

33-2055

NRC Form 313 I (12-81) 10 CFR 30		U.S. NUCLEAR REGULATORY COMMISSION		1. APPLICATION FOR: (Check and/or complete as appropriate)	
APPLICATION FOR BYPRODUCT MATERIAL LICENSE INDUSTRIAL				<input checked="" type="checkbox"/>	a. NEW LICENSE
					b. AMENDMENT TO LICENSE NUMBER
					c. RENEWAL OF LICENSE NUMBER L&L 21388
See attached instructions for details.					
Completed applications are filed in duplicate with the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety, and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555 or applications may be filed in person at the Commission's office at 1717 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland.					
2. APPLICANT'S NAME (Institution, firm, person, etc.) Camco Wireline, Inc.		3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION Mr. David A. Nyberg 03110			
TELEPHONE NUMBER: AREA CODE - NUMBER EXTENSION (907) 562-2132		TELEPHONE NUMBER: AREA CODE - NUMBER EXTENSION (907) 562-2132 or 659-2800			
4. APPLICANT'S MAILING ADDRESS (Include Zip Code) (Address to which NRC correspondence, notices, bulletins, etc., should be sent.) P.O. Box 4-1551 Anchorage, AK 99509		5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED (Include Zip Code) Camco W/L Spline Rd. Prudhoe Bay, Alaska and at temporary job sites.			
(IF MORE SPACE IS NEEDED FOR ANY ITEM, USE ADDITIONAL PROPERLY KEYED PAGES.)					
6. INDIVIDUAL(S) WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL (See Items 16 and 17 for required training and experience of each individual named below)					
FULL NAME				TITLE RECEIVED BY L&L	
a.	David J. Tousley	Supervisor		Date 6/14/83	
b.	Gary M. Rigdon	Operator		Log June 1, 1983	
c.	Jerry L. Weiser	Operator		By Brown	
7. RADIATION PROTECTION OFFICER David A. Nyberg		Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15. 6/17/83			
8. LICENSED MATERIAL					
L I N E NO.	ELEMENT AND MASS NUMBER A	CHEMICAL AND/OR PHYSICAL FORM B	NAME OF MANUFACTURER AND MODEL NUMBER (If Sealed Source) C	MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTI- VITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME D	
(1)	Americium 241	Sealed sources	Gulf Nuclear AmBe 71-1	Not to exceed 3 curies per source	
(2)	Americium 241	Sealed sources	Gulf Nuclear AmBe 71-1	Not to exceed 3 curies per source	
(3)	Cesium 137	Sealed sources	Gulf Nuclear, Inc VL-1	Not to exceed 100 millicuries per source	
(4)	Cesium 137	Sealed sources	Gulf Nuclear, Inc VL-1	Not to exceed 100 millicuries per source	
8603240006 860123 REG 5 LIC30 50-21388-01 PDR					
DESCRIBE USE OF LICENSED MATERIAL E					
(1)	For use in oil and gas well logging.				
(2)	For use in oil and gas well logging.				
(3)	For use in oil and gas well logging.				
(4)	For use in oil and gas well logging.				

19804460-5A
Application
6/14/83
Brown 1780

9. STORAGE OF SEALED SOURCES

LINE NO.	CONTAINER AND/OR DEVICE IN WHICH EACH SEALED SOURCE WILL BE STORED OR USED. A.	NAME OF MANUFACTURER B.	MODEL NUMBER C.
(1)	3 curie Neutron Shield	Gulf Nuclear	14 x 14
(2)	3 curie Neutron Shield	Gulf Nuclear	14 x 14
(3)			
(4)			

10. RADIATION DETECTION INSTRUMENTS

LINE NO.	TYPE OF INSTRUMENT A	MANUFACTURER'S NAME B	MODEL NUMBER C	NUMBER AVAILABLE D	RADIATION DETECTED (alpha, beta, gamma, neutron) E	SENSITIVITY RANGE (milliroentgens/hour or counts/minute) F
(1)	Survey	Victoreen	493	1	Gamma	0 - 0.5; 0 - 5.0 0 - 50 mR/hr.
(2)						
(3)						
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☒ a. CALIBRATED BY SERVICE COMPANY

NAME, ADDRESS, AND FREQUENCY

Gulf Nuclear, Inc.
202 Medical Center Blvd.
Webster, Texas 77598 (6 mos.)

☐ b. CALIBRATED BY APPLICANT

Attach a separate sheet describing method, frequency and standards used for calibrating instruments.

12. PERSONNEL MONITORING DEVICES

TYPE (Check and/or complete as appropriate.) A	SUPPLIER (Service Company) B	EXCHANGE FREQUENCY C
<input checked="" type="checkbox"/> (1) FILM BADGE <input checked="" type="checkbox"/> (2) THERMOLUMINESCENCE DOSIMETER (TLD) <input type="checkbox"/> (3) OTHER (Specify): _____ _____ _____	Gulf Nuclear, Inc. 202 Medical Center Blvd. Webster, Texas 77598	<input type="checkbox"/> MONTHLY <input checked="" type="checkbox"/> QUARTERLY <input type="checkbox"/> OTHER (Specify): _____ _____ _____

13. FACILITIES AND EQUIPMENT (Check where appropriate and attach annotated sketch(es) and description(s).)

- ☐ a. LABORATORY FACILITIES, PLANT FACILITIES, FUME HOODS (Include filtration, if any), ETC.
☒ b. STORAGE FACILITIES, CONTAINERS, SPECIAL SHIELDING (fixed and/or temporary), ETC.
☒ c. REMOTE HANDLING TOOLS OR EQUIPMENT, ETC.
☐ d. RESPIRATORY PROTECTIVE EQUIPMENT, ETC.

14. WASTE DISPOSAL

a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED

Gulf Nuclear, Inc. 202 Medical Center Blvd. Webster, TX 77598

b. IF COMMERCIAL WASTE DISPOSAL SERVICE IS NOT EMPLOYED, SUBMIT A DETAILED DESCRIPTION OF METHODS WHICH WILL BE USED FOR DISPOSING OF RADIOACTIVE WASTES AND ESTIMATES OF THE TYPE AND AMOUNT OF ACTIVITY INVOLVED. IF THE APPLICATION IS FOR SEALED SOURCES AND DEVICES AND THEY WILL BE RETURNED TO THE MANUFACTURER, SO STATE

Sealed sources will be returned to the manufacturer for disposal.

INFORMATION REQUIRED FOR ITEMS 15, 16 AND 17

Describe in detail the information required for Items 15, 16 and 17. Begin each item on a separate page and key to the application as follows:

15. **RADIATION PROTECTION PROGRAM.** Describe the radiation protection program as appropriate for the material to be used including the duties and responsibilities of the Radiation Protection Officer, control measures, bioassay procedures *(if needed)*, day-to-day general safety instruction to be followed, etc. If the application is for sealed source's also submit leak testing procedures, or if leak testing will be performed using a leak test kit, specify manufacturer and model number of the leak test kit.
16. **FORMAL TRAINING IN RADIATION SAFETY.** Attach a resume for each individual named in Items 6 and 7. Describe individual's formal training in the following areas where applicable. Include the name of person or institution providing the training, duration of training, when training was received, etc.
 - a. Principles and practices of radiation protection.
 - b. Radioactivity measurement standardization and monitoring techniques and instruments.
 - c. Mathematics and calculations basic to the use and measurement of radioactivity.
 - d. Biological effects of radiation.
17. **EXPERIENCE.** Attach a resume for each individual named in Items 6 and 7. Describe individual's work experience with radiation, including where experience was obtained. Work experience or on-the-job training should be commensurate with the proposed use. Include list of radioisotopes and maximum activity of each used.

18. CERTIFICATE

(This item must be completed by applicant)

The applicant and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 30, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.

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.

a. LICENSE FEE REQUIRED
(See Section 170.31, 10 CFR 170)

b. CERTIFYING OFFICIAL *(Signature)*

c. NAME *(Type or print)*

David A. Nyberg

(1) LICENSE FEE CATEGORY: 170.31 (5)

d. TITLE
North Slope District Manager

(2) LICENSE FEE ENCLOSED: \$ 460.00

e. DATE

11780

ITEM 6. INDIVIDUAL (S) WHO WILL USE OR DIRECTLY SUPERVISE THE
USE OF LICENSED MATERIAL.

d. Bill C. Ochiltree

District Manager

ITEM 8. LICENSED MATERIAL

	ELEMENT AND MASS NUMBER	CHEMICAL AND/OR PHYSICAL FORM	NAME OF MANUFACTURER AND MODEL NUMBER	MAXIMUM NUMBER OF MILLCURIES AND/OR SEALED SOURCES AND MAXIMUM ACTI- VITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME
	A	B	C	D
(5)	Americum 241	Sealed Source	Gamma Tron, Inc. AM-HP	Not to exceed 250 millicuries per source.
(6)	Americum 241	Sealed Source	Gamma Tron, Inc. AM-HP	Not to exceed 250 millicuries per source.
(7)	Iridium - 192	Any form	-	30 millicuries total (10 mci per study)
(8)	Iodine - 131	Any form	-	30 millicuries total (10 mci per study)

DESCRIBE USE OF LICENSED MATERIAL

	E
(5)	For use in oil and gas well logging.
(6)	For use in oil and gas well logging.
(7)	Tracer studies in oil, gas, & water injection wells.
(8)	Tracer studies in oil, gas, & water injection wells.

ITEM 15. RADIATION PROTECTION PROGRAM.

Leak Test Kit - Gulf Nuclear, Inc.
Manufacturer and model #LTK-1.

ITEM 16 & 17. FORMAL TRAINING IN RADIATION SAFETY & EXPERIENCE.

RESUME

David A. Nyberg
Age 45
SSN 037-24-6550

COMPANY EXPERIENCE:

Camco Wireline, Inc.

1977 - present

FORMAL RA TRAINING:

Ft. Sill, OK. - Advanced officer training class. Part of instruction included a two (2) week course in NBC. Part of course was devoted to principles and practices of radiation protection; radioactivity measurement, monitoring techniques, and instruments; Biological effects; calculation of radioactivity.

RADIOISOTOPE EXPERIENCE:

On the job training in the safe use and application of radioactive material applying to tracer surveys. Two years experience with safe handling and monitoring U.S. Army Artillery Nuclear Projectiles in Europe.

ITEM 16 & 17. FORMAL TRAINING IN RADIATION SAFETY & EXPERIENCE.

RESUME

Jerry L. Weiser
Age 28
SSN 455-11-6904

COMPANY EXPERIENCE:

Gearhart Industries	1974 - 1978
K & N Perforators	1978 - 1981
Mid-Coast Logging & Perforating	1981
Gear-Tex Well Services	1981 - 1982
Camco, Inc.	1982 - Present

FORMAL RA TRAINING:

Gearhart Industries	1974 - 1978
K & N Perforators	1978 - 1981
Mid-Coast Logging & Perforating	1981
Gear-Tex Well Services	1981 - 1982
Camco, Inc.	1982 - Present

RADIOISOTOPE EXPERIENCE:

On the job training in the safe use and application of radioactive material applying to well logging and tracer surveys. Nine years experience in the use of 5 curie and 3 curie neutron sources and Iodine 131 tracer material used in Gamma Ray/Neutron, fluid density and tracer surveys. Radiation Safety Officer for Camco, Inc. in Broussard, Louisiana for 3 months.

ITEM 16 & 17. FORMAL TRAINING IN RADIATION SAFETY & EXPERIENCE.

RESUME

Bill C. Ochiltree
Age 38
SSN 437-66-1249

COMPANY EXPERIENCE:

GLPS - Texas
El Toro Perforators
Gearhart Industries
Camco Wireline, Inc.

1967 - 1968
1968 - 1970
1971 - 1975
1975 - Present

FORMAL RA TRAINING:

GLPS
El Toro Perforators
Gearhart Industries

Company sponsored
schools given by
Gulf Nuclear, Inc.

RADIOISOTOPE EXPERIENCE:

On the job training in the safe use and application of radioactive material applying to well logging and tracer surveys. Over fifteen (15) years experience in the use of 5 curie and 3 curie neutron sources and Iodine 131 tracer material used in Gamma Ray/Neutron, fluid density and tracer surveys.

ITEM 16 & 17. FORMAL TRAINING IN RADIATION SAFETY & EXPERIENCE.

RESUME

David J. Tousley
Age 36
SSN 516-58-6514

COMPANY EXPERIENCE:

Dresser Atlas
Gearhart Industries, Inc.
Camco Wireline, Inc.

1977 - 1978
1978 - 1983
Present

FORMAL RA TRAINING:

Gearhart Industries, Inc.

10-24-79

RADIOISOTOPE EXPERIENCE:

On the job training in the safe use and application of radioactive material applying to well logging and tracer surveys. Over six (6) years experience in the use of 20 curie, 5 curie, and 3 curie AmBe and Cesium density sources and Iodine 131, 192 tracer materials for Gamma Ray/Neutron, fluid density and tracer surveys.

