a number of points on each scale. In addition to these survey instruments Dr. Green possesses thin end window GM tubes, scintillation counters and a 2 pi gas flow proportional counter of his own design which is used for counting and analysis. Dr. Green explained that on the commercial available 2 pi gas flow counters the counting region is usually hemispherically shaped and he stated that the counting efficiency was not exactly the same for all areas in this type of a chamber. The two pi counter which he has made consists of a [illegible] wire probe inside the counting chamber rather than a single loop of wire probe in a commercially available [illegible]. He stated that with the many different wire probes in the chamber the chamber is equally sensitive in all areas and he felt that this was much more efficient for counting wipes which may have contamination over the entire surface, rather than located at a point source would be.

PERSONNEL MONITORING AND EXPOSURE DETERMINATION

23. Currently the assigned film badges are used by 5 persons. Mr. Volland who does the mixing of gases also wears a pocket dosimeter. Film badges are received by the licensee on a bi-weekly basis from Tracerlab, Inc. The film badge records are sent to Mr. Matelsky who reviews and files them. Temporary badges may also be assigned to people who work for short periods of time in the hot lab such as someone who might assist Dr. Green on a specific experiment. Each individual who is assigned a film badge, receives a written report quarterly and annually, showing the amount of exposure received.

24. As mentioned above, Mr. Volland wears a pocket dosimeter along with his film badge. He records results for this pocket dosimeter daily, and at various intervals his daily results are sent to Mr. Matelsky. Dr. Green has other pocket dosimeters available for use by anyone who would want to use one. Dr. Green stated that he wears a pocket dosimeter occasionally, such as times when he may be using one of the larger sealed sources of Cobalt 60 or Cesium 137.

RADIATION SURVEY AND/OR EVALUATIONS

25. In the research laboratory periodic surveys are conducted by Dr. Green which include both the radiation levels in mr per hour and wipe tests of the area to determine if there is any contamination present. These results are recorded in Dr. Green's personal notebook.

26. The Isotope Committee is responsilbe for conducting physical radiation surveys in each area where radioactive materials are used. In the gas mixing plant, the evaluation for radiation hazards involving tritium gas has been based on the maximum credible accident. If all the tritium gas in a single storage cylinder were to be released inside the gas mixing room, the concentration would still be less than the maximum permissible concentration as specfied by 10 CFR 20. There is also a complete change of air in this room each minute.

27. For an evaluation of the hazards involved within the licensee's use of Krypton gas, Mr. Matelsky and Dr. Green have taken gas samples in the lamp plant at the point where Krypton gas is to be ejected into one of the lamps. For the purpose of this survey, the lamps were removed from the line and a Krypton gas was allowed to be released directly into the atmosphere at the time the samples were being taken. These were then analyzed by Dr. Green in his laboratory at which time he used known volumes of krypton gas as a calibration for this counting system. Records of these results are maintained by the licensee

27. (continued)

showed that even that with such a condition existing, the air concentrations were still less than those permitted by 10 CFR 20.

POSTING AND LABELING

28. A radiation area existed in the hot lab and in Dr. Green's laboratory near the area where the Cobalt 60 sealed source was stored. This area was posted in colors of magenta on yellow bearing the standard radiation caution symbol and the words "Caution-Radiation Area." In this laboratory on the storage cabinet and on the door leading to the hot lab there were signs in the colors of magenta and yellow bearing the radiation caution symbol and the words "Caution Radioactive Material."

29. Each container that was observed in the hot lab and in the gas mixing plant which was used for the storage of radioactive materials was noted to be labeled in the colors of magenta on yellow bearing the radiation caution symbol and the words "Caution Radioactive Materials." Additional information noted on each label gave the kind of isotope, the amount of the isotope and the date of measurement of that amount. The gas mixing room and area of the wire plant were also ~~posted~~ with signs in the colors of magenta on yellow and bearing the radiation caution symbol and the words "Caution Radioactive Materials" and "Caution Radiation Area."

30. It was noted that Form AEC-3 was posted on the walls of various use areas.

LEAK TESTS

31. All wipes of sealed sources possessed under the -6 license are conducted by Dr. D. H. Green. He also performs the analysis of these wipes using a Nuclear-Chicago Model 2612 survey instrument with a thin end window (1.4 milligrams per square centimeter) GM tube. Wipe tests are based on the beta analysis of the sample. A copy of the procedures has been submitted previously. The results of all leak test analysis are sent to the Radioisotope Committee for the review.

WASTE DISPOSAL OR TRANSFER OF SPENT SOURCES

32. Within the Research Laboratory all radioactive materials of measurable quantity which have been disposed of has been in the form of a gas. This is disposed of by bleeding small amounts from tanks up the hood and out through the exhaust system. Dr. Green stated that other trace quantities of material have been washed down the sink in the process of washing beakers or other containers in which the material had been stored.

33. Byproduct material used in the production department is released in the licensee's products to the general public. Such release is authorized by the license.

REPORTS OF THEFT AND LOSS

34. Those interviewed stated that no byproduct material has been lost or stolen.

INCIDENTS OR UNUSUAL OCCURRENCES

35. Those interviewed stated that they had no knowledge of any incidents or occurrences which have happened with regard to the handling or use of licensable materials.

RECORDS

36. Mr. Matelsky stated that the Purchasing Department in each area has records showing all materials which have been received in a specific plant. With regard to licensed material, the responsible user in each area must keep a running inventory of such materials on hand in the area of his responsibility and beginning February 1, 1965 must submit a current inventory of all materials, which are licensable, to Mr. Matelsky and the Radioisotope Committee, on a

36. (continued)

monthly basis. In the past whenever a responsible user would receive material in his area he would give specific information regarding this receipt in writing to Mr. Matelsky, and when material was shipped from his department he would again file a written report with Mr. Matelsky showing this. Mr. Matelsky keeps a master inventory in his office of all licensed materials which is located in each specific area. This inventory is kept on the basis of reports submitted by the responsible users. Periodically, the inventories of the specific areas and the master inventory maintained by Mr. Matelsky are reviewed and compared. All inventory records were scanned through the date of the last inspection to the present time and it appears that the licensee has remained within the possession limits of each specific license at all times. It should be noted that if the licensee has material under a research license, and a process is perfected where it can be used to production, transfer records are maintained showing the transfer of this material from the research (-4) licensee to the production (-5) licensee.

37. The licensee's records show that occasional surveys including direct and smear surveys and air samples have been made in the various use areas. The direct reading and smear survey results show that these are at the level of instrument background and that air samples show less than 10 CFR 20 limits. The licensee's leak test records were reviewed for 1964. These records show that all sealed sources were leak tested on April 28, 1964 and again on October 28, 1964. All results showed removable contamination of less than .002 microcuries.

38. At the time of this inspection it was observed that the licensee maintained film badge supplier reports from 1963 through the date of this inspection. These were all breifly scanned and it was noted that in each instance where any exposure was noted an explanation showing cause for this exposure was written on the records. The licensee does maintain a modified Form AEC-5. It contains all the information required by AEC-5 and in addition has a column such that the pocket dosimeter readings can be compared to those shown on the film badges if a dosimeter was worn during that period. It was noted that for the year 1964 all personnel who are involved in the by-product material programs showed film badge results of 0.

INDEPENDENT MEASUREMENTS

39. At the time of this inspection the AEC representative, using an Eberline Model E-500B survey instrument, made a physical radiation survey of Dr. Green's laboratory. The highest radiation level to be noted was 8 mr at the surface of lead storage containers in the corner of the laboratory. The general background in the balance of this laboratory showed maximum results of less than 0.2 mr/hr.

