GENERAL ELECTRIC

RE-ENTRY

SYSTEMS

DIVISION

GENERAL ELECTRIC COMPANY, 3198 CHESTNUT ST., PHILADELPHIA, PENNSYLVANIA 19101
Phone (215) 823-2000
Safety Office, 215/823-3745

OFFICIAL RECORD COPY

Applicant G615275
Check No.
Amount/Fee Category #70-2D
Type of Fee Renewal
Date Check Rec'd 6/3/83
Received By Brown

May 23, 1983

RECEIVED BY LFMB
Date 6/3/83
Log June 1
By Brown
Orig. To
Action Compl. 6/3/83

U.S. Nuclear Regulatory Commission
Region I, Nuclear Material Section B
631 Park Avenue
King of Prussia, Pennsylvania 19406

Dear Sirs:

Enclosed is an application for renewal of License No. SUB-831 (Docket or Reference No. 040-07344). Also enclosed is a check for $70.00 to cover the renewal application fee.

If there are any questions, please contact the undersigned.

Sincerely,

Jack McFadden

John R. McFadden, Health Physicist
Safety Office, Rm. 3026
215/823-3745

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MAY 25 1983

NRC FORM 2
3-82
10 CFR 40

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR SOURCE MATERIAL LICENSE

APPROVED BY OMB
3150-0019
EXPIRES 12-31-83

Pursuant to the regulations in Title 10, Code of Federal Regulations, Chapter 1, Part 40, application is hereby made for a license to receive, possess, use, transfer, deliver or import into the United States, source material for the activity or activities described.

1. LICENSE INFORMATION *(Check one)*

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NO.
- [XX] C. RENEWAL OF LICENSE NO. SUB-831
- [ ] D. PREVIOUS LICENSE NO.

2. NAME OF APPLICANT General Electric Company
Re-entry Systems Operation

PRINCIPAL BUSINESS ADDRESS
3198 Chestnut Street
Phila., PA 19101

3. STATE THE ADDRESS(ES) AT WHICH SOURCE MATERIAL WILL BE POSSESSED OR USED

See attachment labeled Item 3.

4. NAME OF PERSON TO BE CONTACTED CONCERNING THIS APPLICATION John R. McFadden

TELEPHONE NUMBER *(Of person to be contacted)* (215) 823-3745/962-4570

5. DESCRIBE PURPOSE FOR WHICH SOURCE MATERIAL WILL BE USED

Research, development, and manufacturing programs related to the missile and space programs.

6. STATE THE TYPE OR TYPES, CHEMICAL FORM OR FORMS, AND QUANTITIES OF SOURCE MATERIAL YOU PROPOSE TO RECEIVE, POSSESS, USE, OR TRANSFER UNDER THE LICENSE

A. TYPE	B. CHEMICAL FORM	C. PHYSICAL FORM *(Including % U or Th)*	D. MAXIMUM AMOUNT AT ANY ONE TIME *(Kilograms)*
NATURAL URANIUM	ANY	ANY	700 COMBINED
URANIUM DEPLETED IN THE U-235 ISOTOPE	ANY	ANY	
THORIUM *(Isotope)*	ANY	ANY	100

E. MAXIMUM TOTAL QUANTITY OF SOURCE MATERIAL YOU WILL HAVE ON HAND AT ANY TIME *(Kilograms)*
800 kilograms

7. DESCRIBE THE CHEMICAL, PHYSICAL, METALLURGICAL, OR NUCLEAR PROCESS OR PROCESSES IN WHICH THE SOURCE MATERIAL WILL BE USED, INDICATING THE MAXIMUM AMOUNT OF SOURCE MATERIAL INVOLVED IN EACH PROCESS AT ANY ONE TIME, AND PROVIDING A THOROUGH EVALUATION OF THE POTENTIAL RADIATION HAZARDS ASSOCIATED WITH EACH STEP OF THOSE PROCESSES.

See attachment labeled Item 7.

8. LIST THE NAMES AND ATTACH A RESUME OF THE TECHNICAL QUALIFICATIONS INCLUDING TRAINING AND EXPERIENCE OF APPLICANT'S SUPERVISORY PERSONNEL AND THE PERSON RESPONSIBLE FOR THE RADIATION SAFETY PROGRAM *(or of applicant if an individual).*

See attachment labeled Item 8.

9. DESCRIBE THE EQUIPMENT AND FACILITIES WHICH WILL BE USED TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE OR PROPERTY AND RELATE THE USE OF THE EQUIPMENT AND FACILITIES TO THE OPERATIONS LISTED IN ITEM 9; INCLUDE:
A. RADIATION DETECTION *(including film badges, dosimeters, counters, air sampling, and other survey equipment as appropriate, the description of radiation detection instruments should include the instrument characteristics such as type of radiation detected, window thickness, and the range(s) of each instrument).*

See attachment labeled Item 9.A.

B. METHOD, FREQUENCY AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED IN A. ABOVE, INCLUDING AIR SAMPLING EQUIPMENT *(for film badges, specify method of calibrating and processing, or name supplier).*

See attachment labeled Item 9.B.

MAY 2 5 1983

9C. VENTILATION EQUIPMENT WHICH WI[illegible] USED IN OPERATIONS WHICH PRODUCE DUS[illegible] [illegible]JMES, MISTS, OR GASES, INCLUDING PLAN VIEW SHOWING TYPE AND LOCA[illegible]N OF HOOD AND FILTERS. MINIMUM VELOCITIE[illegible] MAINTAINED AT HOOD OPENINGS AND PROCEDURES FOR TESTING SUCH EQUIPMENT.

See attachment labeled 9.C.

10. DESCRIBE PROPOSED PROCEDURES TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE AND PROPERTY AND RELATE THESE PROCEDURES TO THE OPERATIONS LISTED IN ITEM 7; INCLUDE:

A. SAFETY FEATURES AND PROCEDURES TO AVOID NONNUCLEAR ACCIDENTS, SUCH AS FIRE, EXPLOSIONS, ETC., IN SOURCE MATERIAL STORAGE AND PROCESSING AREAS.

See attachment labeled 10.A.

B. EMERGENCY PROCEDURES IN THE EVENT OF ACCIDENTS WHICH MIGHT INVOLVE SOURCE MATERIAL.

See attachment labeled 10.B.

C. DETAILED DESCRIPTION OF RADIATION SURVEY PROGRAM AND PROCEDURES.

See attachment labeled 10.C.

11. WASTE PRODUCTS

A QUANTITY AND TYPE OF RADIOACTIVE WASTE THAT WILL BE GENERATED

☐ NONE WILL BE GENERATED

☒ SEE ATTACHED SUPPLEMENTAL SHEET — See attachments labeled 11.A. and 11.B.

B. DETAILED PROCEDURES FOR WASTE DISPOSAL

12. IF PRODUCTS FOR DISTRIBUTION TO GENERAL LICENSEES OR TO THE GENERAL PUBLIC UNDER AN EXEMPTION CONTAINED IN 10 CFR 40 ARE TO BE MANUFACTURED, USE A SUPPLEMENTAL SHEET TO FURNISH A DETAILED DESCRIPTION OF THE PRODUCT, INCLUDING:

A. PERCENT SOURCE MATERIAL IN THE PRODUCT AND ITS LOCATION IN THE PRODUCT.

B. PHYSICAL DESCRIPTION OF THE PRODUCT INCLUDING CHARACTERISTICS, IF ANY, THAT WILL PREVENT INHALATION OR INGESTION OF SOURCE MATERIAL THAT MIGHT BE SEPARATED FROM THE PRODUCT.

C. BETA AND BETA PLUS GAMMA RADIATION LEVELS *(Specify instrument used, date of calibration and calibration techniques used)* AT THE SURFACE OF THE PRODUCT AND AT 12 INCHES.

D. METHOD OF ASSURING THAT SOURCE MATERIAL CANNOT BE DISASSOCIATED FROM THE MANUFACTURED PRODUCT.

See attachment labeled 12.

13. CERTIFICATE

(This must be completed by the applicant)

The applicant and any official executing this certificate on behalf of the applicant named in item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 40, and that all information contained herein, including any supplements attached hereto, is true to the best of our knowledge and belief.

Jack McFadden	John R. McFadden	5/23/83
APPLICANT'S SIGNATURE	PRINTED OR TYPED NAME	DATE

Health Physicist

TITLE OF CERTIFYING OFFICIAL AUTHORIZED TO ACT ON BEHALF OF THE APPLICANT

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.

Ger al Electric Co.-RSO
31S :hestnut Street
Philadelphia, PA 19101

SUB-831 RENEWAL 5/83

ITEM 3.

The licensee's facilities at:

a. 3198 Chestnut Street, Philadelphia, PA

b. D and Luzerne Streets, Philadelphia, PA

c. 401 East Hunting Park Avenue, Philadelphia, PA

d. STC Building 100, Goddard Blvd, King of Prussia, PA

e. Temporary job sites of the licensee anywhere in the United States where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material

Remarks: Mass simulator tests utilizing prefabricated depleted uranium metal alloy components and the testing and handling incident to launch of re-entry vehicles containing prefabricated depleted uranium components need to be performed at Vandenberg Air Force Base, California, and Cape Canaveral Air Station, Florida.

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319 Chestnut Street
Phila., PA 19101

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ITEM 7
Any use fulfilling the following three conditions: covered by statement in item 5, included in activities permitted by category of license, and approved by the Ionizing Radiation Advisory Group; see attachments labeled 8 and 10.C. for composition and responsibilities of the IRAG.

The current or planned uses are as follows:

A. TYPE: natural or depleted uranium
CHEMICAL FORM: elemental
PHYSICAL FORM(including % U or Th): solid, powder (99+ % U)
USE: as additive in fabrication of cast epoxy rods
MAX. AMT. PER PROCESS AT ANY ONE TIME: 100 grams (U)
MAX. AMT. AT ANY ONE TIME: 5 kilograms (U)
POTENTIAL HAZARDS: Generation of airborne particulate contamination and inhalation; surface contamination and ingestion.
CONTROL MEASURES: Use of glovebox with HEPA-filtered exhaust; area contamination surveys.
REMARKS: These items, after being received in approximately one kilogram quantities, are placed in a glovebox. At the surface of the bottles in which the items are received, the exposure level is approximately 2 mR/hr or less, and, at a distance of three feet, is equal to background. The glovebox contains a nitrogen atmosphere at a slight positive pressure (approximately 0.25 inch of water). The glovebox's gas outlet is equipped with an absolute filter disc. Approximately one hundred grams of radioactive powder is transfered to a beaker containing an epoxy resin; after mixing and addition of catalyst, the mixture is poured into rod-shaped molds and allowed to cure at room temperature. The cast epoxy rod is the end product; trimming and cleaning of these rods are performed in the glovebox. External radiation exposure is very low, and the use of the glovebox for operations involving powder or liquid manipulation controls the potential incorporation hazard; periodic wipe tests on the glovebox and its vicinity are made to check on the glovebox's integrity; the rods are made to the specifications of the buyer who uses them for research purposes.