ITEM 16 & 17. FORMAL TRAINING IN RADIATION SAFETY & EXPERIENCE.

RESUME

Gary M. Rigdon
Age 30
SSN 287-42-8547

COMPANY EXPERIENCE:

Birdwell Div. S.S.C.
Gearhart Industries, Inc.
Camco Wireline, Inc.

1975 - 1978
1978 - 1981
August 1982 - Present

FORMAL RA TRAINING:

Birdwell School - Tulsa, OK
Gulf Nuclear School

May 1975 - June 1975
September 1978

RADIOISOTOPE EXPERIENCE:

On the job training in the safe use and application of radioactive material applying to well logging and tracer surveys. Over six (6) years experience in the use of PuBe, AmBe, and Cesium sealed sources used in open hole logging, and both Iodine and Iridium liquid form tracer material. Handled 20 curie, 5 curie, and 3 curie sealed sources.



CAMCO Wireline, Inc.

Wireline Services

Radioactive Material Storage,

Usage and Operating Instructions

CONTENTS

CHAPTER

- I. GENERAL
- II. PROCEDURES FOR STORAGE
- III. PROCEDURES FOR TRACER APPLICATIONS
- IV. PROCEDURES FOR LOST SOURCE DOWNHOLE

APPENDICIES

CHAPTER I

GENERAL

1. RADIATION PROGRAM MANAGEMENT AND RESPONSIBILITY
2. RADIATION SAFETY OFFICER
3. PERSONNEL MONITORING PROCEDURES
4. STORING AND SECURING RADIOACTIVE MATERIALS
5. POSTING REQUIREMENTS
6. RECORDS MANAGEMENT
7. PROCEDURES FOR TRANSPORTING RADIOACTIVE MATERIALS

APPENDIX A

1. COMPANY ORGANIZATION CHART
2. AREA MONITORING FORM 50
3. VEHICLE MONITORING FORM
4. UTILIZATION LOGS
5. RECEIPT & DISPOSAL LOG
6. QUARTERLY EXPOSURE RECORD
7. LEAK TEST RECORD

CHAPTER I

GENERAL

1. Radiation Program Management and Responsibility

- a. The Radiation Protection Officer is to be designated overall manager for the radiation program. The organizational chart of the department is shown at Appendix A-1.
- b. The duties of the Radiation Protection Officer include the delegation of authority to persons responsible for carrying out the duties such as that of Radiation Safety Officer, overall responsibility for records, surveys, the forming of committees where necessary and in general the administrative procedures for the entire radiation program. His responsibilities will include:
 - (1) Training of personnel in the safe handling of radioisotopes and emergency procedures.
 - (2) Approval of equipment and techniques for the storage, use and disposal of radioisotopes.
 - (3) Maintenance of current records on tracer acquisitions and uses in the field.
 - (4) Supply the field with film badges and ensure that all users wear their personnel monitoring equipment.
 - (5) Maintenance of radiation exposure records.
 - (6) Making sure that Camco complies with the applicable regulations of the U.S. Atomic Energy Commission.
 - (7) Ensure that licensed materials that are possessed or used are limited to those materials specified in the license.
 - (8) Ensure that the licensed materials are used only by those individuals authorized by the license.
 - (9) Ensure that licensed material is properly secured against unauthorized removal at all times.
 - (10) Supervise leak testing of sealed sources.
 - (11) To serve as a point of contact and give assistance in case of emergency.
 - (12) Conduct radiation safety inspections periodically.

2. The Radiation Safety Officer is responsible to the Radiation Protection Officer and in general is to conduct or cause to be conducted the programs and responsibility delegated by the Radiation Protection Officer. These duties might include:
 - a. Site surveys
 - b. Records, personnel monitoring records and compilation
 - c. Vehicle survey records
 - d. Training and qualifying personnel
 - e. Conducts periodic safety checks to assure the radiation protection program

3. Personnel Monitoring Procedures

All personnel directly related to activity involving radioactive materials will wear a film badge. Film badge records will be quarterly and monitoring will be at least on a quarterly basis.

It is clearly understood that maximum acceptable dose levels are not to exceed 1.25 Rem per calendar quarter or no more than 5.0 Rem per calendar year.

It is also clearly understood that in the event these doses are greater than those listed above that proper notification will be posted with the licensing authority. Also reports of dosages will be maintained on at least a quarterly basis.

4. Storing and Securing Radioactive Materials

Upon receipt of the radioactive materials the receiving records will be placed in a properly marked file. The materials will be placed in a secure area that is properly marked with appropriate signs around the perimeter. This area will be either a room, a storage area or a storage bunker but will in any case contain a door or lock type top. Materials when not in use will remain in the storage area properly locked and secured.

5. Posting Restricted Area, Vehicles and Labelling Containers

- a. Posting restricted area/storage area and areas where radiation levels are expected to achieve 2 mR/hr. will be labelled with signs stating "Caution - Radiation Area" or "Caution Radioactive Materials". These signs will bear the radiation symbol and be magenta and safety yellow in color. The signs will be conspicuous and obvious from all directions. In the event that the levels exceed 5 mR/hr. then a sign stating "Caution - High Radiation Area", magenta and safety yellow in color will be conspicuously posted.

A proper Notice to Employees will also be posted where it is obvious to employees.

- b. Vehicle Placarding. All vehicles transporting or containing radioactive materials will bear a placard on four sides that bears the proper labelling according to D.O.T. specifications, the word "RADIOACTIVE". This placard approximately 6" X 30" will be placed on the vehicle only when the vehicle is transporting or storing radioactive materials.

The placard is black lettering on a safety yellow background. It is clearly understood that this placard will not be displayed if the vehicle is not carrying or storing radioactive materials.

- c. All containers carrying or storing or used for transporting radioactive materials will bear a tag with the identification of the radioactive materials, the quantity of the radioactive materials and the date that the radioactive materials was that particular quantity. The tag will also state "Caution - Radioactive Material".

6. Records Management

- a. Utilization Log - This log will contain the master file on each type or shipment of radioactive materials received and the distribution of each such shipment. This master file will be maintained at the facility. (Appendix A-4)
- b. Receipt and transfer records will be maintained in files to show at all times where material is to be located or if it is disposed of. (Appendix A-5)
- c. Personnel exposure records, film badge, TLD or dosimeter reports will be maintained in a separate file. All quarterly reports on each person using radioactive materials will be kept at the Prudhoe Bay, Alaska office. (Appendix A-6)
- d. Leak test records on all sealed sources will be maintained on each sealed source. These records will indicate leak testing at six month intervals. (Appendix A-7)
- e. Survey records which include building or storage area surveys conducted on a quarterly basis will be maintained in a file. These surveys will reflect in milliroentgens readings at a point on each side and the top of the storage area. (Appendix A-2)
- f. Vehicle surveys will be conducted at monthly intervals and these surveys will be maintained in a file. (Appendix A-3)
- g. Surveys will be conducted by monitoring a well bore at the surface prior to use of any radioactive material and remonitoring the well bore upon completion of the work. These numbers will be recorded. A survey meter or tool which is acceptable will be used for the monitoring process. Records of this survey performed on each job will be maintained in a file. (Appendix B-3)

Note: A master file of "a" thru "g" is on file at the Anchorage, Alaska office.

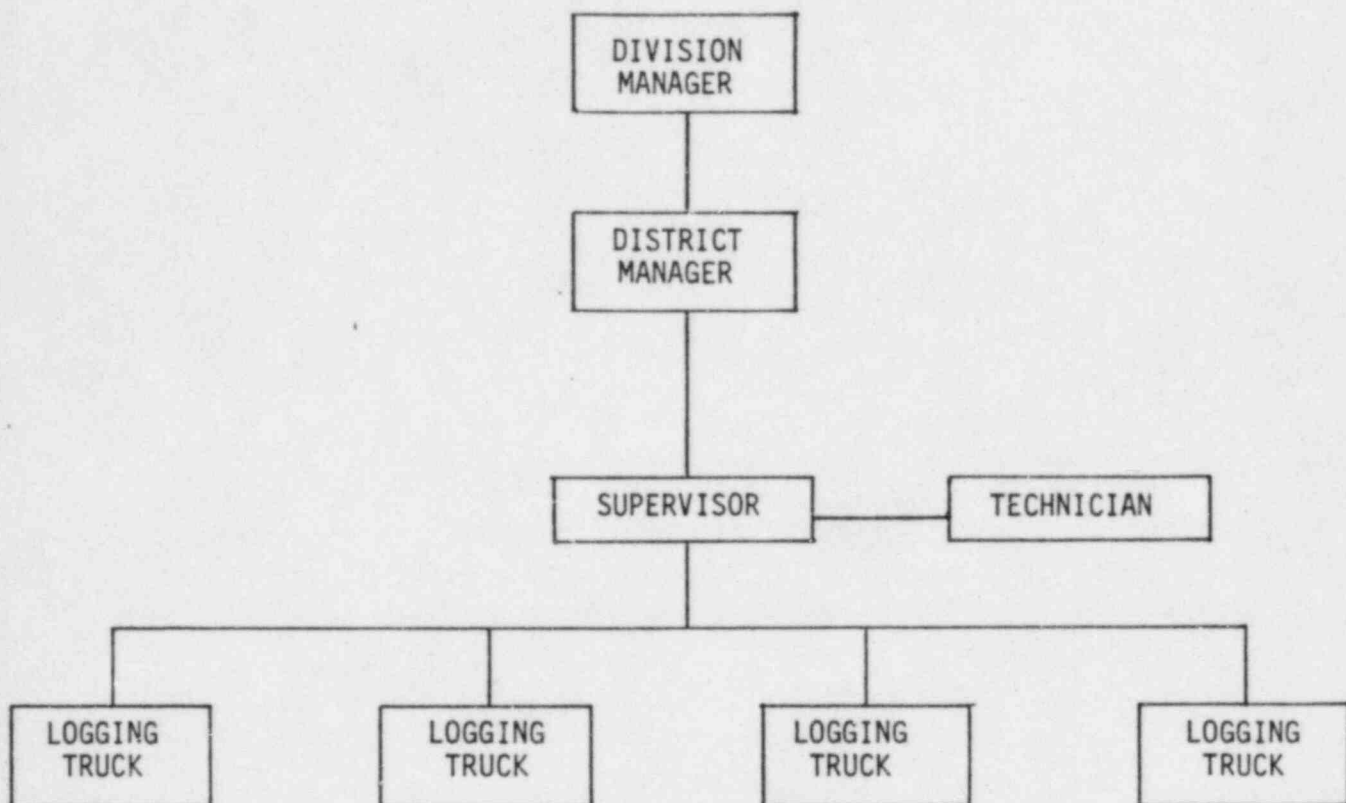
7. Procedures for Transporting Radioactive Materials

- a. Radioactive materials may be transported by company vehicle or private vehicle provided the vehicle is marked properly and the material transported is properly packaged and marked. An identification will be on each container transported and the vehicle will be placarded with the proper D.O.T. markings.
- b. The vehicle transporting radioactive materials will be clearly placarded with a 6" X 30" safety yellow background with black letters sign that reads "Radioactive".
- c. Packages transported will be packaged as received from the supplier. These packages generally bear a diamond shaped Yellow III label.

It is clearly understood that signs will be removed when the vehicle does not transport radioactive materials.

APPENDIX A-1

ORGANIZATIONAL CHART
ELECTRIC WIRELINE DEPARTMENT



APPENDIX A-2

AREA MONITORING FORM 50

All radioactive materials storage bunkers and downhole storage facilities are to be monitored for radiation levels each month. This check should be made at the same time that inventory is made.

Type Survey Meter Used _____ Date _____

Meter Serial No. _____ Location _____

Date Calibrated _____

1. Background _____ mr/hr.*

2. Radiation level at surface of bunker door
(measure each door separately (no measurement is needed if bunker is empty - indicate if empty)).

No. 1 _____ mr/hr.

No. 2 _____ mr/hr.

No. 3 _____ mr/hr.

3. Radiation level at 1 meter from bunker door

No. 1 _____ mr/hr.

No. 2 _____ mr/hr.

No. 3 _____ mr/hr.

4. Background _____ mr/hr.*

5. Highest radiation level at surface of downhole storage (on cover).

_____ mr/hr.

Signature

Make out Form 50 in duplicate. Retain one copy at location and forward second copy to Camco, Incorporated, Anchorage, Alaska.

*Normal background is recorded at least 30 feet from the storage bunker or 6 feet from the cover of the downhole storage.

Monitor each truck with maximum load of radioactive material in place. Retain copies of this at location. After this is done, each truck is to be monitored monthly with all radioactive material removed.

