

SOP 94-04

RETRIEVAL OF Cf NEUTRON SOURCES

PREPARED BY: Charles G. Heidel DATE: 4-18-94

REVIEWED BY: Charles C. Heidel DATE: 4-18-94
 OPERATIONS SUPERVISOR

[Signature] DATE: 4-18-94
 HEALTH PHYSICS SUPERVISOR

APPROVED BY: Wade J. [Signature] DATE: 4-19-94
 FACILITY DIRECTOR

PURPOSE

The purpose of this document is to provide a procedure for the recovery of the neutron sources that have fallen from the POP source carrier. Presently the neutron sources are laying on the source carrier track inside the bunker. The source shall be contained to prevent the accidental movement of the source off of the track.

PRECAUTIONS

The following precautions shall be observed during the operation:

- A. Typically no more than four personnel shall be in the radiography bay during the actual source recovery operation. Qualified transfer operators under the supervision of the Operations Supervisor and the Health Physicist shall perform the actual source recovery operation.
- B. All components which come in contact with the sources shall be treated as potentially contaminated.
- C. The following radiation safety precautions shall be observed during all phases of the operation.
 1. Stay times are required.
 2. Pocket dosimeters shall not exceed $\frac{1}{4}$ of full scale.
 3. Mock up training and pre-work briefing is required.
 4. Radiation surveys shall be performed concurrent with the recovery operation.

RECOVERY OPERATIONS

- A. The following equipment shall be in place prior to commencing the recovery operation:
 1. polyethylene shielding in the form of beads and/or sheets in top of the carrier storage area not to exceed the height of the metal cover
 2. polyethylene back stop = three feet away from bunker door
 3. source intermediate containment barrel to the south side of the bunker door
 4. source intermediate containment barrel full of demineralized water
 5. remote camera in place and looking at the end of the source carrier track
 6. position alarming dosimeters "chirpers" near the diverter box and the bunker storage tube
 7. position a high range radiation area monitor (RAM) detector near the diverter box

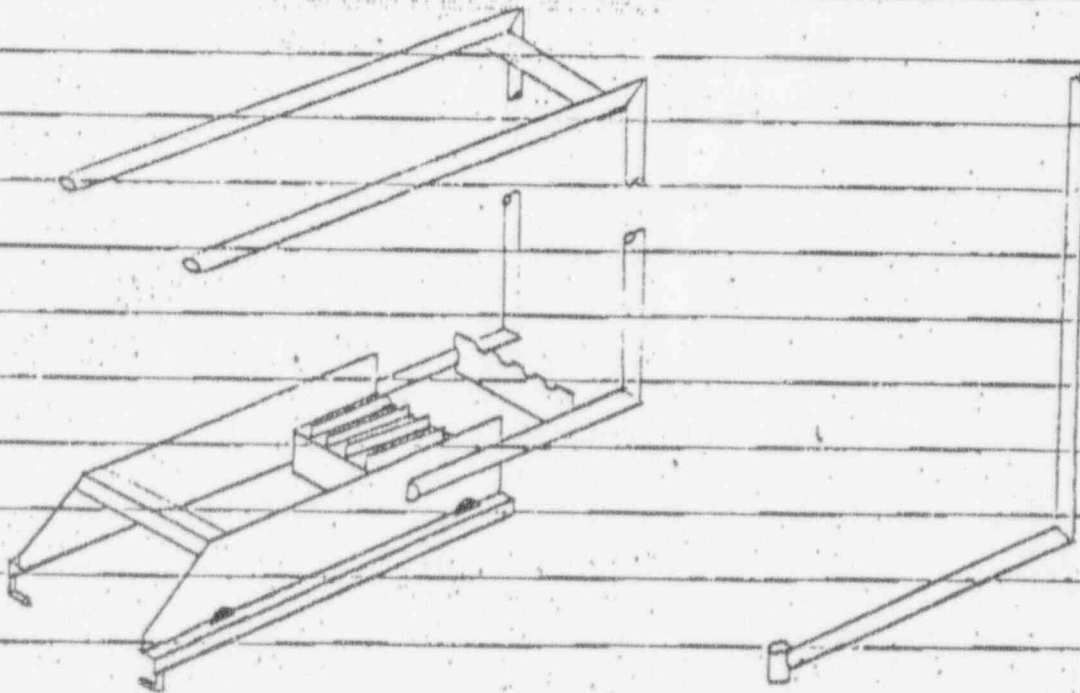
- B. Place the recovery shield on the source carrier track by performing the following steps:
1. *Place the recovery shield (attachment 1) below the source carrier track and*
 Lower the recovery shield (attachment 1) below the source carrier track and contact the bunker wall with the front rollers on the recovery shield.
 2. Open the bunker door and slowly raise the recovery shield until it slides into the bunker door opening and contacts the source track.
 3. Ensure the front rollers are below the source carrier track.
 4. Slowly continue to move the recovery shield until the bottom stop contacts the end of the source carrier track.
 5. Raise the back end of the recovery shield upward (approximately 1/2 inch) and move the recovery shield into the bunker until the recovery shield contacts the source carrier rotational operating gear.
 6. Raise the back end of the recovery shield upward (approximately 1/2 inch) and move the recovery shield into the bunker until the recovery shield is clear of the source carrier rotational operating gear.
 7. Set the recovery shield down until it is resting on the source carrier track.
 8. Slowly move the recovery shield into the bunker until it stops.
 9. Check the position of the recovery shield with bunker camera. The recovery shield should be forward enough to cover the access slot and rear such that neither one is visible using the in-bunker camera.
- C. The Cf sources shall be recovered in the following manner:
1. Place the recovery tool (attachment 1) in one of the slots on the cover plate.
 2. *move the recovery tool forward until it is in the guide plate.*
 Move the recovery tool forward until it is in the guide plate.
 3. Slowly move the recovery tool forward until it is positioned over one of the three neutron sources.
 4. Energize the electromagnet and slowly lift the neutron source off the source carrier track by raising the source recovery tool slightly.
 5. Slowly remove the recovery tool being careful not to bump the neutron source.
 6. Position the neutron source over the source intermediate containment barrel and deenergize the electromagnet.
 7. Repeat steps 1 through 6 until all the neutron sources are in the source intermediate containment barrel.
 8. Securely attach flexible tubing to the bunker stainless steel tubing from the diverter box to the bunker storage tube.