B. TYPE: natural or depleted uranium
CHEMICAL FORM: acetylacetonate of uranium
PHYSICAL FORM (including % U or Th): solid, powder (38 % U)
USE: same as 7.A.
MAX. AMT. PER PROCESS AT ANY ONE TIME: same as 7.A.
MAX. AMT. AT ANY ONE TIME: same as 7.A.
POTENTIAL HAZARDS: same as 7.A.
CONTROL MEASURES: same as 7.A.
REMARKS: same as 7.A.

C. Type: natural thorium
Chemical form: elemental
Physical form (including % U or Th): solid, powder (99+ % Th)
Use: same as 7.A.
Max. amt. per process at any one time: 100 grams (Th)
Max. amt. at any one time: 5 kilograms (Th)
Potential hazards: same as 7.A.
Control measures: same as 7.A.
Remarks: same as 7.A.

ITEM 7 (cont'd.)

D. Type: natural thorium
Chemical Form: acetylacetonate of thorium
Physical Form (including % U or Th): solid, powder (37% Th)
Use: Same as 7.A.
Max. Amt. per process at any one time: Same as 7.C.
Max. Amt. at any one time: Same as 7.C.
Potential Hazards: Same as 7.A.
Control Measures: Same as 7.A.
Remarks: Same as 7.A.

E. Type: Natural or depleted uranium
Chemical Form: Uranium dioxide
Physical Form (including % U or Th): solid, powder (88% U)
Use: as additive in fabrication of cast epoxy
Max. Amt. per process at any one time: 1 Kilogram (U)
Max. Amt. at any one time: 228 Kilograms (U)
Potential Hazards: Same as 7.A.
Control Measures: Use of radiochemical fume hood with hepa-filtered exhaust and area contamination surveys.
Remarks: This item is received in powder form. The usual shipment includes twelve 5 lb.-bags, and standard operating procedure requires that the total quantity on hand at one time not exceed 100 pounds. When needed, the powder is transferred from storage to a designated hood which is equipped with absolute filters; here, one kilogram of powder is transferred to a porcelain dish. The remainder of the powder is returned to storage; the dish, containing the dispensed powder, is placed in an oven set at 600 degrees F for six hours; at the end of six hours, the oven temperature is lowered to 300 degrees F and maintained there until the powder is removed for use. This oven is not in the hood. This oven and other ovens in the same area, which are used to heat cure epoxy compounds containing the radioactive material, are equipped with excess temperature cutoff devices. After the powder has been dried, the dish is transferred back to the hood where the powder is put into a beaker containing an epoxy resin and mixed with the resin. This mixture is rolled in a mill inside the hood. After milling, the hardener is added to the mixture. This compound is then poured into large syringes. The syringes are used to dispense the compound into molds outside the hood. The compound-filled molds are placed in an oven set at 140 degrees F for curing. After curing, the compound and the hold are mechanically and electrically mated to a subassembly; this subassembly is then mechanically and electrically tested before being incorporated into a larger assembly. None of the operations performed on the cured radioactive compound involve machining, drilling, heating, or any other stress which could produce respirable radioactivity. The final assembly containing the source material is transferred to a Department of Defense agency. In some cases, the mixture of resin and radioactive material, as a viscous paste (catalyst not added), is transferred to a DoD agency. Personnel radiation badges, air samples, and bioassay results have indicated that personnel involved in the mixing and curing operations receive far less than 10 percent of the maximum permissible whole body radiation exposure; smear tests and air samples indicate minimal contamination levels. Personnel radiation badges indicated that assemblers and testers received less than twenty-five percent of the maximum permissible whole body radiation exposure.

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ITEM 7 (cont'd.)

F. Type: Natural or depleted uranium
   Chemical Form: elemental
   Physical Form (including % U or Th): prefabricated solid metal alloy components (90 to 99+% U)
   Use: Mass Simulator
   Max. Amt. per process at any one time: 20 Kiligrams (U)
   Max. Amt. at any one time: 456 Kilograms (U)
   Potential Hazards: Surface contamination due to contact with bare simulator and external dose accumulation.
   Control Measures: Surface contamination surveys, remote testing, and external radiation surveys.
   Remarks: This item is received as a prefabricated solid metal alloy component weighing approximately 20 kilograms and is utilized as a mass simulator in the shape and size in which it is received. The component is not altered chemically or physically. It is placed in a holding fixture. Mechanical and electrical connections are made to already existing and designated terminals on the component. Remote testing (3 to 6 feet) is performed on the component in uncovered and enclosed conditions. After testing, the radioactive component, in the uncovered or enclosed condition, is packaged and transferred to the original shipper or to an organization designated by the original shipper. Incorporation hazards associated with handling these components are zero to minimal; external whole body radiation exposure levels (uncovered or enclosed component: 0.5 mR/hr, gamma, at one foot) are not a problem during testing; "hands-on" time with uncovered component (233 mrem/hr, beta, at surface - Radiological Health Handbook, revised January 1970) is minimal and so skin dose is not a problem.

G. Type: Natural Thorium
   Chemical Form: Thoriated magnesium metallic alloy (elemental thorium or ThO_2)
   Physical Form (including % U or Th): solid metal alloy plate (1-4% Th)
   Use: Fabrication into a finished structural panel using conventional machining methods (such as surface turning, milling, and drilling).
   Max. Amt. per process at any one time:
     Machining: 3.6 Kilograms (Th)
     Filing and Abrading: 0.72 Kilogram (Th)
   Max. Amt. at any one time: 66 Kilograms (Th)
   Potential Hazards: Surface and airborne contamination due to machining fires; generation of airborne contamination due to machining, filing, and abrading.
   Control Measures: Strict adherence to existing successful magnesium fire control procedures; collection of fines and chips as radioactive waste; periodic contamination surveys and air monitoring; establishment of surface contamination control areas; hepa-filtered exhausts where required by potential for aerosol generation.
   Remarks: The thoriated magnesium will be received as solid plates. Each plate will be approximately 4.5 feet wide x 7 feet long x 1.5 inch thick and will weigh approximately 400 pounds (181 Kilograms) (containing approximately 8 pounds (3.6 kilograms) of thorium).

G. Remarks: (cont'd)

Each plate will be milled and drilled in the machine shop one at a time. After completion of machining, the machined part will have approximately the same outside dimensions as the raw stock but will only weigh approximately 80 pounds (36 Kilograms) (containing approximately 1.6 pounds (0.72 Kilogram) of thorium). The other approximately 320 pounds (145 Kilograms) of the raw stock plate will be in the form of metallic chips and some small pieces.

It is planned to utilize three machines located in one machine shop and to perform the deburring (filing) and abrading of the machined parts within the same shop.

Based on information obtained from users with many years of experience with manufacturing operations on thoriated magnesium alloy, conventional machining processes yield particles as chips and turnings which are too heavy to become airborne and consequently need no exhaust; users' air sampling results for mechanical operations (ex. grinding) on machined parts have not indicated the need for ventilation control.

Routine air sampling will be performed for the first six months to verify that airborne contamination does not exceed the levels specified in 10 CFR 20.203(d) or one to two percent of levels cited in 10 CFR 20.106(a).

Hepa-filtered enclosures or local exhaust equipment will be used if required due to generation of airborne contamination levels exceeding previously cited levels. All exhaust systems are designed following specifications in the "Industrial Ventilation" manual published by the American Conference of Governmental Industrial Hygienists.

Subsequent monitoring will be performed when the nature or frequency of the machining/fabrication process changes to one which could increase the generation of airborne contamination.

Routine surveys for removable surface contamination will be made in the area. Fines and chips will be collected and controlled as radioactive material.

Removable surface contamination from large pieces of thoriated magnesium is not expected to be a problem. Surveys will be performed to quantify the magnitude of this hazard.

External exposure dose control should not be a significant hazard. A typical raw stock plate will measure approximately as follows:

Distance from plate surface (feet)	mR/hr
0	3
1	2
3	0.5
6	0.2

Personnel radiation badges will be issued initially to verify this.

G. Remarks: (cont'd.)

Magnesium is one of the combustible metals, and a magnesium (thoriated) fire could result in the spread of airborne and surface radioactive contamination.

Strict adherence to existing, successful magnesium fire control procedures will be implemented.

The machined part will be transferred to another Aerospace Operation prior to its assembly into an Aerospace Vehicle.

At this time, it is planned to dispose of the scrap (320 pounds of each raw stock plate) by one or a combination of the following methods:

1. NRC - licensed radioactive waste disposal company

2. Return to plate manufacturer (Dow Chemical Company)

H. Type: Matural thorium

Chemical Form: Thoriated tungsten metallic allow (elemental thorium or ThO_2)

Physical Form (including % U or Th): solid metal alloy billets (1-4% Th)

Use: Fabrication into a finished component using conventional machining operations (such as surface turning and milling)

Max. Amt. per process at any one time: 0.1 Kilogram (Th)

Max. Amt. at any one time: 20 Kilograms (Th)

Potential Hazards: Same as 7.G. except for fact that this alloy is not combustible.

Control Measures: Same as 7.G. except for fact that combustible metal fire control procedures are not needed in this case.

Remarks: This item is received as solid metal alloy billets/bars/rods of approximately 2 to 4 Kilograms each. The pieces of raw stock are subsequently machined to the desired configurations. After machining, the thoriated parts are installed into a larger assembly. The final assembly containing the source material is transferred to a DoD agency or to another contractor as directed by the DoD agency.

Routine air sampling, contaminated air control, contamination surveys, and waste disposal procedures will be the same as those used for thoriated magnesium (7.G.).

External radiation exposure should not be a significant hazard. A typical billet will measure approximately 0.5 mR/hr at the surface and 0.1 mR/hr at three inches.

ITEM 8

Prior to the start of any work with radioactive materials, all operations involving radioactive materials must be approved by the Ionizing Radiation Advisory Group (IRAG) according to mandatory safety procedure M-6.

A copy of M-6 is enclosed. This document includes: policy statement and responsibilities and procedures (for all personnel working with ionizing radiation, for their supervisors, for their managers, for the IRAG, and for each member of the IRAG). Also included in M-6 are the responsibilities and procedures for procuring, receiving, using, transporting, and disposing radioactive materials.

Further information concerning the IRAG and radiation safety administration and procedures is contained in attachment labeled 10.C. Training of individual users and their supervisors is addressed in attachment labeled 10.C.e.

Current members of the IRAG are as follows (resumes enclosed):

Chairman:	T.P. Handley	- Mgr. of Industrial Security, Safety, and Administrative Services
Member:	C.B. Chilton	- Mgr. of Industrial Safety and Hygiene
Member:	S.J. Mucha, M.D.	- Medical Director
Secretary:	J.R. McFadden	- Health Physicist
Secretary: (Alternate)	A.W. Kobylinski	- Industrial Hygienist (Alternate Health Physicist)

General Electric Company - RSO
3198 Chestnut Street
Phila., PA 19101

SUB-831 RENEWAL 5/83

ITEM 8 (continued)

RESUME - THOMAS P. HANDLEY - MGR. INDUSTRIAL SECURITY, SAFETY & ADMINISTRATIVE SERV.

A. Education
Wentworth Institute (b)(6) Ex 6
Boston, Massachusetts (b)(6)

Numerous company sponsored courses in Business Management, Safety for Supervisors, Computer Programming, Radiographic Course, Office of Civil Defense Courses in Radiological Monitoring for Instructors. MHW Radiation Safety Course.