Truck No.	Back Sign	Front Sign	Left Sign	Right Sign

APPENDIX A-3

MONTHLY VEHICLE SURVEY

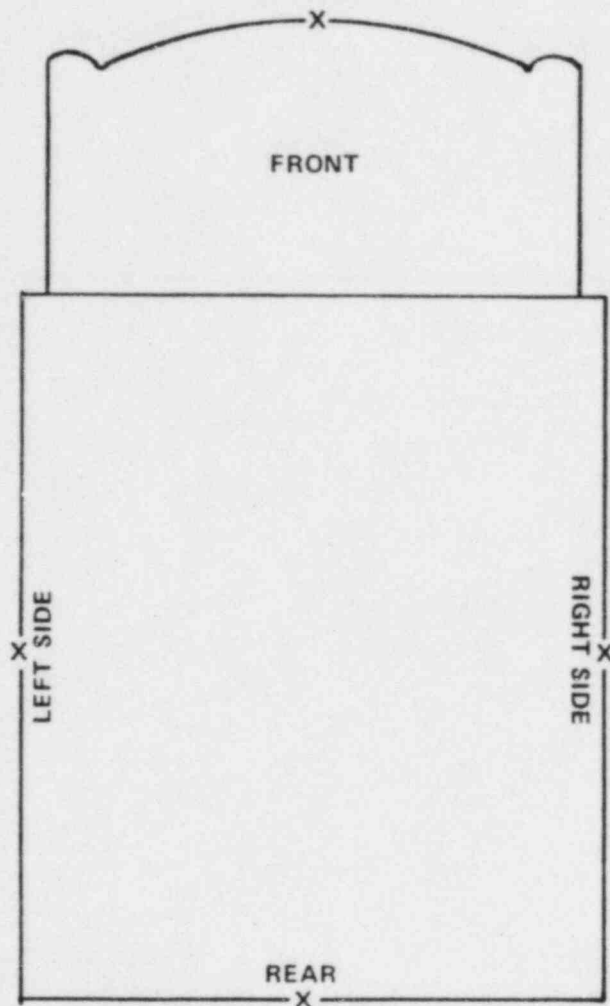
DATE _____

SURVEY METER IDENTIFICATION:

MANUFACTURER _____ SERIAL NO. _____

MODEL NO. _____

ALL READINGS IN MR/HOUR



SURVEY

FRONT _____ MR/HR

REAR _____ MR/HR

RIGHT SIDE _____ MR/HR

LEFT SIDE _____ MR/HR

X - DENOTES POSTING WITH
RADIOACTIVE SIGNS

OPERATOR

UTILIZATION LOG

Month of _____ 19____

[illegible]

MASTER RECEIPT AND DISPOSAL LOG

[illegible]

APPENDIX A-6

RADIATION EXPOSURE RECORD

[illegible]

APPENDIX A-7
LEAK TEST RECORD

[illegible]

CHAPTER II
PROCEDURES FOR STORAGE

1. STORAGE
2. TRANSPORT
3. PROCEDURES FOR USE OF RADIOACTIVE SOURCES
4. RADIATION SURVEYS
5. LEAK TEST PROCEDURES
6. PROCEDURES FOR LOST SOURCE DOWNHOLE
7. EMERGENCY PROCEDURES

APPENDIX B

1. STORAGE PIT CONSTRUCTION
2. SAFETY CURVE AMBE SOURCE
3. MONITORING FORM 100
4. HANDLING TOOL
5. SOURCE SHIPPING CONTAINER
6. PHYSICAL LOCATION OF INSIDE STORAGE PIT
7. SOURCE HOLDER

CHAPTER II

PROCEDURES FOR STORING SEALED SOURCES OF RADIOACTIVE MATERIALS

1. Storage

Radioactive sources must be locked in their shield and kept in a locked storage, trunk compartment, cabinet, pit or chained and locked to an integral part of the truck when not in use.

Storage facilities must be designed or positioned so that no person in an uncontrolled area can receive more than 2 mR in any one hour or more than 100 mR in any seven consecutive days.

a. Storage Pits (Downhole)

- (1) Minimum of two feet of earth, concrete or fill separating adjacent pits.
- (2) Pits to be a minimum of four feet deep.
- (3) Lids to be screwed on or recessed in, designed to exclude water and equipped with a locking device.
- (4) Same as b-3 below.
- (5) See Appendix B-1 for pit construction.

b. Surface Storage

- (1) Steel bunker with locking device.
- (2) Sources are placed inside steel box in their transport shields.
- (3) Maximum reading on contact, 2 mR or less. If higher reading, a fenced perimeter will be established at the 2 mR level.

c. Posting

All storage areas must be posted "Caution - Radioactive Material". On surface storage bunker, the posting "Caution - Radioactive Material" must be on four sides and on controlling fences for the area.

2. All radioactive material sources used will be stored in their shielded transport containers. They will be removed from surface storage vault and placed on vehicles, either in lock type transport cases or will be chain locked to an integral part of the vehicle. Vehicle will then be placarded with D.O.T. specification "RADIOACTIVE" signs on all four sides.

3. Procedures for Use of Radioactive Sources

Company personnel directly in charge of logging operations utilizing radioactive sources are responsible for the health protection of all personnel associated with the sources and the general public who may be associated, at all times. The above personnel (company) must personally supervise all source handling operations, transportation, storage and shipping according to the following regulations.

- a. Company personnel who have been trained in handling sealed sources shall be the only ones who perform operations involving the sources.

All customer personnel shall be required to be remote to these operations.

- b. Only the company approved handling tools will be used. (Appendix B-4)
- c. All sources are to be transported in the approved and locked source shipping containers. (Appendix B-5)
- d. Our standard neutron logging source assembly encloses a 3.0 curie Americium-241 Beryllium neutron source. A dose rate of approximately 16-18 mR/hr. (neutron and gamma) is present at one meter from the shielded source.
- e. Using the remote handling tools the source is removed from the shipping or transport container. The source is attached to the logging tool and placed inside of the well. When logging operation is finished, the logging operator will remove tool from well, utilizing remote handling tool, the source will be removed from the tool and placed back into the storage container. The time-distance factors must be used effectively when working with radioactive sources to keep exposure to a minimum. When utilizing the remote handling tools a safe distance is provided but care and practice are needed to decrease the handling exposure time. (Appendix B-2)
- f. Any sources that you are not familiar with, in handling and usage, contact the Radiation Safety Officer before using them in a logging job.

4. Radiation Surveys

- a. Pit source storage bunker - Remove storage or transport container from bunker. Place source in vehicle in secure position, (locked containment). Survey vehicle on all four sides. Record on Radioactive Monitoring Form 100. (Appendix B-3)
- b. Arrival at well site - Using low level survey meter, monitor the area before commencing job, and record. After job is finished remonitor area to determine there is no contamination around well site. Record on Form 100. After arriving at storage site monitor vehicle to show free of contamination.
- c. The following handling equipment must be present and used on well sites: gloves, handling tongs, protective clothing.

5. Leak Test Procedures

- a. Wipe tests on all sources must be performed at intervals not exceeding six months.
- b. Source will be wipe tested with Gulf Nuclear, Inc. Model LTK-1 Leak Test kit.
- c. Leak test kits will be mailed to Gulf Nuclear at Webster, Texas for counting.
- d. Reports will be sent back to licensee with leak test certificate.

6. Procedure for Lost Source Downhole

- a. When a source is lost notify the well owner or his representative that a source is stuck in the well. As soon thereafter as possible hand him a drawing of the source and housing model. This will enable him to know before he starts the fishing operation, the quantity, type of radioactive material and the mechanical construction of the capsule and tool involved.
- b. Notify the Radiation Safety Officer immediately, if a source of any type is lost in a well or misplaced. This should be done by telephone followed by a written report of complete well location, etc. (The Proper agency has to be notified within twenty-four hours. Some agencies require notification before fishing operations are started. A source is considered lost at the same moment that it is no longer in control of the logging operator such as when stuck down hole, cable breaks, unhooked from the cable, etc.).
- c. During the critical fishing operations the mud being circulated should be monitored using gamma ray equipment with the downhole tool in the mud.
- d. You have only time and distance factors available to reduce the radiation field and personnel exposure, while the source is being fished out. Where practical, everyone except the driller and enough personnel to cover the hole, should remain in the work area.
- e. All handling of the drilling rig equipment should be handled by the customer and actual handling of the source should be done by Camco, Inc. Wireline Services personnel.

7. Emergency Procedures

Emergencies vary greatly in their respective hazards. These are sometimes in the form of spills, fires, explosions or vehicle wrecks which consequently result in the spread of radioactive material contamination. The National Bureau of Standards Handbook Number 48, Emergency Guides, are used as a guide for the procedures. These procedures are general and any specific emergency would certainly involve additional procedures not covered in the outline.

a. Vehicle Wreck

In the event of an accident while transporting radioactive materials, efforts should be made to minimize the exposure of any persons. This would include roping off the area, notification of the investigating officer, and Radiation Safety Officer at the home office should be notified immediately, making sure that the area is not left unattended. This will enable the Radiation Safety Officer to notify the proper governmental agency.

b. Fire and Other Emergencies

- (1) notify all personnel in the area immediately

- (2) attempt to put out all fires if a radiation hazard is not immediately present
- (3) notify the fire department
- (4) notify the Radiation Safety Officer
- (5) the Radiation Safety Officer will set up restrictions governing the fire fighting and other emergency activities
- (6) following the emergency, monitor the area and ascertain the emergency devices necessary for safe decontamination
- (7) decontaminate
- (8) the Radiation Safety Officer will have to approve the area before work can resume
- (9) monitor all persons involved in combating the emergency
- (10) prepare a complete history of the accident and report to the Radiation Safety Officer who will in turn report it to the proper State Agency

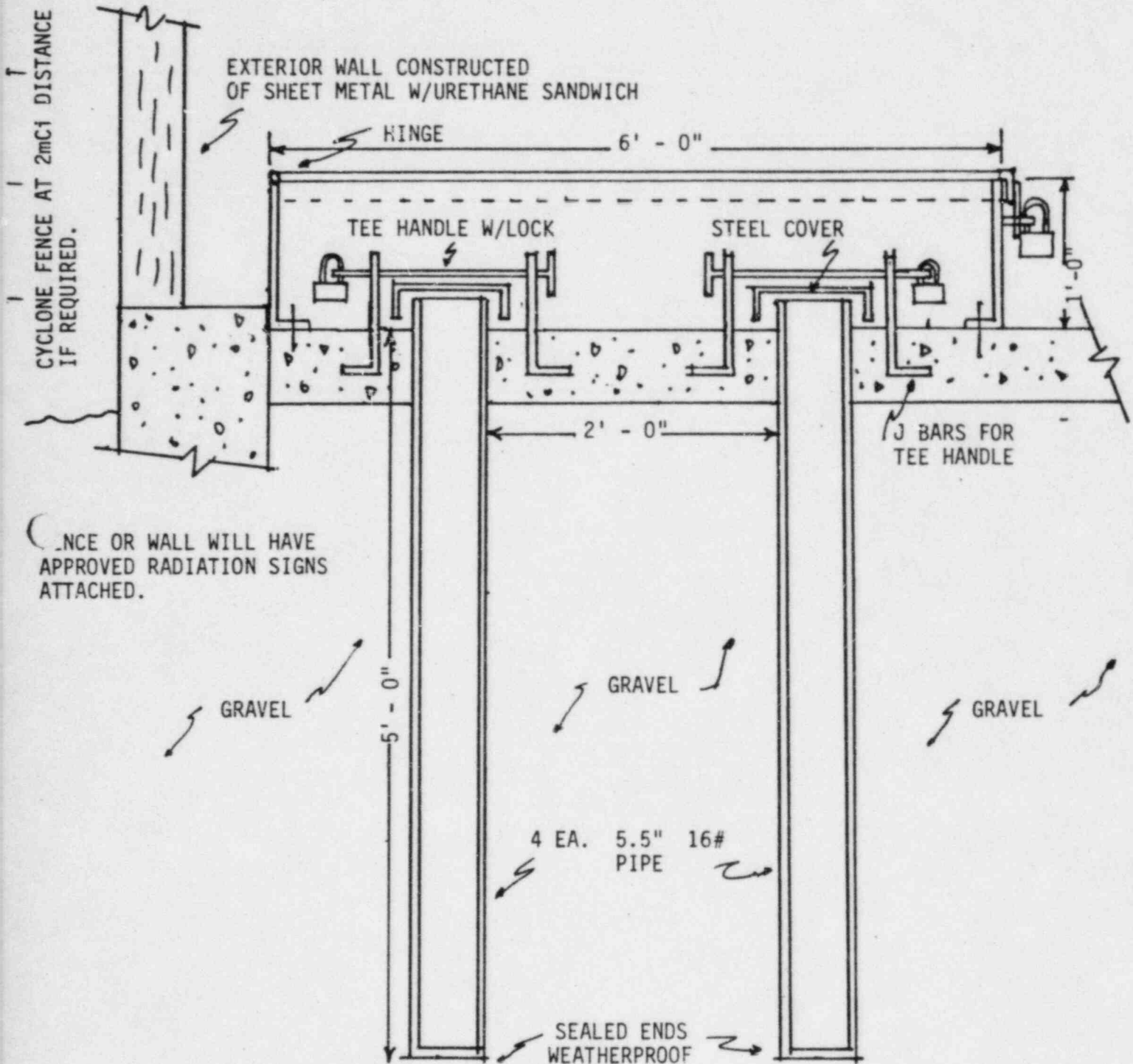
c. Leaking Source

- (1) if a source is leaking which the logging tool would indicate, shut the operations down
- (2) notify contractor and immediately call Radiation Safety Officer for instructions
- (3) set up control procedures for keeping personnel out of the immediate area until instructions are received from the Radiation Safety Officer