LICENSE CONDITIONS

40. The various license conditions of both Licenses No. 34-54-4 and -5 were discussed with Mr. Matelsky and Dr. Green at the conclusion of this inspection. The results of this inspection were discussed with Dr. D. H. Green, Radiophysicist and Mr. R. Matelsky, Chairman of the Isotope Committee. They were informed that the program appeared to be in very good condition and that no items of noncompliance were noted with regard to any of the two licenses covered in these notes. Namely 34-54-4 and -5. A clear Form AEC-591 was issued for these two licenses.

LICENSEE TELEPHONE NOTIFICATION OF INSPECTION
(GENERAL)

Licensee: Brush Electric Co.
Licenses No: [illegible] Villa Park, Cleveland. 37-54-4, -5.
Type Inspection: Reinspection

Date: Jan 6, 1965
Individual Contacted: (Name & Title) Mr. I. [illegible], Head of Ind. Hygiene [illegible] Chairman of Isotope Comm
Contacted by: [illegible] Ashley

The following information was given to the licensee:

A. Informed of inspection of above listed licenses to ~~be performed~~ on Tues. Jan 19, 1965 @ 0800-0930 (also Wed. 1-20-65)

B. AEC representative may be accompanied by a representative of the state or local Health Agency.

C. Inspection of the program will include:

1. Observation of operations
2. Inspection of facilities and equipment
3. Review of following records:
   a. Receipts, transfers, and/or disposals
   b. Surveys to show an evaluation of use and storage of licensed material
   c. Personnel monitoring (film badges, pocket dosimeters, etc.)
   d. Leak tests (if applicable)
   e. Reports of incidents, loss or theft, or overexposures

   Additional Records for 10CFR70 Licenses

   f. Inventory
   g. Form AEC-578, Material Status Report
   h. Form AEC-388, Material Transfer Report

D. Remarks:

Form CO:III-2

(16)

August 29, 1966

Mr. I. Matelsky, Chairman
Isotope Committee
General Electric Company
Lamp Division
Nela Park
Cleveland, Ohio 44112

Dear Mr. Matelsky:

As a result of the inspection on August 10 and 11, 1966, a Form AEC-591, INSPECTION FINDINGS AND LICENSEE ACKNOWLEDGMENT, is issued for Licenses No. 34-54-4, -5, and SMB-191. You will note that this form indicates that no item of noncompliance was noted. It is not necessary that you complete Item 6 of this form nor that you acknowledge receipt of this form.

I wish to express my appreciation for the cooperation extended to me during the inspection.

Sincerely yours,

Loren J. Hueter
Radiation Specialist
Region III

Enclosure:
AEC-591

9203140267

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

D/3

OFFICE ▶	CO:III	CO:III				
SURNAME ▶	Hueter/btc	Allen				
DATE ▶	8-29-66	8-29-66				

C/16

FORM AEC-318 (Rev. 9-53) U. S. GOVERNMENT PRINTING OFFICE 16—62761-6

Form AEC-591
(6/1/65)

UNITED STATES ATOMIC ENERGY COMMISSION
DIVISION OF COMPLIANCE

-4, E(1). II, Re #5
-5 & 10 CFR 30, E. III, Re #4

INSPECTION FINDINGS AND LICENSEE ACKNOWLEDGMENT

1. LICENSEE	2. REGIONAL OFFICE
General Electric Company Lamp Division Nela Park Cleveland, Ohio 44112	REGION III, DIV. OF COMPLIANCE OAKBROOK PROFESSIONAL BLDG. OAK BROOK, ILLINOIS 60523
3. LICENSE NUMBER(S)	**4. DATE OF INSPECTION**
34-54-4, -5 and SMB-191	August 10 and 11, 1966

5. INSPECTION FINDINGS

☒ A. No item of noncompliance was found.

☐ B. Rooms or areas were not properly posted to indicate the presence of a RADIATION AREA. 10 CFR 20.203(b) or 34.42

☐ C. Rooms or areas were not properly posted to indicate the presence of a HIGH RADIATION AREA. 10 CFR 20.203(c) (1) or 34.42

☐ D. Rooms or areas were not properly posted to indicate the presence of an AIRBORNE RADIOACTIVITY AREA. 10 CFR 20.203(d)

☐ E. Rooms or areas were not properly posted to indicate the presence of RADIOACTIVE MATERIAL. 10 CFR 20.203(e)

☐ F. Containers were not properly labeled to indicate the presence of RADIOACTIVE MATERIAL. 10 CFR 20.203(f) (1) or (f) (2)

☐ G. Storage containers were not properly labeled to show the quantity, date of measurement, or kind of radioactive material in the containers. 10 CFR 20.203(f) (4)

☐ H. A current copy of 10 CFR 20, a copy of the license, or a copy of the operating procedures was not properly posted or made available. 10 CFR 20.206(b)

☐ I. Form AEC-3 was not properly posted. 10 CFR 20.206(c)

☐ J. Records of the radiation exposure of individuals were not properly maintained. 10 CFR 20.401(a) or 34.33(b)

☐ K. Records of surveys or disposals were not properly maintained. 10 CFR 20.401(b) or 34.43(d)

☐ L. Records of receipt, transfer, disposal, export or inventory of licensed material were not properly maintained. 10 CFR 30.51, 40.61 or 70.51

☐ M. Records of leak tests were not maintained as prescribed in your license, or 10 CFR 34.25(c)

☐ N. Records of inventories were not maintained. 10 CFR 34.26

☐ O. Utilization logs were not maintained. 10 CFR 34.27

Loren E. Hunter
(AEC Compliance Inspector)

6. LICENSEE'S ACKNOWLEDGMENT

The AEC Compliance Inspector has explained and I understand the items of noncompliance listed above. The items of noncompliance will be corrected within the next 30 days.

(Date) _____ (Licensee Representative — Title or Position) _____

COPIES: ☐ LICENSEE; ☒ COMPLIANCE REGION; ☐ DIV. OF ST. & LIC. REL.; ☐ DIV. OF COMPLIANCE

Mailed 8-30

9203/0271

REPORT COMPILED SHEET

Identifying Information

Type Report (circle) 591 592

1. Licensee: General Electric Company
2. Address: Lamp Division
   Nela Park
   Cleveland, Ohio
3. License No(s): 34-54-4, -5, and SMB-191
4. Date of Inspection: August 10, and 11, 1966
5. Inspector: Loren J. Hueter
6. Status of Compliance: Compliance

Items of Noncompliance

7. Section of Regulation or License Condition	Details Paragraph:
A.	A.
B.	B.
C.	C.
D.	D.
E.	E.
F.	F.
G.	G.

Classified Information

8. This report contains classified or business confidential information.
   Yes
   No

Loren J. Hueter — Inspector — 9-9-66 — Date

E Jon — Reviewer — 9-12-66 — Date

HEALTH PHYSICS ANALYSIS

The Lamp Division of General Electric whose headquarters is at Nela Park, Cleveland, Ohio, appears to have a very fine program concerning the procurement, handling and supervision over the entire program involving the use of radioactive materials.

Inspected during this inspection was License No. 34-54-4 which is a broad license covering research and development work, the -5 license under which authorization the licensee manufactures and distributes glow lamps containing Hydrogen 3 or Krypton 85 and License No. SMB-191 which authorizes the licensee to possess up to 5100 pounds of thorium and uranium for use in research, and for making components of lamps and other items containing thorium as an alloy as authorized in the license for distribution as unimportant quantities of licensed material, as generally licensed items and to licensed authorized recipients where appropriate.