B. Work Experience

1961-1963	Radiation Protection Officer, License #37-2006-05
1963-1965	Instructed Radiological Monitoring for PA Fallout Shelter Management Course at Penn State University
1968-1978	Chairman, Ionizing Radiation Advisory Group, License #37-2006-05 per Valley Forge Space Center Safety Manual Procedure M-6.0

General Electric Company - RSO
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Phila., PA 19101

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ITEM 8 (continued)

RESUME:

Charles B. Chilton
Manager, Industrial Safety & Hygiene
General Electric Company
Space Systems Division
P.O. Box 8855
Philadelphia, Pa 19101

Education:

BS - Virginia Polytechnic Institute, Blacksburg, Va. - Agricultural Eng.
MS - Temple University, Philadelphia, Pa. - Industrial Hygiene

Certified Safety Professional - #1410
Registered Professional Engineer in Safety Engineering, State of California - #676

Work Experience:

U.S. Army - 6 months active duty, 23 years active reserve, rank of Lt. Col. Taught/attended numberous chemical, biological, radiological (CBR) courses.

Factory Insurance Association - Fire Protection Engineer - 5 years

Celanese Corporation - Safety Supervisor - 5 years

Borg-Warner Corporation - Safety Manager - 1 year

General Electric Company - Safety Manager - 12 years

Member:

ASSE
NFPA
AIHA

Supervised HP activities 12 years.

Attended numerous HP short courses (U.S. Army, AIHA).

Completed two graduate level HP courses (Temple University)

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Phila PA 19101
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ITEM 8 (continued)

RESUME - STEPHEN J. MUCHA, M.D., F.A.C.S., MEDICAL DIRECTOR

Exp6

A. Education

(b)(6) - B.S. Degree in Biology from Franklin & Marshall College Lancaster, Pa.
1956 - M.D. Degree from the University of Pennsylvania, School of Medicine, Philadelphia, Pa.

B. Post Graduate Training

1956-1957	Internship rotating at U.S. Naval Hospital, Philadelphia, Pa.
1957-1961	General Surgical Residency, U.S. Naval Hospital, Philadelphia, Pa.
1961-1964	Assistant Chief of Surgery, U.S. Naval Hospital, Camp Lejeune, N.C.
1964-1967	Chief of Surgery, U.S. Naval Hospital, Roosevelt Roads, Puerto Rico.
1967-1971	Assistant Chief of Surgery, U.S. Naval Hospital, Philadelphia, Pa.
1971-1978	Chairman, Department of Surgery, Naval Regional Medical Center, Philadelphia, Pa.
1978-	Medical Director, General Electric Company RSO, Philadelphia, Pa. Private Practice.

C. Memberships

1971-1978	Chairman, Disaster Committee, Naval Regional Medical Center, Philadelphia, Pa.
1971-1978	Member, Radiation Committee, Naval Regional Medical Center, Philadelphia, Pa.
1978-1982	Member, Ionizing Radiation Advisory Committee, General Electric Company RSO, Philadelphia, Pa.

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Phila., PA 19101

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ITEM 8 (continued)

RESUME - JOHN R. McFADDEN - GE/SSD HEALTH PHYSICIST

Ex 6

A. Education
Ph.D. Purdue University, W. Laf., Ind., 1967-1971, Bionucleonics.
M.S. Temple University, Phila., Pa., 1966-1967, Radiological Health.
B.A. St. Joseph's College, Phila., Pa., (b)(6) Biology

B. Work Experience
7/72 to 10/72: Public Health trainee in radiological health unit of Philadelphia Health Department. Primary responsibilities included inspection of diagnostic x-ray machines and operations by industrial radiographers.
11/72 to 12/73: Health physicist with Nuclear Radiation Consultants, New Haven, Conn. Consultation in health/medical physics provided to hospitals in Conn. and Mass.
1/74 to 6/82: Health physicist for General Electric Company - RESD.
6/82 to present: Health physicist for General Electric Company - SSD.

C. Experience with Radiation

Isotope	Maximum Amount	Employer	Duration	Type of Use
Co-60	5000 Ci	N. R. Consultants	1 year	Radiation Therapy
P-32	0.02 "	"	1 "	"
Ra-226	0.1 "	"	1 "	"
Au-198	0.002 "	"	1 "	Nuclear Medicine
Se-75	" "	"	1 "	"
Hg-197	" "	"	1 "	"
I-131	0.001 "	"	1 "	"
Tc-99m	0.05 "	"	1 "	"
I-125	0.02 "	"	1 "	In Vitro Research
Depleted U	50 lbs.	"	1 "	Shielding
C-14	0.001 Ci	Purdue University	2 "	In Vivo Research
Any accelerator produced radionuclide with atomic no. 3-83 inclusive	10 "	GE/RESD	4 "	Instrument calibration and research
Ra-226	0.1 Ci	GE/RESD	4 "	Vacuum determination and fire detection
Any by-product material between at. nos. 3 and 83 inclusive	60 Ci	"	4 "	Research and Development (10 CFR 30)
H-3	100 Ci	"	4 "	"
Any by-product material	1 "	"	4 "	Activated electronic components
Ni-63	0.024 "	"	2 "	GC detector cells
Natural or depleted U	1500 lbs.	"	2 "	Solid metal alloys and powders-R & D
Natural Th	40 "	"	2 "	Powders and metal alloys-R & D

D. Certification in Comprehensive Health Physics by HPS-1981

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3. 3 Chestnut Street
Phila., PA 19101
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ITEM 8 (continued)

Resume Alfred W. Kobylinski GE/SSD Industrial Hygienist

A. Education

MS Occupational Health (Industrial Hygiene)
Drexel University, Philadelphia, PA 1980

BS Biology, Pennsylvania State University
University Park, PA (b)(6)

Ex 6

Also attended several professional development courses dealing with radiation safety presented by the American Industrial Hygiene Association and other professional organizations.

B. Work Experience

1974-76 Toxicology Technician
Ayerst Laboratories, Animal Health Division
Chazy, NY 12921

Assisted in the operation of diagnostic x-ray equipment used for the examination of laboratory animals.

1976-78 Research Technician
Physiology Department
Thomas Jefferson University
Philadelphia, PA

Performed cardiovascular physiology studies utilizing radioactive tracer micorspheres labelled with SR^{85}, Ce^{147} and I^{125}. I was responsible for: Safe handling and use of microspheres, conducting surveys to determine radiation levels in lab area, and for the determination of and safe disposal of all contaminated materials.

12/79-present Industrial Hygienist
General Electric Company
Space Systems Division
King of Prussia, PA 19406

Under the direction of the Space Systems Division Ionizing Radiation Advisory Group, I have functioned as Radiation Safety Officer for the divisions 3 NRC Licenses.

G eral Electric Co. - RSO
8 Chestnut Street
Phila., PA 19101
SUB-831 RENEWAL 5/83

ITEM 8 (continued)

Experience with Radiation

Isotope	Maximum Amount	Location	Duration	Type of use
Cerium-147	4 millicuries	Thomas Jefferson University	1.5 years	Medical Research
Strontium-85	4 millicuries	Thomas Jefferson University	1.5 years	Medical Research
Iodine-125	4 millicuries	Thomas Jefferson University	1.5 years	Medical Research
Cobalt-60	5000 curies	General Electric Company	3 years	Gamma Irradiation
Krypton-85	18 curies	General Electric Company	3 years	Leak Tests
Strontium-90	10 curies	General Electric Company	3 years	Irradiation Source
Plutonium-238	90 millicuries	General Electric Company	3 years	Calibration
Plutonium 239	microcuries	General Electric Company	3 years	Calibration
Cesium 137	100 millicuries	General Electric Company	3 years	Calibration Source
Americium-241	millicuries	General Electric Company	3 years	Research
Uranium-235	microcuries	General Electric Company	3 years	Research
Uranium 238	microcuries	General Electric Company	3 years	Research
Natural Thorium	50 kilograms	General Electric Company	3 years	Structural Material
Any Neutron activated radionuclide with atomic no. 3-83 inclusive	0.1 Ci	General Electric Company	3 years	Electronic Component Research

Item 9.A.

RADIATION DETECTION EQUIPMENT	#	RADIATION DETECTED	RANGES	WINDOW THICKNESS	USE
Victoreen Model 440 Air Ionization Survey Meter	1	alpha, beta, gamma, X-ray	0-3, 10, 30, 100, 300 mR/hr	3.0 mg/cm^2	Exposure rate surveys
Victoreen Model 470A Air Ionization Survey Meter	1	alpha, beta, gamma, X-ray	0-3, 10, 30, 100, 300, 1000 mR/hr and R/hr	17 mg/cm^2	Exposure rate surveys
Eberline Model E-120 GM Survey	1	beta, gamma, X-ray	0-0.5, 5, 50 mR/hr (0-700, 7K, 70K cpm)	30 mg/cm^2	Contamination & radiation surveys
Eberline Model E-500B GM Survey Meter	2	beta, gamma, X-ray	0-0.2, 2, 20, 200, 2000 mR/hr	30 mg/cm^2	Contamination & radiation surveys
W.B. Johnson & Assoc. Model GSM-5 Survey Meter with Model GP-200 GM probe	1	beta, gamma, X-ray	0-0.2, 2, 20 mR/hr (0-500, 5K, 50K cpm)	1.4 mg/cm^2	Contamination & radiation surveys
Nuclear Measurements Corp. Model PC-4 Proportional Counting System	1	alpha, beta, gamma, X-ray	0-3500K cpm	windowless	Counting wipe samples and air filters

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Item 9A.

RADIATION DETECTION EQUIPMENT	#	RADIATION DETECTED	RANGES	WINDOW THICKNESS	USE
W.B. Johnson & Assoc. Model (A/B) SP-2A Scintillation Probe with W.B. Johnson & Assoc. GSM-5 Meter	1	alpha with alpha phosphor wafer	0-500, 5K, 50K cpm	1 mg/cm^2 aluminized mylar	Contamination surveys
"	1	beta with beta phosphor wafer	"	"	"
W.B. Johnson & Assoc. Model (A/B) SP-2A Scintillation Probe with NMC PC-4	1	alpha with alpha phosphor wafer	0-3500K cpm	"	Counting wipe samples and air filters
"	1	beta with beta phosphor wafer	"	"	"
Teledyne Isotopes Multi Area Dosimeter and Personnel Badge (TLD type) - supply and processing by Teledyne (whole body and ring badges)	as needed	beta, gamma, X-ray	-	-	Monitoring personnel using items

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Item 9.A.

RELATED EQUIPMENT

UNICO Model 300, 6.7 cfm thru 4-inch diameter Whatman 41 filter, equipped with rotameter, one unit available.

Gelman Little Giant, 14 lpm (0.49 cfm) at vacuum load of 10 inches of mercury (from manufacturer's pressure-volume characteristic curve), one unit available.

MSA Monitaire Sampler, 0-10 cfh (0-0.166 cfm) flow range, equipped with rotameter, one unit available.

Dupont Personnal Air Sampler, 2 lpm (0.07 cfm), three units available.