APPENDIX B-1

UNDERGROUND STORAGE PIT

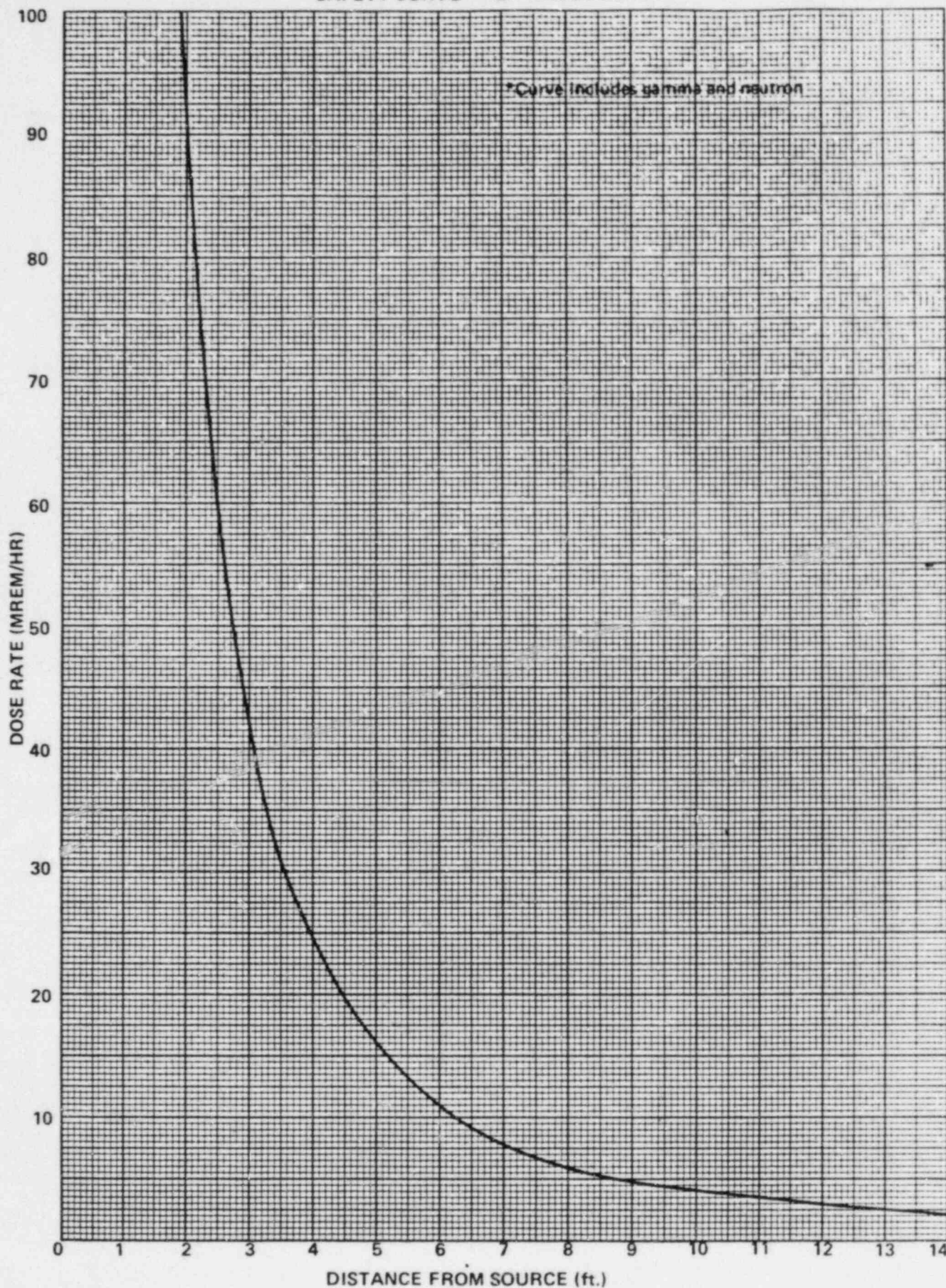
6' X 6' METAL COVER W/DOUBLE LOCKS CONTAINING 4 EACH 5.5" PIPES TO DEPTH OF 5' - 0" W/SINGLE LOCK ON EACH INDIVIDUAL PIPE.



A CYCLONE FENCE WILL BE INSTALLED AT A DISTANCE OF 2mCi ON ALL THREE SIDES OF THE UNDERGROUND STORAGE PIT AS A MINIMUM IF REQUIRED OR WILL BE INSTALLED AT A CONVENIENT DISTANCE TO ALLOW FOR ENTRY TO THE PIT. THE FENCE WILL HAVE A GATE AND WILL BE LOCKED AT ALL TIMES. ALL THREE SIDES OF THE FENCE WILL HAVE APPROVED RADIATION SIGNS.

APPENDIX B-2

SAFETY CURVE* - 2.7 AmBe SOURCE



APPENDIX B-3
RADIOACTIVE MONITORING FORM 100

Date _____

Company _____ Well _____

Field _____ County _____ State _____

Operator _____ Servicemen _____

Engineer _____ Other Personnel _____

Job Ticket No. _____ District _____

Type Meter _____ Serial No. _____ Date Calibrated _____

Monitoring Procedure Before Leaving Shop
Truck Loaded (Before Leaving Shop)

Background Count _____ mr/hr. (50 ft. clear of R/A Material)

Source No. _____ Isotope _____ Strength _____

Tracer Type _____ Strength _____

Back Sign _____ Front Sign _____ Right Sign _____ Left Sign _____

Monitoring Procedure Before Operations Begin

Background _____ mr/hr.

Wellhead _____ Rubber Hose & Fittings _____ Gloves _____

Handling Tools _____ Engr. Hands & Clothing _____ Ejector Tool _____

Area where work is to be performed _____

Monitoring Procedure After Operations Complete

Wellhead _____ Rubber Hose & Fittings _____ Gloves _____

Handling Tools _____ Engr. Hands & Clothing _____

Area where work performed _____ Thyroid Check Engr. _____

Witness _____

Additional Personnel
Name

_____ No. 1 _____ mr/hr.

_____ No. 2 _____ mr/hr.

_____ No. 3 _____ mr/hr.

_____ No. 4 _____ mr/hr.

Additional Personnel
Witness

_____ No. 1 _____ mr/hr.

_____ No. 2 _____ mr/hr.

_____ No. 3 _____ mr/hr.

_____ No. 4 _____ mr/hr.

Exact location of any significant contamination _____

Steps taken to remedy _____

Amount of Tracer taken on job _____ Amount used _____ mc

Truck Monitoring Before Leaving Job Site (Loaded)

Back Sign _____ Front Sign _____ Right Sign _____ Left Sign _____

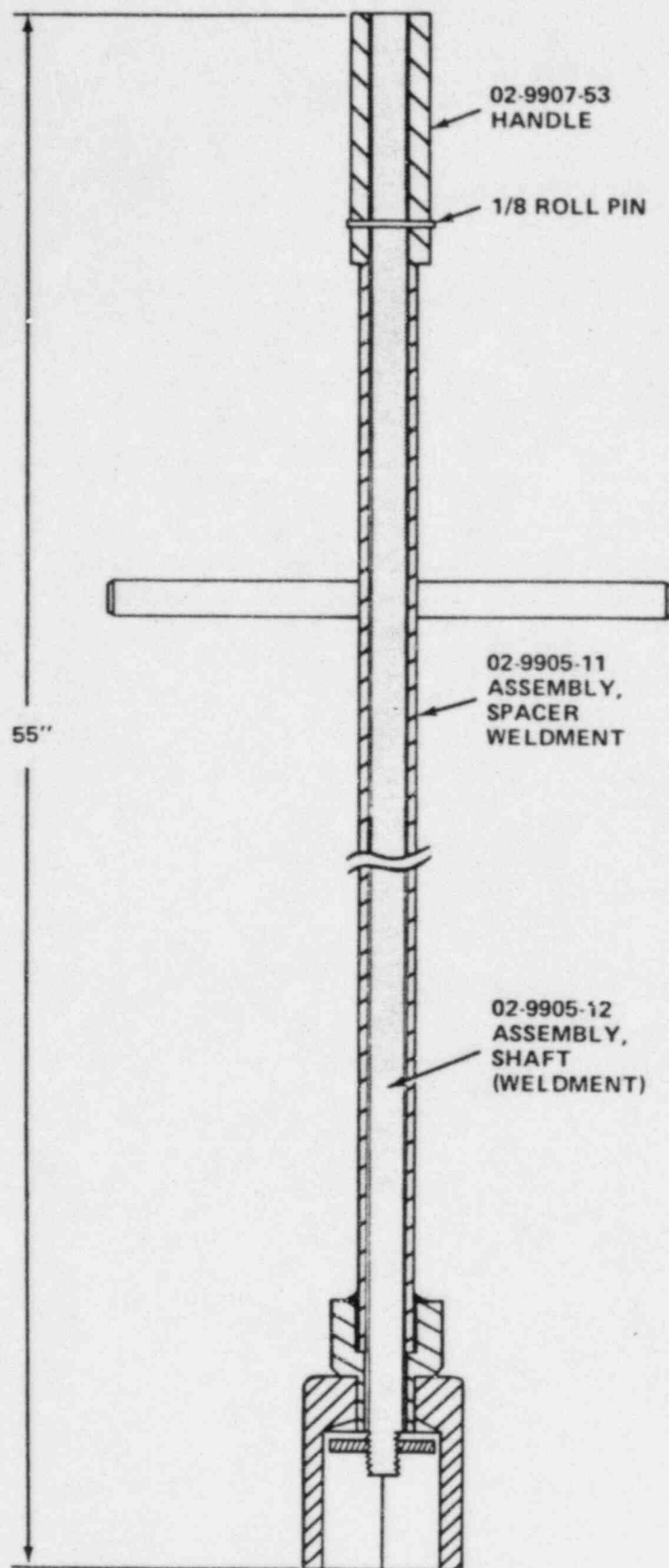
Truck Monitoring After Unloading at Shop and Material Put into Proper Storage Area

Back Sign _____ Front Sign _____ Right Sign _____ Left Sign _____

Make in Triplicate: (1) Attach to Job Ticket (2) Retain at District Office (3) Anchorage, Alaska