9. Place the end of the flexible tubing into the funnel of the source intermediate containment barrel.
10. Attach the magnetic pigtail to the teleflex and position the diverter to the cask position.
11. Clear the bay of all personnel other than those involved in the actual transfer.
12. Extend the teleflex drive cable into the source intermediate containment barrel.
13. Verify coupling to the source by retracting the drive cable slowly and noting an increase in the "chirp" rate of the chirpers that were located by the Health Physics personnel.
14. Retract the source until the source is in the diverter box and record the dose rate on the RAM.
15. Remove the flexible tubing to the bunker stainless steel tubing from the diverter box to the bunker storage tube.
16. Attach the stainless steel tubing from the diverter box to the bunker storage tube.
17. Extend the source from the diverter box to the bunker storage tube.
18. Disengage the source from the magnetic pigtail by raising the source several feet, then extending the teleflex at a rapid rate and quickly reversing the cranking direction of the teleflex.

NOTE: A released (from the magnet) source can be heard as it hits the bottom of the storage tube.
19. Verify the source has been disengaged from the magnetized teleflex drive by slowly retrieving the teleflex drive and listening to the "chirp" rate of the chirpers. If necessary repeat step 18.
20. Disconnect the bunker stainless steel tubing from the diverter box to the bunker storage tube.
21. Repeat steps 8 through 20 until all the neutron sources are located in the bunker storage tube.

CONCEPTUAL SKETCH

RECOVERY SHIELD



RECOVERY SHIELD

RECOVERY TOOL

ATTACHMENT 1



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE MEDICAL OPERATIONS AGENCY
BROOKS AIR FORCE BASE, TEXAS

28 April, 1994

MEMORANDUM FOR SM-ALC/TI-1

FROM: HQ AFMOA/SGPR
8901 18th St
Brooks AFB TX 78235-5217

SUBJECT: Recovery Plan for Californium-252 Radiography Sources from the Maneuverable Neutron Radiography System

References: (a) SM-ALC/TI-1 Memo, Amendment to USAF Radioactive Material Permit No. 04-10117-2AFP, 19 Apr 94