The entire radioactive material program is controlled by the Isotope Committee. Mr. I. Matelsky is Head of the Industrial Hygiene Activity of the Lighting Research Laboratory and is also Chairman of the Isotope Committee. The other members of the committee are Dr. D. H. Green, Radiophysicist, and Mr. G. Shernit, of the Finance Administration Operation. All technical evaluations are made by Dr. Green. Mr. Matelsky coordinates the activities and is also considered to be the Radiological Safety Officer and has the overall responsibility for the safe handling of radioactive materials. Mr. Shernit is the Administrations voice on that committee.

The inspector was impressed with the apparent carefulness spent by members of the Isotope Committee in evaluating the hazards associated with any use of radioactive materials prior to authorizing such use.

No items of noncompliance were observed or otherwise noted during the course of the inspection with respect to any of the three licensed programs inspected. However, the licensee did have one unusual happening on July 1, 1966, involving the loss of one 17.5 curies of Hydrogen 3 gas — ~~was~~ essentially an inert form, as a result of a leak in a connection ~~on~~ the low pressure side of a line supplying tritium to the manufacturing unit producing glow lamps. Pertinent information pertaining to the course of events at the time of the happening and evaluations of the incident made by licensee personnel and their recommended procedures to prevent recurrence is covered in the body of the report under the sections entitled, Incidents or Unusual Occurrences and Management Discussion as well as Exhibits A and B attached to the report. According to the evaluation made by licensee personnel, personnel in the vicinity at the time of the loss were not exposed to concentrations greater than that permitted by 10 CFR Part 20 and reporting of the loss to DML was not required based on their evaluation of the exposure of individuals to concentrations of radioactive materials and the concentrations of radioactive materials released to an unrestricted area. Based on the information supplied by the licensee, the inspector is of the opinion that the evaluation made by licensee personnel is apparently a valid and acceptable evaluation. Independent calculations by the inspector using information obtained from the licensee would indicate that the individual closest to the point of release would have been exposed to a concentration approximately only ~~xxxxxxxxxxx~~ 1/14 of that ~~permitted for occupational~~ in a restricted area which would require being reported pursuant to 10 CFR 20.405(1) and that the concentration of Hydrogen 3 in gaseous form released to an unrestricted area (considering the unrestricted area being the exhaust of the room) was only 1/25,000 of that concentration which is required to be reported pursuant to 10 CFR 20.405(3).

According to statements made by those interviewed, the use of hydrogen in the form of a gas was originally chosen as the material to be used in glow lamps etc. because of its relative inertness and that the facilities were designed with rapid air changes (approximately one air change per minute) to keep the hazard to a minimum in the event of such a happening. Also as discussed in the management discussion, the licensee is taking steps in order to prevent a recurrence of this happening in the future.

The inspector is of the of the opinion that these ~~that those~~ licensed programs as currently conducted present no significant health or radiation hazard to individuals involved.

General Electric Company
Cleveland, Ohio
August 10 and 11, 1966

EXPANDED NOTES

GENERAL INFORMATION

9. This announced reinspection was conducted on August 10 and 11, 1966. Mr. I. Mateleski, Industrial Hygienist, was notified on telephone on August 5, 1966, of this scheduled inspection.

10. The secretary to Mr. James C. Wynd, Engineer in charge of Radiological Health Unit for the State of Ohio, was contacted by telephone on August 2, 1966, in the absence of Mr. Wynd. The secretary stated that a state representative would probably not accompany the inspector due to shortage of personnel due to vacations, etc. The inspector was unaccompanied.

11. During this inspection the following were interviewed and provided the information set forth in this report:

Mr. I. Mateleski, Chairman of the Isotope Committee and Head of the Industrial Hygiene activity.
Dr. D. H. Green, Radiophysicist.
Mr. G. Shernit, Finance and Administration Operation.
Ted Yocum, Lamp Metals and Components Department pertaining to the source material information.

All information in this report is in substance unless otherwise indicated.

INSPECTION HISTORY

12. The last previous reinspections of License No. 34-54-4 (which was Reinspection No. 4) and License No. 34-54-5, (which was Reinspection No. 3) were conducted on January 19 and 20, 1965, and revealed no items of noncompliance. The last previous reinspection of License No. SMB-191 was reinspection No. 3 which was conducted on October 21 and 22, 1963, and also revealed no items of noncompliance. The subject of this report is Reinspection No. 5 of License No. 34-54-4, Reinspection No. 4 of License No. 34-54-5, and Reinspection No. 4 of License No. SMB-191 with no items of noncompliance being revealed or noted with respect to any of the three licensed programs.

PROGRAM

13. License No. 34-54-4 is a broad license for research and development which authorizes receipt and possession of up to 500 millicuries of any byproduct material between the Atomic Nos. 3 - 83 plus additional amounts of Krypton 85, Hydrogen 3, Argon 39, Promethium 147, Strontium 90, and Cesium 137. All basic research and development work is still carried out by Dr. D. H. Green in his laboratory at the Lamp Division in Nela Park. If through research and development a certain process appears to be feasible in the production area, this operation will be set up in a pilot plant in Nela Park, which is also under the supervision of Dr. Green. If the pilot plant test shows the operation to be feasible on the production line, the authorization to do this on a production basis is then requested by the licensee under their -5 license.

PROGRAM, Cont'd.

14. continued.

15. The only research work which is currently being conducted under the broad license involves the use of Sodium 22 which is being used in multivapor lamps for research studies. Under the -4 license, Dr. Green has stored in his laboratory various containers containing low levels of byproduct material including sealed sources which will be described under the section entitled leak tests. The individual containers were observed to be appropriately labeled.

15. Hydrogen 3 and Krypton 85 gases are still used continuously by the licensee for the manufacture of glow lamps under authorization of the -5 license. Spark gaps which are also authorized for manufacture under this license have not been manufactured for approximately 7½ years and glow switches are still not being manufactured as was the case at the time of the last previous inspection. During the manufacture of the glow lamps, approximately 1½ curies of Krypton 85 gas are used per month under the -5 license and from approximately 3 to 30 curies per month of Hydrogen 3 are used in the manufacture of glow lamps with the large quantities of tritium being used just in the past two months starting with the licensee's manufacture of a new type of glow switch containing larger quantities of tritium. The licensee's records show that each glow lamp which makes use of Krypton 85, contains between 0.004 to 0.01 microcuries of Krypton 85 depending upon the type of lamp being manufactured. Glow lamps utilizing Hydrogen 3 contain from 0.02 to somewhat less than 10 microcuries for a special rapid fire type glow lamp application which the licensee has recently appli received authorization for manufacture of such devices. The recent starting of the manufacture of these special rapid fire glow lamps has accounted for the licensee's significant increase in the use of tritium per month with records showing the licensee using 4.08 curies of tritium in May of 1966, 19.3 curies in June, and 30.6 curies in July 1966. However, it was stated by licensee personnel that the vast majority of the tritium glow lamps still produced are those containing only approximately 0.02 microcuries of tritium.

16. Amendment No. 7 dated March 23, 1966, to the -5 license raised the possession limit for tritium from 50 curies to 400 curies. In addition to the use as described above, the licensee also prepares gases tagged with Hydrogen 3 and Krypton 85 for distribution to other authorized recipients on a rather small scale basis. In all cases, shipments of tagged gases have been to other General Electric Divisions. In each case, records show that the Lamp Division would obtain the license number and specifications or a copy of the recipient's AEC byproduct material license. All pertinent information is received by Mr. Matelsky and kept on file.

PROGRAM, Cont'd.

18. continued.

19. Under License No. SMB-191, the licensee uses thorium for the manufacture of one and two per cent thoriated tungsten wire billets, [illegible]iated tungsten welding rod, welding electrodes, and electrodes for vacuum furnaces and emission mixes containing thorium. By way of amendment to the license dated July 1, 1966, the licensee is also authorized to use thoriated-metal base alloys to produce mill products from billets for purposes of increased thermal and machineability characteristics for distribution to authorized recipients pursuant to 40.51 of 10 CFR Part 40. However, the licensee as of the inspection date had not actively engaged in this program which it was learned that one of the products would be nickel with a small percentage of thorium contained therein.