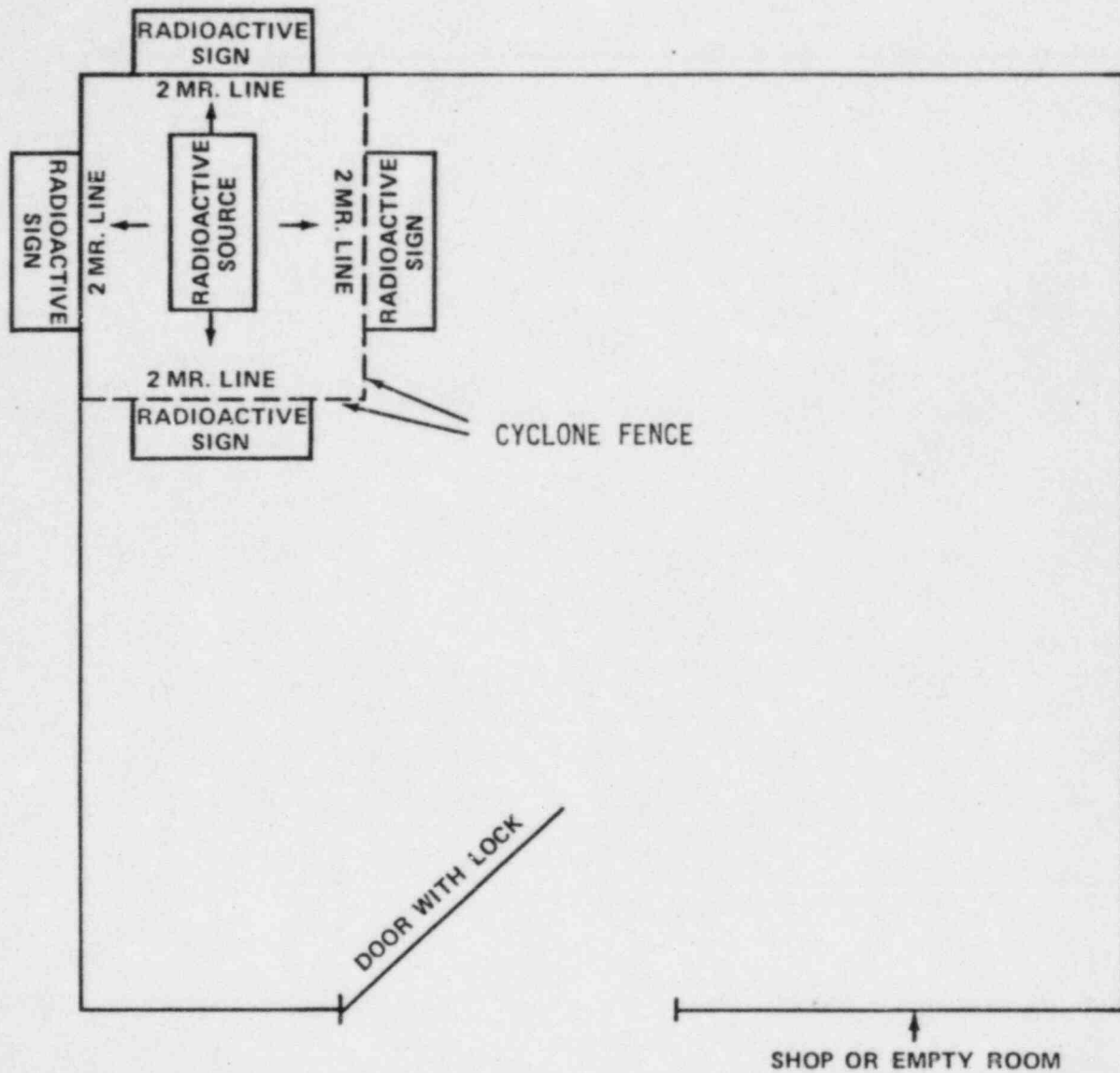
APPENDIX B-4

SOURCE LOADING TOOL ASSEMBLY F/1-11/16 SOURCE HOLDER - 3 curie AmBe 241 02-9907-10



APPENDIX B-6

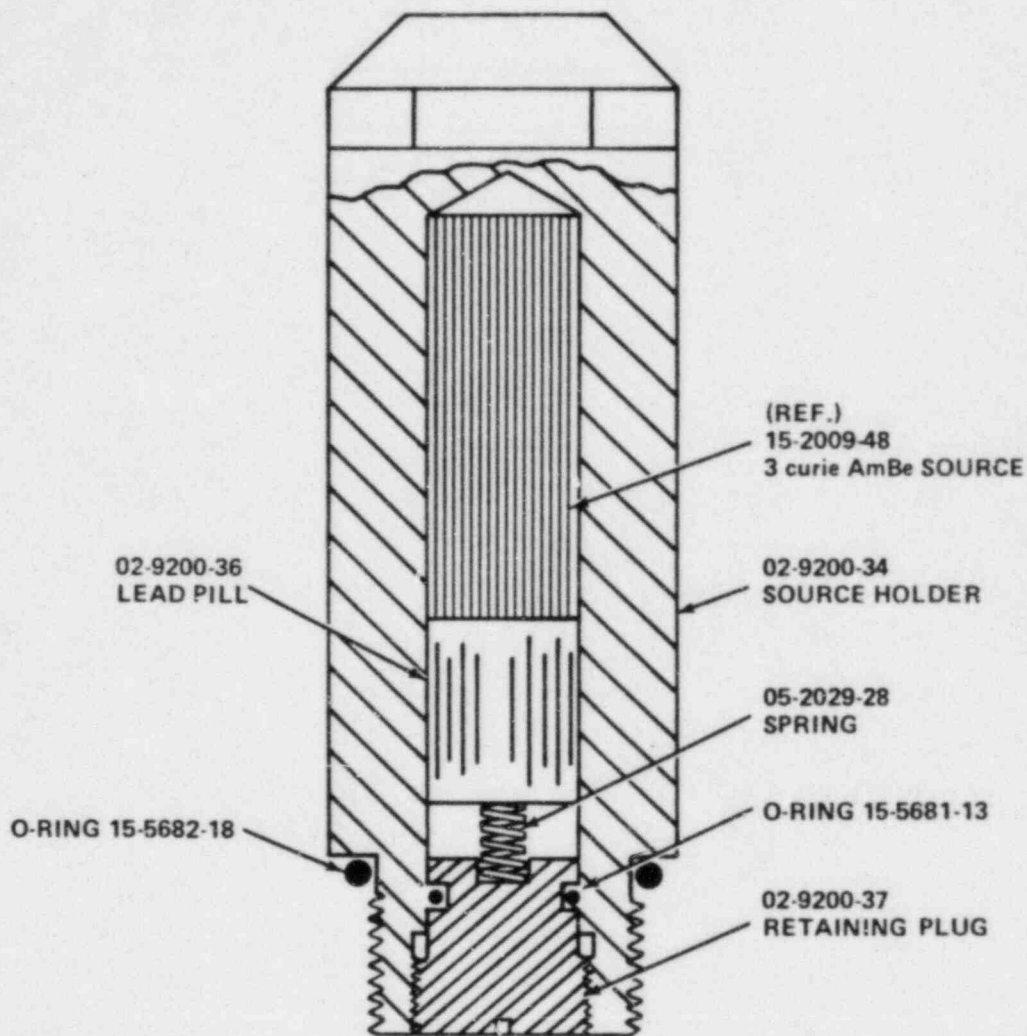
PHYSICAL LOCATION OF INSIDE STORAGE PIT



NOTE: Source shield should be locked and when not in use it is usually wise to have it where it is not easily removed.

APPENDIX B-7

SOURCE HOLDER ASSEMBLY 3 curie AmBe SOURCE 02-9200-18



CHAPTER III
PROCEDURES FOR TRACER APPLICATIONS

1. OIL FIELD TRACER APPLICATION
2. SAFETY PRECAUTIONS
3. HEALTH PHYSICS REGARDING ACTUAL FIELD STUDIES
 - A. MONITORING JOB SITES
 - B. HANDLING EQUIPMENT
 - C. POCKET DOSIMETERS
 - D. FILM BADGES
4. TRACER PACKAGING
5. HANDLING AND FIELD EQUIPMENT CHECK LIST
6. OPERATING PROCEDURES
7. EMERGENCY PROCEDURES
8. MONITORING TECHNIQUES FOR PERSONNEL
9. TRANSPORTATION AND DISPOSITION OF RADIOACTIVE WASTE
10. SAFETY PROCEDURES FOR HANDLING RADIOACTIVE TRACERS
 - A. INTRODUCTION
 - B. HANDLING PROCEDURES
 - C. CONTAMINATION SURVEY TECHNIQUES
 - D. DECONTAMINATION PROCEDURES

APPENDIX C

1. HAND EXPOSURE FROM RADIOACTIVE TRACERS
2. RADIATION LEVELS AT 1 FOOT FROM UNSHIELDED RADIOACTIVE TRACER
3. RADIATION LEVELS AT 3 FOOT FROM UNSHIELDED RADIOACTIVE TRACER
4. CONTAMINATION INSPECTION SHEET
5. EMERGENCY PROCEDURES REPORT
6. REPORTING AGENCIES

CHAPTER III

PROCEDURES FOR TRACER APPLICATIONS

1. Oil Field Tracer Applications

Selection of the isotope depends on the study to be performed. Listed below are the critical isotopes and some injection techniques.

Iodine - 131
Iridium - 192

The method of injection depends on the type of equipment available and the pressure and condition of the well. The following are descriptions of applicable techniques.

- a. Materials are placed in breakable vessels and attached to a logging device. When in the well they are exploded by use of a squib charge.
- b. The material can be poured or inserted by using a syringe directly into the well head. Used where no pressure is involved.
- c. Where sand is concerned the sand is generally blended at the slurry hopper.
- d. An appropriate amount of the isotope is added to an injection tool which is controlled from the truck panel board permitting limited quantities of material to be injected.

Studies covered are as follows: acidizing operations, cement top locations, cement channel locations, casing seat channel locations, water flood directional flow, oil injection profiles, interface markers, flow calibrations, oil slurry cement locations, gas flow calibrations, gas channel locations behind casing, gas injection profiles, gas flooding, recovery projects, fracturing, and permeability surveys.

2. Safety Precautions

Generally, the following safety facts should be known and observed when utilizing radioactive tracer materials.

- a. Safety through Distance - Distance can be an effective measure from a source. Safe distances should be known for the amounts of radioactive material being handled.

Examples of exposure rates at various distances from 100 millicurie sources:

<u>Radioactive Material</u>	<u>3 Feet</u> mR	<u>6 Feet</u> mR	<u>9 Feet</u> mR
Iridium - 192	61	15.25	6.8
Iodine - 131	25	6.25	2.8

- b. Safety through Shielding - Certain materials are effective shields against radiation. The half-layer value is the amount of shield necessary to reduce the radiation one-half.

Half layer value for some common materials:

<u>Radioactive Material</u>	<u>Lead</u>	<u>Steel</u>	<u>Concrete</u>
Cobalt - 60	0.49"	0.87"	5.0"
Cesium - 137	0.25"	0.68"	2.1"
Iridium - 192	0.19"	0.5"	1.9"

- c. Safety through Stay Time - The safety of an individual may be gained by controlling the amount of time he is exposed to radiation. If exposure attains an unsafe limit, personnel should be rotated. (Appendix C-1, 2, & 3)

3. Health Physics Regarding Actual Field Studies

- a. Monitoring job site before initiation of work and on completion to assure no contamination is left at the well site by recording data on Form 100. (Appendix B-3)
- (1) Using a low level survey meter, and before work initiation, monitor the area. Record the observations on a sketch of the area.
 - (2) Certify the area clean before commencing the job.
- b. Handling Equipment - the following items shall be worn at all times when handling the radioactive material while health physics problems are present:
- (1) Gloves*
 - (2) Face masks**
 - (3) Handling Tongs*
 - (4) Protective Clothing*
- c. Pocket Dosimeters can be worn by personnel who are handling the radioactive materials. If, however, personnel also carry personnel film badges, the option is present as to whether the pocket dosimeter be worn. The advantage to the pocket dosimeter is direct reading, and if the radiation level is not excessive (Generally 1 to 10 mCi. of Iodine - 131 will be handled per injection), then it should be the option of the field safety officer as to whether pocket dosimeters be worn.

* These items will always be worn in handling radioactive materials, thus, preventing the possibility of contamination to the person who is actually handling the radioactive material.

** Face masks shall be worn at all times when gaseous radioactive material is being used in a field study. The face mask shall be a type approved by the National Bureau of Mines and should contain an excellent organic filter agent.

- d. Film Badges - It will be mandatory for all personnel working in the restricted area (an area greater than 2 mR/hr.) to wear a film badge.

4. Tracer Packaging

All packages received from the suppliers containing radioactive materials shall be monitored prior to their leaving their facilities. The dosage limits shall comply to the D.O.T. shipping regulations which are a maximum of 200 mR/hr. at the surface of a shipping container and a maximum of 10 mR/hr. at a distance of one meter from the surface of the container.