Bendix Model 4-16003, 15 cfm thru 4-inch diameter Whatman 41 filter, equipped with guage reading directly in cfm based on calibrated orifice principle.

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Item 9.B.

Radiation monitoring equipment is calibrated every six months and following repair at four different distances from the following source: Cobalt-60, 15 millicuries on 2/19/70, in Radiation Products Division's Model 571 meter calibration kit, SN 108.

Radiation counting equipment is calibrated on each day that counting operations are performed. The following calibrated sources are used:

Am-241	6.1	microcuries	on	07/06/77
Ba-133	1.19	"	"	10/07/77
C-14	0.046	"	"	06/18/76
Cd-109	11.0	"	"	05/12/77
Co-57	1.17	"	"	08/09/77
Co-60	0.01	"	"	09/18/69
Co-60	1.25	"	"	08/11/77
Cs-137	1.08	"	"	08/18/77
I-129	0.099	"	"	01/ /77
Na-22	8.36	"	"	04/01/69
Ni-63	0.0345	"	"	12/06/76
Pu-239	0.005	"	"	12/10/74
Sr-90	0.01	"	"	02/26/69

Personnel monitoring badges (TLD-type) are supplied and processed quarterly by Teledyne Isotopes Co., 50 Van Buren Avenue, Westwood, New Jersey 07675.

Air sampling equipment is calibrated once per year or before use. Low volume samplers are calibrated using a Mark III flowmeter kit from Fisher Scientific Co. (0.4 to 23,400 cc/minute), and high volume samplers are calibrated using a tubular extension (21.5 inches long and 4 inches in diameter) with an Alnor Instrument Co. Series 600 Velometer (30-300 fpm).

Calibrations are normally performed by, or under the direction of, the health physicist.

Item 9.C.

Procedure for designing, maintenance, and testing (for adequate capture velocity) of ventilation systems with HEPA-filters are given in 10.C.4.E.

1. Plan view - site of use of Item 7.A., 7.B., 7.C., 7.D., and 7.E.

   Attached is a plan view of room U8614 of Building 100 in King of Prussia. The glovebox and HEPA-filtered hood previously described are shown. Also, the location of a lockable storage cabinet where small quantities of radioactive material are stored is indicated.

   Also attached is a plan view of room U8604 of Building 100 in King of Prussia. This room is an alternate for the uses cited and it has two hoods and one glovebox connected to a common HEPA-filter system. Entry into this room is controlled by a cypher lock.

2. Plan view - site of use of Item 7.F.

   Attached is a plan view of room 1641 at 3198 Chestnut Street in Philadelphia. Typical locations of a simulator during test and during storage are shown. Entry into this room is controlled by a cypher lock.

3. Plan view - site of use of Item 7.G.

   Attached is a plan view of room T470 (track level) at 3198 Chestnut Street in Philadelphia. The machining operations will be performed in this room. This room actually extends six feet below basement level. Two thirds of the perimeter has a wall consisting of a six foot concrete face starting at the floor of the machine shop with a nine foot wooden face above that followed by a 10 foot opening to the ceiling. One third of the perimeter has a solid wall from floor to ceiling. HEPA-filtered local exhaust will be used at each work station where air sampling indicates the need.

4. Plan view - site of raw stock storage of Item 7.G.

   Attached is a plan view of the GESCO warehouse at 401 E. Hunting Park Avenue, Philadelphia, where the raw stock will be stored. The GE/RSO section consists of approximately 3870 sq. ft. of floor space with a 20 foot ceiling height. The plates will be stacked in accordance with NFPA recommendations.

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5. Plan view - site of chip storage of Item 7.G. and Item 7.H.

Waste (chips and small pieces) will be placed in closed metal drums and will be stored on an outside ramp area within the security perimeter of the building complex. Attached is a plan view of the second floor of 3198 Chestnut Street which shows the receiving ramp area where the chips will be stored. Two locations on the ramp (Col. AA-9 and Col. AA-21) will be used.

6. Plan view - site of use of Item 7.H.

Attached is a plan view of the fourth floor of 3198 Chestnut Street with a cross-hatched area showing the machining location. HEPA-filtered local exhaust will be used at this location if air sampling indicates the need.

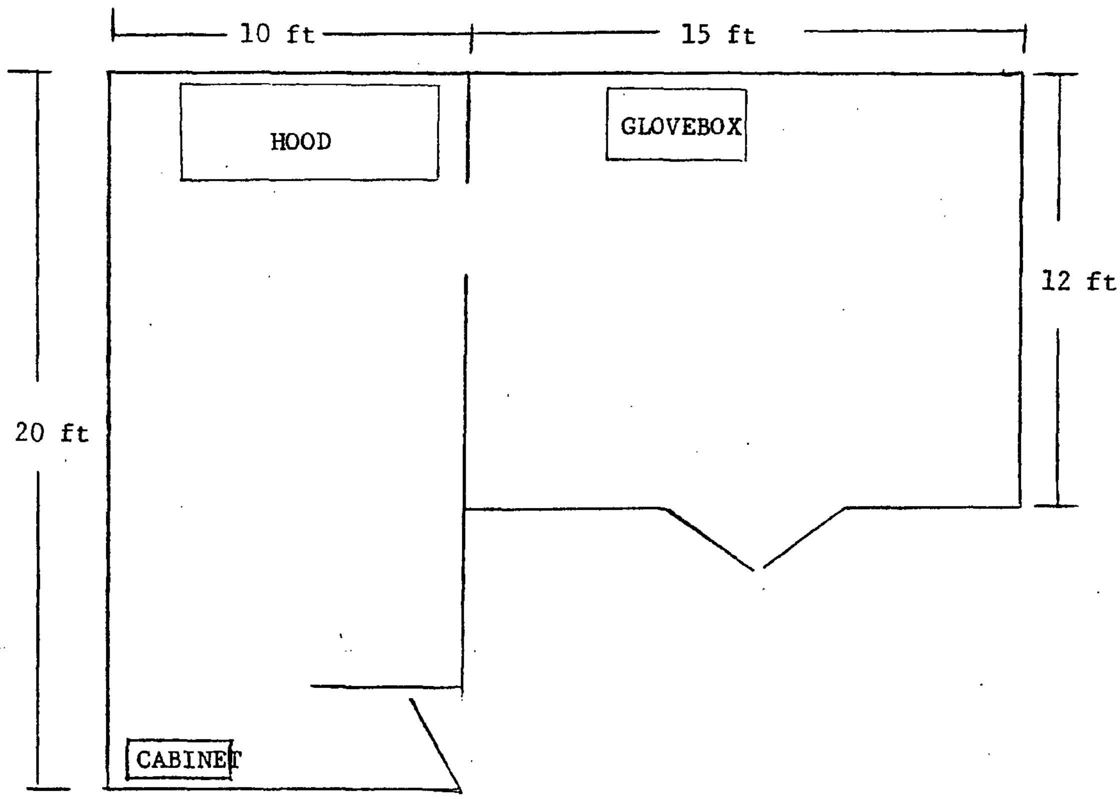
7. Plan view - site of storage of Items 7.A. thru 7.E. and 7.H.

Attached is a plan view of room T596 at 3198 Chestnut Street. This room is used as the health physics storage area. A sketch of the room is attached. Pertinent dimensions are as follows:

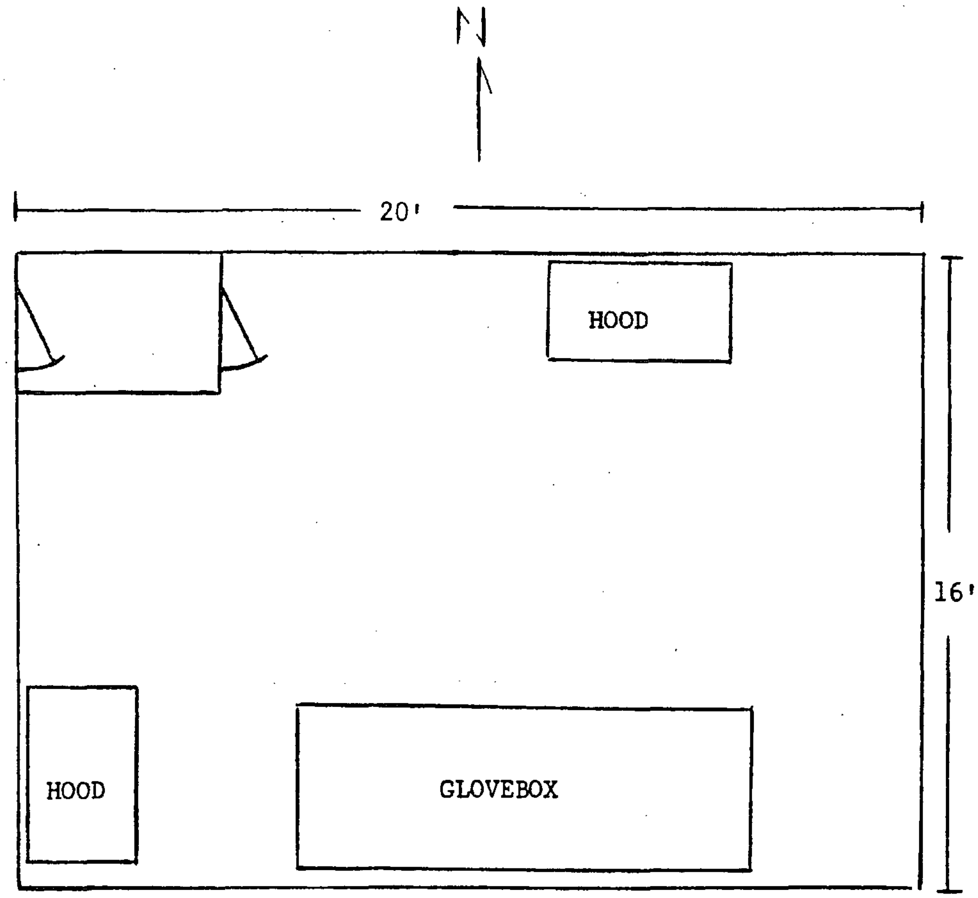
North wall:	12"	solid	concrete	block	
South wall:	16"	"	"	"	
West wall:	12"	"	"	"	
East wall:	16"	"	"	"	plus 8" cinder block
Ceiling:	5"	concrete			

Floor: room is on lowest level; earth beneath floor.
Room elevation: 14'

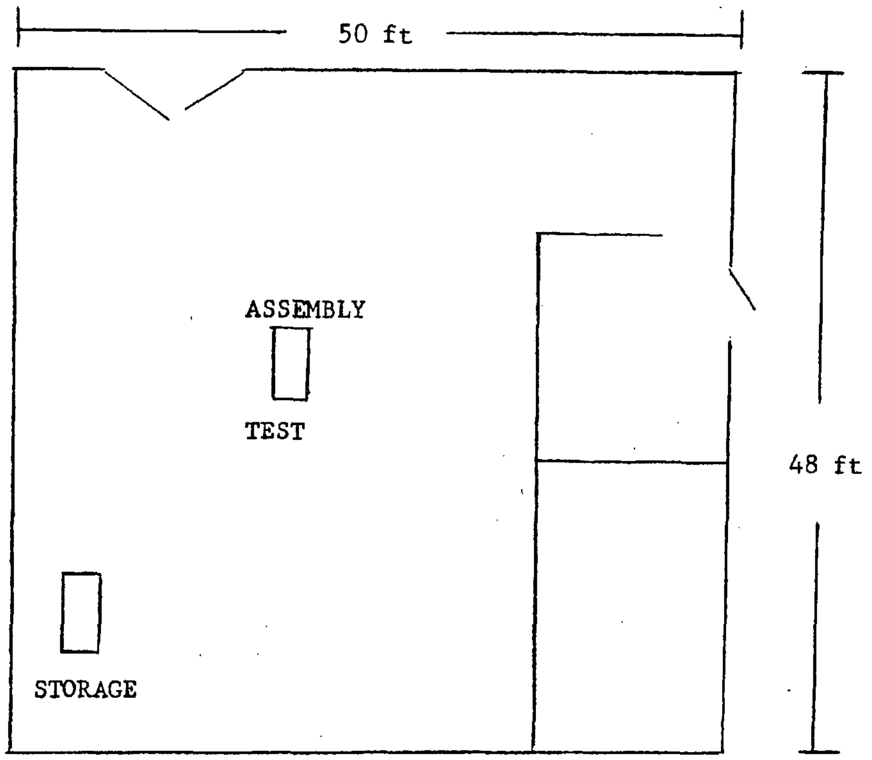
This room is secured by a combination lock on the door.