(b) SM-ALC/TI-1 Memo, Radiographic Equipment Failure, 24 Mar 94

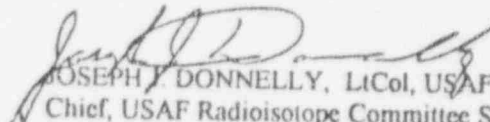
Reference (a) above contains procedures for recovery of subject californium-252 sources. In order for us to adequately review your requested operation, we require that a recovery plan be submitted that contains:

- a. The names of the members of the recovery team, their qualifications, training, and duties on the recovery team.
- b. Information on the type of specific training to be provided in preparation for this recovery and how it will be documented.
- c. Emergency procedures that discuss credible accident scenarios, responses, and notifications.
- d. Descriptions of the positions of Qualified Transfer Operator, Operations Supervisor, and Health Physicist including required training and experience.
- e. Planned dose limits and the basis for calculating stay times. Estimated dose rates at key positions around the bunker and estimated total doses for the operators. If pocket dosimeters are to be used, then describe them and give their full scale range.
- f. A description of the type of surveys to be conducted before, during, and after the operation. What individuals will perform the surveys? What action levels will be used and what actions will they trigger?
- g. Diagrams of the equipment described in your recovery procedures and floor plans of the locations of the recovery team.

In addition, we will require that an interim report be submitted detailing results of the dry runs. This report must be submitted before we will authorize the final source recovery.

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Request a response by 27 May 1994. If you have any questions, please contact Capt Montgomery at DSN 240-3331 or commercial (210) 536-3331. Telefax: DSN 240-4382, (210) 536-4382. E-Mail: montgome@afoms.brooks.af.mil.


JOSEPH J. DONNELLY, LtCol, USAF, BSC
Chief, USAF Radioisotope Committee Secretariat
Office of the Surgeon General

cc:
SM-ALC/TIR
HQ AFMC/SGB
HQ AFMOA/SGP
USNRC, Region IV



DEPARTMENT OF THE AIR FORCE

HEADQUARTERS SACRAMENTO AIR LOGISTICS CENTER (AFMC)
McClellan Air Force Base, California

5 May 94

MEMORANDUM FOR HQ AFMOA/SGPR
ATTENTION: CAPT MONTGOMERY

FROM: SM-ALC/TI-1
5335 Price Ave
McClellan AFB CA 95652-2504

SUBJ: Recovery Plan for Maneuverable Neutron Radiography System Californium-252 Sources
- INFORMATION MEMORANDUM

REF: (a) SM-ALC/TI-1 Memo, Amendment to USAF Radioactive Material Permit No. 04-10117-2AFP, 19 Apr 94

(b) HQ AFMOA/SGPR Memo, Recovery Plan for Californium-252 Sources from the Neutron Radiography System, 28 Apr 94

1. Reference (a) forwarded a procedure to recover the subject Californium-252 sources. Reference (b) requested a recovery plan be submitted so that HQ AFMOA/SGPR (RIC) can adequately review the requested operation.

2. In accordance with reference (b), the following information is provided:

a. The recovery team will consist of the following members:

<u>Name</u>	<u>Qualification</u>	<u>Training</u>	<u>Normal Duties</u>
C. Heidel	SRO QTR	SRO 40 hr Cf-252 Source Handling Course	OS
K. Kiger	SRO QTR	SRO 40 hr Cf-252 Source Handling Course	SRO
K. Barton	HPT	RCT NRRPT	HPT

SRO - Senior Reactor Operator (AFR 122-14)
QTR - Qualified Transfer Operator
OS - Operations Supervisor (Reactor Operations)
HPT - Health Physics Technician
RCT - Radiological Control Technician (US NAVY)
NRRPT - National Registry of Radiological Protection Technologist



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b. The recovery phase of the operation (Steps B.1-B.9 and C.1-C.7 of SOP 94-04, Retrieval of Cf Neutron Sources) will be dry-run trained using mock-ups in one of the McClellan Nuclear Radiation Center (MNRC)(Bldg 258) radiography bays. The transfer phase of the recovery (Steps C.7-C.21 of SOP 94-04, Retrieval of Cf Neutron Sources) will not be dry-run trained since source transfers are routine operations. Rosters of personnel involved in the training will be maintained and a written report will be forwarded to the RIC upon completion of the training.

c. The worst case accident scenario would be dropping a Cf-252 source on the bunker floor between the bunker carrier storage area and the source intermediate containment barrel. The required response would be to immediately evacuate the area. The Chief, Health Physics Branch (the permit RSO), the Chief, Nuclear Licensing and Operations, and the RIC would be promptly notified.