20. [illegible] A letter [illegible], to various persons in areas of thorium usage from I. Matelsky, Chairman of the Radioisotope Committee, giving the suggested breakdown of the amounts of thorium which each department should try to limit themselves to. This letter was sent out following the issuance of an amendment to the license dated October 12, 1965, which among other things increased the licensee's maximum possession limit from 1600 pounds of thorium and uranium to 5100 pounds. The letter [illegible] gives the breakdown based upon the 5100 pound limitation. Each area of use has an inventory which they must maintain and copies of this inventory are also held by the Isotope Committee to assure that the maximum possession limit is never exceeded.

21. Records revealed that for the year of 1965, the licensee purchased 1600 pounds of thorium in the form of a nitrate and 240 pounds of thorium in the form of an oxide from the Lindsay Light and Chemical Company of Chicago. The nitrate form was used in wet doping of tungsten metal powder on a 1 per cent or 2 per cent wet basis, with the oxide being used for dry doping process. The licensee works with a batch approximately six times per year with each batch containing approximately 50 to 100 pounds of thorium. In wet doping the thorium is suspended in water [illegible] a large plastic bottle by air agitation and the slurry made with tungsten powder. The slurry operation is performed in a large steam heated kettle serviced by a canopy exhaust hood. After blending the slurry is dried, fired in small silica trays, reduced [illegible] pressed into ingots preparatory to drawing into wire. Some material is formed into billets, slabs, and ingots by means of a hydropress. Some of the material ends up as wire containing one to two per cent thorium, some as welding rods containing two per cent thorium, and some is pressed and centered and extruded into [illegible] or billets for further work and sold to authorized recipients over the country. The licensee ascertains that each individual who receives other than exempt materials or generally licenseable quantities, has a specific AEC license to authorize their possession and use of the material. [illegible]

22. The licensee's primary customers are Taylor Forge and Pipe Company of Chicago, Thiokol of Utah, Carlton Forge of California, Lockheed, Electro Optical and Douglas Aircraft. As of August 1966, the licensee also had 190 pounds of thoria in the form of refractory brick used as an insulator [illegible] furnaces used for experimental purposes and engineering at the licensee's facility at the wire plant. Also as of August 1966, the licensee had on hand scrap material containing mostly 1% thorium with the total thorium content in this scrap totallying approximately 154 pounds as of that date. The licensee has

PROGRAM, Cont'd.

22. continued.

disposed of no scrap material containing thorium alloy to date. Licensee personnel indicated that they may wish to dispose of this material sometime in the future to recover the valuable tungsten contained therein, and stated that licensing personnel would be contacted at that time to work out an acceptable procedure pertaining to their having some scrap recovery outfit recover the tungsten and properly recover and handle the thorium contained therein.

23. The licensee has only a few pounds of uranium, this material having been used only on rare occasions for experimental work. No uranium has been transferred to other licensees or in products manufactured.

ORGANIZATION

24. The Lamp Division of the General Electric Company still has its headquarters in Nela Park, Cleveland, Ohio. Mr. D. Scarff is the Vice President of General Electric and the General Manager of the Lamp Division. Under the General Manager, there are a number of different organizations which are parallel in the division. These include the Lighting Research Laboratory, the Large Lamp Department, the Miniature Lamp Department, the Photo Lamp Department, the Lamp Metals and Components Part Department, Lamp Glass Department, Outdoor Lighting Section, and the Legal Department.

25. The Lighting Research Laboratory is basically a service organization which provides service to the various operations within the Lamp Division. Dr. Henry Marvin has since February of 1965, been General Manager of the Lighting Research Laboratory. Within the Lighting Research Laboratory, Mr.Matelsky is the Head of the Industrial Hygiene activity and is also Chairman of the Isotope Committee. Dr. D. H. Green, who was interviewed, is in the Radiophysical Division of the Lamp Engineering Research. Mr. George Shernit is within the Finance and Administrative operations which is part of the Lighting Research Laboratory.

26. Mr. Ted Yocum was interviewed and furnished the information at the Wire Plant pertaining to the source material license pertaining to the possession and use of thorium and small quantities of uranium. All gas mixing operations are supervised and under the technical responsibility of Mr. Robert Volland as at the time of the last inspection. However, most of the actual mixing is conducted by Mr. C. R. Butler or in his absence by Mr. Jack Cole. Mr. Joseph Franco, Supervisor of Glow Lamp Area of the Lamp Plant at the time of the last previous inspection has since been replaced by Mr. Roger Voss who currently assumes responsibility for supervision of Glow Lamp Area of the Lamp Plant.

27. The licensee has a Radioisotope Committee whose members are still Mr. I. Matelsky, Chairman, who is also Head of Industrial Hygiene Activity for the Lamp Plant, Dr. D. H. Green, who is a Radiophysicist and supervises all research work conducted under the -4 license and Mr. George Shernit of Finance and Administration operations. This committee has the overall authority in responsibility for the entire radioactive materials program and for that matter all sources of ionizing radiation whether they be licenseable or not. Mr. Matelsky, the Committee Chairman and Head of the Industrial Hygiene Activity, has the overall responsibility for determining the actual need for radioactive materials to be used, for coordinating the application for the license to procure and use such material, for seeing that personnel monitoring devices are available and used where appropriate and that surveys are made to evaluate the hazards involved in each operation. The technical decisions necessary in this program are made by Dr. D. H. Green. Mr. Shernit coordinates the activities from an administrative viewpoint and signs applications for the business representative. Mr. Matelsky is also listed on previous license applications as the Radiological Safety Officer and has the responsibility for seeing that all radioactive materials are handled in a safe manner within the Lamp Division of General Electric Company.

ADMINISTRATIVE CONTROL

28. The control of the entire isotope program has been given to the Radioisotope Committee. Mr. George Shernit is the business representative on this committee

ADMINISTRATIVE CONTROL, Cont'd.

28. continued.

and speaks for the administration on this committee. There is no other review of the committee, the Radiation Safety Officer or individual users by anyone in management. As committee chairman, Mr. Matelsky shares administrative responsibilities with Mr. Shernit.

RADIATION SAFETY PROCEDURES

29. At the time of this inspection Mr. Matelsky maintained copies of all the byproduct material and source material licenses issued to the Lamp Division of General Electric Company and copies of 10 CFR 20, 10 CFR 30 through 36 and 10 CFR 40.

30. No general instructions have been written concerning the safe handling of radioactive materials. For each specific instance, letters were written from Mr. Matelsky to the responsible user in a specific area. The responsible user in each area is also designated in writing to the Isotope Committee. Responsible users in each area are the only ones who can acknowledge receipt of byproduct material and they are responsible for maintaining a correct inventory for the material in their area. Beginning on February 1, 1965, a new monthly inventory form was put into use which includes all information formerly maintained on the older receiver and user forms. Each responsible person fills out the monthly inventory form and submits it to Mr. Matelsky for his and the Committee's review, to assure that the maximum possession limit is never exceeded.

FACILITIES

31. All research and development work under the -4 license involving isotopes is carried out within Dr. Green's radioisotope laboratory which is located on the third floor of Building 336 at Nela Park. Dr. Green is the only person who works in the laboratory which remains locked at all times when he is not present. The facilities and equipment contained in this laboratory are unchanged from that reported in paragraph 20 of the last previous inspection report dated January 19 and 20, 1965.

