PRNC - 72

PUERTO RICO NUCLEAR CENTER

Procedures for Operating CO^{60} Gamma Pool Irradiation Facility

Mayaguez

OPERATED BY UNIVERSITY OF PUERTO RICO UNDER CONTRACT
NO. AT (40-1)-1833 FOR U. S. ATOMIC ENERGY COMMISSION

AUTHORIZATION

PRNC-72 Procedures for Operating Cobalt-60 Gamma Pool Irradiation Facility in Mayaguez is hereby approved and made operative as of July 1, 1968.

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Director

OPERATING PROCEDURES

COBALT 60

GAMMA POOL IRRADIATION FACILITY

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PROCEDURES FOR OPERATING Co^{60} GAMMA POOL IRRADIATION FACILITY

I. RESPONSIBILITY

The Reactor Division is directly responsible for the safe operation and maintenance of the Gamma Pool Irradiation Facility. The reactor supervisor will appoint the assistant supervisor(s).

II. DESCRIPTION OF SOURCE

(A) ROOM (Figure 1)

The PRNC cobalt-60 Gamma Pool Irradiation Facility (GPIF) is housed in room 121A in the PRNC laboratory building in Mayaguez. This room has a double door to the rear corridor and one single door to laboratory room 103. The door to room 103 is secured with a breakable seal at all times. The room has a cabinet for storing accessory equipment and survey meters. It also has work tables and a water circulating system for the pool. Oxygen, nitrogen, and compressed air will be provided according to the needs of an experiment.

(B) POOL (Figure 2)

A pool 9' x 8' x 14'6" deep, located in room 121, contains the Co^{60} using water as a shield. A dry well is adjacent to one end of the pool with an aluminum plate separating the two sides. Covers provide suitable scattered radiation protection on top of the dry well.

A well with a lead cover is located at the bottom of the pool.

A portable steel bridge across the top of the pool serves as the base for the operator conducting irradiations.

A platform 4' x 8' is located ten feet below the water in the pool. This platform has twelve cylindrical containers to hold the capsules. It also holds the hollow cylinder Variable Geometry Irradiator.

A radiation monitor with audio alarm is preset at 20 mr per hour. The probe is attached to the underside of the bridge above the platform area where the irradiations are conducted.

(C) HOLLOW CYLINDER VARIABLE GEOMETRY IRRADIATOR

The Co^{60} is contained in twelve pencil type capsules, each containing approximately 200 curies. The capsules are inserted in the Hollow Cylinder Variable Geometry Irradiator (VGI) (Figure 3). The VGI is remotely and continuously adjustable to form a hollow cylinder from 5 inches to 19 1/2 inches in diameter. A symmetrical field is obtained by using 3, 6 or 12 capsules.

(D) SAMPLE HOLDERS

Samples to be irradiated may be placed in suitable containers which can be lowered by means of a nylon line, wire or rod. This line, wire or rod will be provided with a stop so that when the sample is being removed it will reach a corresponding catch provided on the bridge.

Container caps may be fitted with connections so as to provide the desired atmosphere.

III. AUTHORIZED PERSONNEL AND RESPONSIBILITIES

(A) SUPERVISOR:

1. The supervisor is responsible for

   a. the facility

   b. training assistant supervisors

c. keys for GPIF

d. changing geometry of variable geometry irradiator

e. seeing that procedures are fully complied with

f. scheduling use of GPIF

g. recommending to Health Physics the personnel to be assistant supervisors

(B) ASSISTANT SUPERVISOR:

1. The assistant supervisor is responsible for items c, d, e, and f under supervisor.

(C) PERSONNEL USING FACILITY:

1. Personnel using the facility are responsible for

a. filing form 663 with Health Physics

b. making appointment to use facility

c. providing materials placed in pool do not contaminate facility

d. placing and removing materials to be irradiated

IV. SOURCE LOADING AND UNLOADING PROCEDURE

(A) STORAGE CONDITIONS

At times it may be necessary to unload the variable geometry irradiator for maintenance of the irradiator mechanism, to attach or remove auxiliary equipment on or around the irradiator, or to drain and clean the pool.