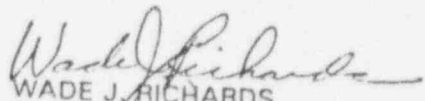
d. The descriptions of the positions of QTO, OS, Health Physicist (HP) and HPT are as follows:

	<u>Location</u>	<u>Duties</u>	<u>Training</u>	<u>Experience</u>
QTO	MNRS floor next to bunker	Operate electromagnet	SRO 40 hr Cf-252 Source Handling Course	8 yrs SRO at MNRC
OS	Top of bunker	Recover sources	SRO 40 hr CF-252 Source Handling Course	11 yrs US NAVY (Nuclear) 10 yrs SRO at ANL-West 8 yrs SRO at MNRC
HP	MNRS Control Room	Monitor operation using radio	B.S., Physics M.S., Physics	13 yrs US NAVY (Nuclear) 5 yrs HP at MNRC
HPT	Top of bunker next to OS	Radiation surveys	RCT NRRPT	6 yrs US NAVY (Nuclear) 2 yrs HPT at MNRC

e. The planned dose limit for recovery personnel will be 500 millirem. The basis for calculating stay times will be actual radiation surveys (see Attachment 1). The actual dose rates at key positions (see Attachment 2) can be determined from Attachment 1. The highest total dose for the operators is estimated to be 165 millirem (based on 15 minutes in the highest expected radiation field). Dosimeter Corporation Model 862 pocket dosimeters (range 0-200 milliroentgens) will be used during the operation.

f. A grid survey has been performed prior to the operation (see Attachment 1). Both neutron and gamma radiation surveys will be performed on top of the bunker by the HPT (see Attachment 2) during the recovery operation. Upon completion of the transfer from the source intermediate containment barrel to the bunker storage tube radiation surveys will be conducted around the entire circumference of the bunker. All radiological surveys will be performed by HPTs. If radiation levels exceed 1000 millirem per hour (steady state) during the recovery phase, personnel will stop work and immediately evacuate the area.

- g. Attachment 2 is a diagram showing the locations of the recovery team members. Attachment 3 is a sketch of equipment described in the recovery procedure.
 - h. A written report will be issued to the RIC upon completion of the dry-run training.
3. For further information, contact Jeff Ching, TIRH, at DSN 633-1023.


WADE J. RICHARDS
Chief, Nuclear Licensing and Operations

Attachments:

- 1. Radiological Survey No. 9424811
- 2. Recovery Phase Sketch
- 3. Recovery Equipment Sketch

RADIOLOGICAL SURVEY 9424811

Location: B248 MNRS BAY Date: 22 APR 94 Time: 1100

Comments: FOLLOWING NEUTRON TRAP INSTALLATION Tech: DWJW Reviewed: [Signature]