32. All Krypton 85 and tritium gases are received in containers under negative pressure and with one exception are all received at the gas mixing area of the Cleveland Wire Plant where the byproduct material is mixed to the desired concentration with a filler gas usually neon and placed in containers under pressure after which they are shipped from the wire plant to other plants within the division with most of the material going to the Cleveland Lamp Plant. Occasionally some of these gases are shipped to other licensee's, however, these have always been to different divisions of General Electric Company. (The one exception is the use of tritium used in the palladium leak method for filling glow lamps with this material being shipped directly from the supplier to the Cleveland Lamp Plant as the material is mixed on a continuing production line basis by means of the palladium leak technique just prior to filling the lamps.) The gas mixing room where most materials are received is a single room having dimensions of approximately 10 by 10 by 10 feet with a small area off to the side of this room being used for storage of radioactive gases. A heavy metal door slides up and down over the storage area. The gas mixing room has an exhaust system which operates such that the air in this mixing room is changed each minute. This facility has changed from that reported at the time of the last inspection. The only significant change in the operation is the fact that approximately 1 curie was the maximum quantity of tritium formerly worked with and mixing operation with such materials being placed in one compressed gas cylinder, whereas with the new authorization to manufacture glow lamps with significantly higher concentrations of tritium, the licensee works with a maximum of 24 curies of tritium at one time with all the 24 curies being contained ~~within a single~~ compressed gas cylinder. A reevaluation of safety in the gas mixing room was made on the basis of the maximum credible accident in which event it is assumed that all the tritium gas in a single storage container were released inside of the gas mixing room in the wire plant. This still reveals that the concentrations would still be

Company Confidential

FACILITIES, Cont'd.

32. continued.

less than the maximum permissible concentration as specified in 10 CFR 20 with the room having a complete air change every minute. The gas mixing area was not observed at the time of this inspection.

33. The areas of thorium use were not observed at the time of this inspection, however, those interviewed explained that the greatest problem area with the thorium is at the wire plant where the thorium is received as thorium nitrate or as thorium oxide. Approximately six times a year 50 to 100 pounds of powder are mixed in a blending operation the powder form after which a slurry is made in the wet process and later comes out as pressed chunks of billets with the eventual product being as wire, welding rods, etc. or billets for distribution to other authorized recipients who possess licenses for their further chemical and/or physical processing of the billets to obtain their desired end product. Air samples are periodically taken while the working with this material in the powder form (to be covered under the section entitled "Surveys.").

EQUIPMENT

34. Maintained in Dr. Green's laboratory for his possession and use is a Nuclear Chicago Model 2612 survey instrument utilizing a thin end window GM tube and a Jordan Radgun. It was also stated that a Tracerlab "cutie-pie" having ranges from 0 - 25, 250, and 2500 mr/hr is still located in the gas mixing plant to conduct surveys in that area when handling Krypton 85. These instruments are not calibrated at any preset time interval according to Dr. Green, but the Nuclear Chicago meter is regularly checked by him by use of the incorporated Carbon 14 check source supplied with the meter. The instruments are occasionally calibrated by him by using Cobalt 60 or Cesium 137 sources possessed by the licensee and calibrating at a number of points on each scale. In addition to these survey instruments, Dr. Green possesses thin end window GM tubes, scintillation counters, and a XXXX 2 pi gas flow proportional counter of his own design which is used for counting and for analysis. This counter has a wire as one of the electrodes in place of the single wire probe used by most instruments which Dr. Green states improves the counting efficiency over the entire inside chamber as compared with a single wire probe. Dr. Green is of the opinion that this system is much more efficient for counting wipes that may have contamination over the entire surface rather than located as a point source.

35. Since the time of the last inspection the licensee has purchased a vibrating Reed electrometer with a sample of gas being placed in an ion chamber and the ionization current caused by the isotope being measured to correspond to the activity of the isotope in question. For tritium gas, this method is accurate down to approximately 4×10^{-5} microcuries per cc according to Dr. B. H. Green. The licensee has a device whereby they can crush a glow lamp in the ion chamber and thus determine whether or not they are getting the desired amount of tritium in the glow lamps and also is used as a means of checking on the palladium leak device for adding tritium to glow lamps to ascertain that the entire system is functioning as desired. It is also used to survey for Krypton 85.

PERSONNEL MONITORING AND EXPOSURE DETERMINATION

36. In conjunction with the licensed program the licensee is furnished one control badge plus seven additional badges by Tracerlab on a bi-weekly basis with four film badges being routinely assigned to personnel and three being used for visitors. Film badge records were inspected from January of 1965, through July 18, 1966, and revealed that the only dose indicated above minimal was for a badge for one individual for one bi-weekly period which indicated 43 mr exposure to beta and/or nonpenetrating radiation and 10 mr gamma and/or x-ray

PERSONNEL MONITORING AND EXPOSURE DETERMINATION, Cont'd.

36. continued.

radiation. Dosimeters were also supplied to personnel entering Dr. Green's research laboratory. The licensee considers the film badge readings as being the valid exposures. The licensee maintains the equivalent of Form AEC-5 and Form AEC-4 for each individual badged. The four individuals being routinely badged are Dr. D. H. Green, Radiophysicist in charge of all research under the -4 license, Mr. I. Matelsky, Chairman of the Isotope Committee who has primary responsibility for safety in operation of all programs involving the use of byproduct material, Mr. C. E. Butler, and Jack Cole, who are involved in the operation of mixing gases at the gas mixing facility at the wire plant. A copy of the quarterly exposure is sent to each individual person as well as a yearly report. A copy is also sent to the Medical Center for the individual personnel medical file. Dosimeters are also worn by individuals at the gas mixing plant and records maintained by those individuals of their exposures as indicated by the dosimeters. However, the licensee's use of Krypton 85 has somewhat decreased since the time of the last inspection and the use of tritium has significantly increased and the dosimeters as well as the film badges are able to detect only the radiation eminating from Krypton 85.

37. No bioassay samples are collected or analyzed based on the relative inertness of the Hydrogen 3 gas and the Krypton 85 and the design of facilities to include rapid dilution and exhausting of air. In the production facility, the high pressure tanks containing the bulk of the gas are stored in enclosures having their own exhaust system and the lines leading away from this enclosure system to the machines where the gas is added to the glow lamps, is under pressure only slightly above atmospheric pressure.

LEAK TESTS

38. The licensee possesses eight sealed sources under authorization of the -4 license, with all wipe tests of the sealed sources being conducted by Dr. Green. The analysis of these wipes are conducted by using a Nuclear Chicago Model 2612 survey instrument with a thin end window (1.4 milligrams per square centimeter) GM tube. Wipe tests are based on the beta analysis of the sample, a copy of the procedures having been previously submitted. The instrument is calibrated with a radium 226 source. The eight sealed sources are designated as follows: No. 1 5 curie Cesium 137 Ohmart HM-8. No. 2 - nominal 10 millicurie Cobalt 60, Shield E-31B. No. 3 - nominal 2 millicurie Cesium 137. No. 4 - nominal 1 millicurie Cobalt 60 R-31 No. B-174. No. 5 - nominal 20 millicurie Strontium 90 beta applicator. No. 6 Thallium 204 (USRC). No. 7 - Promethium 147 (USRC). No. 8 - Strontium 90 Isolite source (USRC). Records revealed that these sources have all been tested on the following dates: October 28, 1964, April 28, 1965, October 28, 1965, April 28, 1966. All tests have revealed less than 0.002 microcuries of removable contamination. These sources have all remained in storage since the time of the last previous inspection except for purposes of instrument calibration.

