Form AEC-313
8-64
10 CFR 30

UNITED STATES ATOMIC ENERGY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

Form approved
Budget Bureau No. 38-R027

INSTRUCTIONS.—Complete Items 1 through 16 if this is an initial application or an application for renewal of a license. Information contained in previous applications filed with the Commisson with respect to Items 8 through 15 may be incorporated by reference provided references are clear and specific. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail two copies to: U.S. Atomic Energy Commission, Washington, D.C., 20545, Attention: Isotopes Branch, Division of Materials Licensing. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. An AEC Byproduct Material License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30, and the Licensee is subject to Title 10, Code of Federal Regulations, Part 20.

1. (a) NAME AND STREET ADDRESS OF APPLICANT (Institution, firm, hospital, person, etc. Include ZIP Code.)

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, Texas 77058

(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED (If different from 1 (a). Include ZIP Code.)

Health Physics Laboratory
Building 263A
Lyndon B. Johnson Space Center
Houston, Texas 77058

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

Biomedical Applications Branch
Medical Services Division
Space and Life Sciences Directorate

3. PREVIOUS LICENSE NUMBER(S) (If this is an application for renewal of a license, please indicate and give number.)

Amendment of 42-09388-02 in its entirety.

4. INDIVIDUAL USER(S) (Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in Items 8 and 9.)

A. W. Orsak/Radiological Safety Officer
D. J. Waggett/Health Physicist
C. M. Barnes/Radiological Health Officer

5. RADIATION PROTECTION OFFICER (Name of person designated as radiation protection officer if other than individual user. Attach resumé of his training and experience as in Items 8 and 9.)

See Individual Users Item 4.

6. (a) BYPRODUCT MATERIAL (Elements and mass number of each.)

Cobalt-60

(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME (If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.)

Sealed source, metallic cobalt, doubly encapsulated in stainless steel, heliarc welded. Manufactured in accordance with Lockheed Nuclear Products, Lockheed-Georgia Company Drawing 442-2089B (See Supplement No. 1).

Assembly I to contain 120 curies maximum.
Assembly II to contain 12 curies maximum.
Assembly III to contain .12 curies.

8408220460 840813
NMS LIC30
42-09388-02 PDR

7. DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED (If byproduct material is for "human use," supplement A (Form AEC-313a) must be completed in lieu of this item. If byproduct material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.)

Byproduct Material will be used in activities associated with the NASA spaceflight programs. Purposes for use by NASA will include development and calibration of systems for measuring space radiation, irradiation of animals and materials to study resulting effect or damage and dosimeter studies on items designed for spaceflight. The Byproduct Material is associated with a custom built irradiator facility described in Item 13 of this application.

See Supp. Folder for Attachments

95755

(Continued on reverse side)

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 *(Use supplemental sheets if necessary)*

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection			Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments	See Supplement No. 2.		Yes No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity			Yes No	Yes No
d. Biological effects of radiation			Yes No	Yes No

9. EXPERIENCE WITH RADIATION. *(Actual use of radioisotopes or equivalent experience.)*

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
		See Supplement No. 2.		

10. RADIATION DETECTION INSTRUMENTS. *(Use supplemental sheets if necessary.)*

TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mr/hr)	WINDOW THICKNESS (mg/cm²)	USE (Monitoring, surveying, measuring)
See Supplement No. 3 Appendix D JSCM 1860B "Radiological Health Manual"					

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE.

See Supplement No. 3
Part 3.12 Instrument Calibration
JSCM 1860B

12. FILM BADGES, DOSIMETERS, AND BIO-ASSAY PROCEDURES USED. *(For film badges, specify method of calibrating and processing, or name of supplier.)*

Film Badge Service provided by R. L. Landauer, Jr. & Company.
Frequently calibrated pocket dosimeters used in high radiation areas.

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS IN DUPLICATE

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No

(See Supplement No. 5)

14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.

(See Supplement No. 4)

15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved. (See Supplement No. 4).

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 30, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

JUN 26 1978

Date ______________

Applicant named in item 1

By: Richard S. Johnston
Director of Space and Life Sciences

Title of certifying official

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.

2450

Supplement 1
Reference 6.(a) & (b) of Form AEC 313
Application for Renewal of License No. 42-09388-02
Lyndon B. Johnson Space Center

The Cobalt-60 metal pellets, doubly encapsulated in stainless steel, will be utilized in a pneumatic Flexo-Rabbit irradiator system. The original sources and irradiator were custom designed for JSC by Lockheed Nuclear Products, Lockheed-Georgia. As noted on the Attachment 1, Drawing No. 442-2089B, Assembly I contains a maximum of 120 curies, Assembly II contains a maximum of 12 curies and Assembly III contains a maximum of .12 curies of Cobalt-60.

On June 8, 1977, the original sources were replaced by Gamma Industries of Houston, Texas, with sources built to the original specifications with minor modifications. The modifications included in the new sources are: (See Attachment 2).

1. Increased wall thickness of both the primary and secondary encapsulation in all three assemblies.

2. Assembly III (120 millicurie maximum) originally designed for a Cobalt needle, contains a Cobalt pellet similar to Assembly I and Assembly II.

3. An aluminum spacer has been placed in all three assemblies which essentially acts as a tertiary capsule for the Byproduct Material.

The sources were fabricated by the Gamma Industries Laboratory in Baton Rouge, Louisiana, under Louisiana Division of Radiation Control License No. LA-0006-L01/L03.

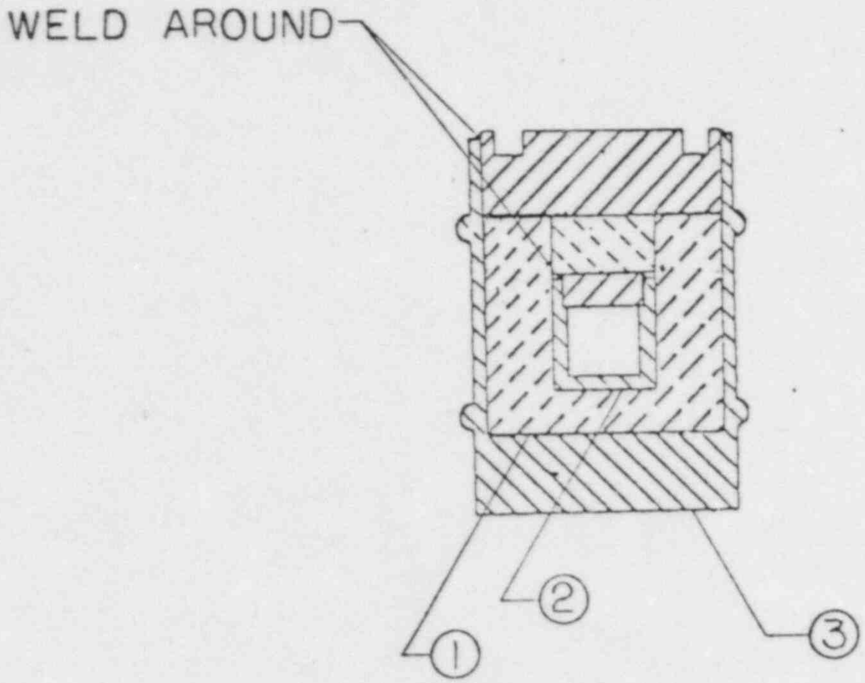
95755

2450

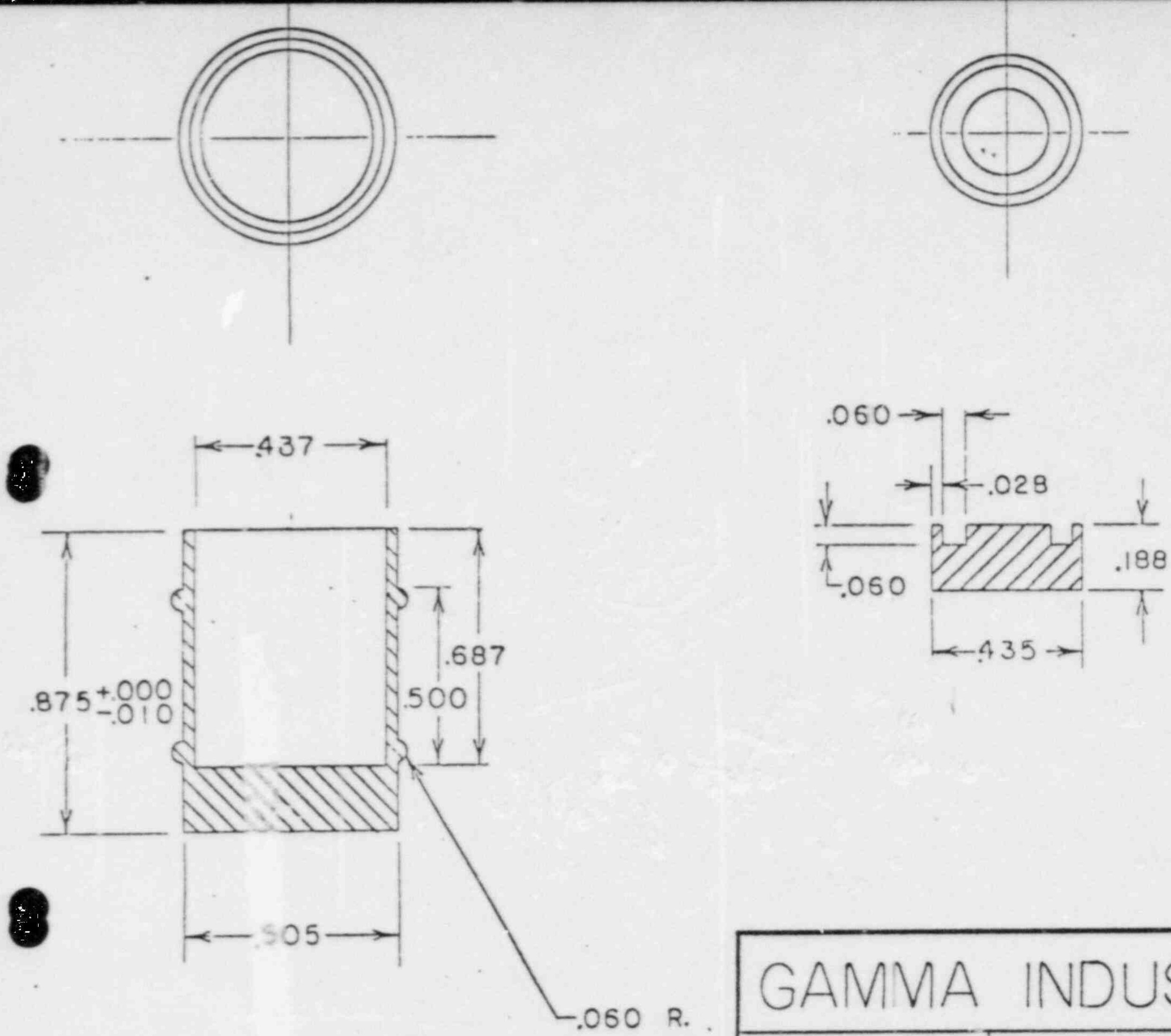
ITEM NO.	DESCRIPTION	PART NO.
1	LOCKHEED OUTER CAPSULE	801-8060-104
2	LOCKHEED 100. Ci SPACER	801-8060-103
3	Co-60 PRIMARY CAPSULE	801-8001-102

