



DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR LOGISTICS
WASHINGTON, D.C. 20310

24 JAN 1974

DALO-MAB-I

US Atomic Energy Commission
ATTN: Mr. Frank C. Davis
Directorate of Licensing
Materials Branch
Washington, DC 20545

Dear Mr. Davis:

Reference your letter of 19 October 1973 asking for additional information regarding an application for renewal of Byproduct Material License No. 29-01022-07 issued to the US Army Electronics Command, Fort Monmouth, New Jersey.

Attached is the additional information requested.

Sincerely yours,

R. H. RATCLIFF
LTC, GS
Acting Chief, Program and Budget Division

1 Incl
as (2 cys)

COPIES SENT TO
REGULATORY OPERATIONS

FF/B

Information in this record was deleted
in accordance with the Freedom of Information
Act, exemptions 2
FOIA- 2006-0238

OPERATING PROCEDURES FOR THE UNDERGROUND VAULT
COBALT-60 IRRADIATION FACILITY

LOCATION: Bldg. 401, Evans Area of Fort Monmouth

ORGANIZATION: Nuclear Hardening Research Group; Electronics Materials and Nuclear Hardening Research Area; Electronic Technology & Devices Laboratory; Directorate of Research, Development & Engineering; US Army Electronics Command.

1. References

- a. License application for renewal and amendment of AEC License No. 29-01022-07.
- b. ECOMR 385-9.

NOTE: Copies of the above references are available in the Console Room in the Office of the Supervisor of Radiation Facilities (Bldg. 401, X61683) and the Radiological Protection Officer (Room 13, Bldg. 55, X61292).

2. Description of Facility: see Supplement E of Reference 1a.

3. Purpose: The purpose of these procedures is to:

- a. Provide guidance to individuals who may have occasion to enter the area.
- b. Serve as a check list or reminder to approved operations.
- c. Serve as a training aid for individuals studying to become approved operators of the facility.
- d. Minimize the exposure of personnel to radiation and radioactive material.
- e. Minimize the release of radioactive material if the sealed source should rupture.

4. Applicability: These procedures apply to:

- a. Visitors.
- b. Custodial Personnel.
- c. Maintenance Personnel.
- d. Individuals who position material to be irradiated.
- e. Facility Operators.
- f. Operator Trainees.
- g. Emergency Personnel (Firemen, Guards, Rescue Squad, etc...)
- h. Inspectors.
- i. Any other individuals who may have occasion to enter the areas involved.

5. Responsibility:

- a. The leader of the Nuclear Hardening Research Group or his designated representative is responsible for enforcement of these procedures.
- b. The Supervisor of Radiation Facilities or his designated representative have the responsibility of insuring that individuals do not enter the exposure room without an approved operator being present to directly supervise the entrance.

Incl 1

W J Jan 24, 1974

c. Approved operators and individuals authorized to directly supervise the work of individuals undergoing operator training shall insure that the items listed in these Operating Procedures are carried out and that every individual entering the area involved are appraised of the potential hazards.

d. Individuals entering the areas involved have the responsibility of following the instructions given by the approved operator in charge at the time they are in the areas.

6. Personnel Limits:

a. Control Room.

(1) Up to 10 individuals may be in the Control Room when the source is in its storage position.

(2) Up to 6 individuals may be in the Control Room when the source is in its UP (expose) position. An approved operator must be present when anyone is in the Control Room and the source is in its UP (expose) position.

7. Radioactive Material Limits: The amount of ~~CO~~BALT-60 in the Exposure Room at any one time shall not exceed []

8. Radiation Limits:

a. Console Room. The shielding material between the Exposure Room and the Console Room shall be maintained in such a manner that the exposure rate in the Console Room does not exceed 5 mR/hour at locations near the Exposure Room door and the surfaces of other shielding between the two rooms. The average exposure rate in the room shall not exceed 2 mR/hour.

b. Exposure Room. (Source and shield plug down).

(1) The exposure rate over the source, 30 inches above the platform, shall not exceed 250 mR/hour.

(2) The exposure rate 30 inches above the platform and 40 inches from a perpendicular line that passes through the source shall not exceed 1 mR/hour.

9. Exposure Limits: The exposure rates and the length of time spent in the Underground Vault Area shall be controlled so that the exposure limits given in ECOMR 385-9 are not exceeded. NOTE: A copy of ECOMR 385-9 is available for use in the Console Room and in the Office of the Supervisor of Radiation Facilities (Bldg. 401, X61683) and the Radiological Protection Officer (Rm 13, Bldg. 55, X61292).