5. Handling and Field Equipment Check List

The specific application may require additional radiation detection equipment than that listed below, but, generally the field equipment will consist of the following items:

- First aid kit
- Kim-Wipes (industrial type)
- Sponges
- Large and small polyethylene storage bags for containing contaminated equipment, sponges, etc.
- Protective clothing
- Two remote handling tongs
- Masking and plastic electrical tape
- Plastic wash bottles
- Rubber gloves
- Labels for the return of radioactive waste
- Dosimeter and charger
- Film badges
- Concentrated wash solution
- Low level survey meter (Victoreen Model 493)

6. Operating Procedures

- a. Pre-job knowledge and planning - The Radiological Safety Supervisor must know:

- (1) Type of radiation involved.
- (2) Intensity of radiation.
- (3) Relative hazard of each type of radiation.
- (4) What the "stay time" (maximum allowable exposure time) is.
- (5) What the possible contamination problems are.
- (6) Any internal contamination problems.
- (7) What industrial nuisance, removable contamination will create.
- (8) What controls must be dictated to protect personnel.
- (9) Plan methods for controlling access to radiographic area.

b. Specific procedures will vary with the individual job applications. In general, the following procedures should be followed:

- (1) Plan the job in advance.
- (2) Monitor the area and measure the background radiation level.
- (3) Optimum mixing location should be selected. Radioactive material should be mixed with injection fluid as close to well head as possible.
- (4) Define the area which is prohibited to unauthorized personnel. (2 mR/hr. is the maximum allowable radiation to people not wearing film badges).
- (5) Mix radioactive material with injection fluid with special consideration given to splashing, wind conditions, and any other outside influence which could interfere with the safe handling of the material.
- (6) Plastic or rubber gloves should be worn at all times while handling radioactive materials. If wind velocity is sufficient to cause blowing, goggles and respirator should be used.
- (7) Exposure time should be controlled. If exposure approaches the maximum permissible limit, personnel should be rotated.
- (8) Allow no eating, smoking, or drinking in the restricted area.
- (9) Following the completion of the operation, the entire area should be monitored.
- (10) Radioactive Contamination Inspection Data Sheet should be filled out and given to customer. (Appendix C-4)

7. Emergency Procedures

Emergencies vary greatly in their respective hazards. Sometimes these emergencies are in the form of spills, fires or explosions which consequently, result in the spread of radioactive contamination. Emergency procedures contained in the National Bureau of Standards, Handbook No. 48, are given here as a guide. It must be recognized that these procedures are general and any specific emergency would certainly involve additional procedures not specifically covered in this outline.

a. Spills involving no radiation hazard to personnel:

- (1) Notify all personnel in the area at once.
- (2) Permit only a minimum number of personnel in the vicinity of the spill.
- (3) Confine the spill immediately.
- (4) Notify the Radiation Protection Officer.
- (5) Decontaminate.
- (6) Monitor all personnel involved in the spill and cleaning.
- (7) Permit no person to resume work in the area until it has been surveyed and approved by one of the approved individual users specified on the AEC Radioactive Material License.

b. Spills involving radiation hazard to personnel:

- (1) Notify all personnel not involved in the spill to vacate the area at once.
- (2) If the spill is liquid and the hands are protected, right the container.
- (3) If the spill is on the skin, flush thoroughly.
- (4) If the spill is on the clothing, discard outer or protective clothing at once.
- (5) Switch off all fans. Vacate the room.
- (6) Notify the Radiation Protection Officer as soon as possible.
- (7) Take immediate steps to decontaminate the personnel involved.
- (8) Decontaminate the area.
- (9) Permit no person to resume work in the area until a survey is made and approval of the Radiation Safety Officer is secured.
- (10) Prepare a complete history of the accident, and give details in the Emergency Procedures Report. (Appendix C-5)

c. Injuries to personnel involving radiation hazards:

- (1) Wash minor wounds immediately under running water while spreading the edges of the gash.
- (2) Call a physician, preferably one who is qualified to treat radiation injuries.
- (3) Permit no person involved in a radiation injury to return to work without the approval of the attending physician.
- (4) Report all radiation accidents (wounds, over-exposure, ingestion, inhalation) to your supervisor.
- (5) Prepare a complete history of the accident and give the details in the Emergency Procedures Report.

d. Fire and other major emergencies:

- (1) Notify all personnel in the area at once.
- (2) Attempt to put out all fires if radiation hazard is not immediately present.
- (3) Notify the Fire Department.
- (4) Notify the Radiation Safety Officer.
- (5) Govern the fire fighting or other emergency activity by the restrictions of the Radiation Safety Officer.
- (6) Following the emergency, monitor the area and determine the emergency devices necessary for safe decontamination.
- (7) Decontaminate.
- (8) Permit no person to resume work without approval of the Radiation Safety Officer.

- (9) Monitor all persons involved in combating the emergency.
- (10) Prepare a complete history of the accident and give details in the Emergency Procedures Report.

8. Monitoring Techniques for Personnel

- a. Check hands (finger tips), shoes (soles and heels), face (nostrils) first.
- b. Remove any contaminated clothing to a covered bin and continue monitoring.
- c. Check hands ALWAYS before eating, drinking, or smoking. Cleanse carefully of contamination (scrub with soap and water), and check again.

9. Transportation and Disposition of Radioactive Waste

a. Transportation of Radioactive Material

- (1) Radioactive materials being transported must meet the same requirements as packing of materials.
- (2) When transporting radioactive materials in a passenger automobile, the materials should be carried in the trunk compartment at the furthest point possible away from the passengers or driver.
- (3) When transporting radioactive materials in a truck, the materials should be carried in a closed compartment at the furthest point possible away from the passengers or driver.
- (4) Any vehicles transporting radioactive materials should be posted with suitable signs.
- (5) Radioactive materials should be packed in such a manner so that there is no danger of spilling or loss.
- (6) In the event of an accident while transporting radioactive materials, efforts should be made to minimize the exposure of any persons. This could include any action such as roping off the area and notifying investigating officers. The Region Office should be notified immediately in order that the State Agency may be contacted if necessary.

b. Storage of Radioactive Materials

- (1) Radioactive materials shall be stored in a suitable shielded container and will be covered at all times with suitable lids to prevent unnecessary exposure. Only authorized personnel shall have access to the storage facility. Suitable markings will be placed at the location.
- (2) An additional storage facility of suitable construction will be provided for the storage of empty containers which have contained radioactive materials, contaminated objects such as tools, rags, clothing, etc. This storage facility shall remain locked at all times. Suitable markings will be placed at the location.

c. Records and Reports: The following records and reports will be made:

- (1) Maintain records showing the radiation exposures of all individuals for whom personnel monitoring is required. These records will be preserved until a date five years after termination.
- (2) Each licensee shall report by telephone and telegraph to the Federal or State Agency, the theft or loss of any source of radiation immediately upon knowledge of it.
- (3) Each licensee shall notify the Federal or State Agency upon an incident causing an individual to receive radiation in excess of the permissible limit.
- (4) Each licensee shall advise any individual employed or associated with him annually, of such individual's exposure to radiation as shown on the records maintained.

d. Water Disposal

- (1) Disposal by release into sanitary sewage systems - No licensee shall discharge radioactive material into a sanitary sewage system, unless it is readily soluble in water and does not exceed the MPC as specified in 10 CFR or applicable State regulations.
- (2) Disposal by burial - No licensee shall dispose of radioactive material by burial without a permit obtained from the Federal or State authorities.
- (3) Disposal by incineration - No licensee shall dispose of radioactive material by means of incineration.
- (4) If it becomes necessary to dispose of any radioactive material, contact Gulf Nuclear, Inc. for proper steps to be taken.

e. Markings

- (1) Symbols prescribed by this section shall use the conventional radiation caution colors (magenta or purple on yellow background). The symbol is the conventional three-bladed design.
- (2) Use of signs - A sign or signs bearing the radiation symbol (CAUTION - RADIOACTIVE MATERIALS) shall be used in the following instances:
 - (a) Radiation areas.
 - (b) Rooms or areas where radioactive materials are stored in quantities exceeding those specified in 10 CFR or applicable State regulations.
 - (c) Containers in which radioactive materials is stored.
 - (d) Vehicles transporting radioactive material.
 - (e) Packages used for shipping.

10. Safety Procedures for Handling Radioactive Tracers

- a. Introduction - In order to give proper safety consideration to the various radioactive materials used in tracer surveys, the following information should be understood by all field users. The relatively low activity levels of the tracer units allow some latitude in handling techniques such that moderate safety precautions are sufficient.

The major safety problem is the prevention of accumulation of radioactive material in the body. The activities typically used are from 100 to 10,000 times the tolerable limit for internal accumulation. The degree of this particular hazard depends on the biological activity of the isotope, its half-life and the nature of the tracer preparation.

- b. Handling Procedures - The large variety of tracer preparation used, or available for use, is such that no fixed procedures can be specified for each tracer unit. In general though, the majority of tracers may be handled for a few minutes without the use of extension tools. Appendix C-1, 2 and 3 indicate the relative hazards of working with various amounts of four tracer materials.

Appendix C-1 gives the allowable handling time in minutes per week for various amounts of Iodine - 131, Iridium - 192, Scandium - 46 and Zirconium - 95. This is based on actual measurements made by Gulf Nuclear, Inc., our tracer supplier and a maximum allowable radiation exposure of 5.0 rems per year or 1.25 rems per quarter (18.75 rems for extremities) as specified in the pertinent Federal regulations. We must stay within the handling times as indicated on the chart in order that we may continue to handle the unshielded tracer units without the benefit of hand type monitoring devices such as wrist film badges, finger dosimeters, etc. or remote handling devices. However, the use of the normal safety equipment such as survey meters, rubber gloves, etc. and the regular film badge is still required.

The allowable handling time is determined as the maximum time in minutes per week that a person can work with his hands (rubber gloved) in direct contact with unshielded tracer units. The allowable handling time as indicated on Appendix C-1 is not additive, that is, you cannot, for example work for 18 minutes with 10 millicuries of Iridium - 192 and 42 minutes with an equal amount of Iodine - 131 in one week. If several hand exposures to both types of tracer materials are received during one week, the exposures must be rationed.

Example: If in one calendar week a person directly handles 20 millicuries of Iodine - 131 for 3 minutes, 10 millicuries of Iridium - 192 for 3 minutes and 15 millicuries of Iodine - 131 for 4 minutes, these exposures are totaled as follows: From the chart the allowable handling time for 20 millicuries of Iodine - 131 is 21 minutes. Hence the exposure to the hands for 20 millicuries of Iodine - 131 is 3 divided by 21, or .143 of the weekly allowable handling time. Similarly, the exposure for the 10 millicuries of Iridium - 192 is 3 divided by 18, or .167; and that for the 15 millicuries of Iodine - 131 is 4 divided by 28, or .143. Adding these three fractions, $.143 + .167 + .143$ equals .453, or a little less than half the total allowable handling time for that particular calendar week.

WHEN THE VARIOUS EXPOSURES ADD TO A TOTAL OF MORE THAN 1.000 THE WEEKLY ALLOWABLE HANDLING TIME HAS BEEN EXCEEDED AND THE FOLLOWING WEEK'S WORK MUST BE LIMITED ACCORDINGLY.

Appendix C-2 and C-3 indicate the radiation levels that are present for various amounts of the tracer materials at one and three feet from the unshielded tracer units.

Please remember that tolerances are not meant for working levels but as maximum safe levels only, and that the objective should be to obtain a minimum exposure during tracer operations. This can be accomplished by working as rapidly, yet carefully, as possible with the tracer units and also by distributing the actual direct handling of the unshielded materials among as many qualified people as possible.

c. Contamination Survey Techniques

(1) Surveying of Area and Equipment

The ideal mixing and injection operation would have no spills and leave no residue of tracer material in any of the vessels or pipes through which the tracer was injected. In practice such an ideal may not be realized, and a survey of the area is necessary so that the proper procedures may be followed to assure that no remaining contaminant can cause harm to company personnel, the customer's personnel, or the general public.

A survey meter must be used with the beta shield open to survey the entire area where mixing has been done, and the pipes and associated components through which the mix was conducted to the well, to be sure that no concentration remains that may cause harm, either by external radiation or by possible contamination of food or water supplies.

Contamination of the probe must be avoided completely. If any contact survey is made, the probe is to be protected with a sheet of paper between the object and probe. A contaminated probe can render the survey meter useless for low level measurements.

Spills should be cleaned up and, if possible, injected into the well with the main tracer unit. The area of the spill should then be surveyed with the probe approximately one inch above the surfaces.

Any areas or items of equipment which indicate any amount of detectable radioactivity, above background, shall be considered contaminated and appropriate measures taken to remove such concentrations. (See Paragraph d).

(2) Surveying of Individuals

The greatest care in survey measurement is taken on items of personal equipment such as shoes, gloves, clothing and handling tools, as well as exposed portions of the body of personnel working with radioactive materials. This is because of the much greater probability of ingestion from such items.

The survey meter should also be used with the beta shield open to read the radiation level of clothing worn by the individual performing the mixing operation or any other clothes suspected of contamination. This should be done immediately following the mixing operations. If any indication of radioactive contamination is found on items of clothing, equipment, etc., or on the person of personnel involved in the operation,

every effort should be made to remove the activity. (See Paragraph d for decontaminating.)

d. Decontamination Procedures

The radioactive tracer preparations are down by factors of 50 to 200 below the dangerous levels for external radiation hazards. The major hazard involved with these tracer preparations is the factor of ingestion. The ingestion tolerance is from one part per thousand to one part per ten thousand of the typical activities used. Thus, great care is exercised by company personnel to avoid contamination of hands, clothing and other personal items. Accidental concentrations of radioactive material are cleaned up, dispersed, or disposed of safely.

Decontamination shall, in general, be accomplished by rinsing and flushing fresh water through the equipment, or washing and scrubbing of contaminated items of clothing or portions of the individual's body. A detergent may be added to the water to aid this process. Portions of the equipment which cannot be decontaminated by this method shall be disassembled and scrubbed with water and detergent followed, if necessary, by steam cleaning. A 15% hydrochloric acid solution may be used to remove contamination from the surface of non-porous materials. Other chemicals may be had for decontamination but their use should be limited due to their toxic nature.

Articles of clothing can normally be easily decontaminated by washing and scrubbing with water containing a strong detergent. This also applies to portions of the exposed individual's body. If efforts to decontaminate items of clothing on the job are unsuccessful, the clothing should be removed immediately to be washed after returning to the home station nearest the job location. Contaminated articles of clothing, rags, etc. should never laundered in a home or commercial laundry. Such washing and scrubbing is restricted to the job site or the company base. If the contamination cannot be removed economically, the clothing shall be discarded and treated as radioactive waste.