95755

SUPPLEMENT 1
ATTACHMENT 2
1978 Renewal Application
License No. 42-09388-02

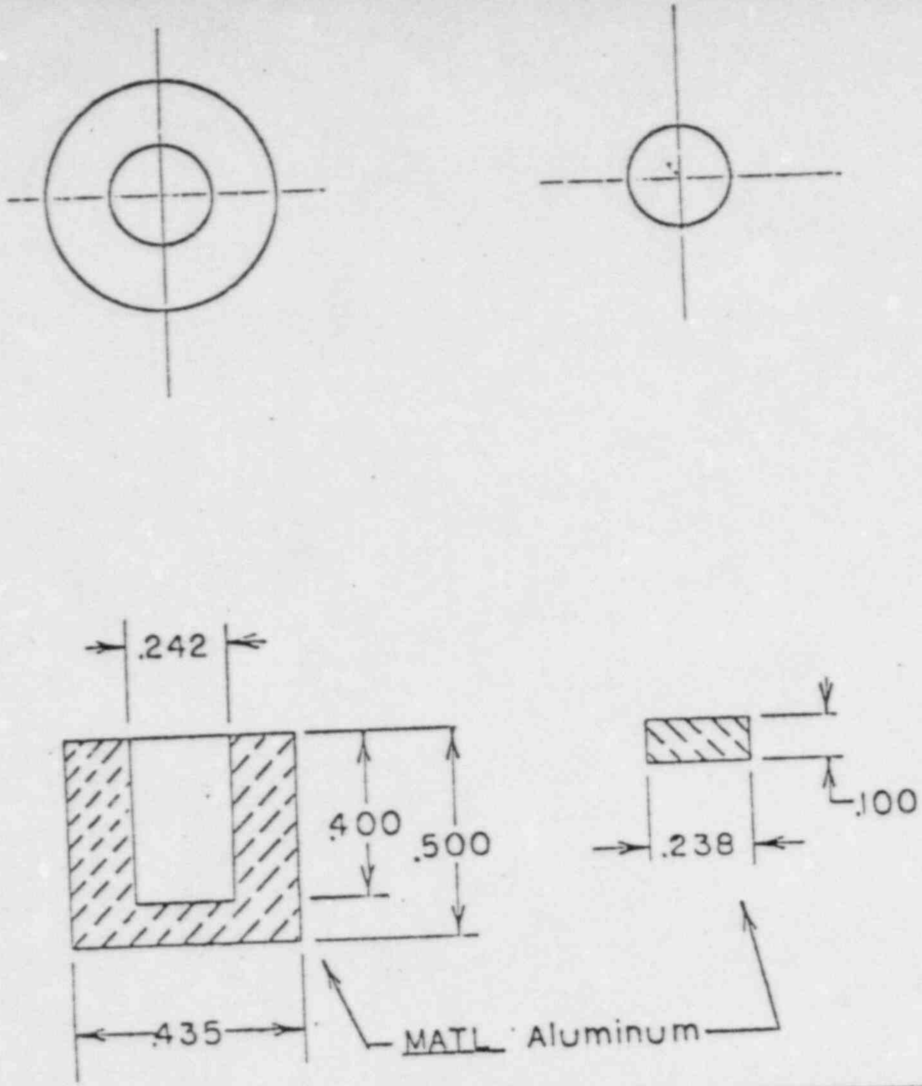


GAMMA INDUSTRIES B.R., LA.		
SCALE: NONE	APPROVED BY:	DRAWN BY KJR
DATE: 6-29-77		REVISED
LOCKHEED 100 Ci CAPSULE ASSEMBLY		
		DRAWING NUMBER 801-8060-003



TOLERANCES ±.002 unless
otherwise indicated

GAMMA INDUSTRIES B.R., LA.		
SCALE: 2/1	APPROVED BY:	DRAWN BY KJR
DATE: 6-27-77		REVISED
LOCKHEED OUTER CAPSULE		
		DRAWING NUMBER 801-8060-104

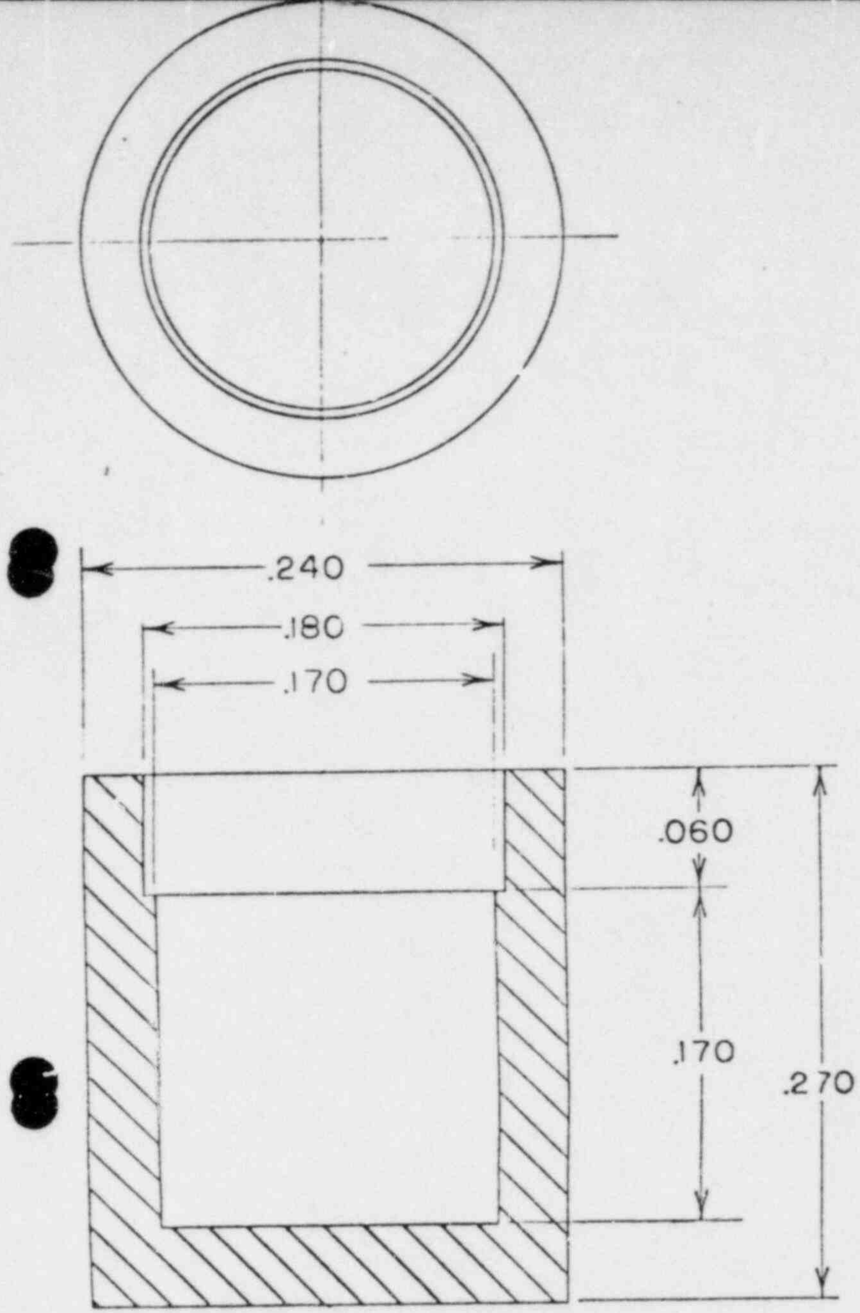


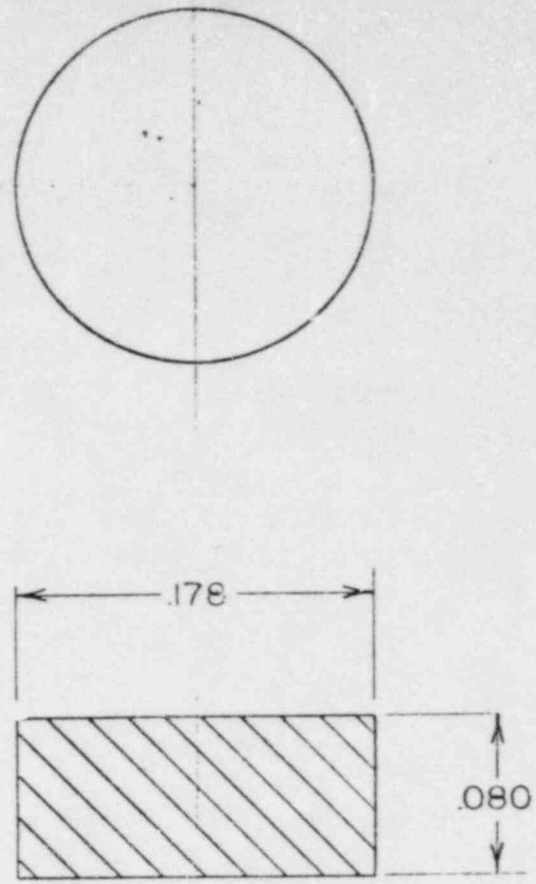
GAMMA INDUSTRIES B.R., LA.

SCALE: 2/1	APPROVED BY:	DRAWN BY KJR
DATE: 6-29-77		REVISED

LOCKHEED 100 Ci SPACER

DRAWING NUMBER 801-8060-10





Mat'l S.S.

GAMMA INDUSTRIES B.R., LA.