10. Dosimetry Requirements:

a. Radiation workers shall wear their film badges while in the Underground Vault area.

b. Each individual who performs work in the Exposure Room shall wear a film badge and a pocket dosimeter (0-200 mR) while in the room. At least one of each two individuals working in the room shall wear a "chirpee" type of instrument. The two individuals shall stay together if only one of them is wearing a "chirpee".

E 2 2

c. At least one out of each group of four or less of visitors in the Exposure Room at one time shall wear a personnel dosimeter. The members of such a group shall stay close to each other so that any exposure indicated by the dosimeter will be representative of each member of the group.

d. The Supervisor of Radiation Facilities, the Radiation Protection Officer or one of their designated representatives, or the approved operator in charge of the facility at the time may require the use of additional personnel dosimeters and/or radiation detectors.

11. General Safety Precautions:

a. Individuals wishing to visit the Underground Vault Area, to have material irradiated, or to enter the area for some other reason (other than for emergency reasons) should schedule the visit so that advance preparations can be made. Contact the Supervisor of Radiation Facilities or his assistant (X61683) to make reservations.

b. Individuals shall sign in and be issued personnel dosimeters, radiation detection and measuring devices before entering the restricted portion of Bldg 401. These steps are carried out in the Bldg 401 office nearest the entrance to the building.

c. All individuals going to the Console Room shall be accompanied by an approved operator or his designated representative.

d. Only approved operators or their designated representatives will sign for the key to the Underground Area.

e. Only an approved operator may obtain the key for the switch lock that operates the solenoid air valves that control the positioning of the source by air flow.

f. An approved operator and at least one other individual shall be in the Underground Vault Area while the door to the Exposure Room is open.

12. Source Storage:

a. The source will be kept in its storage container with the lead plug over the source if:

- (1) The source is not in use.
- (2) Individuals are in the Exposure Room.
- (3) A leak test of the source indicates the source is leaking.
- (4) Radioactive contamination is found in the Exposure Room.

b. The steps to follow in order to put the source in its storage position are listed in Item 14e below.

13. Emergencies:

a. No air pressure.

(1) If source capsule is in the lead storage container it cannot be raised to exposure position until air pressure is supplied. A small emergency air compressor can be put into service by opening necessary valves.

(2) Source capsule in exposure position. The source can be returned to the lead storage container by pulling the handle on the Bowden cable in the Control Room which in turn opens the latch holding the lead storage plug. Then by using the mechanical arm, attached to the plug, the plug can be lowered. The lowering of the plug pushes the source capsule into the lead storage container.

b. Electrical Power failure.

(1) The source capsule automatically returns to the lead storage containers with any interruption of the electrical circuits.

(2) The emergency power generator automatically energizes if electrical power remains off for more than ten seconds. This emergency generator supplies electrical power to all components and supplies light to operate on during an emergency.

c. If the meter that indicates exposure rate at the source exhaust air vent reads above 3 mR/hour or if there are other indications the source is leaking:

(1) Cut off the air supply valve to the source controls. This hand valve is located on the wall to the right of the console.

(2) Shut off the Console Room exhaust fan. The switch for this fan is located on the wall beside the electrical panel.

(3) Leave the Underground Vault Area. Close the door at the top of the stairs as you leave. Remove your shoes as you leave the area (they may be contaminated).

(4) Proceed to the Large Work Area of the building. If anyone is in the work area ask them to contact the Supervisor of Radiation Facilities or the Radiological Protection Office (X61292) and ask for assistance. If no one is in the area try to contact the Radiological Protection Office yourself. Two phones are in the large Work Area.

(5) Proceed to the nearest restroom, wash exposed portions of the body and remove outer garments. Remain in or near the restroom until you have been checked for contamination.

14. Sequence of Operations.

a. Pre-Entry Requirements.

(1) Obtain advanced approval of the Supervisor of Radiation Facilities or his designated representative.

(2) Register in office for film badge (if not permanently assigned) and personnel monitoring equipment (dosimeter, chirpee).

(3) Accompany approved operator (who has signed out for the Underground Vault Keys) to locked entrance of Vault Console Room.

b. Entry into Console Room. Upon entering the Console Room operator will:

(1) Activate equipment by turning on main electrical switch on wall panel.