The capsules will be stored in individual cylinders in the underwater platform when it becomes necessary to remove the irradiator mechanism, or they will be stored in the lead shield provided in the bottom of the pool when drainage of water is necessary. Normally, the

the capsules will be kept in position in the irradiator.

The grapplers and irradiator geometry adjusting tool will be kept locked in their special holders.

(B) LOADING AND UNLOADING SOURCE

There will always be two persons from the Reactor Division involved in loading and unloading the VGI; one supervisor or assistant supervisor and a regular operator. The supervisor in chage is responsible for seeing that the following steps are carried out.

1. Lock entrance door.
2. Unlock grapplers and secure portable survey meter.
3. Supervisor check and assure proper function of radiation monitor and alarm, using low level gamma source. Check survey meter.
4. Make an inventory of capsules (a portion may be in the irradiator and the remainder must be in their individual storage cylinders).
5. The reactor operator aiding in the unloading and loading operation will remain on one side of the pool with a portable survey meter to check for radiation during the rest of the procedure.
6. Using grappler, remove Co^{60} capsules one by one from VGI and place in storage cylinders.
7. Have the aid check and confirm the fact that the VGI is unloaded.
8. Remove VGI from pool and perform the necessary work on it.
9. Return VGI to underwater platform.
10. Using grappler, replace Co^{60} capsules in VGI one by one.

(C) CHANGING VGI GEOMETRY

VGI geometry may be changed only by the supervisor or assistant supervisor using the following procedure:

1. Unlock geometry adjusting tool.
2. Insert tool in rotating gear and turn until desired radius is indicated by position indicator.
3. Remove and lock tool in its holder.

V. TYPICAL IRRADIATION PROCEDURE

The supervisor or assistant supervisor in charge will be responsible for the irradiation operation. The person (or his designated representative) requesting the use of the facility will insert the samples into the irradiator and remove them from the irradiator.

The following precautions will be observed by the supervisor or assistant supervisor in charge:

1. Supervisor check and assure proper function of radiation monitor and alarm, using low level gamma source. Check survey meter.
2. Make sure that samples to be irradiated are properly packed, tied or sealed so that pool water is not contaminated.
3. If gas under pressure is to be used in a container make sure all connections are tight and proper pressure is maintained.
4. Make sure that the stop on the lowering line, wire or rod is properly latched under the catch on the bridge.
5. Observe insertion of sample into irradiator to insure that capsules and irradiator mechanisms are not damaged or that setting is not altered.
6. After irradiation is completed, observe removal of sample while at the same time monitoring with survey meter.

7. While the sample is kept under five feet of water after catching on the stop, visually check irradiator and sample to insure that all capsules are in proper place.

8. Record irradiation in log book.

VI. SAFETY PROVISIONS IN CASE OF UTILITIES FAILURE OR MALFUNCTION

(a) WATER LOSS

Water may be lost from the pool in three ways: (1) evaporation (2) pumping (3) earthquake cracking the walls. Evaporation lose will be compensated by the water supply line with a float valve that opens when the water level drops one inch. All permanent connections to and from the pump are not more than one foot below the normal level of the water; therefore, it is impossible to drain the pool below that level.

Only in the event that the pool is to be deliberately drained will a temporary connection be used so that water may be completely pumped out. This connection is to be removed after refilling pool.

If an earthquake of sufficient magnitude to crack the reinforced concrete walls should occur, resulting in a loss of water, the area would be vacated. Health Physics would be notified and necessary remedial action taken. As an example, the source might be covered with sand or dirt to provide temporary shielding. Specific remedies will depend on circumstances.

(B) POWER FAILURE

The operation of the GPIF is entirely manual with the exception of the alarm systems and lights. A battery-operated portable light is available. In the event of electrical failure, all experiments will be stopped and the GPIF put in stand-by (storage) condition following the previously outlined procedure.

(C) CAPSULE INCIDENT

There are various events in which a capsule incident is conceivable.

1. Drop

If a capsule is dropped it would always fall to the bottom of the pool or to the platform or other object above the bottom. Whenever a drop occurs, the capsule will not present a radiation hazard. The capsule is to be picked up with the grappler and returned to its place.