Type: Radiation Beta Gamma Neutron X-ray

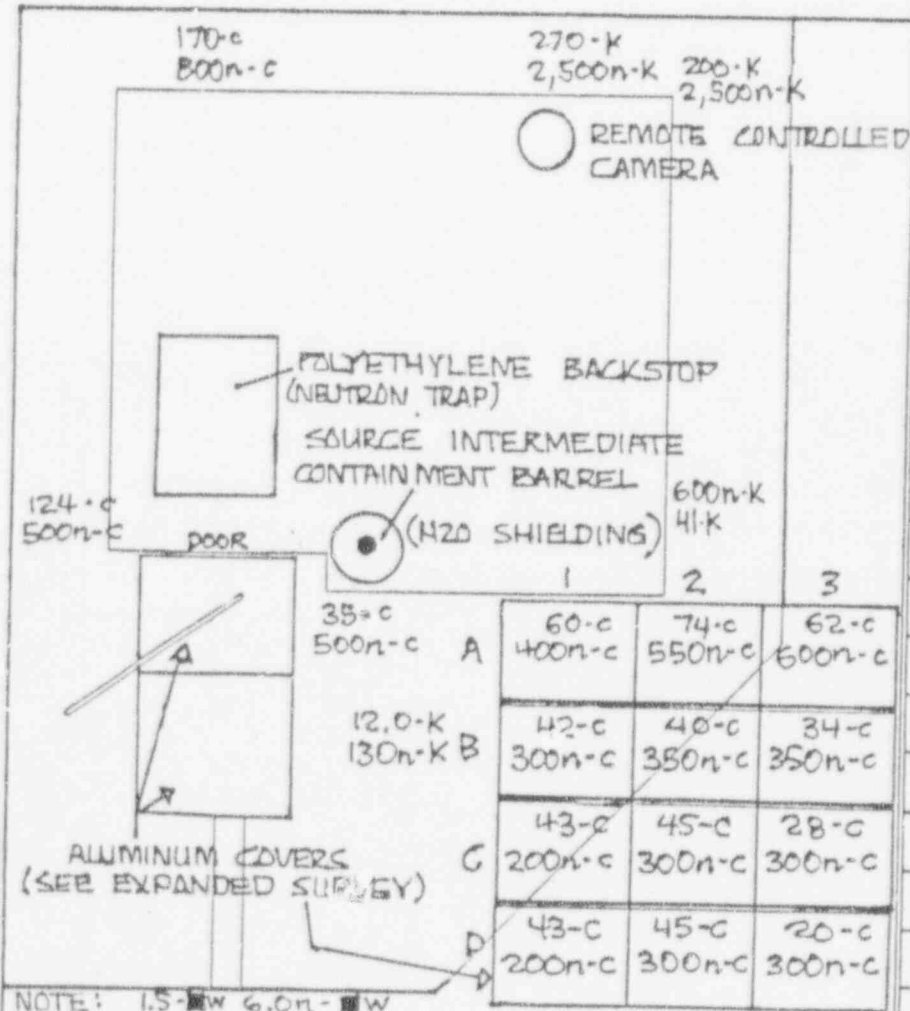
Contamination: Alpha Beta Gamma

Instrument: Manufacturers: VIC Model No: 450 SN: 1354 Date Calibrated: 29 MAR 94
NRC NP2 304 OCT 93
EBERLINE ASP-1 441 OCT 93

- Legend:
- 1. H=hand
 - 2. W=wrist
 - 3. F=floor
 - 4. C=contact
 - 5. Swipes are 100 cm² except as noted
 - 6. All readings gamma (mR/hr) except as noted
 - 7. Neutron readings (mrem/hr) identified with the letter 'n'
 - 8. Pancake GM CF, (effic.) = NA dpm/cpm
 - 9. Pancake GM CF, (16 cm² -> 100 cm²) = 6.25
 - 10. Frisk: (Net cpm)(CF₁)(CF₂) = dpm/100 cm²
 - 11. Swipe (100 cm²): (Net cpm)(CF₁) = dpm/100 cm²

Circled #'s indicate a swipe. Triangled #'s indicate a frisk. Frisks are within 0.5'.