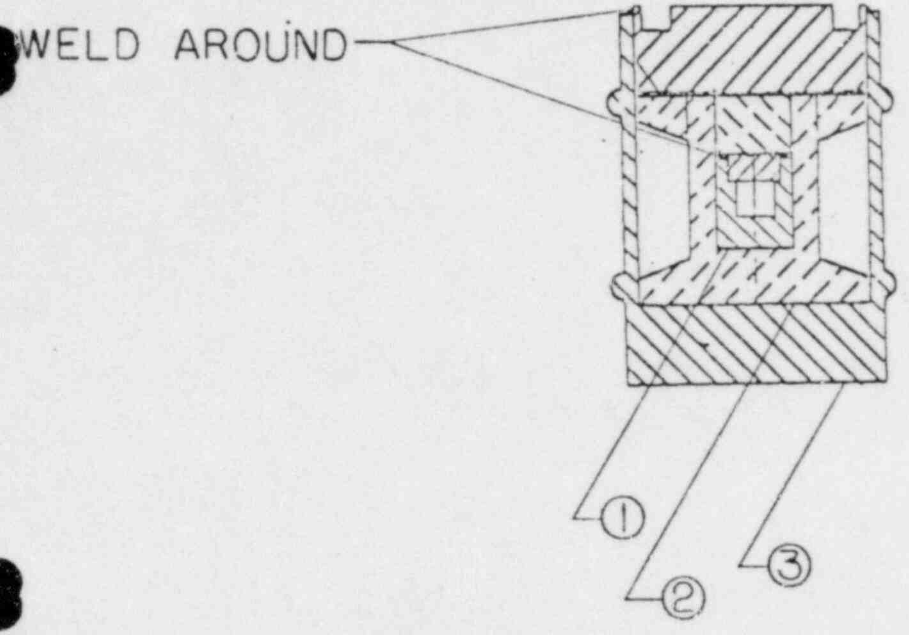
SCALE: 10/1	APPROVED BY:	DRAWN BY KJR
DATE: 6-27-77		REVISED

Co-60 PRIMARY CAPSULE

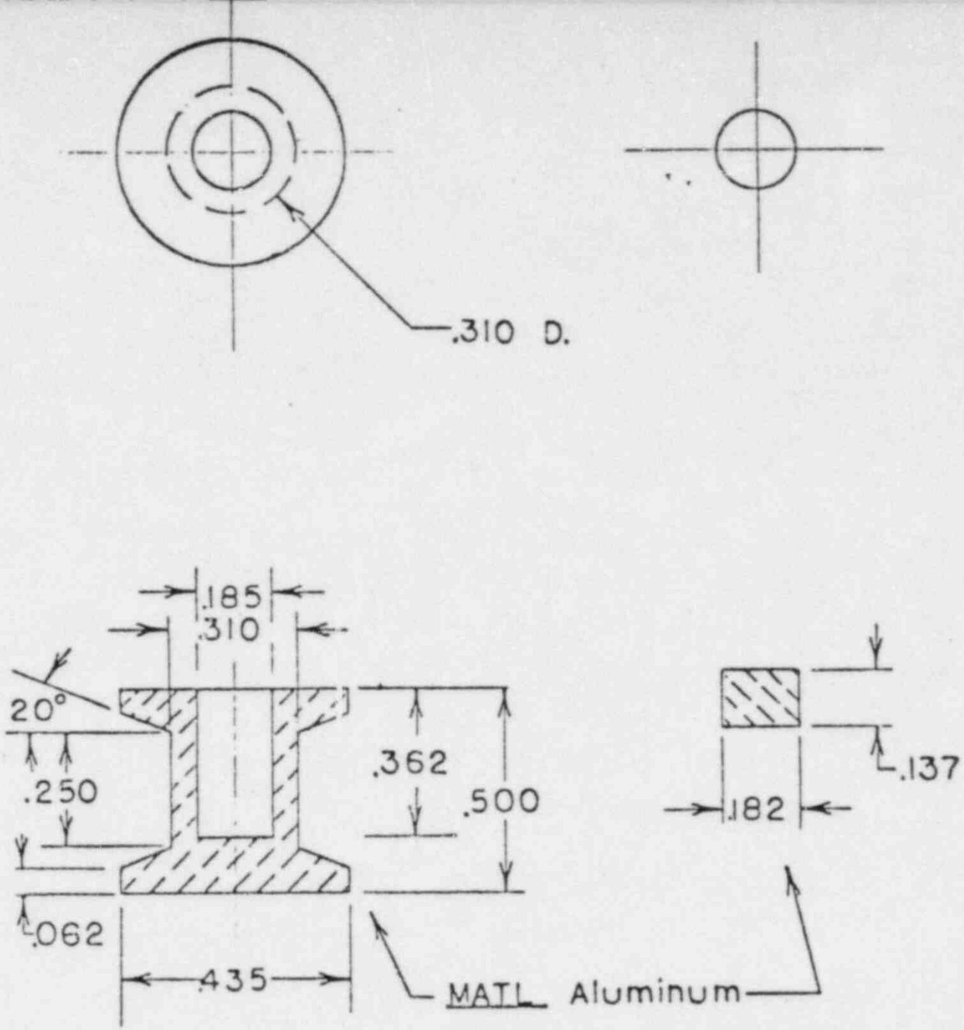
PRIMARY CAPSULE FOR 100 CURIE COBALT-60 LOCKHEED ASSEMBLY - DWG 801-8060-002	DRAWING NUMBER 801 8001 102

ITEM NO.	DESCRIPTION	PART NO.
1	Co-60 PRIMARY CAPSULE	801 8001 101
2	LOCKHEED 100 Ci SPACER	801 8060 102
3	LOCKHEED OUTER CAPSULE	801 8060 104

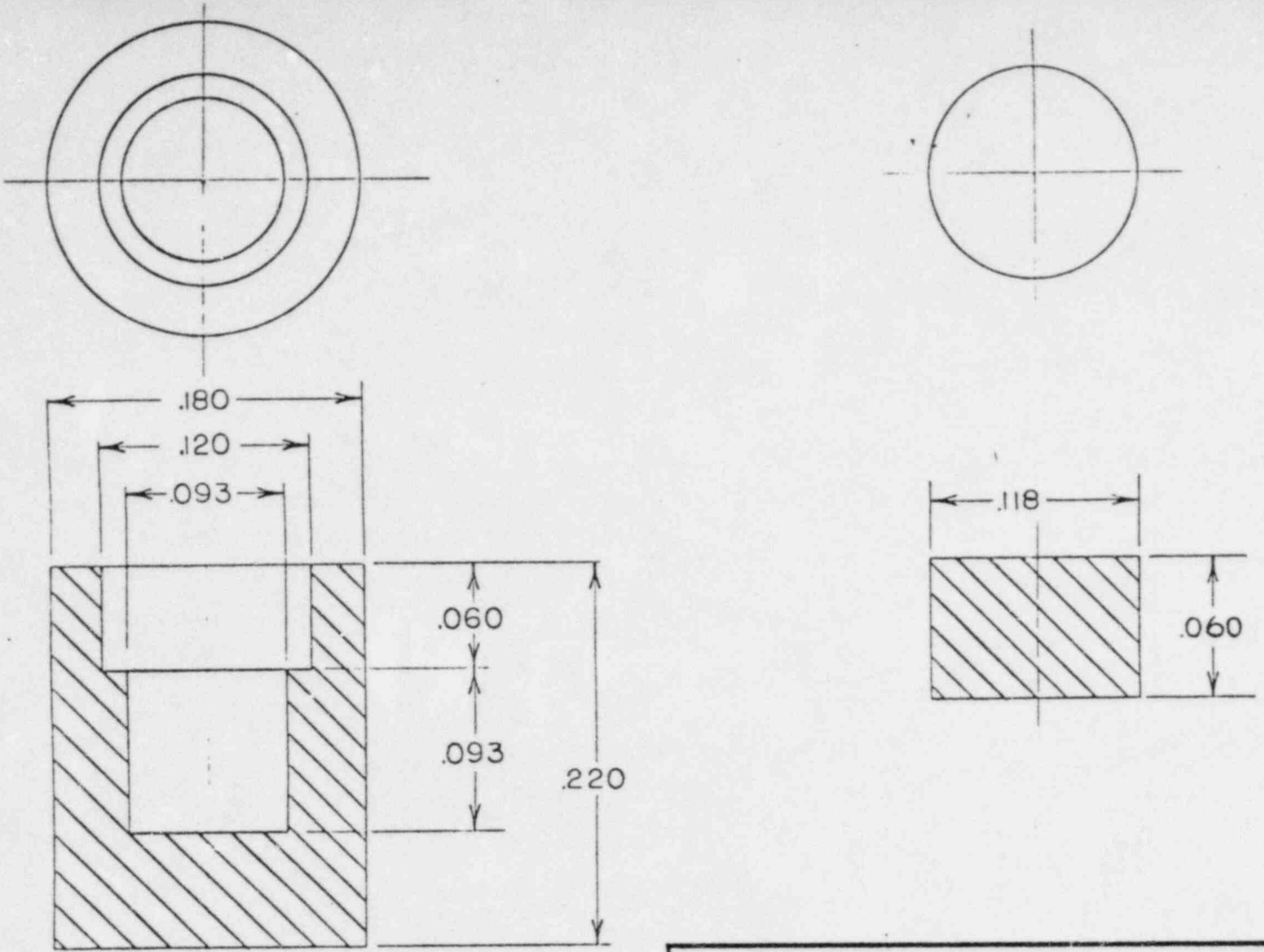
95755



GAMMA INDUSTRIES B.R., LA.		
SCALE: NONE	APPROVED BY:	DRAWN BY KJR
DATE: 6-29-77		REVISED
LOCKHEED CAPSULE ASSY.		
		DRAWING NUMBER



GAMMMA INDUSTRIES B.R., LA.		
SCALE: 2/1	APPROVED BY:	DRAWN BY KJR
DATE: 6-29-77		REVISED
LOCKHEED 10 & .1 Ci SPACER		
		DRAWING NUMBER 801-8060-102



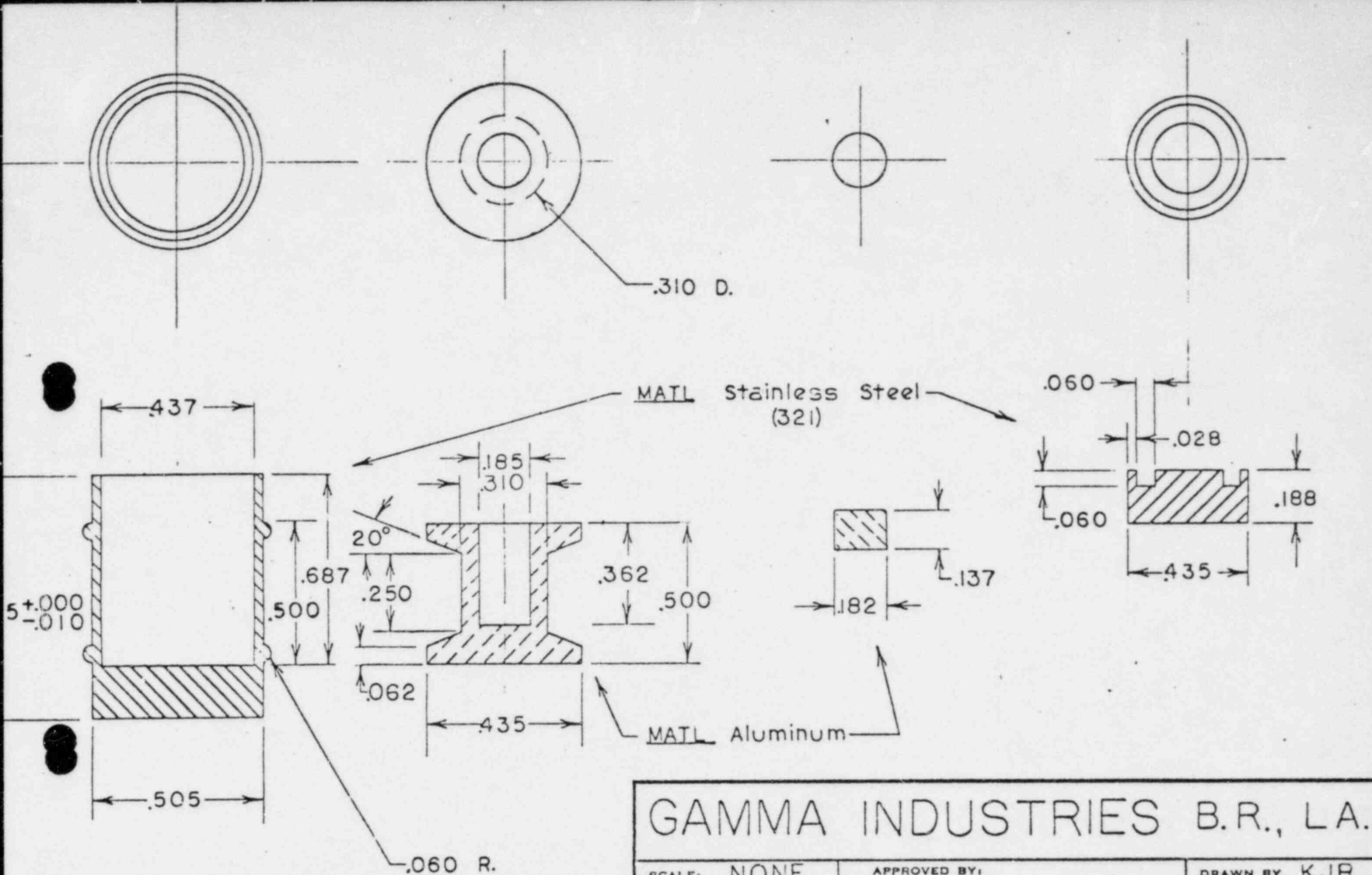
Mat'l. S.S.