2. Jamming in VGI

The capsules are not forced into place so any jamming should be of a minor degree, although if this incident occurs, a Health Physicist will be called before proceeding further.

The VGI is made of aluminum and a capsule could become wedged in it. If this does occur, all other capsules will be removed from the VGI. The capsule will be pulled up with the VGI held in place until it becomes loose. A sudden release of the capsule cannot produce radiation hazard because it can be lifted over four feet before abnormal radiation levels can be detected at the surface.

3. Accidental Catching With Experiment

One or more capsules may accidentally hook or otherwise catch on a sample container and be pulled out of the VGI while the sample is being removed. The nylon line, wire or rod used to lower and raise samples into and from the irradiator will be provided with a stop. Prior to an irradiation the nylon line, wire or rod will be engaged in the catch on the bridge so that when the sample is removed from the irradiator it will remain under at least five feet of water.

At this time the supervisor in charge will inspect both irradiator and samples. If a capsule has been accidentally raised, it will be dislodged from the sample and lowered to its proper position.

4. In case of malfunction the Health Physics Division should be notified.

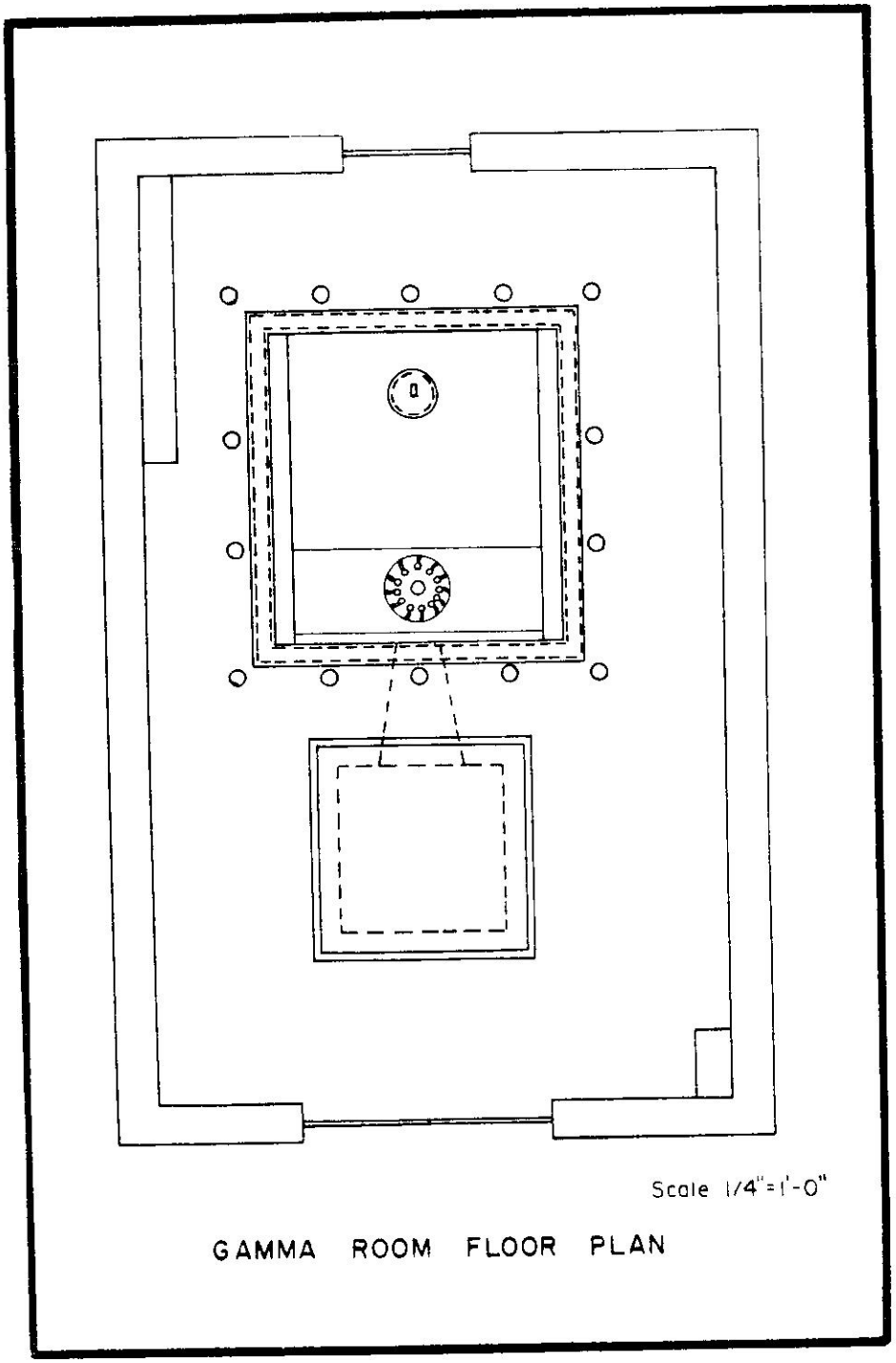
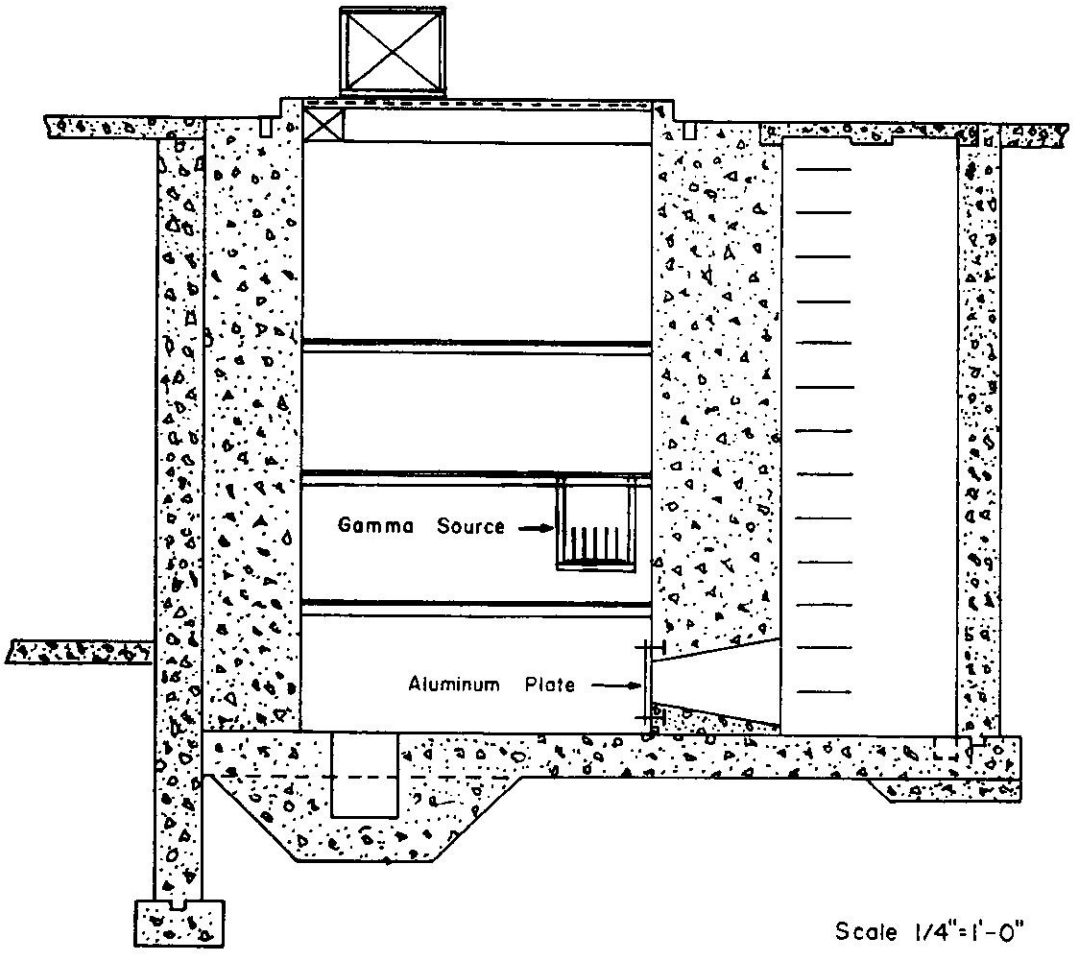