As indicated above (See Paragraph c-2) every effort should be made to decontaminate any contaminated area of the body. Scrubbings should be repeated until activity is removed. The same safety precautions shall be applied to the above operations as were applicable for tracer mixing and injection in particular.

- (1) Rubber gloves shall be worn during decontamination procedures involving personal contact with the equipment.
- (2) Food, cigarettes, etc., shall be kept outside the clean-up area. Quantities of radioactive material which present no hazard outside the body can be very dangerous if the same amount is internal.
- (3) The wash water shall be treated as radioactive waste. If wash water is discharged into sanitary sewerage system, the dilution of the activity by the sewerage must be such that the tolerance established for such disposal by the AEC are not exceeded.

Since we do not have the capability of assaying the wash water for the concentration of contaminant in microcuries per milliliter, we must use the amount of tracer material actually used on the job and the average daily water consumption at the base in determining that we are not exceeding tolerances.

If the wash water is discharged into a septic tank, then the surface of the fluid in the septic tank shall be surveyed after each such decontamination operation, and if any activity above background is noted, the tank shall be posted with a radiation warning sign alerting everyone concerned of the possible hazard.

If standard decontamination efforts are unsuccessful, the procedures to be followed shall depend on the value and ownership of the items involved, the degree of contaminations, and the half-life of the contamination activity. Every effort shall be made to thoroughly decontaminate rented or borrowed equipment. If all efforts to decontaminate items or equipment, clothing, etc., have failed to render the radioactive contamination to background and the measurable activity is apparently "fixed" the user in charge has three alternatives. They are as follows:

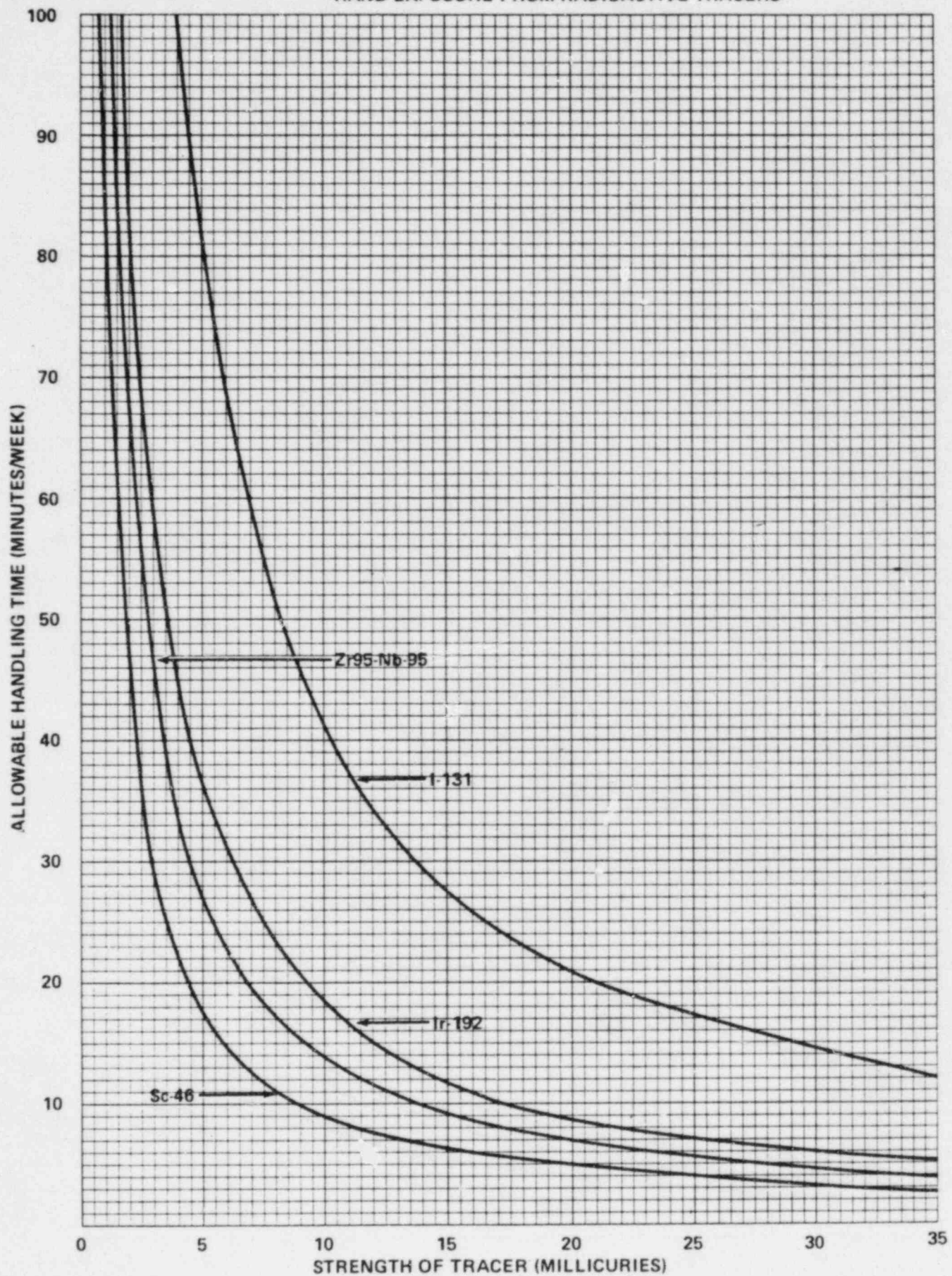
- (4) If the "fixed" contamination measures less than 0.2 mR/hr. at one centimeter, the item of equipment, article of clothing, etc., can be returned to normal use.
- (5) If the "fixed" contamination measure more than 0.2 mR/hr. at one centimeter, the item or items in question shall be treated as radioactive waste and disposed of accordingly.
- (6) If the item containing the "fixed" contamination (which measures more than 0.2 mR/hr. at one centimeter) is such that it is continually used in tracer operations, e.g. parts of a dump bailer, tracer injector, etc., and will be used in no other operation, then it may continue to be used if it is labeled properly and treated as a radioactive source and if the radiation measures less than 2.0 mR/hr. at three inches from the surface.

More persistent activities remaining on injection apparatus, customers equipment, etc., are steam cleaned or chemically treated for contamination.

The user in charge shall be responsible for all contaminated equipment. That is, for any equipment, waste, area, or wash water that falls within the above alternative situations. The user in charge shall personally supervise its safe disposition either by staying on the job until the contamination is removed or transporting the equipment to the base where it may be stored awaiting further decontamination efforts.