(2) Open valve supplying air pressure to source controls.

(3) Open valve at bottom of filter to remove all water from air lines.

(4) Check readings of monitors for the console room and the one for the source exhaust air.

(a) If the Console Room Area monitor indicates that the exposure rate is over 2 mR/hour, notify the Supervisor of Radiation Facilities or the RD&E Radiological Protection Office (X61292).

(b) If the exhaust air monitor reads over 3 mR/hour follow the instructions in Item 13c, "EMERGENCIES", above.

c. Entry into the Exposure Room.

(1) Make sure all entrants have required dosimeters and radiation instruments.

(2) Check, and make sure source storage plug is down, in storage position.

(3) The operator will place the source control switch key in his pocket and keep it there.

(4) The first individual to enter the Exposure Room must take survey meter readings before and during entrance.

(5) Check survey meter at end of maze to insure that the source is in its safe position.

(6) When setting up equipment for exposures do not lean over source rise tube.

d. Raising the Source.

(1) Make sure all equipment is secure and in correct position.

(2) Remove all excess cables and wires.

(3) Leave Exposure Room making sure to bring survey meter out.

(4) The operator in charge will check the Exposure Room to insure that everyone is out of the room before proceeding to (5) below.

(5) Close lead clad maze door to maze and the exposure room making sure interlock closes and green light shows on console.

(6) Check the level of solution in the zinc bromide window. Green light on console should be ON.

(7) Check air pressure gauges for UP and DOWN controls. The pressure on the UP gauge should be between 8 and 13 psi while the pressure on the DOWN gauge should be between 13 and 25 psi. If the air pressure is beyond the ranges given, contact the Supervisor of Radiation Facilities before proceeding.

(8) Using mechanical arm raise lead storage plug and lock in UP position by pushing the bowden cable handle.

(9) Insert the key in source control switch. Turn the key clockwise. This will activate air control and blow source to exposure position where it will be held by spring loaded pins. Red light on console will light as well as red lights in upper hallway and outside on building and earth mound, as long as source is in the UP position.

(10) If overnight or weekend exposures are required notify the fire department on X61432, also the security guards X61670.

e. Lowering the Source.

(1) Insert key in source control switch and turn it counter-clockwise. This forces air above capsule blowing it down into storage container. All remote monitors should return to zero, red lights will go out and green light will appear on console.

(2) Lower lead shield covering window if it is in its UP position.

(3) Open lead shield door leading to exposure room.

(4) Turn on exhaust fan to remove ozone air due to exposure.

(5) Take survey meter and enter exposure room to remove equipment or make changes for further exposures.

f. Leaving Underground Vault.

- (1) Make sure all excess equipment, cables, etc. are removed from exposure room.
- (2) Make sure you have the keys to both the source switch and the door of the vault before leaving.
- (3) Turn off air pressure valve to source controls.
- (4) Turn off all radiation monitors.
- (5) Turn off air vent blower.
- (6) Pull main electrical switch.
- (7) Make sure door to entrance of Underground Vault is locked.
- (8) Turn in all personnel monitors and sign out in office. (Bldg 401)

15. Periodic Inspection and Maintenance Procedures

There are four interlocks that keep the source from raising.

a. The lead door to the exposure room is controlled by a micro-switch. If the door light on the control panel is red, the source will not go up. If the source is up and the door is opened the action of the interlock will cause the source to be blown down into the storage container.

b. Zinc bromide level. There is a micro-switch on a float to check the level of the zinc bromide filled window. If the indication light is red the source will not go up. If the window liquid should leak out into the exposure room and not be apparent in the control room, a drop in the level of the zinc bromide liquid will cause the float to activate the micro-switch. If the source was in the exposure position it would activate the air valve, blowing the source back into the storage container making it safe to enter the control room.

c. Radiation monitors. There is a toggle switch on the control panel that turns the Victoreen area monitors off in case they need to be worked on. If this switch is in the off position the source cannot be raised. The control room monitor is set at 3 mr/hr, and the exhaust air monitor is set at 3 mr/hr. When the control power is turned on, the needles go up to these settings and the warning bell comes on. Each meter has to be reset to release the warning bell interlock.

d. The sonic alarm system must be in the on position or the source will not raise. When the system is first activated the warning bell will ring until the system reaches equilibrium.

e. All of the interlocks work with air-electric valves. When the source is not in use, the air shut off valve is turned clockwise to the closed position. The air shut off valve must be turned counter clockwise to the open position before the source can be raised. The source capsule cannot be raised to exposure position if there is no air pressure.

f. The following checks will be made every six months (March & Sept):

(1) Turn on main power to control panel and console containing monitoring system by closing knife switch located on electrical panel at the foot of the stairs.