Figure 1



GAMMA POOL CROSS SECTION

Figure 2

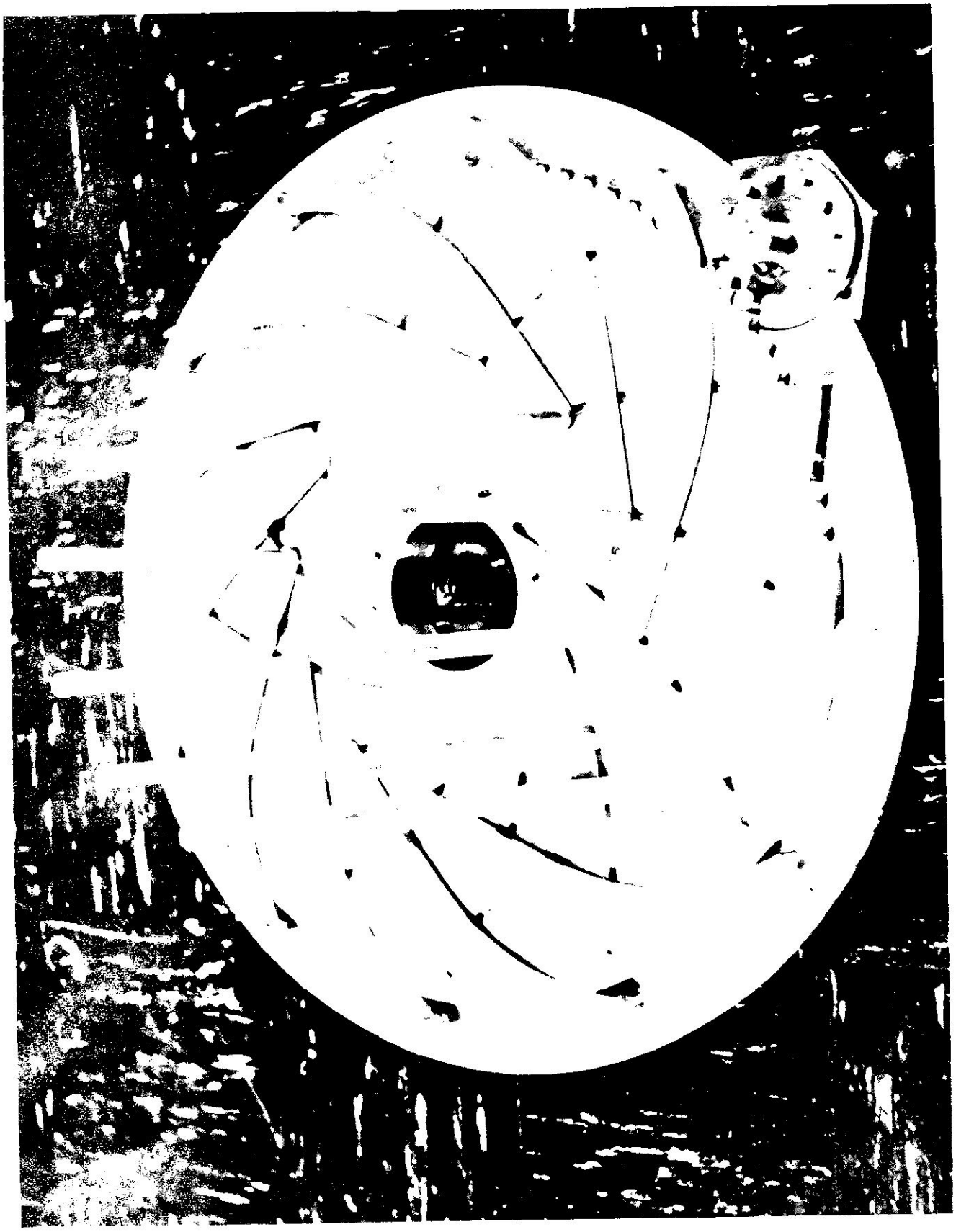


Figure 3