GAMMA INDUSTRIES B.R., LA.

SCALE: 10/1	APPROVED BY:	DRAWN BY KJR
DATE: 6-27-77		REVISED

Co-60 PRIMARY CAPSULE

PRIMARY CAPSULE FOR 10 AND 0.1 CURIE COBALT-60 LOCKHEED ASSEMBLY - DWG 801-8060-003	DRAWING NUMBER 801 8001 101



TOLERANCES ±.002 unless otherwise indicated

GAMMA INDUSTRIES B.R., LA.		
SCALE: NONE	APPROVED BY:	DRAWN BY KJR
DATE: 5-19-77		REVISED
10 & .1 Ci LOCKHEED CAPSULE		
TO REPLACE ASSEMBLIES II & III OF LOCKHEED DWG 442-2089-B		DRAWING NUMBER 801-8060-003

Supplement No. 2
Reference 4,5,8,9 of Form AEC 313
Application for Renewal of License No. 42-09388-02
Lyndon B. Johnson Space Center

2450

Resumes of:

C. M. Barnes, D.V.M., Ph.D./Radiological Health Officer

A. W. Orsak/ Radiological Safety Officer

D. J. Waggett/ Alternate Radiological Safety Officer

RADIOLOGICAL SAFETY OFFICER - Arnold W. Orsak

The position of Radiological Safety Officer has been established to perform the functions and responsibilities prescribed in 10 CRF 33. Mr. A. W. Orsak is presently appointed to this position. The Radiological Safety Officer also administers the day-to-day operation of the radiation protection program supported by one health physicist. The experience and training of Mr. Orsak is stated below:

A. Pertinent Training

1. Graduate, Sam Houston State College, 1963.
   Bachelor of Science in Biology; minor in chemistry.

2. Radiation Protection Training

   a. Basic Radiological Health, USPHS, 2 weeks, 1964.
   b. Occupational Radiation Protection, USPHS, 2 weeks, 1965.
   c. Management of Radiation Accidents, USPHS, 2 weeks, 1965.
   d. Radium Hazards and Control, USPHS, 1 week, 1965.
   e. Medical X-ray Protection, USPHS, 2 weeks, 1964.
   f. Orientation in Occupational Health, USPHS, 1 week, 1964.
   g. Radiflo Supervisors Course, C. E. Corporation, 2 weeks, 1966.
   h. Radef Monitors Instructor's Course, OCDM, 1 week, 1964.

B. Experience with Radiation

1. Supervisor of Radiological Health Services, Kelsey-Seybold Clinic, contractor to Johnson Space Center (JSC), January 1969 to present. Appointed Radiological Safety Officer for JSC, Houston, Texas, March 1969.

2. Supervisor at Texas Instruments, Dallas, Texas.
   500 curies of Krypton 85 in hermetic seal checks and two 150 KV X-ray machines were used for internal defect check of transistors and integrated circuits. Responsibilities included Radiological Health Training, Radiation Instrument repair and calibration and periodic radiological health surveys. (1966-1968).

3. Radiation Health Specialist - Texas State Department of Health, Austin, Texas. (1963-1966).

   Duties:

   a. Calibration of survey instruments with sealed gamma (Max. 300 mCi) and neutron sources (Max. 5 Ci).

b. Radiation hazards evaluation surveys o' radioisotopes (kilocurie quantities), and machine produced radiation (up to 14 MeV).

c. Inspection of radioactive material licensees which included colleges, hospitals, research laboratories, radiographers, well loggers and clinics, for compliance with Texas State Regulation.

d. Investigation of incidents such as lost sources, overexposures and contamination monitoring and clean-up.

e. Evaluation of applications and procedures for Texas license.

f. Prepare for appropriate signatures new and amended Radioactive Material License, containing special conditions which might apply.

g. Radiation Safety Officer for State Health Department (1965-1966) which involved accountability, leak tests and surveys for approximately six civil defense source sets and 10 calibration sources. All sources ranged from 2 to 300 mc (cobalt and cesium).

ALTERNATE RADIOLOGICAL SAFETY OFFICER - Dennis J. Waggett

The program at JSC is fast moving, requiring daily action at the Radiological Safety Officer level, and an alternate to the Radiological Safety Officer has been designated to assure immediate action and continuance of the program. Mr. D. J. Waggett, Health Physicist is designated as Alternate Radiological Safety Officer and his experience and training is stated below:

A. Education and Training

1. San Jacinto Jr. College - AA Degree

2. University of Houston

3. Radiological Health Short Courses:

   a. Nuclear Warfare School, U. S. Navy

   b. Environmental Surveillance and Analysis; Tracerlab

   c. Laser Beam Analysis and Biological Effects; Tracerlab

   d. Basic Radiological Health Course; USPHS

   e. Occupational Radiation Protection Course; National Center for Radiological Health

   f. Radionuclide Analysis by Gamma Spectroscopy Course; USPHS

B. Experience with Radiation

Health Physicist - Johnson Space Center/Kelsey-Seybold Clinic, September 1966 to present.

Duties:

a. Radioactive materials, including sealed and unsealed sources, multicurie sources, neutron sources and special nuclear material, a 120 curie Co-60 High Range System and a 100 curie Co-60 irradiator.

b. Radiation Producing Equipment, routine radiological considerations of such devices as radiography units, medical, dental and radiography X-ray units and a Van de Graaff Accelerator.

c. Radiological Surveys - Routine radiological surveys of NASA buildings and laboratories, such as isotope storage areas, neutron generators and miscellaneous diffraction equipment.

d. Environmental surveillance consisting of air, water, soil and vegetation collection with subsequent laboratory preparation and analysis for radioactive material control.

e. Leak testing of sealed sources held under NRC License granted to NASA-JSC.

f. Decontamination - Routine decontamination of laboratory equipment and laboratory work areas.

RADIOLOGICAL HEALTH OFFICER - C. M. Barnes, D.V.M., Ph.D.

The Radiological Health Officer at JSC is responsible for planning, directing and coordinating all aspects related to operations administered by the Center. The experience and training of Dr. Barnes is stated below:

A. Pertinent Training

1. Doctor of Veterinary Medicine, 1944, Texas A & M University, College Station, Texas.

   Doctor of Philosophy, 1957, in Comparative Pathology, University of California, Davis, California.

2. Radiation Protection Training:

Where Trained	Duration of Training	On Job	Formal Course
Principles and Practices of Radiation Protection			
Hanford Atomic Products Opns.	2 yrs.	Yes	No
University of California, Berkeley and Davis, California	2 yrs.	Yes	Yes
Oak Ridge National Lab.	2 wks.	No	Yes
Radioactivity Measurement and Monitoring Techniques			
Hanford Atomic Products Opns.	2 yrs.	Yes	No
University of California	2 yrs.	Yes	Yes
Mathematics and Calculations Basic To Use and Measurement of Radioactivity			
University of California	2 yrs.	No	Yes
Biological Effects of Radiation			
Hanford Atomic Products Opns.	2 yrs.	Yes	No
University of California	2 yrs.	No	Yes
Related Formal Training:			
College Mathematics	14 hrs.		
College Physics	15 hrs.		
Radiation Physiology	3 hrs.		
Research in Radiation Biology	19 hrs.		

B. Experience with Radiation

1. Present assignment is, Radiological Health Officer, Johnson Space Center, NASA, Houston, Texas. Responsible for planning, directing, coordinating, and supervising all aspects of radiological problems involved in manned space flight. Prescribes the radiation dose criteria for manned space probes; provides biological data and equations relating to crew safety and mission success; evaluates experimental results from ground based and in-flight experiments as related to human in-flight safety; establishes research programs to accurately simulate in controlled experiments those conditions likely to occur in manned space flight; monitors and technically supervises the research activities of the Johnson Space Center in meetings with the Radiation Panel, National Academy of Science, the Department of Energy, the Department of Defense, and other organizations with authority to commit the Center in matters pertaining to radiobiological research: responsible for technical documentation, budget estimates, and other recommendations for equipment, medical material, and allied developments for laboratory and other facilities required in long range problems.

2. 1966-1967: Chief, Veterinary Services, USAF Air Proving Ground Center and the USAF Special Air Warfare Center, Eglin AFB, Florida 32542. Responsible for management of all veterinary programs including routine public health activities, research into hazards of lasers, and biological, radiological, and chemical warfare agents conducted on site.

3. 1952-1962: Manager, Life Sciences Program, USAF-USAEC Aircraft Nuclear Propulsion Office, Headquarters, U.S. Atomic Energy Commission, Germantown, Maryland. Was responsible for a contractual effort of approximately 2 million dollars annually in basic biological research with particular reference to radiation toxicology, development of radiation protective drugs, field testing of toxic materials. This biological research program was in support of the nuclear powered rocket for space use (Project Rover), the nuclear powered ramjet (Project Pluto), and the Systems for Nuclear Auxilliary Power for space and earth application (Project SNAP). Coordinated this program with that of the Biology and Medicine Division, AEC, the Department of Defense, and other research groups. Developed the protocol and led discussions with national safety advisory groups resulting in federal approval of the first use of nuclear power sources in Space.

4. 1956-1958: Manager, Life Sciences, and Human Factors Project Officer, Detachment 1, Hq., Air Research and Development Command, Wright Patterson AFB, Ohio. This work consisted of managing the radiobiological and human factors effort necessary to support development of a nuclear powered bomber for the Air Force. Was

technical monitor of approximately ten contracts (1.5 million dollars) involving radiation toxicology studies in domestic and wild animals, crew compartment habitability design studies and basic radiation exposure criteria. Conducted hazards testing of nuclear fuel elements and simulated various accidents involving nuclear powered aircraft.

5. 1954-1956: Graduate student, University of California, Berkeley, and Davis campuses. Curriculum was in comparative pathology with a fair share of the program slanted toward medical physics and radiation biology with nominal coursework in advanced pathology. The graduate committee was composed of Professors Joseph G. Hamilton and John H. Lawrence in Medical Physics; Professor E. L. Dobson in Radiation Physiology; Professor D. R. Cordy in Pathology; and Professor Logan M. Julian in Research in Radiation Biology. The Ph.D. degree in Comparative Pathology was received on June 5, 1957. Title of Thesis was: "A Comparative Study of the Reticuloendothelial System in Developing Chickens." This research used radioactive tracer colloid material to permit a quantitative analysis of the phagocytic function in reticuloendothelial cells.