POSTING AND LABELING

39. A radiation area existed in the hot lab in Dr. Green's laboratory near the area where the sealed sources were stored. This area was posted with an appropriate sign indicating the radiation area. Posted on the storage cabinet and on the door leading to the hot laboratory were appropriate signs indicating the presence of radioactive material.

40. Each container that was observed in the hot laboratory was noted to be labeled with appropriate signs to indicate the presence of radioactive material and in addition, information pertaining to the isotope, the activity, and date of assay was also observed to be labeled on the containers. Although other areas were not specifically visited, it was stated by those individuals interviewed that the areas were appropriately posted with signs to indicate the presence of radioactive material and a radiation area where appropriate and that containers are appropriately labeled.

POSTING AND LABELING

41. A Form AEC-3 was posted on the wall in the hot laboratory of Dr. Green's experimental laboratory. It was stated that Form AEC-3 was also posted in other areas where byproduct materials are stored and used.

RADIATION SURVEYS AND/OR EVALUATIONS

42. In the Research Laboratory, periodic surveys are conducted by Dr. Green which include both radiation levels in mr/hr and wipe tests of the area to determine if there is any contamination present. These results were recorded in Dr. Green's personal notebook. A review of his records revealed no detectable contamination from the smear surveys and the only significant gamma levels were near the storage location of the sealed Cesium 137, Cobalt 60 sources with a maximum reading of about 5 mr/hr at 12 inches from the storage location.

43. In the other areas of use, gamma level surveys in conjunction with the use of Krypton 85 and storage of powdered thorium and beta smear surveys and air samples for alpha activity where appropriate are conducted by Mr. Matelsky or Mr. Arnold Ratkje, Assistant to Mr. Matelsky. The smear surveys and the air sample filters are analyzed by Dr. Green with his equipment. Direct radiation surveys and samples are taken when significant work is being conducted with radioisotopes and when new shipments are brought in. A review of the records indicated that the last beta-gamma surveys were conducted on August 8, 1966, with the last beta-gamma survey prior to that having been conducted approximately two months previous to that date. All beta wipes indicated no detectable removable activity. The only gamma activity observed was low level activity in the immediate area surrounding the Krypton 85 bottles stored in an open face but vented storage rack. The licensee also uses the vibrating reed electrometer on occasion to collect an air sample and to analyze it for tritium or Krypton 85 concentrations. The vibrating reed electrometer which has been purchased since the last previous inspection was discussed previously in the report.

44. Membrane filters are used for the air samples conducted in conjunction with the use of thorium at the Lamp Metals and Components Department at the Wire Plant and also within a component of the large lamp plant at the Cuyahoga Lamp Plant at Nela Park. Air surveys are not conducted on a routine basis but only when a specific operation might warrant the conducting of such tests. As an example, air samples are conducted during approximately three of the six operations per year involving the production of metal alloys containing thorium which is initially obtained in the form of a powder. A review of the records revealed that the highest air concentrations revealed by such surveys during the alloying process since the last previous inspection was observed during an air sample survey conducted on October 12, 1965, which revealed a concentration of 0.83×10^{-11} microcuries per cc during a tray operation with this operation taking approximately 15 to 30 minutes to complete approximately six times per year. This value is less than 1/3 of that permitted in a restricted area for natural thorium if the person were to be exposed to such concentrations for forty hours in a period of seven consecutive days. Air samples have been taken in breathing zones and in general work areas for each step in the operation where there can possibly be airborne concentration. The instrument used draws air at a rate of approximately one cubic foot per minute with samples usually being taken for a period of approximately 15 minutes. Dr. Green analyzes these filters with his 2 pi proportional gas flow counter with calibration being performed with a standard radium D and E source in equalibrium. The analysis is made on the alpha activity and the beta particles are not counted because of the region of proportionality used with the counter. Dr. Green stated that he divides all the counts by a factor of 2 before converting the results to microcuries which is permissible and possibly even conservative because of the thorium decay chain where from 2 to 6 alpha particles will be admitted per each decay of thorium 232 depending on the time which has elapsed since the chemical separation of thorium. Approximately four days are allowed to elapse between the sampling and analysis of the samples to allow for decay of naturally occurring radon and thoron daughter products in the air.

RADIATION SURVEYS AND/OR EVALUATIONS, Cont'd.

45. The next highest air concentration as revealed by analysis of air samples was a concentration of 0.30×10^{-11} microcuries per cc at the Cuyahoga Lamp Plant at Nela Park during a tray cleaning operation on May 19, 1966. This operation also took only a relatively short period of time to complete.

WASTE DISPOSAL OR TRANSFER OF SPENT SOURCES

46. Within the research laboratory all radioactive materials of measurable quantities which have been disposed of has been in the form of a gas. This is disposed of by bleeding small amounts from tanks up the hood and out through the exhaust system. Dr. Green stated that other trace quantities of material have been washed down the sink in the process of washing beackers or other containers in which the material had been stored.

47. Byproduct material used in the Production Department as pertains to Krypton 85 and Hydrogen 3, is released in the licensee's products to the general public as is authorized by the license.

48. Thorium is also released to the general public in products containing unimportant quantities of byproduct materials and generally licenseable quantities of byproduct material and where appropriate, to other licensed authorized recipients. The licensee also has approximately 154 pounds of thorium contained as an alloy in scrap material (reference to thorium) which the licensee had been accumulating, ~~the amount being approximately 4 pounds in excess of that~~ The licensee has disposed of no scrap material to date.

INCIDENTS OR UNUSUAL OCCURRENCES

49. According to statements made by those interviewed, the licensee has experienced no theft or loss of byproduct material since the time of the last previous inspection and no licensee personnel have been overexposed to direct radiation or concentrations of radioactive material in conjunction with the possession and use of licensed radioactive material.

50. The licensee has experienced one unusual occurrence involving the release of Hydrogen 3 gas during the manufacture of glow lamps under the program licensed by License No. 34-00054-5. The happening took place while filling the special rapid fire glow lamps which are authorized to contain up to 10 microcuries of tritium. The pressurized supply tank contained 24 curies of tritium initially mixed with neon gas. However, at the time of the happening, the tank contained 17.5 curies of Hydrogen 3, as 6½ curies had already been placed into glow lamps from this tank at the time of the happening. The loss took place at approximately 7:25 PM on July 1, 1966, during the second shift operation. The point of the loss was near the center of a room on the second floor in Building A at the Cleveland Lamp Plant. The pressurized tank containing the tritium mixed with neon was contained within a vented enclosure. The low pressure line leading from the tank a distance of several feet leads to the glow lamp machine where material is placed into each glow lamp. The loss occurred when a connecting rubber separated from the valve nipple at a coupling in the fill gas line located near to the glow lamp machine. According to Mr. Roger Voss, Supervisor of the glow lamp area, the failure would result in very rapid loss of gas (estimated at less than 1 minute) even though the failure was on the low pressure side of the system.

51. According to Mr. Voss and statements made by Mr. Matelsky and Dr. Green, it was stated that the most logical reason for the loss was probably due to human error. It was stated that the machine adjusters routinely inspect the line and if they observe any connecting rubbers in the line that appear to be deteriorating, it is common practice for the machine adjuster to replace these connecting rubbers between the valve nipple and the fill gas line nipple. This operation had been performed on the morning of July 1, 1966, by one of the machine adjusters at the junction of the valve nipple and the fill gas nipple where the loss of gas subsequently occurred. It was stated that a subsequent inspection revealed that (the [illegible] release) the connecting rubber placed between the valve nipple and the fill gas line

INCIDENTS OR UNUSUAL OCCURRENCES, Cont'd.