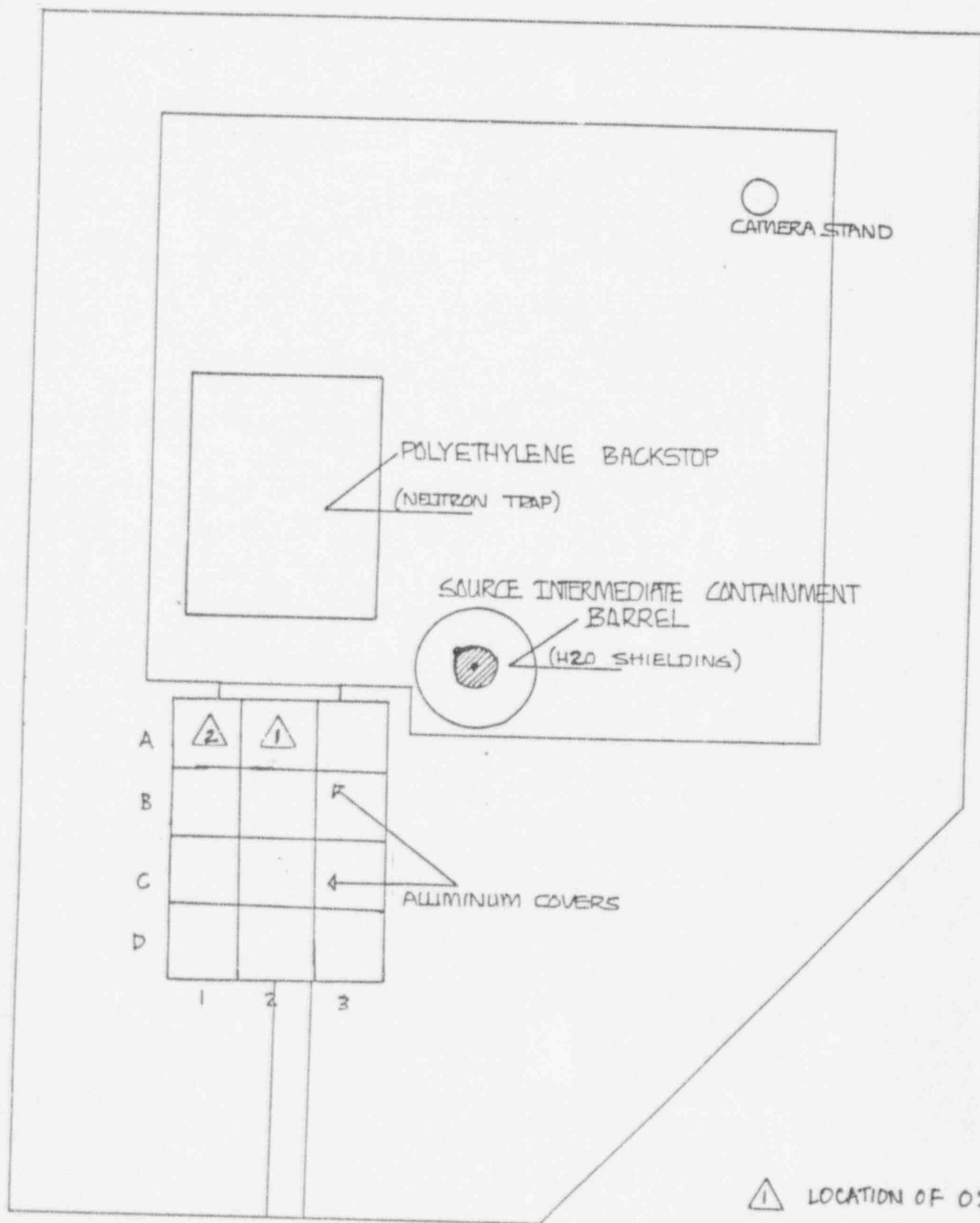
K = KNEE LEVEL
ALL READINGS WITH DOOR OPEN



NOTE: 1.5'-w 6.0n'-w
 WITH 2" OF POLY ON TOP
 C2 = 25-c / 170n-c
 D2 = 30-c / 120n-c

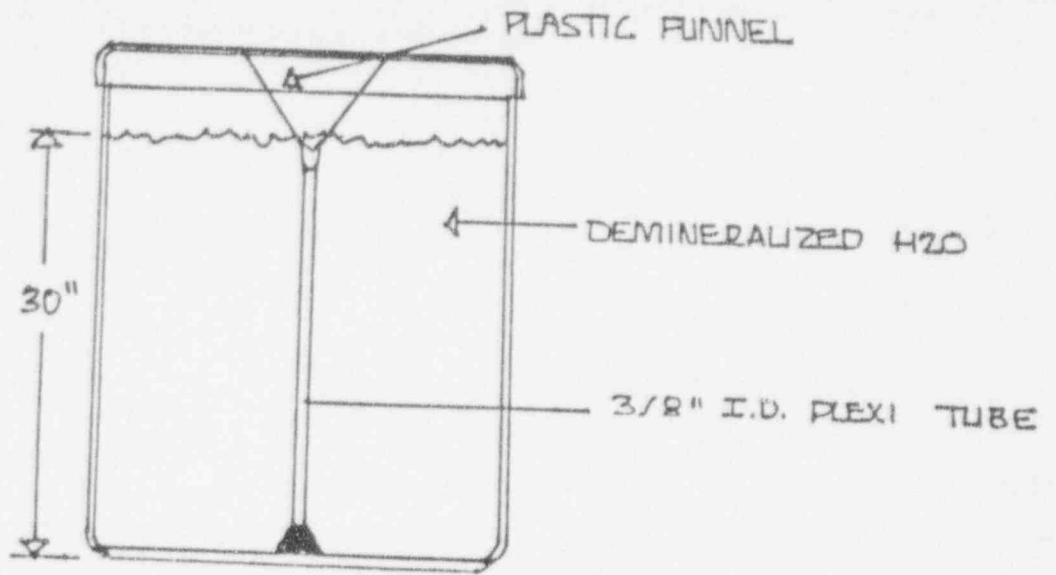
Location	#	Bkgd (cpm)	Net (cpm)	dpm/100 cm ²
	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			
	17			
	18			
	19			
	20			
	21			