6. 1952-1954: Training with Industry at the Experimental Animal Farm, the General Electric Company, Hanford Atomic Products Operation, Richland, Washington. Activity centered about studies on the toxicology in domestic animals of various fission products released to the atmosphere at the Hanford nuclear production facility. Training was received in the management of an experimental animal farm which included sheep, swine, poultry, and laboratory animals in a controlled environment. Research was primarily radioiodine toxicity in sheep. However, brief studies were conducted on toxicity in chickens and plutonium inhaled by dogs. Four months of this period was spent on Eniwetok Atoll assisting in the investigation of nuclear fallout problems in the local fauna and flora resulting from hydrogen bomb testing at that site.

Supplement No. 4
1978 Renewal Application (Form AEC-313)
Byproduct Material License 42-09388-02
Reference Items 14 and 15

2450

The radiation protection program is described in a series of Attachments to this sheet:

ATTACHMENT 1: Organization and Functions

ATTACHMENT 2: Operating Procedures

ATTACHMENT 3: Leak Test and Disposal

Supplement No. 4
Attachment 1

ORGANIZATION AND FUNCTIONS

The Johnson Space Center is headed by Dr. C. C. Kraft, Jr., Director, and he is supported by staff offices performing certain special functions. Program offices reporting to the Director are responsible for the direction of specific manned spaceflight programs. An Administrative Directorate, reporting through the Associate Director is responsible for the business affairs and administrative support of the Center, and five other directorates, reporting to the Director, are responsible for certain operational functions and technical support of JSC programs. Responsibility for assuring proper and safe use of Byproduct Material has been delegated to the Director of Space and Life Sciences (JSC Management Instruction 1860.4E, Appendix A, Supplement 3).

Dr. C. M. Barnes is responsible for the functional management of the radiological health program, along with other manned spaceflight aspects of radiation technology. The radiological health activity is supported by a health physics group provided under a medical support services contract. The contract health physics group provides professional services for the performance of radiation safety evaluation of usages of Byproduct Material, advice on radiation protection including special training to users, performance of initial and periodic radiation surveys, surveillance of all radiation use and applied health physics procedures such as leak tests, storage and issue of Byproduct Material, personnel dosimetry, instrument calibration, and all related recordkeeping. A contractor Health Physicist has been designated as JSC Radiological Safety Officer to administer the detailed health physics program. He relates to NASA through the Radiological Health Officer in the Biomedical Applications Branch, Medical Services Division, Space and Life Science Directorate.

(See Figure 1, page 2-5, Supplement 3).

Supplement No. 4
Attachment No. 2

OPERATING PROCEDURES
HEALTH PHYSICS LABORATORY

Irradiator and Calibration System Operation

General

Operation of the Irradiator and Calibration System is authorized by the Byproduct Material License 42-09388-02 issued to the Lyndon B. Johnson Space Center, and all operation shall conform to applicable parts of the U. S. Nuclear Regulatory Commission, Rules and Regulations, Title 10, Code of Federal Regulations and conditions of referenced license. All operating personnel shall be familiar with the operating procedures and the provisions of the license. Copies of each shall be posted conspicuously in the laboratory.

Control Procedures

a. Authorization for Use. Only those individuals approved as users on Byproduct Material License 42-09388-02 will use or directly supervise use of the Irradiator and Calibration System.

b. Scheduling of Use. All approved uses of the Irradiation and Calibration System shall be subject to schedules submitted to and approved by the Radiological Safety Officer or his alternate.

c. Records of Use. All use of the Irradiation and Calibration System shall be recorded. Such records shall incorporate date of use, total time each source is out of the storage cask, names and identification of users, signature of person performing pre-operational safety inspection, description of operation, and dosimetry records.

Supplement No. 4
Attachment No. 2

Subject: Operating Procedures, Health Physics Laboratory, (Irradiator and Calibration System Operation - continued).

d. Access to Laboratory. Access to the laboratory during operation of the Irradiation and Calibration System shall be limited to those persons authorized by the supervising health physicist and having proper dosimetry as specified in these procedures.

Operating Rules for Irradiation and Calibration System

a. The person acting as supervising health physicist will supervise and be responsible for overall safe operation of the irradiation and calibration system during operation.

b. Only authorized personnel will be allowed to operate the Irradiation and Calibration System in accordance to limitations of the authorization.

c. The facility shall not be left unattended while sources are in the exposure position.

d. Two persons shall be present during all operations of the system with the 100 curie and 10 curie sources.

e. The 100 curie Cobalt-60 source shall not be used in excess of one (1) hour in any 24-hour period.

f. The traverse mechanism shall not be energized for relocation on the receiver tube until all sources have been returned to the storage container.

Supplement No. 4
Attachment No. 2

Subject: Operating Procedures, Health Physics Laboratory, (Irradiator and Calibration System Operation - continued).

g. The control console key shall be maintained in a locked metal cabinet, access to which is limited to individuals approved as users on Byproduct Material License 42-09388-02.

Operating Procedures for Irradiation and Calibration System

*a. A pre-operational safety inspection shall be made of the Health Physics Laboratory Facility Prior to each operation. The inspection shall consist of:

(1) A walk-through inspection of the High Radiation Area enclosed within the facility to assure that the area is clear of all unauthorized personnel.

(2) A direct Inspection of all gates and doors and securing of locks.

(3) Informing personnel within the facility of intended operations.

(4) Verification of the proper operation of interlocks, area monitors, alarms, limit switches and stops.

(5) Verification that authorized personnel only are in the control room or restricted area, with proper dosimetry for each person.

*If items mentioned are not satisfactory, discrepancies must be corrected before proceeding.

Supplement No. 4
Attachment No. 2

Subject: Operating Procedures, Health Physics Laboratory, (Irradiator and Calibration System Operation - continued).

*b. An operational safety inspection shall be made of the Health Physics Laboratory Facility immediately after activation of the Irradiation and Calibration System and periodically during operation. The inspection shall assure that:

(1) All remote area monitor readings are of nominal value.

(2) The dose rate at the operator's position is of nominal value.

(3) A visual inspection of the High Radiation Area is conducted.

(4) An Inspection of the restricted area for unauthorized presence of personnel is conducted.

(5) The dose rates at the predetermined inspection points are of nominal value.

c. A post-operational safety inspection shall be made of the Health Physics Laboratory Facility after each operation of the system. The inspection shall assure that:

(1) The remote area monitor reading is of nominal value for the sources in the storage position.

(2) The dose rate at the storage cask is of nominal value.

(3) The cask is in storage position.

(4) Records of use are properly prepared.

*If items mentioned are not satisfactory, discrepancies must be corrected before proceeding.

Supplement No. 4
Attachment No. 2

Subject: Operating Procedures, Health Ph-sics Laboratory, (Irradiator and Calibration System Operation - continued).

Personnel Monitoring Procedures

a. Each person will wear a gamma sensitive film badge and a pocket chamber or self-reading dosimeter, and will log results daily.

b. Weekly exposure will not exceed 100 mRem unless specifically authorized by the Radiological Safety Officer.

c. Dosimetry devices will be used to measure extremity exposure when it will vary significantly from whole body exposure.

d. A record will be maintained in the laboratory of exposure data from all dosimetry devices except film badges.

EMERGENCY PROCEDURES

IRRADIATION/CALIBRATION SYSTEM OPERATION

JOHNSON SPACE CENTER

LICENSE # 42-09388-02

EMERGENCY PROCEDURES

a. Source fails to leave storage cask - Notify Radiological Safety Officer or Health Physicist and suspend operation until trouble is investigated and corrected by Health Physics.

b. Source fails to leave exposure position - Notify Radiological Safety Officer and suspend operation immediately. Clear laboratory compound of all personnel not required for remedial procedures. Do not attempt remedial procedures until directed to do so by Radiological Safety Officer.

c. Source fails to complete traverse - Notify Radiological Safety Officer and Security immediately. Determine radiation field pattern and clear the laboratory compound of all personnel. If source position creates the potential for significant exposure outside the laboratory compound, coordinate with Security to have a suitable area closed. Remedial operations will be directed by the Radiological Safety Officer.

d. Suspected or known overexposure to radiation

The JSC Clinic, with a staff of fifty (50) professional health care personnel, will be utilized, in the following manner:

(1) Request ambulance transfer of the exposed person(s), Est. 3333, to the JSC Clinic.

(2) Contact the JSC Radiological Safety Officer, or alternate, at Ext. 5936.

(3) After assuring that the facility is secured, accompany the exposed person(s) to the JSC Clinic, Building 8, and provide the details to the attending physician.

(4) The physician will proceed with prescribed medical treatment with consultation of the Kelsey-Seybold Clinic Nuclear Medicine physician, if needed.

(5) Should further treatment or confinement be requested, the patient(s) will be transferred by JSC ambulance to a Houston Medical Center hospital, accompanied by a JSC physician.

(6) The JSC Radiological Safety Officer, or alternate, will supervise any necessary clean-up operation and maintain a constant surveillance on the status of the exposed person(s).

(7) An immediate investigation will be conducted by the Radiation Safety Committee, assisted by the Radiological Health staff, to determine the cause of overexposure or accident involving nuclear materials. The facility will not be operated until this review is complete and approval of the Radiation Safety Committee is received.

Supplement No. 4
Attachment No. 3

LEAK TEST AND WASTE DISPOSAL

Leak tests of sealed sources are performed by health physicists provided under a Medical Support Services contract and the results certified to the Radiological Safety Officer and the Radiological Health Officer. Records of leak test results shall be maintained for inspection by the Commission.

Assay of leak tests will be in laboratory-type nuclear counting instruments capable of detecting radioactivity of less than .005 microcuries of removable contamination.

Wipe and assay procedures will be approved by the Radiological Safety Officer and will be conducted on schedules to meet conditions of Licenses issued to JSC.

Radioactive waste shall be picked up and maintained by contractor health physics personnel. No local disposal of radioactive material will be performed. All disposal will be by off-site contract services, wherein the material is transferred to persons licensed by the Nuclear Regulatory Commission and/or Agreement State to receive and/or dispose of radioactive materials.

2450

Supplement No. 5
1978 Renewal Application (Form AEC 313) Reference 13
License No. 42-09388-02

FACILITIES AND EQUIPMENT NAMED IN ITEM 13

Please reference the following drawings and representations previously submitted with the application dated February 10, 1970.

Drawings:

I. Lockheed Nuclear Products Dwg. No. 442-2065
442-2072
442-2073
442-2076A
442-2089B
442-2093

II. Modified Health Physics Laboratory Protective Features (Building 263A).

III. Lockheed-Georgia Company
Operating and Maintenance Manual
High Range Cobalt-60 Calibration System
April 1969

IRRADIATION AND CALIBRATION SYSTEM

System Description

A high range irradiation and calibration system was custom-designed and installed by Lockheed Nuclear Products into an existing NASA/Johnson Space Center Facility approximately ten years ago. The system design has demonstrated, with routine maintenance, a dependable and safe means of producing dose rates to test articles ranging from 10 milliroentgen per hour to a 100 roentgen per hour. The system consists of three sealed Cobalt-60 sources located in individual portals of a storage cask. The storage cask is designed with a rotating turret that allows for the remote selection of the shielded closed position or one of the three source portals. Attached to the top of the storage cask turret is a pneumatic transfer tube through which the source travels to and from a predetermined setting within a 30-foot tunnel that is parallel to and approximately two feet above the building foundation. The carrier gas is supplied by regulated nitrogen gas cylinders with a normal operating pressure of 50 pounds per square inch in the system which is vented through a high efficiency filtering device. The operators remote console allows for the following controls:

1. Key operated ON-OFF switch.
2. Selection of source - 100 millicuries, 10 curies or 100 curies.
3. Selection of distance from source location to irradiation area or test article.
4. Selection of manual or automatic-timed exposures.
5. Selection of appropriate timer and time setting.
6. Monitoring of dose rates at operators console and both ends of the tunnel.
7. Monitoring of carrier gas supply and pressure.
8. Activation of pneumatic system to transfer selected source to predetermined source location.
9. Visual monitoring of entrances to storage area and irradiation area.
10. Activation of pneumatic system to transfer source to storage container.
11. Rotation of storage container turret to shielded closed position.