51. continued.

nipple was cut approximately 1/4 inch too short. It was stated that the rubber connector was a precut item which was evidently somewhat shorter than that normally used. It was also stated that a secondary possible reason for the failure may have been an overabundant application of castor oil to this rubber prior to insertion. The new connection was checked at the time of the replacement by the machine adjuster and found to be free of leaks. The fill gas line was at a pressure of 12 pounds gage which was well below the maximum operative limit.

52. The room in which the happening occurred has a volume of 113,440 cubic feet and the room has roughly an equivalent of one air change per minute with an exhaust of 96,000 cubic feet per minute with the flow of air to the top of the room where it is exhausted to the atmosphere. It was also stated that the heat generated by the glow lamp units causes air in the immediate vicinity to rise.

53. It was stated that approximately forty persons may have been present in the room itself, however, the nearest operator is estimated to have been located not closer than approximately eight feet from the point of release.

54. Each glow lamp is checked for proper operation after it leaves the manufacturing unit. Immediately following the loss of the gas, the check out of the glow lamps revealed that the glow lamps were not functioning properly and the unit was shut down and it was soon learned of the loss of the gas. Due to the rapid loss of the gas (previously mentioned as less than 1 minute) and the rapid change of air due to the ventilation system, licensee personnel feel with a certainty that all of the tritium was effectively eliminated from the building at the time the machine was shut off.

55. Mr. Roger Voss, Supervisor of the glow lamp area, was immediately contacted and he subsequently contacted Mr. Mafelsky, Industrial Hygienist and Chairman of the Isotope Committee.

56. As the nearest person was estimated to have been not closer than approximately eight feet from the point of release, the licensee made an evaluation of the maximum concentrations of radioactive material such an employee would have been exposed to pursuant to 10 CFR 20.103(a) and (b) pertaining to exposures of individuals to concentrations of radioactive material in restricted areas, and the licensee also made an evaluation of the concentrations in effluents to unrestricted areas pursuant to 20.106 and concluded that upon these two basis, the happening was not reportable pursuant to 20.405(1) and (3).

57. As the nearest individual was assumed to be eight feet from the point of release, the assumption was made for the purposes of the evaluation that the released gas was limited to a sphere having a radius of eight feet and that the air in this sphere was being changed at the rate of one air change per minute based on the room itself being vented at the rate of approximately one air change per minute. Considering the area to be restricted one and the fact that Appendix B, Table I and 10 CFR Part 20 is based on a forty hour exposure per seven consecutive days, the licensee came up with the figure that on this basis the individual would have been exposed to 1.2×10^{-4} microcuries per cc whereas Appendix B, Table I of 10 CFR 20 for Hydrogen 3 for submersion permits 2×10^{-3} microcuries per cc as a limit. The Hydrogen 3 used is in the form of a gas and is essentially an inert gas. All exhaust fans in the room were operating during the second shift operation.

58. In evaluating the concentrations and effluents to unrestricted areas, the licensee considered the eight foot radius sphere as a restricted area and considered for dilution purposes, the amount of air passing through this sphere within a year taking into count the number of days of operation and the number of shifts per day of operation based on the fact that 10 CFR 20.106 (a) and (b) permits the concentrations to be averaged over a period not greater than one year. On this basis the licensee came up with a value of 7.3×10^{-9} microcuries per cc being released to an unrestricted area as compared to 4×10^{-5} microcuries per cc permitted by 10 CFR 20.106(b).

INCIDENTS OR UNUSUAL OCCURRENCES, Cont'd.

59. For the licensee's description of that happening, their evaluation of the happening, and a list of steps taken by the licensee in an effort to prevent future loss as result of similar circumstances, refer to Exhibits A and B attached to this report.

60. According to statements made by those interviewed, and a review of the records, the licensee has experienced no other unusual happenings aside from the one previously mentioned.

RECORDS

61. The Purchasing Department in each area has records showing all materials which have been received in a specific plant. With regard to licensed material, the responsible user in each area must keep a running inventory of such materials on hand in the area of his responsibility and submits to Mr. Matelsky and the Radioisotope Committee a current inventory on a monthly basis of all material which is licenseable. Therefore, Mr. Matelsky keeps a master inventory in his office of all licensed material which is located in each specific area. Periodically the inventories of the specific areas and the master inventory maintained by Mr. Matelsky are reviewed and compared. A review of the inventory records indicated that the licensee has remained within the possession limits of each specific license at all times since the last previous inspections. The licensee also has transfer records showing when the material has been transferred from research status on the -4 license to the production status under the -5 license.

62. Records show that occasional surveys including direct radiation and smear surveys as well as air samples have been made in the various use areas. The direct reading and smear survey results show that these are at the level of instrument background except for those using Strontium 90 and that air samples show less than the appropriate 10 CFR 20 limits. The licensee also maintains records of leak tests which have all been conducted within six month intervals since the time of the last previous inspection and have revealed less than 0.002 microcuries on all such smears.

63. The licensee also maintains film badge reports and records of dosimeter readings which has been covered in further detail under the section entitled Personnel Monitoring and Exposure Determination. These records have revealed no significant exposure since the time of the last previous inspections.

LICENSE CONDITIONS

64. During the course of the inspection the license conditions of Licenses No. 34-54-4 and -5 and SMB-191 were discussed with Mr. Matelsky, Chairman of the Isotope Committee, and Dr. Green, Radiophysicist and a member of the Isotope Committee, and it was determined that the licensee has been conducting the licensed programs in accordance with the respective license conditions for each licensed program.

MANAGEMENT DISCUSSION

65. At the conclusion of the inspection, the inspection findings were discussed with Mr. I. Matelsky, Industrial Hygienist and Chairman of the Radioisotope Committee, and Dr. Green, Radiophysicist and a member of the Isotope Committee. The loss of the 17½ curies of Hydrogen 3 was discussed along with the licensee's proposed steps to prevent a recurrence of such a loss in the future. This included the stressing of the importance to all machine adjusters of the importance of having a sufficiently long connecting rubber between the valve nipple surface and the end of the gas line nipple to give the connection maximum holding surface and using alcohol as a lubricant rather than castor oil because of the former materials tendency to dry quickly, ~~and it should thus not provide a proper seal since the connection cannot be held tight~~. Licensee personnel stated that they are also considering training the first and second shift foreman on how to use the vibrating reed electrometer so that measurements of ionization may be made at the time of loss. Another safety step considered was the possibility of overpressurizing the fill gas line after replacing the connecting rubber in a connection with a test pressure of 40 pound gauge which

MANAGEMENT DISCUSSION, Cont'd.

65. continued.

is deemed to be adequate to determine the strength of the connection. As another preventive measure, the licensee is considering purchasing another flow meter with its auxilary electronic shut-off valve which is currently used in connection conjunction with the Krypton 85 system which shuts off the valve whenever a leak occurs on the low pressure side of the system, [redacted] Mr. Matelsky explained that the reason this has formerly been used for the Krypton 85 system is the fact that all of the Krypton 85 gas bottles are connected together and that in the event of such a loss on the low pressure side, all of the gas bottles would be drained. Mr. Matelsky explained that the reason that this had not been incorporated into the Hydrogen 3 system to date was the fact that the valving system and associated electronics was quite expensive and the fact that to date, Hydrogen 3 cylinder tanks have not been connected together such that in the event of a loss on the low pressure side, only one tank would be drained at a time. However, the licensee had just started using the tanks containing up to 24 curies of tritium as of June 1966, and at the time it was not certain as to whether or not the use of such tanks containing such relatively large quantities of tritium would be used routinely in the production of mass quantities of glow lamps containing larger quantities of tritium. However, Mr. Matelsky stated that it appears that the licensee will be making these glow lamps containing larger quantities of tritium on a mass production basis, and using cylinders containing these larger quantities of Hydrogen 3 and are now strongly considering the feasibility of placing such a flow meter with auxilary electronics into the tritium line connected to tanks containing the large quantities of tritium.