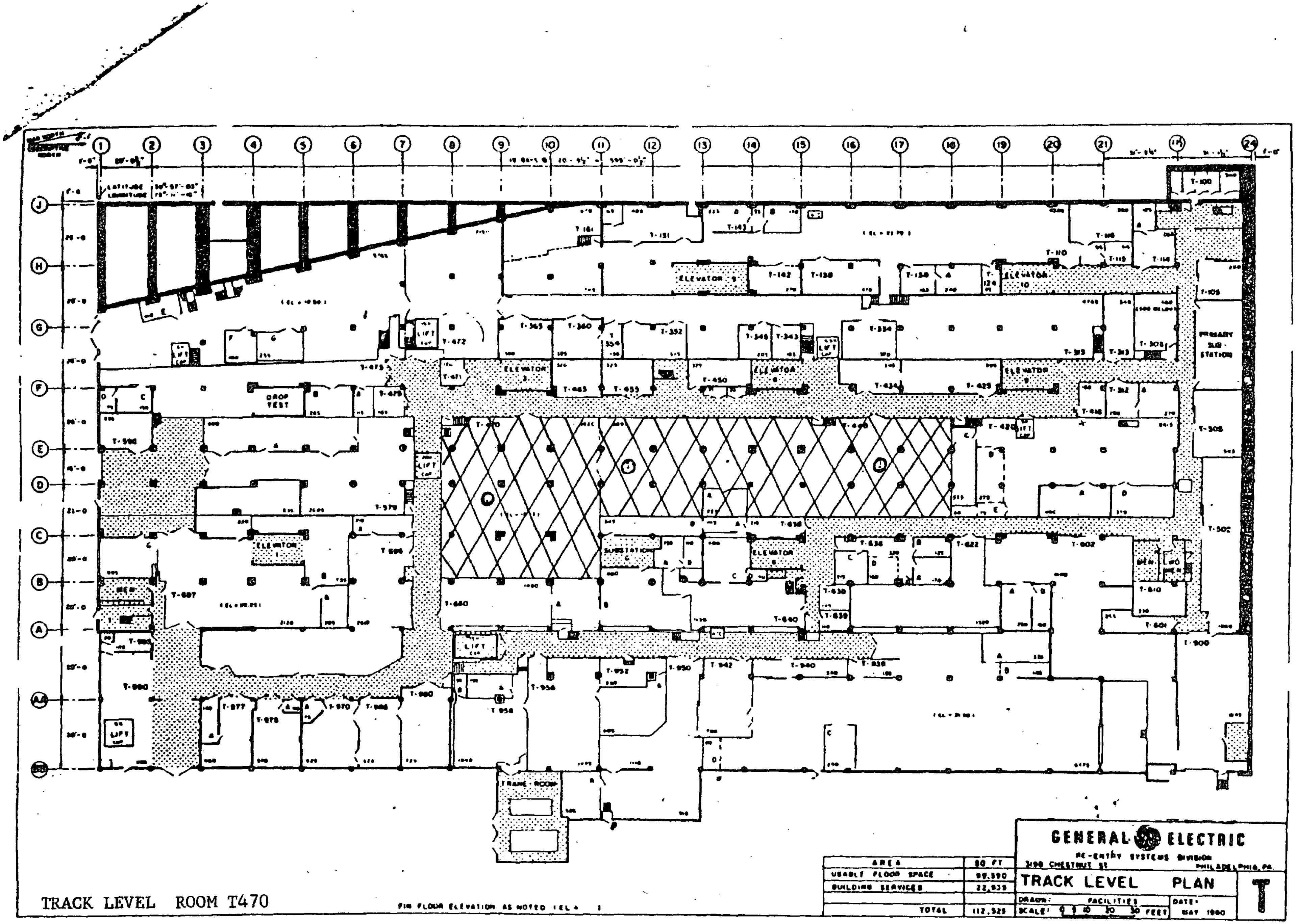
RADIOACTIVE MATERIAL USE LAB   ROOM U8614   KING OF PRUSSIA



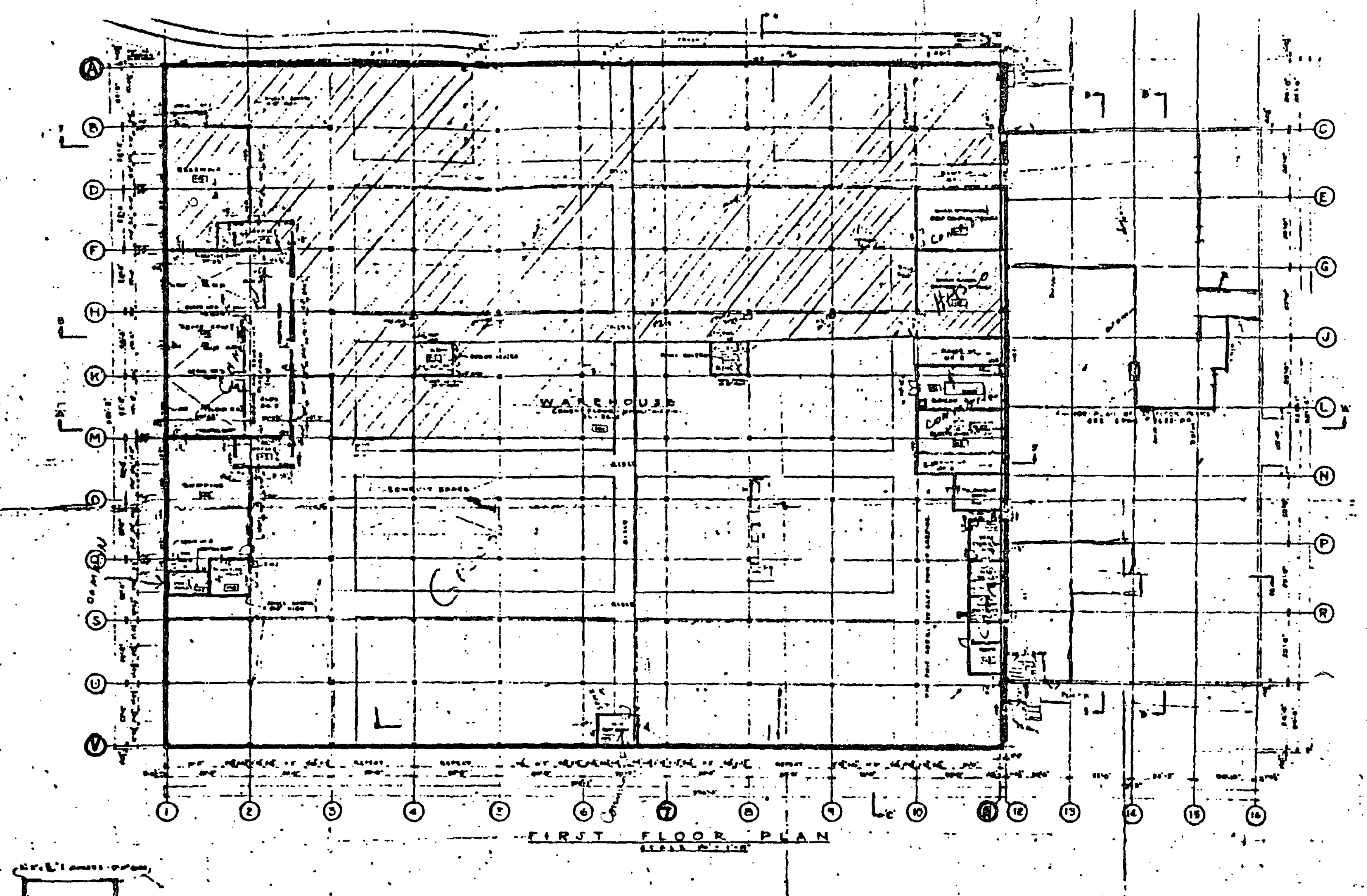
AIR-BORNE RADIOACTIVITY CONTROL ROOM ROOM U8604 KING OF PRUSSIA



SIMULATOR ASSEMBLY/TEST AREA ROOM 1641 CHESTNUT STREET

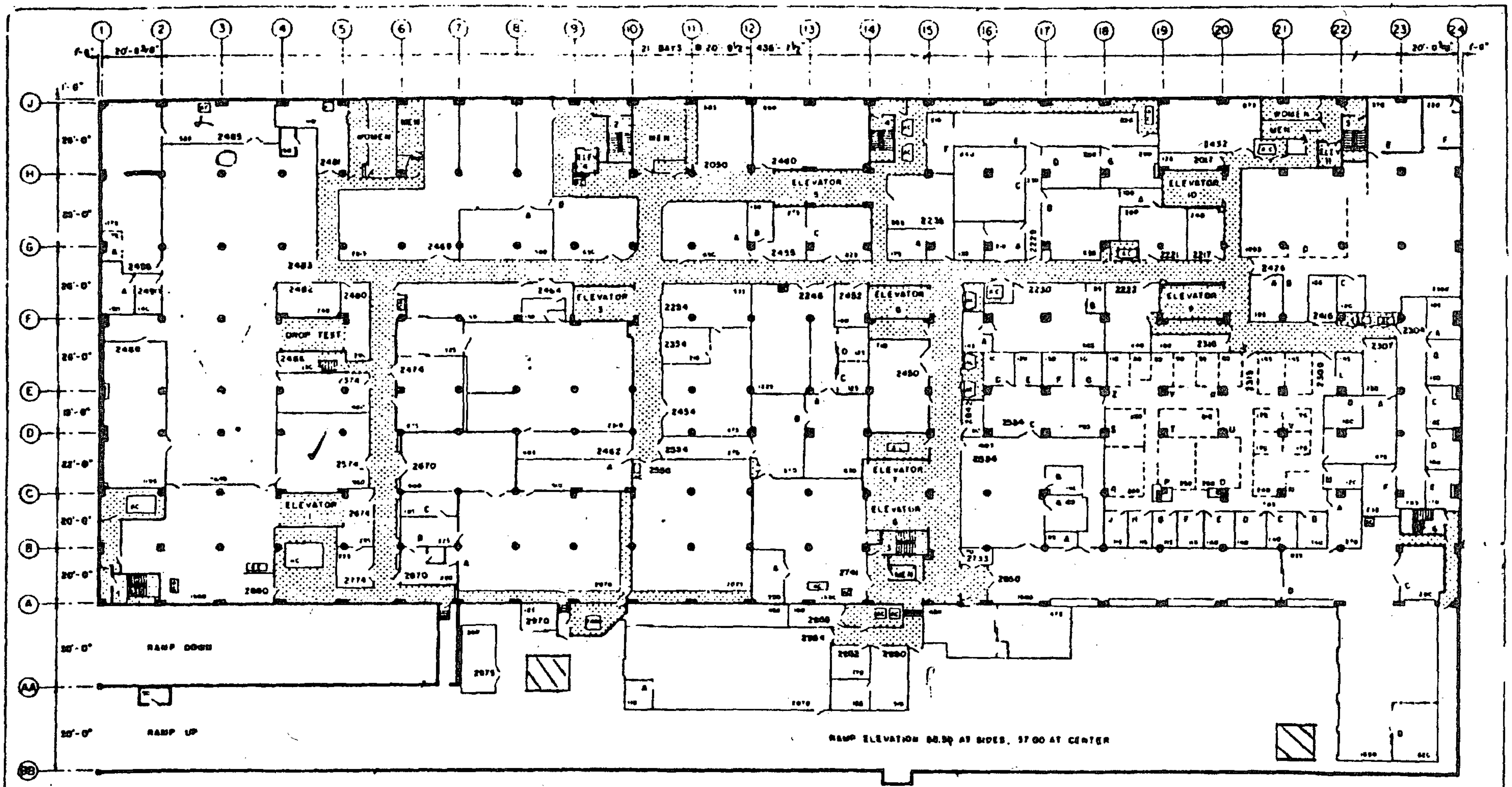


TRACK LEVEL FLOOR PLAN (GE/RSO BUILDING, 3198 CHESTNUT ST., PHILA., PA 19101; CROSS-HATCHED AREA IS PROPOSED RESTRICTED AREA; OPEN CIRCLES IN RESTRICTED AREA REPRESENT LOCATIONS OF 3 FIXED CONVENTIONAL MACHINING TOOLS)



FLOOR PLAN OF GESCO WAREHOUSE, 401 EAST HUNTING PARK AVE., PHILA., PA
(PORTION OF WAREHOUSE BETWEEN COLUMNS A7, V7, V11, & A11 IS OCCUPIED BY GE/RSO)

GE SUPPLY Co. - PHILA., PA.