Supplement No. 5
1978 Renewal Application (Form AEC 313) Reference 13
License No. 42-09388-02

Facility Description

Building 263 Complex consists of two buildings, 263 and 263A, enclosed within a six-foot security fence. Building 263 is primarily a radiation counting laboratory and check source storage area. Building 263A contains the storage area for radioactive waste, storage of radioactive sources, a radiochemical laboratory for short duration projects and the irradiation and calibration system. The building is built of high density concrete that is 12 inches thick with two exceptions: (1) the outer wall of irradiation area directly in line with the tunnel on the opposite end from the storage container is built of low density material to reduce backscatter, and (2) the addition of 2-6 inches of high density concrete and 10-18 inches of soil in the walls of the tunnel. The internal doors of Building 263A that allow entry to the storage area and the irradiation area are equipped with audio alarms that are activated when the key is in the "ON" position. Exterior to Building 263A, the high radiation area, is enclosed in a security fence with visual warning light and sign advising immediate evacuation if light is energized.

As requested by the Nuclear Regulatory Commission, an evaluation of the potential hazards from use of the irradiation and calibration facility was completed. We propose to make changes to the controls of the irradiator mechanism which would obviate two problems discovered during our facility safety review. Details of these changes are encompassed in Supplement 6 of this application.

Supplement No. 5
1978 Renewal Application (Form AEC 313) Reference 13
License No. 42-09388-02

The most recent radiation hazard survey conducted on the irradiator and calibration facility is enclosed with a series of photos to identify items mentioned in the narrative of the system.

ENVIRONMENTAL RADIATION SURVEY

BUILDING 263 COMPLEX

15 MARCH 1978

NASA-JSC

BACKGROUND

A radiation evaluation survey was completed 15 March 1978 of the radiation being emitted from the Cobalt-60 sources, which were installed in the "High Range Calibration System" June 1977, at the Health Physics Laboratory Complex Building 263. These sources were 100 curie, 10 curie and 100 millicurie activities.

PURPOSE

This survey was necessary to evaluate and delineate the various radiation levels within and adjacent to the Building 263 Complex. (See Attachment I and II for location and Attachment III for radiation levels)

The survey was broken down into three units. For each unit of survey, the 100 curie Cobalt-60 source was utilized within the High Range Calibration System tunnel to obtain the maximum radiation levels possible for each area of concern. Unit one of the survey positioned the source at position 1, the north end, unit two of the survey, positioned the source at position 2, the middle, and unit three, positioned the source at position 3, the south end of the High Range Calibration System tunnel. The corresponding control console positions are 600 for the north (unit one), 1440 for the middle (unit two) and 2280 for the south (unit three).

The survey instruments utilized were as follows:

Manufacturer	Model	Range in Milliroentgens/hr.
Victoreen	440	0 - 300
Victoreen	290	0 - 20
Teletector	6612B	0 - 50,000

Subject: Environmental Radiation Survey, Building 263 Complex, NASA-JSC.

The Health Physicists maintained a constant surveillance of the area throughout this survey to prevent unauthorized entry to the Building 263 Complex and adjacent areas.

CONCLUSION

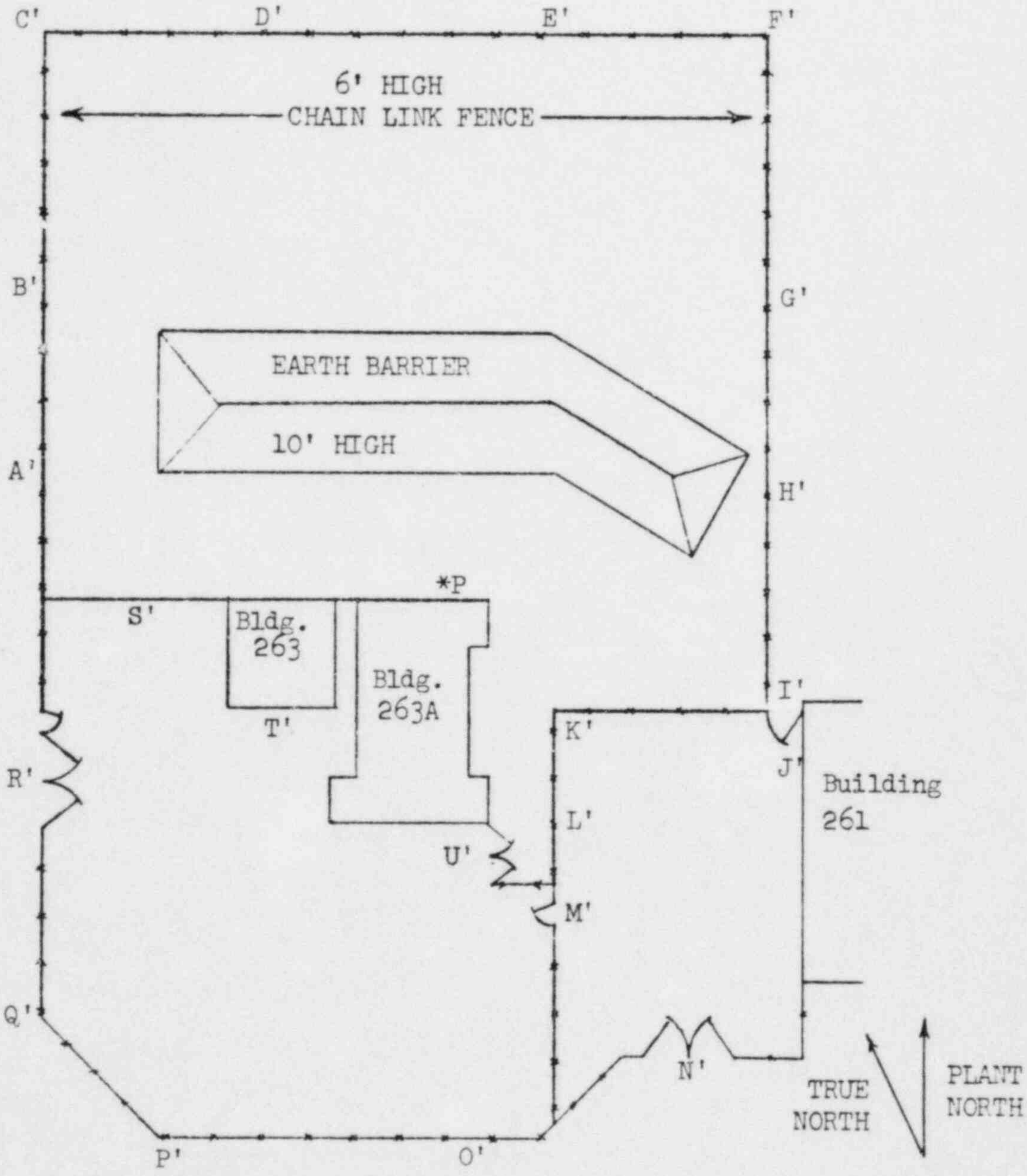
The highest reading obtained, 4,000 milliroentgens/hr., at point P (see Attachment I), is an area confined during High Range Calibration usage. The highest reading obtained, 6 milliroentgens/hr., outside the currently controlled area of the Building 263 Complex was at point K', (see Attachment I). This area would need to be controlled to prevent occupancy during operation of the High Range Calibration System.

Dennis J. Waggett
Health Physicist

PLOT PLAN

HEALTH PHYSICS LABORATORY FACILITIES

FIG. NO. 1

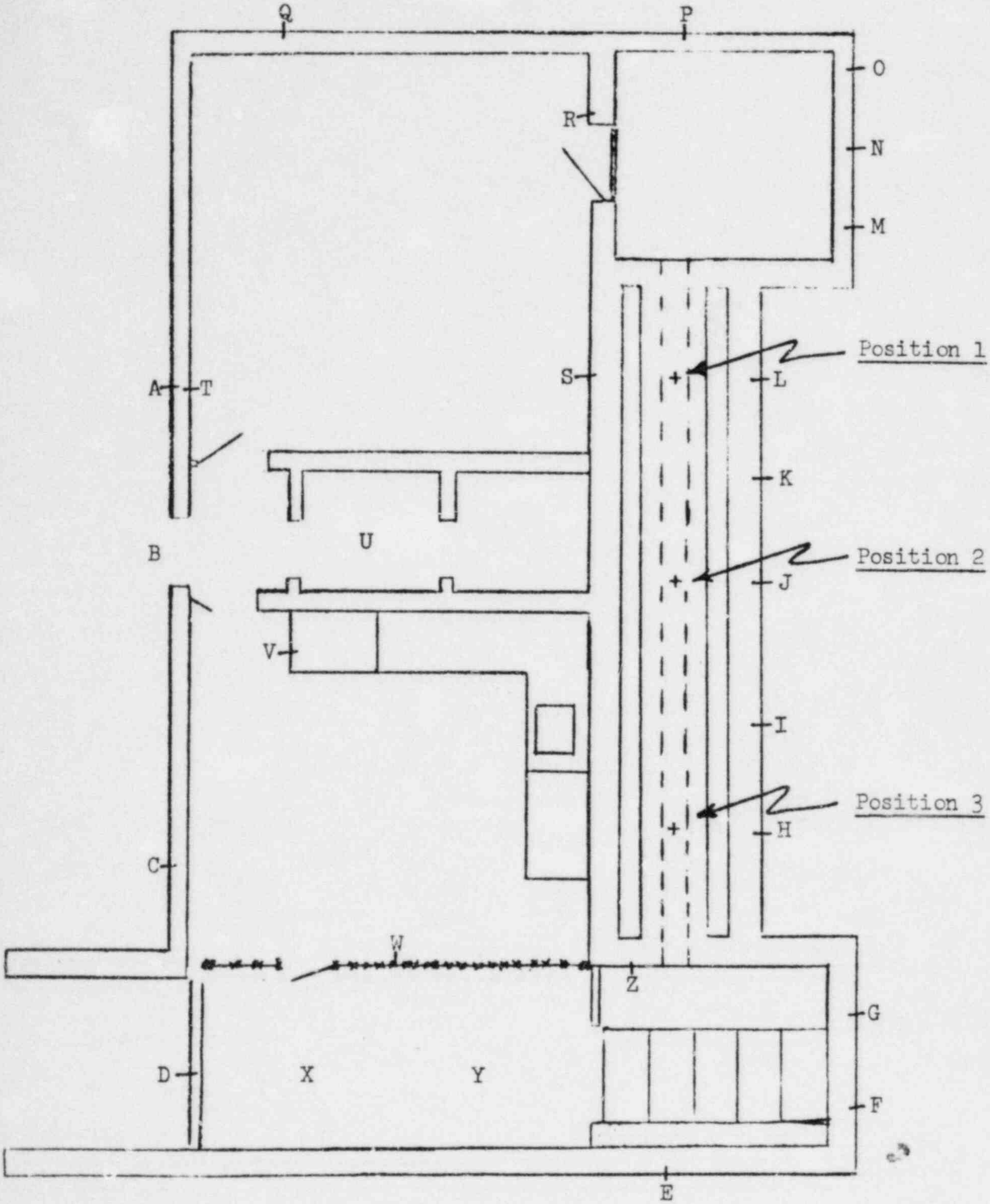


RADIATION SURVEY POINTS

*Highest Radiation Reading

SCALE 1" = 40'