66. Licensee is also considering of using other type connectors that might possibly be more fail safe.

67. These individuals were informed that the inspector is of the opinion that these licensed programs are being appropriately conducted and supervised and were informed that no items of noncompliance were noted with regard to any of the three licensed programs inspected, ~~mainly~~ Licenses No. 34-54-4 and -5 and SMB-191 and a clear Form AEC-591 was subsequently issued for each of these licensed programs.

Exhibit A

G[illegible]ELECTRIC
COMPANY

LARGE LAMP
DEPARTMENT

1762 EAST 45TH STREET, CLEVELAND, OHIO 44103 . . . Area Code 216 . . . .

CLEVELAND LAMP PLANT

August 2, 1966

Mr. I. Matelsky
Melting Research Laboratory, #130
Nela Park

Subject: Loss of Radio Active Tritium Gas During Glow Lamp Manufacture

This letter serves to document an earlier phone conversation concerning the loss of tritium gas on the evening of July 1, 1966 at approximately 7:50 p.m. The loss occurred when the fill gas line connecting rubber separated from the valve nipple, resulting in a loss of 17.5 curies of tritium gas mixed in with our neon fill gas. A failure of this type would result in a very rapid loss of this gas (less than one (1) minute). The manufacturing group is located in building 3, second floor, at nearly the center of this room. All exhaust fans in this room were operating during this second shift operation. At the time of the failure, fifty (50) people were in various locations in this room, with the closest operator being six to eight feet from the point of loss.

The most logical reason for the loss was one of human error when the day shift machine adjustor placed a new connecting rubber between the valve nipple and the fill gas line nipple that was cut approximately 1/4" too short. This operation was done on the morning of July 1, 1966. A secondary reason for failure may have been an overabundant application of castor oil to this rubber prior to insertion. The fill gas line was pressurized to twelve pounds gauge (which is well below our maximum operative limit).

The plant will take the following steps to prevent future loss of this radio active gas:

1. Communicate with each machine adjustor the importance of having a complete connection between the valve nipple surface to the end of the gas line nipple. This will give the connection maximum holding surface.

2. Rather than using castor oil as a lubricant during the insertion of this rubber, we will use alcohol, which will quickly dry after the connection is made. This practice will give the connection greater holding friction.

EXHIBIT A

3. Train first and second shift foremen on how to use the vibrating reed electrometer so that measurements of ionization can be made at the time of loss.

In addition to the above steps, the following ideas are under consideration:

1. The value of over-pressurizing this fill gas line to determine the strength of this connection every time a new rubber is used. A test pressure of 40 pounds gauge should determine if this connection has adequate strength.

2. Determine the feasibility of purchasing another flow meter with its auxiliary electronics and shut off valves which are now used in conjunction with our central system fill gas lines. This system could then be used for the numerous small 200 liter tanks which we use.

3. Investigate other methods of making this connection other than the one presently employed. For example a Welch or Veeco quick disconnect coupling.

If there are any other procedures or methods that should be considered, please bring them to our attention.

CLEVELAND LAMP PLANT, #453

R. E. Voss

Exhibit B

EVALUATION OF INCIDENT AT CLEVELAND LAMP PLANT, JULY 1, 1966

1. THIS INCIDENT INVOLVES THE LOSS OF 17.5 CURIES OF H-3 FROM THE HIGH H-3 DOPING UNIT AT CLEVELAND LAMP PLANT. THE LOSS WAS NOTED AT ABOUT 1:25 P.M. DURING SECOND SHIFT OPERATION. THE ANALYSIS OF THE INCIDENT IS GIVEN IN THE ATTACHED REPORT. THE DISTANCE BETWEEN THE SOURCE OF THE LOSS AND THE NEAREST OPERATOR WAS ABOUT 8 FT., ALTHOUGH APPROXIMATELY 40 PERSONS MAY HAVE BEEN PRESENT IN THE ROOM ITSELF.

2. THE RATIONAL INVOLVED HERE HAS BEEN TO ASSUME THAT THE RELEASED GAS WAS LIMITED TO A SPHERE HAVING A RADIUS OF 8 AND THAT THE AIR IN THIS SPHERE WAS BEING CHANGED AT THE RATE OF 1 AC/MIN. (THE ROOM ITSELF IS VENTED AT THE RATE OF 1 AC/MIN.).

AREA OF SPHERE = $4/3\pi R^3$ = 2140 CU.FT. = 6.13×10^7 ML.

TOTAL ACTIVITY LOST = 17.5×10^6 µC.

A. IF THIS AREA IS CONSIDERED TO BE A RESTRICTED ONE, EXPOSURE MAY BE AVERAGED OVER A PERIOD OF 40 HOURS IN ANY PERIOD OF SEVEN CONSECUTIVE DAYS.

40 HOURS = 2400 MINUTES @ 1 AC/MIN. = 2400 AC/40 HOURS

$2400 \text{ AC} \times 6.13 \times 10^7 \text{ ML} = 1.47 \times 10^{11} \text{ ML/40 HOURS}$

$$\therefore \frac{1.75 \times 10^7 \ \mu c}{1.47 \times 10^{11} \text{ ML}} = 1.2 \times 10^{-4} \ \mu c/\text{ML}$$

APPENDIX B, TABLE 1 OF 10CFR20 FOR H-3 = 2×10^{-3} µC/ML.

THIS EXPOSURE OF PERSONNEL, EVEN AT A DISTANCE OF 8 FT. FROM THE SOURCE OF LEAK WOULD BE WELL BELOW THAT PERMITTED IN A RESTRICTED AREA.

B. IF THIS AREA IS TO BE CONSIDERED AN UNRESTRICTED ONE, THE TOTAL EXPOSURE MAY BE CALCULATED ON THE BASIS OF THE NUMBER OF AIR CHANGES PER WORKING YEAR. THIS AREA IS ON A 3-SHIFT OPERATION, AND OPERATES 5 1/2 DAYS PER WEEK. THE VENTILATION SYSTEM IS IN OPERATION DURING THESE OPERATING PERIODS.

275 DAYS x 24 = 6.6×10^3 HOURS x 60 = 3.9×10^5 MINUTES

= 3.9×10^5 AIR CHANGES

TOTAL H-3 LOST = 17.5×10^6 µC

VOLUME OF SPHERE, R = 8' = 6.13×10^7 ML

THEREFORE: $3.9 \times 10^5 \text{ AC} \times 6.13 \times 10^7 \text{ ML} = 23.9 \times 10^{12} \text{ ML}$.

AND: $\frac{17.5 \times 10^6}{23.9 \times 10^{12}} = .73 \times 10^{-6} = 7.3 \times 10^{-7} \ \mu c/\text{ML}$.

SEC. 20.106(A) OF 10CFR20, AND TABLE II OF APPENDIX "B" SPECIFY EXPOSURE FOR UNRESTRICTED AREAS TO CONCENTRATIONS WHICH, AVERAGED OVER A YEAR, WILL NOT EXCEED 4×10^{-5} µC/ML. THE VALUE CALCULATED IS WELL BELOW THIS VALUE.

EXHIBIT B

c. SEC. 20.405(A) OF 10CFR20 STIPULATES 30 DAY REPORTING IF EXCESSIVE LEVELS IN AN UNRESTRICTED AREA IS 10 TIMES THE APPRECIABLE LIMIT, OR 4×10^{-4} µC/ML. THUS, REPORTING OF THIS LOSS WILL NOT BE REQUIRED.

FOR THE RADIOISOTOPE COMMITTEE

I. MATELSKY
CHAIRMAN

IM:EJP