STORAGE LOCATIONS FOR MACHINING CHIPS ON OUTSIDE RECEIVING RAMP (TWO CROSSHATCHED AREAS - COL. AA9 and COL. AA21)

AREA	SQ FT
USABLE FLOOR SPACE	73,855
BUILDING SERVICES	20,155
TOTAL	94,040

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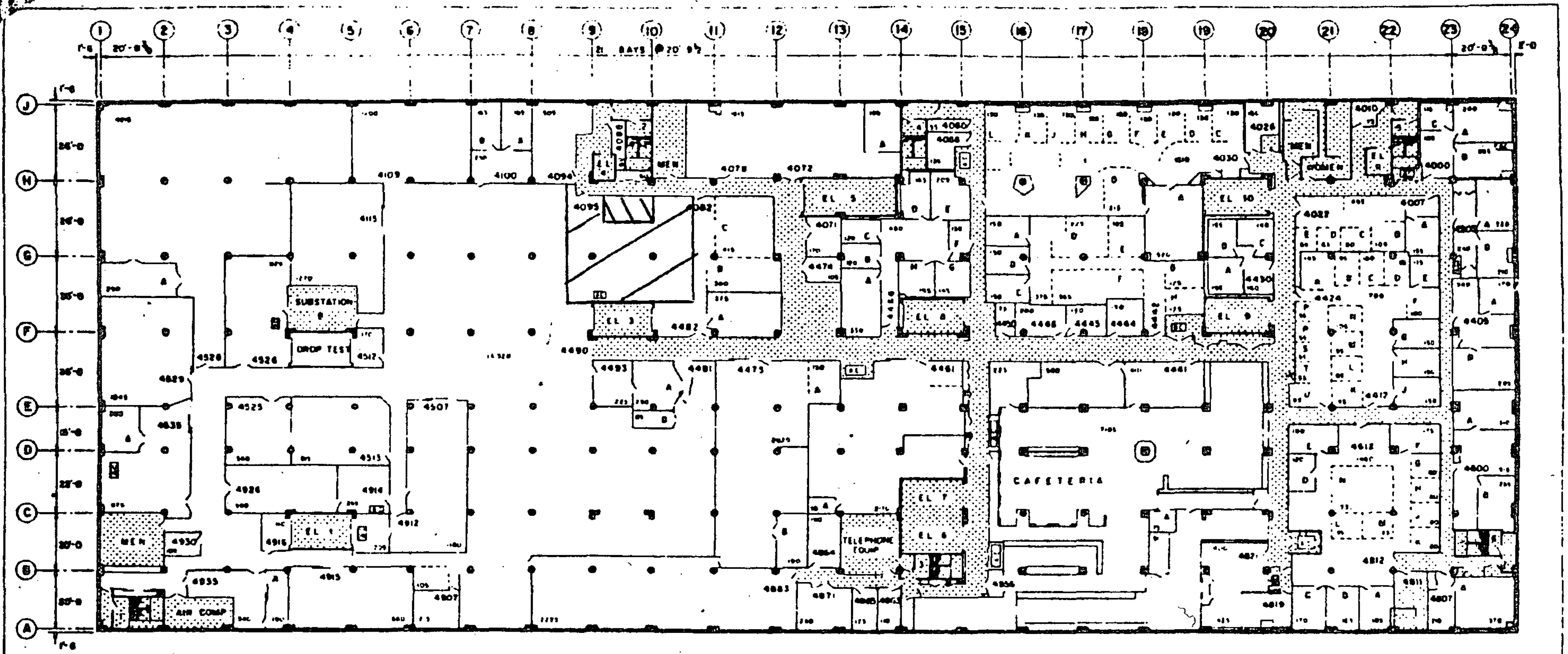
SECOND FLOOR PLAN 2

DRAWN: FACILITIES
SCALE: 0 5 10 20 30 FEET
DATE: AUG 1980



FOURTH FLOOR PLAN (GE/RSO BUILDING, 3198 CHESTNUT ST., PHILA., PA 19101; CROSS-HATCHED AREA (SEE COL. G9) IS PROPOSED RESTRICTED AREA; SMALLER AREA WITHIN RESTRICTED AREA IS MACHINE LOCATION)

FIN FLOOR ELEVATION + 85.25'

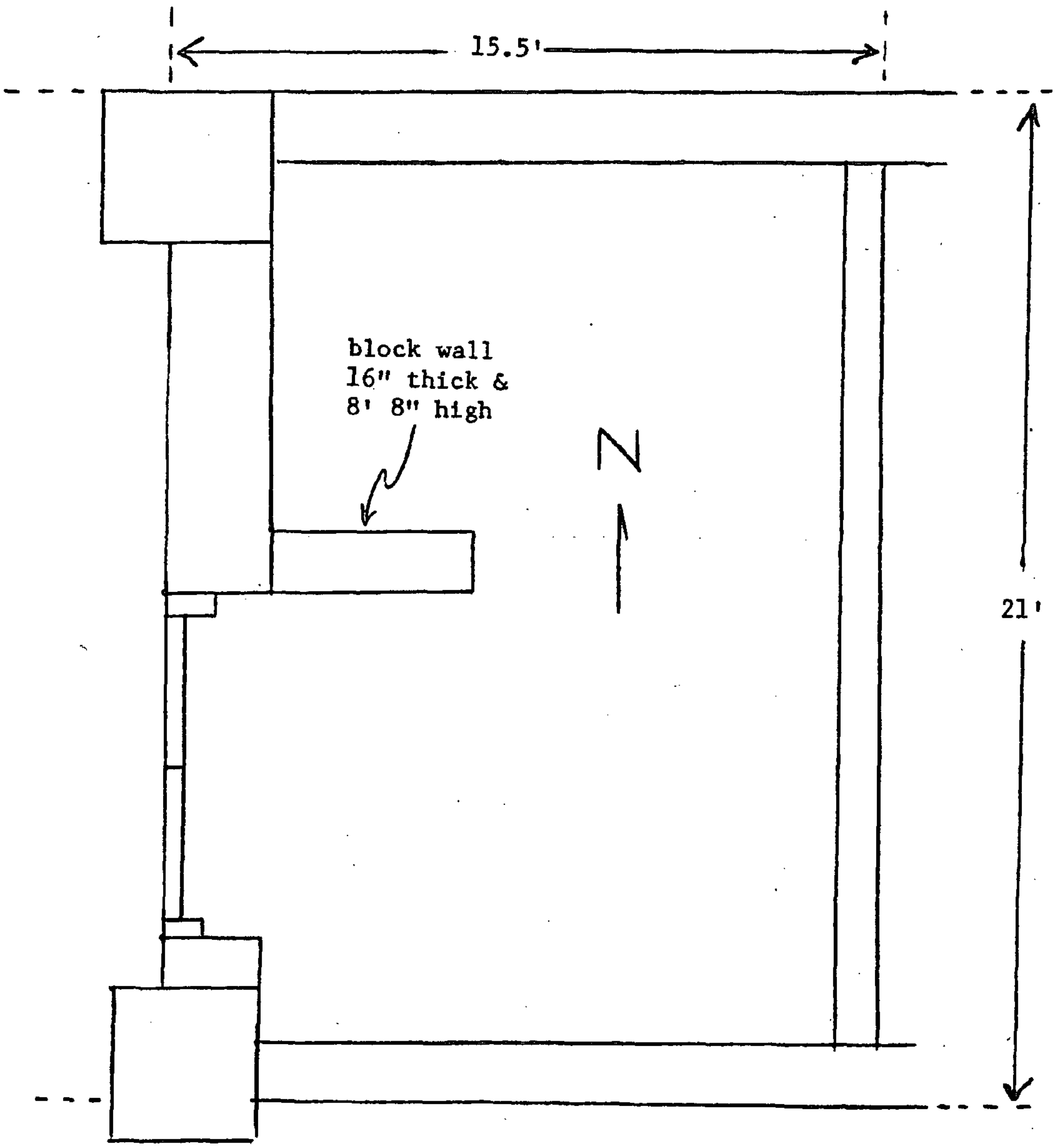
AREA	SQ FT
USABLE FLOOR SPACE	71,260
BUILDING SERVICES	15,340
TOTAL	86,600

GENERAL ELECTRIC
RE-ENTRY AND ENVIRONMENTAL SYSTEMS DIVISION
3198 CHESTNUT ST PHILADELPHIA, PA.