(2) Check all lights on console and control panel. The following lights should be on.

(a) Control panel

Source switch (key) green

Sonic alarm - green

Door to exposure room - red (open) green (closed)

Window - green

Monitors - green

(b) Console

Alarm: Red light will show and alarm will ring until system equalizes. Green light will show, alarm will shut off.

Remote monitors: All meters should be lighted. All monitors should be to zero with red lights out. If red light shows on monitor - reset button must be pushed and held until light stays out. It takes time for monitors to reach equilibrium if the system has been off.

(3) Check interlock on lead door leading to exposure room. When door is closed red light on control panel should go out and green light should show.

(4) Check float level of bromide window, green light should go out and red light activate when float is pushed lower in the solution.

(5) Check operation of lead shield cover for bromide window by throwing switch located on the control panel up or down, to raise or lower. Check limit stop switches by running until window stops automatically at both up and down positions.

(6) Check source safety plug operation by raising plug with mechanical arm attached to it. Check operation of bowden cable holding device, locking plug in up position by pushing in on bowden cable control located above bromide window. Check release of safety plug by pulling handle of bowden cable. This should unlock plug and allow it to return to the down position.

(7) Check remote monitoring meters on console. If power transit has produced high reading(s) push reset button(s).

(8) Check sonic alarm lights and meter. Green light should be on and meter should be in center position. Warmup period will be required to stabilize if system has been idle for a period of time.

(9) Turn on air valve, located on rear wall. This supplies air to the source operating system. Observe air gauges for up and down pressures. Up pressure should be between 12-14 lbs and down pressure approximately 18 lbs. Adjust if necessary.

(10) Check source operations as follows:

(a) Close lead door leading into source room, green light should show.

(b) Check window float level, green light should show.

(c) Check source key switch, green light should show.

(d) Raise lead safety plug using mechanical arm and lock in up position with bowden cable control.

(e) Using source control key, turn switch clockwise, this activates air control valves and raises source capsule to exposure position. Red light on source control switch should activate, green light should go out. Remote area monitor in source room and in maze should show indications of radiation. Red lights in upper-hallway, outside wall of vault and on mound should light.

(f) Source should remain in exposure position when key is returned to center position.

(11) Check source safety operations as follows:

Source in exposure position.

(a) Turn switch key to counter-clockwise position, source should return to storage container and green light should come on.

(b) Open lead door leading to exposure room, source should immediately drop into storage container; red door light on control panel should show.

(c) Push up on back of float level for bromide window forcing float lower in solution, source should automatically drop to storage containers, float level red light should come on.

(d) Check sonic alarm by creating an excessive noise or whistle. This should cause the source capsule to drop into the lead storage container and activate an alarm bell in the hallway above the entrance way. This can be reset on manual by using the reset switch on the console if on automatic, it will reset itself.

(e) Check loss of power by opening knife switch on electrical panel controlling console power. With power off or interrupted, source should automatically return to its lead storage container, green source-light should activate.

(12) Emergency generator check.

Located in a shelter just outside Building 401. Unit consists of a standard Army power unit PU 26-A/U with engine starting controls and an automatic transfer switch. This unit has the capability of automatically starting if any of the three phases are out and shuts off automatically when normal service is restored. This unit supplies emergency power to the control panel and the console of the underground vault so that the source can be put into operation if necessary. A stand-by compressor to supply air pressure is also housed in the shelter to supply emergency air pressure if needed.

(13). To check for operation.

Just inside the door on the wall is a circuit break box. The three main circuit breakers are tied together on the box so that normal service can be cut off. To check put these circuit breakers in the off position. This will activate the automatic engine starting control and will crank the engine. If the engine does not start in 10 seconds there will be a pause of 10 seconds before it tries to start again. This cycle is repeated for 3 times. After the engine starts the automatic transfer switch throws the load on the generator, activating the control panel and console in the underground vault. An emergency light is also connected to this circuit to give light in the vault.