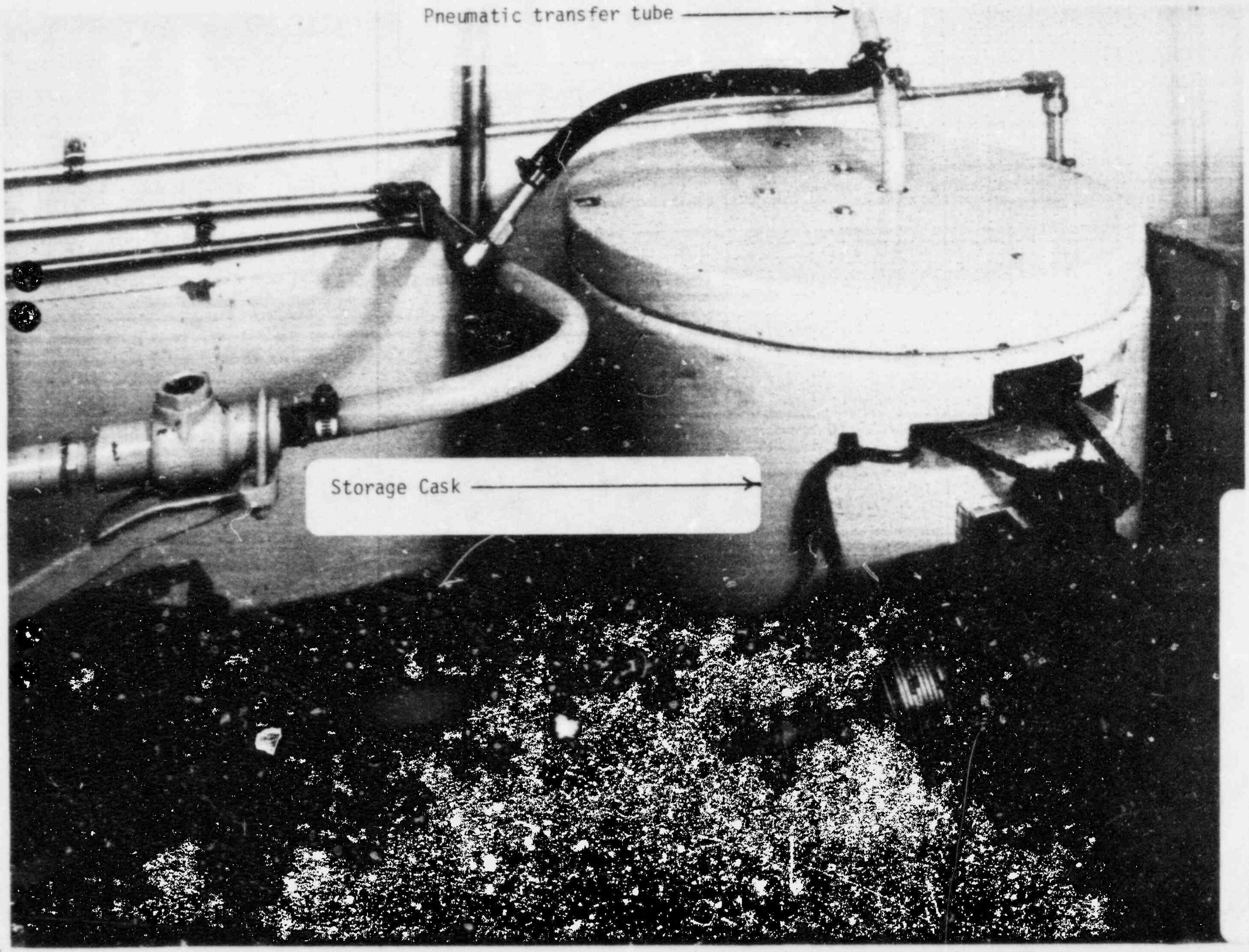
BUILDING 263



RADIATION SURVEY POINTS OF CONCERN

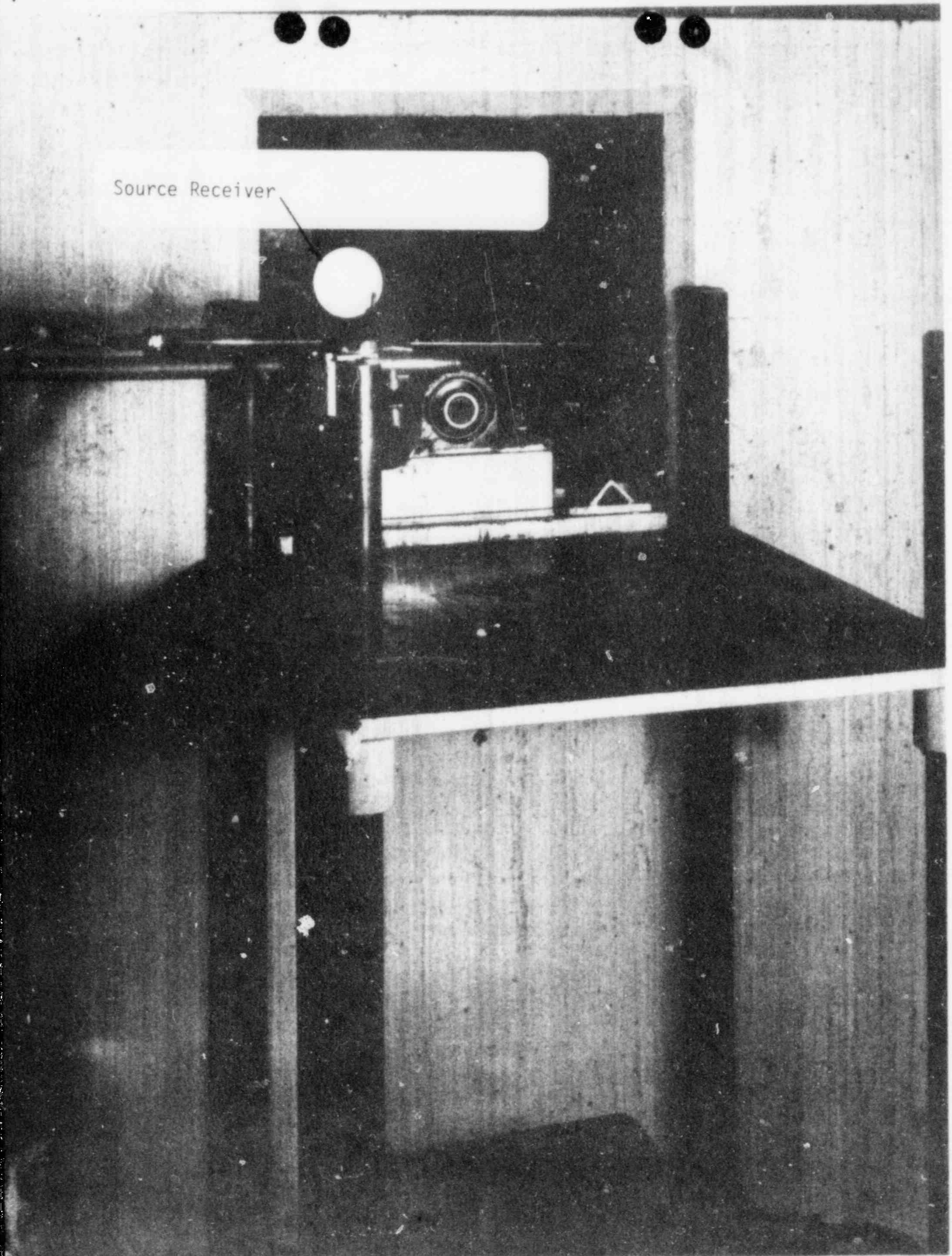
	600	1440	2280				
Area Location See Attachment II	Source Position 1 mR/hr	Source Position 2 mR/hr	Source Position 3 mR/hr	Area Location See Attachment I	Source Position 1 mR/hr	Source Position 2 mR/hr	Source Position 3 mR/hr
A	.1	<.1	<.1	A'	.3	.3	.3
B	.3	<.1	<.1	B'	.3	.3	.3
C	.2	<.1	<.1	C'	.1	.1	.1
D	.2	<.1	<.1	D'	.4	.4	.4
E	.5	.5	3.0	E'	.3	.3	.3
F	1.1	.3	.1	F'	.1	.1	.1
G	.5	.4	.3	G'	.3	.3	.1
H	1.0	.5	700	H'	.6	.2	.2
I	.7	.9	50	I'	1.0	.8	.4
J	1.3	725	.6	J'	.9	.7	.3
K	50.0	.6	.1	K'	5.2	6.0	5.0
L	900	.3	<.1	L'	.6	.7	2.0
M	0.0	.2	.1	M'	.6	.4	.3
N	0.1	.05	<.1	N'	.5	.2	.3
O	0.4	.05	<.1	O'	.2	.2	.2
P	4000	2000	1400	P'	.2	.2	.2
Q	.3	.1	<.1	Q'	.1	.1	.1
R	1.0	.2	.1	R'	.5	.5	.5
S	23.0	<.1	.1	S'	.1	.1	.1
T	.3	<.1	.1	T'	.1	.1	<.1
U	.9	.1	.1	U'	.1	.1	<.1
V	.2	.2	.5				
W	.9	.8	1.5				
X	1.0	.4	1.0				
Y	1.3	.7	4.0				
Z	6.2	10.0	20.0				
	12/8/77	3/15/78	3/15/78		12/8/77	3/15/78	3/15/78