FOURTH FLOOR PLAN

4

DRAWN: FACILITIES
SCALE 0 5 10 20 30 FEET
DATE: OCTOBER 1980



HEALTH PHYSICS STORAGE AREA ROOM T596 Chestnut Street

Item 10.A.

Re-entry Systems Operation has a comprehensive and sucessful fire prevention program including a full-time fire prevention staff. Procedures are documented in the Safety Manual. These procedures may be amended to or detailed in an Ionizing Radiation Advisory Group approval.

Flammable solvents, other than those to be of reagent grade, maybe used only from approved containers. Large quantities in work areas must be stored in approved flammable liquid storage cabinets or in approved safety cans of not over five gallons capacity; only quantities needed for one day's use should be on hand outside the storage cabinet; bulk storage must be in designated central facility.

Fire protection planning is in accordance with OSHA, NFPA, and Factory Mutual recommendations.

Ovens in which radioactive material is heated are equipped with over-temperature-cutoff devices (Item 7.E.)

Special in-house permits are required for the use of heat-producing devices outside certain designated areas.

Fire retardant protective clothing is used by operators of processes producing combustible metal fines. Combustible metal chips and fines are collected in separate, plainly marked, and covered noncombustible receptacles. Raw stock combustible metal and combustible metal chips and fines are stored according to NFPA and Factory Mutual recommendations. Combustible metal fire extinguishers are available at each machining and chip storage location (Item 7.G.).

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Item 10.B.

Re-entry Systems Operation has a general emergency plan which provides for actions to be taken in the event of a radiation emergency. See pages 9 thru 11 of the attached mandatory safety procedure, "Ionizing Radiation Control", for the general emergency procedure and examples of generic types of specific procedures. These procedures may be amended to or detailed in an Ionizing Radiation Advisory Group Approval.

The following is copied from mandatory safety procedure F-1, Fire Safety:

Fire Emergency Procedure

Reporting Fires

1. In event of fire, if you are not absolutely sure of your ability to extinguish the fire, go to the nearest fire alarm pull box and pull handle down. If you are in an area where there are no fire alarm boxes, go to the nearest telephone and dial Fire (3473). <u>Give your name, phone number, and location of the fire</u>.

2. Attempt to extinguish the fire by using the fire extinguisher available for the area. <u>If there is any question of personnel safety, leave the fire area immediately and close all doors</u>.

ITEM 10.C.

Uses of radioactive material under this license will extend to those uses permitted by NRC regulations and the NRC license and approved by the Ionizing Radiation Advisory Group (IRAG) which was established to meet the requirements for a broad scope license. Administrative control is achieved through use of mandatory procedure M-6, "Ionizing Radiation Control", of the Safety Manual.

The Safety Manual is established by Division Policy. Mandatory Procedure M-6, "Ionizing Radiation Control", establishes policy for use of ionizing radiation and authorities of the Ionizing Radiation Advisory Group.

Policies and Authorities

It is the policy of all components to keep the ionizing radiation exposure of all personnel as low as reasonably achievable (ALARA) and, in particular, below all existing federal, state, and Company regulations.

All proposed uses of ionizing radiation shall be reviewed and prior written approval for use secured from the Ionizing Radiation Advisory Group consisting of:

Chairman:	Manager, Industrial Security, Safety, and Administrative Services
Member:	Manager, Industrial Safety and Hygiene
Member:	Director, Medical Services
Secretary:	Health Physicist

The composition of the IRAG currently is: T.P. Handley, Chairman; C.B. Chilton, Member; Dr. S. Mucha, M.D., Member; J.R. McFadden, Secretary. Their resumes are attached in attachment labeled Item 8.

IRAG approval of a proposed use of ionizing radiation is contingent upon a satisfactory completion of a safety evaluation of the proposed use which takes into consideration such matters as the adequacy of facilities and equipment, training and experience of the user, and the operating or handling procedures.

All ionizing radiation machines and radioactive materials shall be procured, received, used, stored, handled, transported, transfered, or disposed in accordance with existing regulations and approvals (i.e., Nuclear Regulatory Commission, Commonwealth of Pennsylvania, General Electric Company, and the IRAG).

The IRAG may revoke any approval which it has issued when an investigation shows justification for such action. In such an event, the radiation user shall immediately relinguish all radioactive materials and ionizing radiation machines to the Manager, Industrial Safety and Hygiene.

Accidents involving radioactive materials in which there is a possibility of ingestion or inhalation of radioactive material or body contamination shall be reported immediately to the members of the IRAG. Accidental exposures (actual or suspected) in excess of the quarterly limits stated in M-6 shall be immediately reported to the IRAG.

Control of potential radiation hazards will be achieved through the application of criteria in the NRC regulations and guidelines and supplemented by criteria in standards and guides of organizations such as the ICRP, the NCRP, the ANSI, the ACGIH, etc.

ITEM 10.C. (continued).

The specific control measures adopted will be commensurate with the potential hazard and will be based on the safety evaluation of the proposed use. The adequacy of these control measures will be monitored by a specific radiation survey program.

The IRAG does not contemplate approving any proposed use which would require (a) a respiratory protection program, (b) a routine bioassay program, (c) the generation of airborne radioactivity which could cause concentration levels in restricted areas greater than those specified in 10 CFR 20.103(b)(1), or (d) the generation of airborne radioactivity which could cause concentration levels in unrestricted areas greater than a few percent of levels specified in 10 CFR 20.106 (a).

Responsibilities of Health Physicist

The health physicist is responsible for the following:
1. Providing radiation safety evaluation and assistance before, during, and at termination of proposed/approved uses.
2. Radiation safety orientation and training.
3. Ongoing evaluation of radiation hazards incident to receipt, use, storage, handling, transport, and disposal of radioactive materials by approved users (radiation survey program).
4. Ongoing evaluation of radiation safety procedures incident to procurement, receipt, use, storage, handling, transport, transfer, and disposal of radioactive materials by approved users (radiation inspection program).
5. Management of radiation safety records (surveys, inspections, material inventories, personnel exposures, and receipt, use, and disposal of materials).
6. Radioactive waste disposal.

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Item 10.C.

General Radiation Protection Program

1. Radiation Safety Evaluations

As mentioned previously, a safety evaluation is performed before approval of any use. Control measures are imposed on the approved use and are based on the pre-operational evaluation. The appropriateness and adequacy of these control measures are operationally evaluated by the radiation survey and radiation inspection programs described later. A further safety evaluation is conducted at termination of an approved use which considers such matters as transfer or disposal of the balance of radioactive material and the contamination levels of material and the contamination levels of facilities and equipment.

2. Radiation Safety Orientation and Training

Personnel whose work involves potential exposure to ionizing radiation and their supervisors are expected to have knowledge of radiation safety commensurate with the potential radiological health problems involved in the proposed use.

The requirements for instruction of individuals vary with the proposed use and with the experience of the individual. Personnel with prior similar experience are nromally considered qualified by the IRAG. Personnel without the required prior experience receive instruction commensurate with the potential radiological health problems involved in the proposed use and in accordance with the requirements of 10 CRF 19.12.

The instructor normally is the radiation safety officer. However, with IRAG approval, other qualified persons have provided this training.

Participative lecture, completion of assigned readings, and on-the-job instruction, separately and in combination, have been used to provide radiation safety training, and the choice is based again on the proposed use and on the experience of the individuals. An orientation session can take anywhere from a quarter of an hour to over an hour.

The competency of an authorized user is verified by various methods. The most common method is observed use under the supervision of an authorized and certified user. The supervising user then certifies to the IRAG that the new user has demonstrated the capability to perform the required work safely. Observation by the radiation safety officer has also been used as a means of verifying user competency. Oral or written tests are seldom used.

3. Radiation Survey Program

This involves measurements of levels of radiation or concentrations of materials present and the evaluation of the consequent radiation bazards incident to receipt, production, use, release, shipping, handling, transport, disposal, or presence of radiioactive materials under the specific set of conditions of approved use.

Item 10.C. (cont'd.)

The survey program utilizes standard instrumentation (Item 9.A.) and techniques in various combinations and at various frequencies depending on the types and degrees of potential exposure.

Frequency of surveys will ordinarily be greater during pilot studies, initial phases of routine operations, and when there is a change in operations which could increase levels of radiation or concentrations of radioactive material.

A. Air Sampling Surveys: Types include personnel (lapel), restricted area, and unrestricted area air sampling and can be performed pre-operationally, during pilot/initial operation, during routine/established operation, and when nature or degree of a routine/established operation changes. Unrestricted area air sampling should be performed at the release point and/or at the common boundary of the restricted and unrestricted areas and/or in the environment as appropriate to the specific approved use and release conditions.

B. Surface Contamination Surveys: Surface types include personnel (ex. skin, hands, etc.), personnel protective clothing (ex. gloves, boots, etc.), equipment and tools, and facilities and plant surfaces. Surface contamination can be classified as fixed or removable. Fixed surface contamination can be measured during exposure/radiation level surveys.

   <u>Removable surface contamination</u> of areas and equipment where powdered and liquid radioactive materials are stored and used must be checked by smear/wipe surveys at a frequency based on wipe results, work activity, type of work activity, and type of radioactivity. Busy areas must be checked at least monthly. Busy areas of operations with a high incidence or risk of producing removable radioactive contamination must be surveyed daily or weekly by the material users as directed by the IRAG approved procedures.

   Sur~~vey~~FACE contamination evaluation should include unrestricted areas surrounding a restricted area which contains surface contamination requiring periodic surveys.

C. Acceptable average surface contamination levels for unrestricted use of premises and equipment (dpm/100 cm^2) are as follows:

	Fixed	Removable
Transurancies, Ra-226	100	20
Th-nat, Th-232, Sr-90, U-232, I-131	1000	200
U-nat, & U-238 (and associated decay products)	5000 α	1000 α
Other β/γ emitters	5000 β/γ	1000 β/γ

D. Exposure/Radiation Rate Surveys:

External radiation levels from concentrated radioactive sources and fixed surface contamination must be checked by direct radiation surveys at a frequency based on the external radiation hazard and quantity of the radioactive material involved, work activity, and type of work activity. Low and medium risk areas must be surveyed at least monthly, and high risk areas, daily or weekly, by the material users as directed by the IRAG approved procedures.

E. Effluent monitoring for releases to unrestricted areas: For airborne effluents, calculational evaluations, calculational evaluations supplemented by stack monitoring, or other environmental monitoring is required as appropriate for any planned and potential releases; for liquid effluents, calculational evaluations, calculational evaluations supplemented by waste stream monitoring/water sampling, or other environmental monitoring is required as appropriate for any planned and potential releases.

As stated previously, the IRAG does not as a policy permit "airborne radioactivity areas" in restricted areas. In almost all cases, this policy results in the use of hepa-filtered contaminated-air-control equipment for filtering air before release to unrestricted areas. At present, there is no generation of contaminated liquid waste. When such waste was generated, it was disposed through a licensed disposal company. Using the method cited in 10 CFR 20.303 would only be considered for small and infrequent amounts of liquid radioactive waste.