RECOVERY PHASE



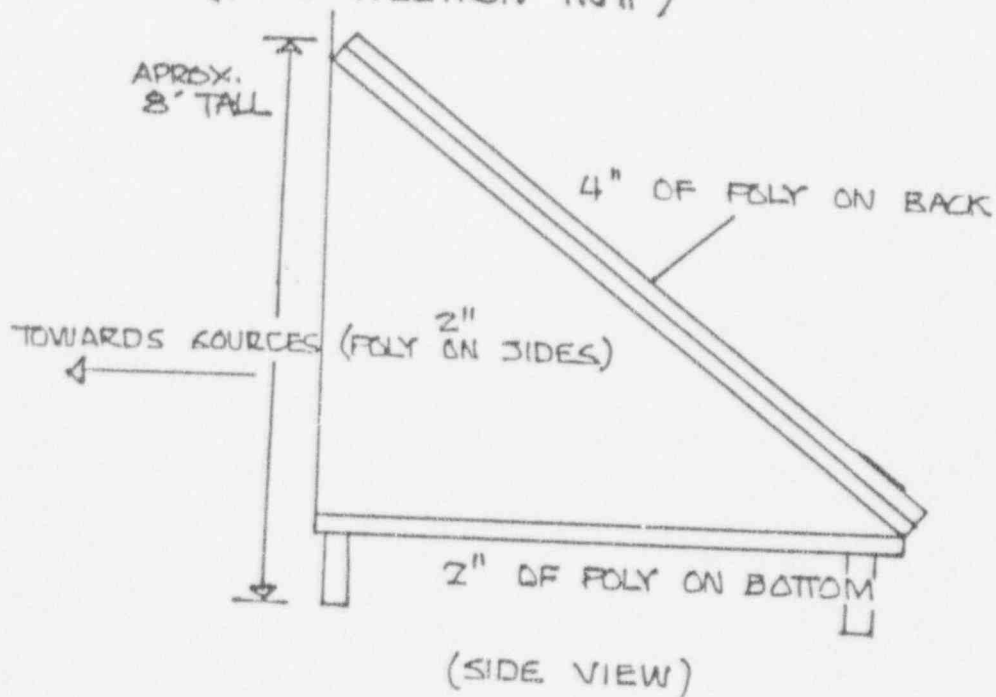
- ① LOCATION OF OS
- ② LOCATION OF HPT
- ③ LOCATION OF QTO

At. In 2



SOURCE INTERMEDIATE CONTAINMENT BARREL

POLYETHYLENE BACKSTOP
(POLY NEUTRON TRAP)



RECOVERY EQUIPMENT



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE MEDICAL OPERATIONS AGENCY
BROOKS AIR FORCE BASE, TEXAS

6 May, 1994

MEMORANDUM FOR SM-ALC/TI-1

FROM: HQ AFMOA/SGPR
8901 18th St
Brooks AFB TX 78235-5217

SUBJECT: Recovery Plan for Maneuverable Neutron Radiography System Californium-252 Sources
(Your Memo, 5 May 94)

Reference: SM-ALC/TI-1 Memo, Amendment to USAF Radioactive Material Permit No 04-10115-
2AFP, Docket No. 030-22419, 19 Apr 94

We have reviewed subject document and have the following comments:

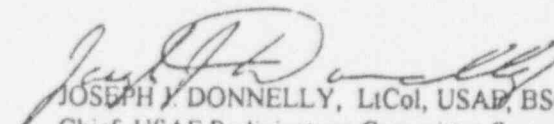
a. Paragraph 2.a. lists the recovery team members and their qualifications. Please identify which of the individuals are qualified Radiographers as defined in 10 CFR Part 34.

b. Which individuals will perform the duties as defined in paragraph 2.d?

c. In paragraph 2.e. you commit to using pocket dosimeters. You are also required to use Air Force issued photon and neutron dosimeters. You should commit to having these processed immediately after the recovery operation.