NASA
S-70-49665

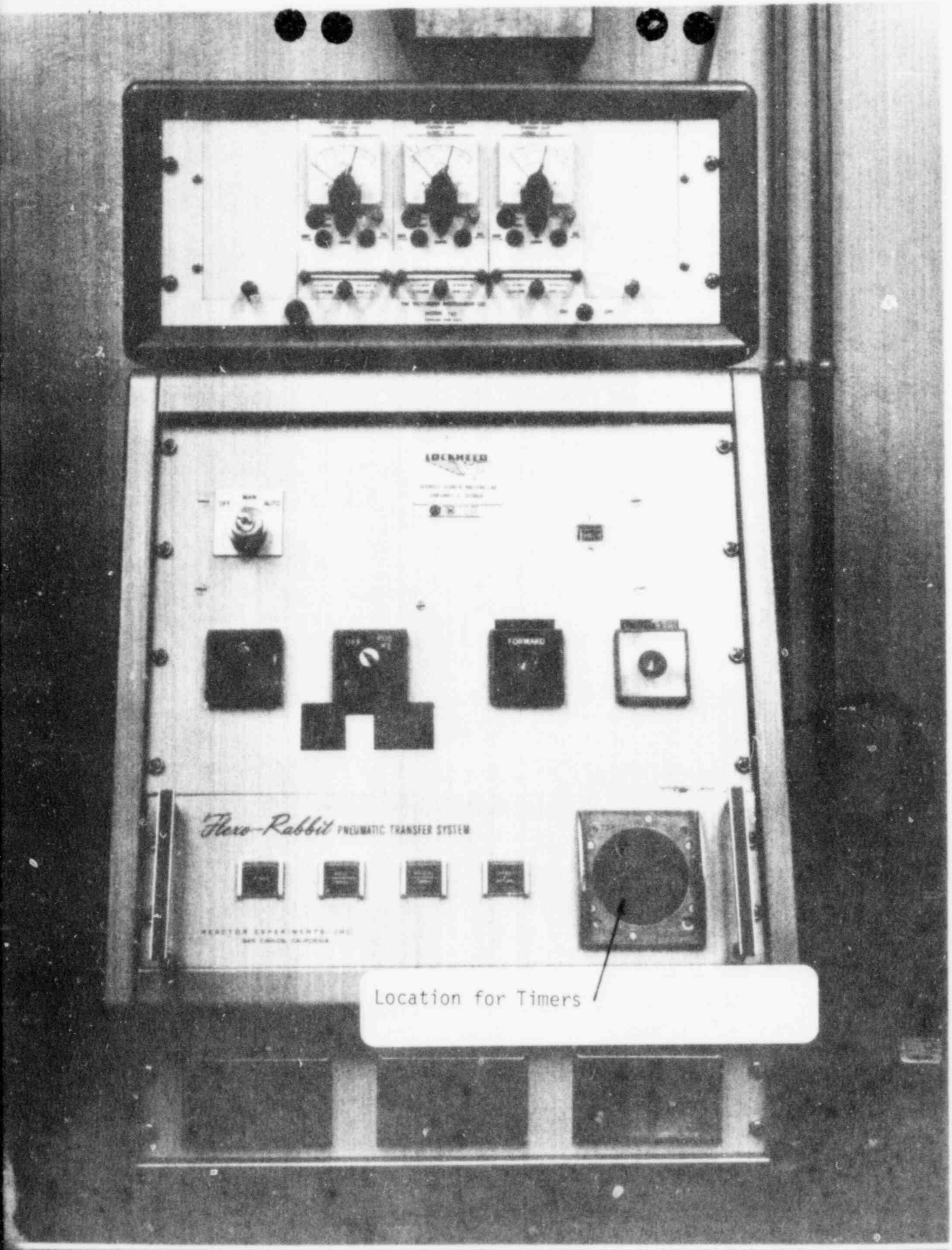


SUPPLEMENT 5
1978 Renewal Application
License No. 42-09388-02

NASA
S-70-49071



NASA
C-70-[illegible]



NASA
S-70-40078

Operator's Console

NW Corner, Bldg. 263A

Irradiator

SUPPLEMENT 6
1978 Renewal Application
License No. 42-09388-02

Previously submitted with letter dated March 2[illegible] 1978, requesting approval.

FAIL SAFE MODIFICATION TO THE
RADIATION CALIBRATION SYSTEM IN BLDG. 263A

In the Radiation Calibration System in building 263A, there are two possible safety hazards that must be eliminated. In the first, it is possible that the radiation source can be left in the exposed position if the electric power fails or the main power switch is turned off, which may allow personnel to be exposed to radiation. In the other case, the radiation source storage turret can accidentally be rotated to a different position while the source is in the test position, and therefore the source cannot be returned to storage.

The modifications proposed on drawing No. EQ263A-1, Sheets EQ-263A-10410-1 through -3 would correct these hazards as follows. In case of power failure or the main switch being turned off, relay K-3 will use the emergency battery power to temporarily open the solenoid valve and return the radiation source to its storage turret. Relay K-4 disconnects power from the turret drive motor whenever a radiation source is out of the storage turret so that the turret cannot be operated until the radiation source is returned to its stored position. A more detailed description of the operation follows.

The uninterruptible power supply is connected to the power line at all times in order to keep the batteries charged in case of power failure.

In normal operation, when the main switch, SW-1 is turned on, line voltage from the uninterruptible power supply activates relay K-3, closing contacts 9-5, 7-11, and 8-12 and opening contacts 10-2. The closing of contacts 9-5 activates the clutch coil, 1-2 and opens contacts 6-7 in the time switch.

The closing of relay K-3 contacts 7-11 and 8-12 allows the source return solenoid valve to operate in the normal way.

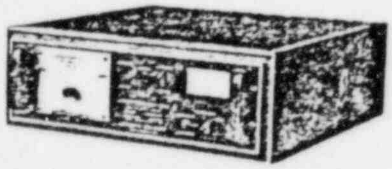
In case of power failure or switch SW-1 being turned off, relay K-3 is deactivated, opening contacts 9-5, 7-11, and 8-12, and closing contacts 10-2. The opening of relay K-3 contacts 7-11 and 8-12 disconnects the source return solenoid valve from the rest of the existing system.

The opening of contacts 9-5 deactivates the time switch clutch coil, closing time switch contacts 6-7, supplying emergency line voltage to the time switch motor. When relay K-3 contacts 10-2 close, emergency line voltage is supplied to the source return solenoid valve through time switch contacts 4-5. This opens the solenoid valve which releases nitrogen to drive the radiation source back to its storage turret. At the end of a predetermined time the time switch motor opens contacts 11-12 and 4-5, turning itself off and closing the solenoid valve.

When the source eject solenoid valve is operated to drive the radiation source to the test position, latching relay K-4L is activated, opening relay K-4 contacts 3-5. This prevents the storage turret from being operated while a radiation source is in the test position. When relay K-3 contacts 10-2 close, relay K-4R closes contacts 3-5 so that the turret drive motor can be operated if desired.

Behlman Engineering Corporation
P.O. BOX 4518 • 427 N. NOPAL STREET • SANTA BARBARA, CALIFORNIA 93103 • (805) 963-8691

UNINTERRUPTIBLE A.C. POWER SOURCES



The UPS-10/500 Series of uninterruptible A.C. power sources are available in the same basic sizes and power ratings as the Series 10/500 standard line of A.C. Power Supplies. Battery back-up power can be furnished by a variety of gelled or liquid electrolyte storage batteries. The lower powered units (100-350 VA) can be furnished with built-in gelled electrolyte batteries.

The photograph illustrates a Model UPS-25 with an output power capability of 250 VA and a self-contained battery pack for 15 minutes of standby operation.

All of the UPS units include a battery charger, electr mechanical or solid state bypass switch, appropriate indicatin lights and power line failure alarm provisions. The output fr quency of the UPS is phase locked to the input power lin frequency under conditions of normal operation. In the eve the A.C. power line fails, the UPS continues to furnish the loa with A.C. power by operating from the battery bank. The outp frequency of the UPS is then determined by the highly stab internal oscillator. During normal operation the load is su plied with power from the output of the UPS. Therefore, the is no switch overtime involved if input power is interrupted.

Battery banks can be furnished for relay rack mounting or the customer's specific requirements. Battery interconne cables are provided with all standard UPS configuration Please call or write for additional details.

OUTPUT POWER	MAXIMUM AMPERES (per phase)	MODEL NUMBER ELECTRO-MECH. BYPASS SW.	MODEL NUMBER SOLID STATE BYPASS SW.	WEIGHT (lbs.)	DIMENSIONS** (Not incl. Batteries)
SINGLE PHASE					
100 VA	1.2	UPS-10-C	UPS-10-C-SS	28	*5¼"H x 15"D x 19"W
250 VA	3.0	UPS-25-C	UPS-25-C-SS	41	*5¼"H x 15"D x 19"W
350 VA	4.2	UPS-35-C	UPS-35-C-SS	54	*5¼"H x 15"D x 19"W
500 VA	6.0	UPS-50-C	UPS-50-C-SS	65	5¼"H x 19"D x 19"W
750 VA	9.0	UPS-75-C	UPS-75-C-SS	70	5¼"H x 19"D x 19"W
1000 VA	12.0	UPS-100-C	UPS-100-C-SS	102	8¾"H x 19"D x 19"W
1500 VA	18.0	UPS-150-C	UPS-150-C-SS	129	14"H x 19"D x 19"W
2000 VA	24.0	UPS-200-C	UPS-200-C-SS	145	14"H x 19"D x 19"W
3000 VA	36.0	UPS-300-C	UPS-300-C-SS	194	21"H x 19"D x 19"W
5000 VA	60.0	UPS-500-C	UPS-500-C-SS	308	29¾"H x 19"D x 19"W
THREE PHASE Y					
300 VA	1.2	UPS3-10-C	UPS3-10-C-SS	45	5¼"H x 19"D x 19"W
750 VA	3.0	UPS3-25-C	UPS3-25-C-SS	77	7"H x 19"D x 19"W
1050 VA	4.2	UPS3-35-C	UPS3-35-C-SS	118	8¾"H x 19"D x 19"W
1500 VA	6.0	UPS3-50-C	UPS3-50-C-SS	159	14"H x 19"D x 19"W
2250 VA	9.0	UPS3-75-C	UPS3-75-C-SS	167	14"H x 19"D x 19"W
3000 VA	12.0	UPS3-100-C	UPS3-100-C-SS	215	21"H x 19"D x 19"W
4500 VA	18.0	UPS3-150-C	UPS3-150-C-SS	301	28"H x 19"D x 19"W
6000 VA	24.0	UPS3-200-C	UPS3-200-C-SS	349	28"H x 19"D x 19"W
9000 VA	36.0	UPS3-300-C	UPS3-300-C-SS	420	42"H x 19"D x 19"W
15000 VA	60.00	UPS3-500-C	UPS3-500-C-SS	725	70"H x 19"D x 19"W

*Available with self-contained gel-cels
**Add 3.5" for all -SS models

PROGRAMMABLE A.C. POWER SOURCES

The entire Series 10/500 A.C. Power Supplies are available with programmable plug-in oscillators. These units may be programmed for output voltage level, frequency or phase angle/s. Any or all of the above functions may be incorporated into a single plug-in oscillator.

All of the generally accepted methods of programming can be used with these units. This includes resistance and voltage programming as well as digital programming with either binary or BCD format from computers, micro-processors, keyboards, punched tape or key punched cards.

Manual local control over voltage, frequency or phase angle can be provided on the front panel of the plug-in oscillator in the form of multi-turn potentiometers. Selection of either local or automatic remote control is an optional feature. A digi readout display mounted on the main front panel of the A. Power Supply can be provided to display the functions ou lined above. The selection of the desired function to be d played (Voltage, Frequency or Phase Angle) may be made either local manual control or remote control.

These programmable A.C. Power Supplies can greatly si plify the design of automatic checkout systems, simulation A.C. power line anomalies, environmental testing, automa production testing, etc.

Please call or write for more details. Your inquiries w receive prompt attention.

THE A.C. POWER SUPPLY PROBLEM SOLVERS

DO YOU HAVE A SPECIAL AC PROBLEM?

- Behlman Engineering versatility can solve it.
- A great variety of options provide solutions to many special requirements.
- Completely special or custom units or systems can be provided.