F. Personnel Dose Monitoring

Personnel radiation badges must be worn by all personnel engaged in operations which have been designated as requiring badges by IRAG. Each individual who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 25 percent of the applicable value specified in paragraph (a) of 10 CFR 20.101 must wear a personnel radiation badge. Badges may be required by the health physicist/IRAG even if one could not or would not likely receive 25 percent of the values referenced previously.

The vendor may be the one listed under item 9.A. or any other supplier with high quality and accuracy of service. The normal badge exchange frequency is quarterly. More frequent exchanges would be used if warranted. For example, highly variable dose rates to personnel or dose rates above three rems per year would warrant a monthly or more frequent exchange. Currently, there is no need for badge exchanges more frequent than quarterly.

Self-reading pocket dosimeters are used only to supplement the badge. The need for pocket dosimeters is very rare for licensed activities. Pocket dosimeter readings are not used for record purposes under licensed activities.

G. Sealed Source Leak Tests

The radiation safety officer performs a leak test on each sealed source at the frequency indicated by the appropriate license. The tests normally consist of wipes of the source with moistened filter paper followed, after drying, by counting in a windowless flow counter. Tongs, etc., are used as required. Leaking sources are normally disposed to radioactive waste. Arrangements may be made with the original supplier to return a source when required.

H. Bioassay Program

The IRAG does not contemplate approving programs which would require routine use of bioassay. Control of exposure to unsealed radioactive materials is achieved through engineered controls. The need for bioassay is therefore limited to accident or emergency situations. Bioassay would, for example, be required in the event an emergency entry is made to clean up a contamination spill outside a hood or glove box. Another example is the situation where an employee is found to be contaminated on the face or head.

Bioassay, when needed, is performed by commercial vendors. Vendors which may be used include Eberline Co., Teledyne Isotopes, Radiation Management Corp., Helgeson Nuclear Services or others depending on the specific isotope to be assayed and the vendor's detection capabilities.

4. Radiation Inspection Program

A. IRAG-approved Radiation Safety Conditions and Procedures

Conditions and procedures, based on the safety evaluation of the proposed use, specific to the proposed use, and documented for the approved use, are used as a baseline for periodic tailored inspections. Documented changes to the IRAG approval, which are a result of operational experience, become part of the baseline inspection.

B. Postings, Signs, Labels, and Tags

Areas and containers in which radioactive material is present must be approved and properly posted and labeled. The radioactive material itself must be tagged or labeled if feasible.

C. Materials Control Provisions for Procurement, Receipt, Use, Shipping, and Disposal through the Radiation Safety Organization

Written procedures require the health physicist's written approval (i) before purchase of any source of ionizing radiation, (ii) before its release to user (after receipt), and (iii) before its shipment. Incoming shipments are surveyed per 10 CFR 20.205 and for dose rate levels before release to user.

Outgoing shipments receive a dose rate and removable contamination (when appropriate) survey of the unpackaged and packaged material to assure that radiological shipping regulations are met.

D. Engineering Controls for Exposure Rate Reduction

Shielding and remote manipulation are used as much as possible to keep exposures as low as reasonably achievable.

E. Engineering Controls for Control of Airborne Radioactivity

Operations producing significant airborne radioactive contamination in a restricted area must provide engineering controls for contaminated air control (complete enclosure, booth/hood-type enclosure, or, only as a last resort, local exhaust) approved by the health physicist. Airborne contamination is considered significant either when concentrations, equal to or in excess of the amounts specified in Appendix B, Table I, Column I of 10 CFR 20, exist (for no matter how short a duration) or when concentrations, which, averaged over the number of hours in any week during which individuals are in the area, exceed 25 percent of the amounts specified in the prior reference. Operations producing any airborne radioactive contamination should provide contaminated air control in order to keep exposures as low as reasonably achievable. All operations given approval must be resurveyed if warranted by increased work activity, new work procedures, or changes in room ventilation.

All exhaust systems are designed following specifications in the "Industrial Ventilation" manual published by the American Conference of Governmantal Industrial Hygienists or equivalent specifications. If air sampling indicates a need for contaminated air control, exhaust systems equipped with HEPA filters are used; for booths, air flow is maintained at 100 to 200 cfm per square foot face; for local exhaust, air capacity and distance between exahust line intake and point of operation are adjusted to give the recommended capture velocity at the point of operation. Ventilation equipment, if required, is checked for proper air flow at least annually using an air velocity meter. Filters are checked periodically and replaced when saturated.

F. Use of Respiratory Protection

The IRAG does not contemplate approving programs which would require routine respiratory protection. Control of exposure to unsealed radioactive materials is achieved through engineered controls. The need for respiratory protection is therefore limited to accident or emergency situations. Its use would, for example, be required in the event an emergency entry is made to clean up a contamination spill outside a hood or glove box.

G. Use of Protective Clothing

Protective clothing must be worn by personnel as specified by IRAG approved procedures in order to prevent personnel contamination and the possible incorporation of radioactive materials.

H. Protective Coverings for Plant Surfaces, Equipment, and Instruments

Protective coverings (trays, etc.) on lab benches and other working surfaces must be used to prevent their contamination when working with powdered or liquid radioactive material (unsealed radioactive material); with liquid radioactive material, the covering should be absorbent and have a leak-proof backing.

I. Surface Contamination Control Areas

Where the spread of surface contamination cannot be limited to a tray or bench top area, a barricaded area may be set up; in the case where the contamination is released with high initial velocity, the barricade may have solid walls and/or ceiling. In either case, the designated surface contamination zone would have a single access/egress point and written procedures for entering or leaving at that point would address the use/disposition of protective clothing and the use of contamination survey instrumentation if required.

J. Storage Conditions

All storage containers and areas for radioactive material must be approved and properly posted by the health physicist. Storage areas for large quantities of radioactive materials (especially those in liquid or powdered form) which produce gaseous radioactive decay products must be well ventilated. Periodic contamination surveys are taken of the storage areas.

K. Radiation Emergency Procedures

See Item 10.B.

5. Records Management

Management of radiation safety records is the responsibility of the health physicist. Records maintained include, but are not limited to, the following: radiation level surveys, radiation safety inspections, radioactive material inventories, personnel exposure results, and the receipt, use, and disposal of radioactive materials.

6. Waste Disposal

Radioactive waste must be kept segregated and disposed of through the Safety Office. Presently, all waste generated is in the solid form including scrap radioactive material, below specification products, contaminated tools and protective coverings, contaminated filters, and decontamination materials. All solid waste and normally all liquid waste, if liquid waste is produced, is disposed through a licensed disposal firm. Small amounts of liquid waste can be disposed through the sanitary sewer system.

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Item 10.C.

Radiation Safety Measures for Specific Uses

1. Use Described in Item 7.A.

Glovebox is used for processing. Removable surface contamination surveys are performed weekly during use periods. Personnel radiation badges are worn. Quantities kept in the lab are limited to those required for near term use. Larger quantities are stored in a well-ventilated, isolated, and secured area.

2. Use Described in Item 7.B. - See 10.C.A. (Specific Uses)

3. Use Described in Item 7.C. - See 10.C.A. (Specific Uses)

4. Use Described in Item 7.D. - See 10.C.A. (Specific Uses)

5. Use Described in Item 7.E.

A radiochemical fume hood is used for powder processing. Removable surface contamination surveys are performed weekly during use periods. Personnel badges are worn. Quantities kept in the process area are limited to those required for near-term use. Larger quantities are stored in a well-ventilated, isolated, and secured area. Ovens in process area have excess temperature cutoff devices.

6. Use Described in Item 7.F.

Removable surface contamination and dose rate surveys are made upon receipt. Personnel radiation badges are worn. There have been no more than two devices in each use area at any one time.

7. Use Described in Item 7.G.

Removable surface contamination and dose rate surveys are made upon receipt. Bulk storage of plates is in a well-ventilated, high-bay warehouse and in accordance with National Fire Protection Association recommendations. Routine air sampling (personnel, restricted area, and unrestricted area) is performed for the first six months around any machining work for which no operational air sampling results are available. Based on air sampling results, periodic air sampling or engineering controls for contaminated air control is instituted per 10.C.4.E. Contamination control personnel barriers with entry/exit frisking procedures and with protective clothing requirements (boots, lab coats, and gloves - fire retardant in required cases) are used around any work area for which no operational removable contamination results are available until these precautions are shown to be unnecessary. Strict adherence to fire safety precautions for the machining of magnesium are followed. Chips are stored in a well-ventilated, isolated, and secured location.

8. Use Described in Item 7.H.

See 10.C.G. (Specific Uses); same except for fact that combustible metal fire control procedures are not needed in this case.

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Item 11.A.

Uses 7.A. thru 7.E. generate a variable amount of waste since requests for such R&D/prototype specimens occur unpredictably and infrequently. One 55-gal. drum of waste is projected for each of the next several years. The waste items will consist of such primary process materials as rejects, quality control specimens, cast epoxy resins, cast epoxy trimmings, such contaminated accessory process materials as equipment, tools (hand tools, molds, beakers, spatulas, syringes, etc.), fixtures, exhaust filters, protective clothing, protective coverings, smears, and waste generated by decontamination procedures.

Use 7.F. generates a very small volume of waste which totally consists of contaminated rags and smears. Five percent of the volume of a 55-gal. waste drum is projected over the next several years.

Use 7.G. will generate a projected twelve 55-gal. waste drums per year for the next several years. Ninety percent of the waste should consist of primary process materials such as machining chips, fines, and scrap, and ten percent of the waste should consist of contaminated accessory process materials such as exhaust filters, protective clothing, and smears. Additional waste will be produced by decontamination procedures.

Use 7.H. will generate a projected two 55-gal. waste drums over the next year. The types and percentages of waste will be very similar to those for use 7.G.

Uses 7.G. and 7.H. may result in the production of some waste in the form of liquid suspensions or solutions due to the use of coolant during machining or abrading, degreasing, and surface coating processes.

Item 11.B.

Normal waste disposal procedure is for the waste to be transfered to a commercial firm licensed to accept such wastes. Currently, waste is transfered to Radiological Services of Teledyne Isotopes, 50 Van Buren Avenue, Westwood, NJ 07675.

In the case of any metallic alloy scrap and chips which are salvagable, they may be returned to the manufacturer or to an eligible scrap dealer (holder of a current NRC or Agreement State license for handling of this type of radioactive waste). Chem-Nuclear Systems, Inc., 240 Stone Ridge Drive, Columbia, SC 29210 is a possibility as a disposal firm for the combustible metallic chips (MgTh) due to their ability to package materials with high fire and reactivity hazard.

Any liquid waste produced will be checked for radionuclide concentrations. Large volumes will be transfered to a licensed commercial waste disposal firm. Small volumes of waste solution may be disposed into the regular sewage system after any necessary dilution with water to reduce the concentration to the required radioactive concentration levels.

Waste storage procedure for uses 7.A. thru 7.F. and 7.H. calls for one 55-gal. waste drum in each of the respective use areas and arrangement for disposal when full. The procedure for use 7.G. calls for interim storage of full 55-gal. drums in an outside storage area (see Item 9.C.).

Item 12.

None of the radioactive material covered by this license is used to manufacture products for distribution to general licensees or to the general public under an exemption contained in 10 CFR 40.