Throwing the circuit breaker back to the on position causes the transfer switch to put the load on normal service and the engine shuts off automatically.

(14) Calibration and Check of Remote Monitoring System

This system provides separate readout, in the control room, of the dose rate at each of the five remote sensing units. The units have logarithmic meter readout covering three decades. Three of the units have 1 to 1000 mR/hr ranges. The fourth unit covers 100 to 100,000 mR/hr and the fifth 0.1-100 R/hr. Radiation levels in excess of pre-set alarm conditions are indicated by a red alarm light for each unit. The system operates on 115V, 60 cycle supply.

The following detailed procedure may be followed to re-calibrate any suitable combination of remote radiation sensing unit and plug-in station unit:

(a) Turn on the remote area monitoring system and allow it to warm up for 10 minutes. Remove the small cover plate on the front of the plug-in station unit, thus exposing the three screw-driver adjust potentiometers: Track, Span and FIL current adjust as well as the filament current measuring jack.

(b) Measure the filament current by plugging into the filament current measuring jack (J-201) a 0.25 V millivoltmeter. Adjust the FIL current adjust potentiometer until the meter reads 0.24V. A model 630 Simpson multimeter switched to the 100 micro-ampere DC range can conveniently be used as a 0.25V millivoltmeter. The proper plug for J-201 is a Switchcraft No. 450 (JAN PJ-038 or VE 39) plug. Changing the filament current shifts the static level of electrometer tube plate current without appreciably changing the change in plate current per decade change in signal or ion current. Moving the FIL adjust potentiometer, therefore, has the same affect as moving the RANGE potentiometer, without affecting the proper setting of the SPAN potentiometer. Measurement of the filament current is desirable primarily to establish that the resistor string, of which the filament is a part, has the proper current and that the zener diode is operating properly.

(c) Irradiate the remote radiation sensing unit connected to the plug-in station unit in question with a gamma radiation field of the intensity indicated on the left end of the meter scale. Adjust the RANGE potentiometer (R-203) on the front panel of the plug-in station unit until the meter reads correctly.

(d) Irradiate the remote radiation sensing unit with the second gamma radiation intensity, preferably at least a decade higher than that used in step 3. Without changing the position of the RANGE control, adjust the SPAN control (R-205) until the indicating meter again reads correctly.

(e) In the event that either step (c) or step (d) cannot be accomplished properly, change the position of the FIL current adjust potentiometer to provide a different filament current and repeat steps (c) and (d).

(f) In the event that it is inconvenient to irradiate the remote radiation sensing unit with an intensity equivalent to the left end meter scale reading (the lowest measurable radiation intensity), any two known on-scale radiation intensities may be utilized for calibration. However, it will be necessary to arrive at successive approximations for the proper adjustment of the SPAN and RANGE controls by performing steps (c) and (d) two or three times, since the SPAN and RANGE controls are not independent of each other for radiation intensities other than that indicated in the previous steps.

(g) Tighten all locks on the screw driver potentiometers and replace the cover plate on the plug-in station unit.

The RANGE control may be adjusted at any time through the use of the built-in calibration device. This RANGE control is provided on the front panel to permit adjustment to compensate for minor long term drifts in the instrument. Its position will not affect the proper SPAN setting or the change in meter reading per decade change in signal or ion current.

g. In addition to the checks described in f the following are performed at the interval indicated.

- (1) Source is leak tested every six months.
- (2) Source head holding mechanism is checked for wear and adjustment every 3 months.
- (3) Micro switch on holding head is inspected and tested for radiation damage every 3 months.
- (4) Wooden platform in source room is checked yearly and replacement made if any radiation damage is present.
- (5) Mercury vapor lamps in exposure room are checked every 3 months, and replaced or repaired if necessary.
- (6) Air system is inspected for leaks every 3 months.
- (7) Filter in air line is drained and purged every month to remove water collected from the air.
- (8) Bowden cable is checked for operation and loose connections every 3 months.

- (9) Safety back-up system is checked every 3 months.
- (10) Remote monitoring systems are checked and calibrated every 6 months.
- (11) Air compressor is oiled and checked every month.
- (12) Emergency power generator and switching mechanism is checked weekly.
- (13) Battery for power generator is checked and maintained monthly.
- (14) Air vent blower is checked and oiled every 3 months.
- (15) Dehumidifiers are checked and oiled every 6 months.