You should propose a date to perform this operation. This date should be sufficiently in the future to allow for our review, for USNRC review and comment, and for dry runs as necessary to ensure safety of the operation.

Request a response by 16 May 1994. If you have any questions, please contact Capt Montgomery at DSN 240-3331 or commercial (210) 536-3331. Telefax: DSN 240-4382, (210) 536-4382. E-Mail: montgome@afoms.brooks.af.mil.


JOSEPH J. DONNELLY, LtCol, USAF, BSC
Chief, USAF Radioisotope Committee Secretariat
Office of the Surgeon General

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DEPARTMENT OF THE AIR FORCE

HEADQUARTERS SACRAMENTO AIR LOGISTICS CENTER (AFMC)
MCCLELLAN AIR FORCE BASE, CALIFORNIA

16 May 94

MEMORANDUM FOR HQ AFMOA/SGPR
ATTENTION: CAPT MONTGOMERYFROM: SM-ALC/TI-1
5335 Price Ave
McClellan AFB CA 95652-2504SUBJ: Recovery Plan for Maneuverable Neutron Radiography System Californium-252 Sources
- INFORMATION MEMORANDUMREF: (a) SM-ALC/TI-1 Memo, (same subject), 5 May 94
(b) HQ AFMOA/SGPR Memo, (same subject), 6 May 94

1. Reference (a) forwarded information on a plan to recovery the subject Californium-252 sources. Reference (b) requested additional information to allow the USAF Radioisotope Committee (RIC) to review the requested operation.

2. In accordance with reference (b), the following information is provided:

a. An additional person will be added to the recovery team::

<u>Name</u>	<u>Qualification</u>	<u>Training</u>	<u>Normal Duties</u>
W. Richards	SRO Level III Radiographer	SRO	FD

FD - Facility Director

SRO - Senior Reactor Operator (AFR 122-14)

Level III Radiographer - ASNT Level III Neutron Radiographer

b. The individuals who will perform the duties defined in paragraph 2.d of reference (a) in addition to Dr. Wade Richards are as follows:


<u>Individual</u>	<u>Position</u>	<u>Location</u>	<u>Duties</u>
C. Hledel	OE	Top of bunker	Recover sources
K. Kiger	QTO	MNRS floor next to bunker	Operate electromagnet

Attach 5

<u>Individual</u>	<u>Position</u>	<u>Location</u>	<u>Duties</u>
J. Ching	HP	MNRS Control Room	Monitor operation using radio
K. Barton	HPT	Top of bunker next to OS	Radiation surveys
W. Richards	FD	MNRS Control Room	Supervise operation using radio

c. The proposed date for performing the recovery operation is 1 Jun 94.

3. For further information, contact Jeff Ching, TIRH, at DSN 633-1023.


WADE J. RICHARDS
Chief, Nuclear Licensing and Operations



DEPARTMENT OF THE AIR FORCE

HEADQUARTERS SACRAMENTO AIR LOGISTICS CENTER (AFMC)
MCCLELLAN AIR FORCE BASE, CALIFORNIA

17 May 94

MEMORANDUM FOR HQ AFMOA/SGPR
ATTENTION: CAPT MONTGOMERY

FROM: SM-ALC/TI-1
5335 Price Ave
McClellan AFB CA 95652-2504

SUBJ: Recovery Plan for Maneuverable Neutron Radiography System Californium-252 Sources
- INFORMATION MEMORANDUM

REF: (a) SM-ALC/TI-1 Memo, (same subject), 5 May 94
(b) HQ AFMOA/SGPR Memo, (same subject), 6 May 94
(c) SM-ALC/TI-1 Memo, (same subject), 16 May 94

1. Reference (a) forwarded information on a plan to recover the subject Californium-252 sources. Reference (b) requested additional information to allow the USAF Radioisotope Committee (RIC) to review the requested operation. Reference (c) provided the additional information requested except for a commitment on dosimetry processing.
2. In accordance with reference (b), Air Force issued photon and neutron thermoluminescent dosimeters will be sent for processing immediately after the recovery operation.
3. For further information, contact Jeff Ching, TIRH, at DSN 633-1023.

Wade J. Richards
WADE J. RICHARDS
Chief, Nuclear Licensing and Operations



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