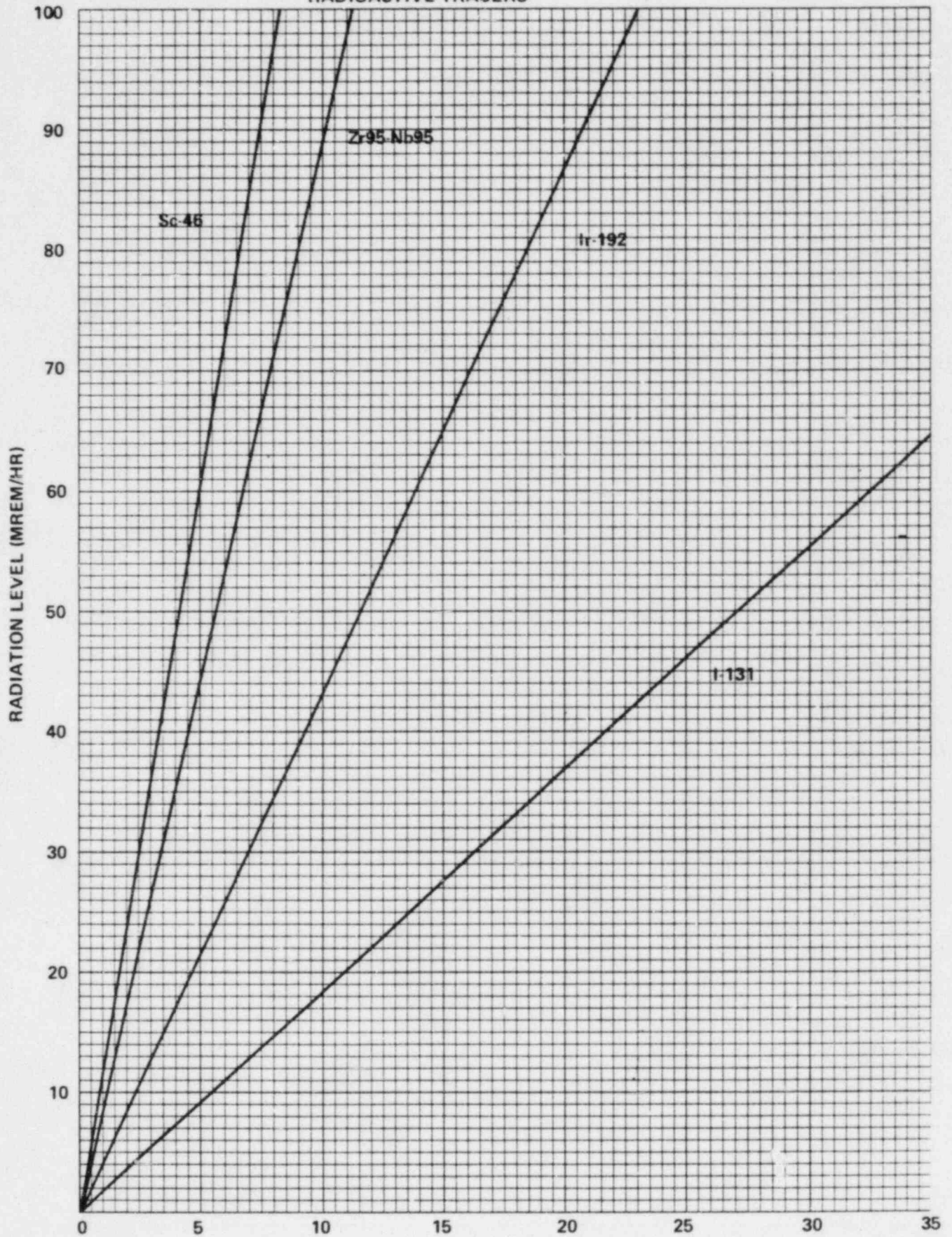
APPENDIX C-1

HAND EXPOSURE FROM RADIOACTIVE TRACERS



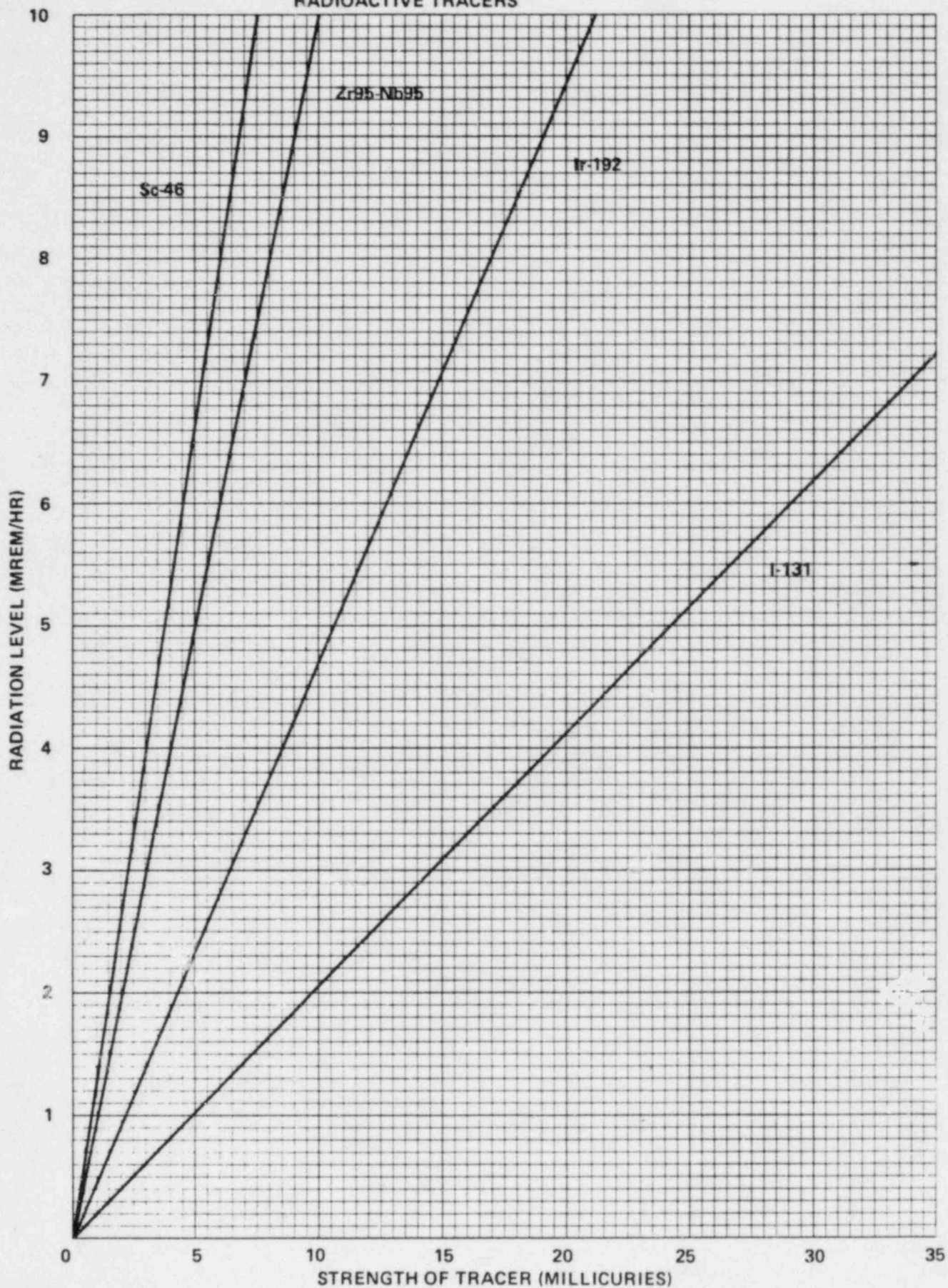
APPENDIX C-2

RADIATION LEVELS AT ONE FOOT FROM UNSHIELDED RADIOACTIVE TRACERS



APPENDIX C-3

RADIATION LEVELS AT THREE FEET FROM UNSHIELDED
RADIOACTIVE TRACERS



APPENDIX C-4
RADIOACTIVE CONTAMINATION
INSPECTION DATA SHEET

Date _____

Company _____ Well _____

Field _____ Borough _____ State _____

Operator _____ Servicemen _____

Engineer _____ Other Personnel _____

Job Ticket No. _____ District _____

Type Meter _____ Serial No. _____ Date Calibrated _____

Background (before Operation began) _____ mr/hr.

Background (after Operation completed) _____ mr/hr.

Explanation of any significant contamination (indicate on sketch)

Well
Head

Amount of significant contamination _____ mr/hr.

Steps taken to remedy: _____

Witness: _____

Make in Triplicate (1) Company Representative (2) District Office (3) Anchorage, AK

APPENDIX C-5

A. EMERGENCY PROCEDURES REPORT

1. Customer: _____

2. Customer's Supervisor: _____
3. Company Supervisor: _____
4. Cause of Emergency: _____

5. Source of Isotope: _____
6. Quantity of Isotope (curies) believed to have been spilled: _____

7. Safety precautions immediately enacted: _____

8. Were there any suspected over-exposures and if so, who:
1. _____ 3. _____
2. _____ 4. _____

EMERGENCY PROCEDURES REPORT (CONT.)

9. Personnel radiation survey, for those working in the Restricted Area:

Name	Head	Face	Body	Hands	Legs	Feet
1. _____	_____	_____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____	_____	_____
6. _____	_____	_____	_____	_____	_____	_____

10. On the sketch of the job site, mark the location of the exact spill.

11. Make an isodose chart if the level of the spill is greater than 10 mr @ 1 foot.

a) one foot: _____

b) three foot: _____

c) six foot: _____

12. Check the air space for contamination: _____

13. Results of wipe tests after clean up emergency procedures are undertaken:

Position No. 1: _____ (dpm)

Position No. 2: _____ (dpm)

Position No. 3: _____ (dpm)

14. Suggestions to future prevention of this accident: _____

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper appears to be from a notebook or a set of legal pads. The edges of the paper are slightly irregular, suggesting it might be a scan of a physical document. There is no handwriting or other markings on the page.

APPENDIX C-6
REPORTING AGENCIES

Personnel/Agencies responsible for Radiological Health Programs. (Notify for emergencies, lost tools down hole, lost sources, major spills.)

1. Company Notification

Radiological Safety Officer - Bill Ochiltree
Office Telephone No. - (907) 659-2800
- (907) 562-2132
Home Telephone No. - (907) 349-1153

Radiation Protection Officer - David Nyberg
Office Telephone No. - (907) 659-2800
- (907) 562-2132
Home Telephone No. - (907) 349-5781

2. State Notification

State of Alaska
Environmental Health Section
Pouch H-60F
Juneau, AK 99811
(907) 465-3120

ATTENTION: Sidney Heidersdorf

3. NRC

United States Nuclear Regulatory Commission
1450 Marie Lane
Suite 210
Walnut Creek, CA 94596
(415) 943-3700

CHAPTER IV
PROCEDURES FOR LOST SOURCE DOWNHOLE

1. DECISION ON RECOVERY OF A SOURCE
2. THE COMPANY'S RESPONSIBILITIES
3. RECOVERY OR ABANDONMENT OF A SOURCE
4. SUMMARY

APPENDIX D

1. DIAGRAM OF CEMENTING LOST SOURCE
2. DIAGRAM OF CEMENTING LOST SOURCE
3. DIAGRAM OF CEMENTING LOST SOURCE
4. DIAGRAM OF CEMENTING LOST SOURCE

CHAPTER IV

PROCEDURES FOR LOST SOURCE DOWNHOLE

This area is an expansion of part 6 of Chapter II.

1. Factors influencing the decision on recovery of a source when stuck in an oil well.
 - a. Cost of the tools versus best estimate of minimum cost and probably maximum cost of recovery.
 - b. The risk of sticking a drill stem and fishing tools, especially if all zones of interest are above the tool.
 - c. Interference of the tool with potential production and deeper drilling.
 - d. Value of clearing the hole for additional logs.
2. When a radioactive source is associated with stuck equipment, the Company becomes more actively involved. Our responsibilities are:
 - a. Remain in contact with the client and offer our best advice and recommendations regarding safe fishing procedures.
 - b. Take care to recognize the possibility that a fishing procedure might damage a source capsule.
 - c. Notify the Nuclear Regulatory Commission or State if it becomes apparent that it be desirable to or advisable to abandon the source in the well.
3. The introduction of the regulatory agencies does not alter the main objectives: to recover the source intact or abandon it in such a way as to protect personnel and property in the future.
 - a. If abandonment of a source appear imminent, the Company notifies the Nuclear Regulatory Commission and State by telephone. We then attempt to determine which line of action is to the best interest of all concerned, what the client wishes to and can reasonably do, and to present a packaged proposal to the agencies for final approval or further recommendations.
 - b. Abandonment of a source in a dry hole is simple. All records, including those of the State agency issuing permits for or controlling the drilling of oil and gas wells, should contain information regarding the depth, date, type and quantity of radioactive materials. The well head, if left above the surface, should contain the same information on an engraved durable metal placard.
 - c. A source left below a producing zone presents little difficulty. In most cases the normal cementing of the production string of casing or tubing will isolate the source (Appendix D-1). If the well is to be produced from open hole completion, cement should be spotted around and/or above it to prevent the movement of fluids past the capsule and eventual destruction of the capsule through abrasion (Appendix D-2).

- d. In questionable cases the life of the capsule and the solubility of radioactive materials might influence the acceptance of the proposal. (The Company's source capsules have an estimated life of 500 years in undisturbed salt water. The solubility of the radioactive materials is in order of one part per billion per week).
- e. Production of gas, water or oil past a source should be prohibited unless the capsule is protected from abrasion. Casing or tubing should be adequate. The spotting of cement, if practical and feasible, adds to the protection (Appendix D-3). Care should be taken in setting casing past the location of the tool to avoid dislodging it. A gamma-ray survey run after the casing is below the zone will give assurance that the tool and source will not be encountered and damaged at a lower level.
- f. In the event a source is left in a producing zone it should be cemented in place if possible. Extreme caution should be used in side tracking to avoid reentering the original hole and damaging the source container (Appendix D-4). Normally, the source is at or near the bottom of the tool. If there were sufficient clearance to place cement around the source the tool would, in most cases, be retrievable. However, the drilling mud would probably harden in a short time to prevent appreciable flow of fluids by the source. In addition, the separation between the new and original hole would reduce the rate of flow at the tool to a very small figure. It is recommended that the new and old holes be separated by at least 15 feet to preclude any possibility of damage to the source by perforating.

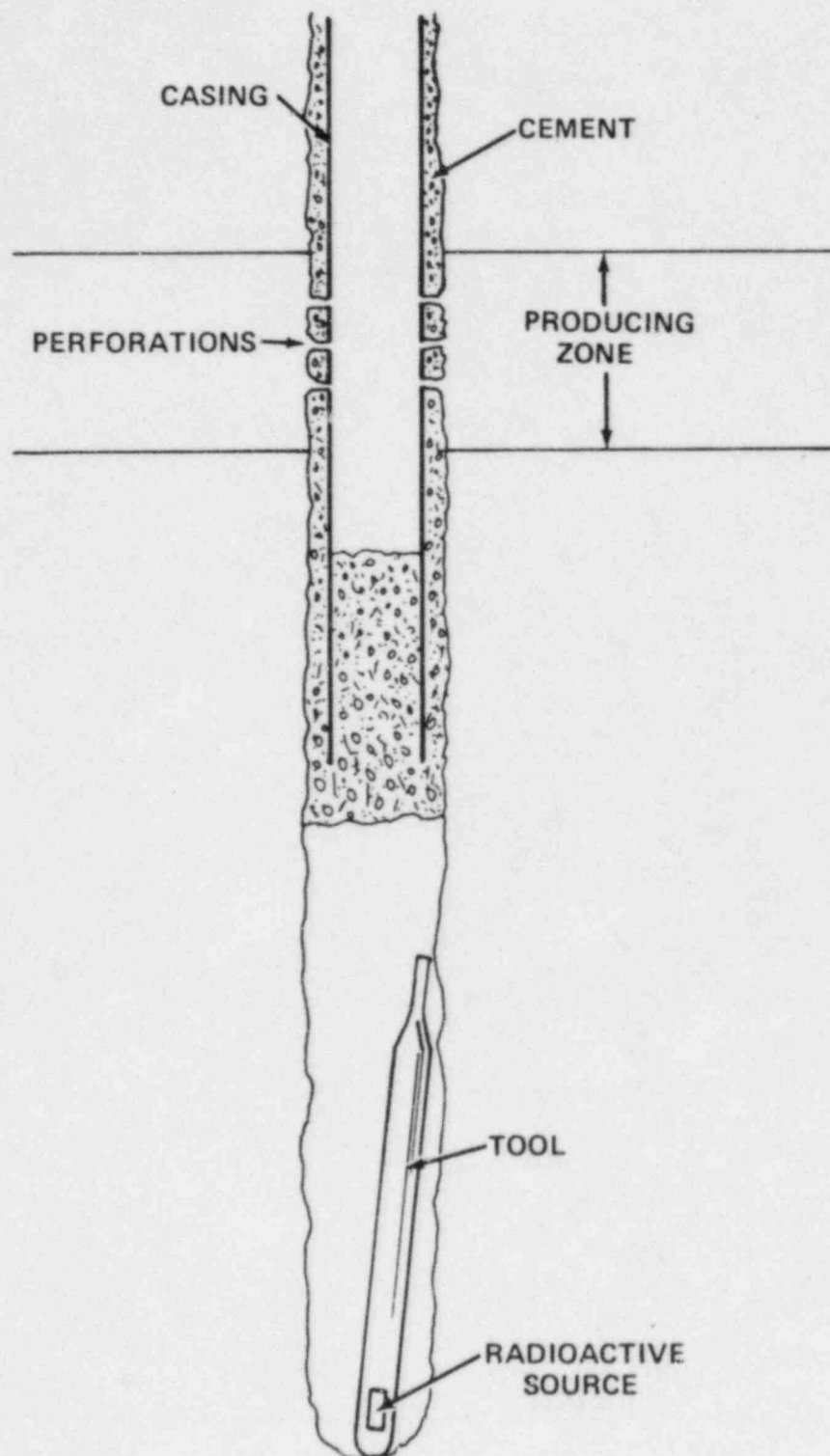
A gamma-ray source abandoned in a well cannot "induce" radioactivity in gas, oil, water, or other materials. For all practical purposes the same may be said of 3 curie, 5 curie and 20 curie AmBe neutron sources. Although neutron flux at one foot from a 3 curie, 5 curie or 20 curie source is negligible in this respect. For example, the flux in a reactor used to activate a cobalt-60 "Pip" tag to 10 microcuries is hundred of millions times greater than that at one foot from a 5 curie source. Although it is not precisely correct to say that there is no activation, induced radioactivity would be almost immeasurable initially and through decay would be totally obscured by natural background radiation long before the material reached the surface.

4. Summary

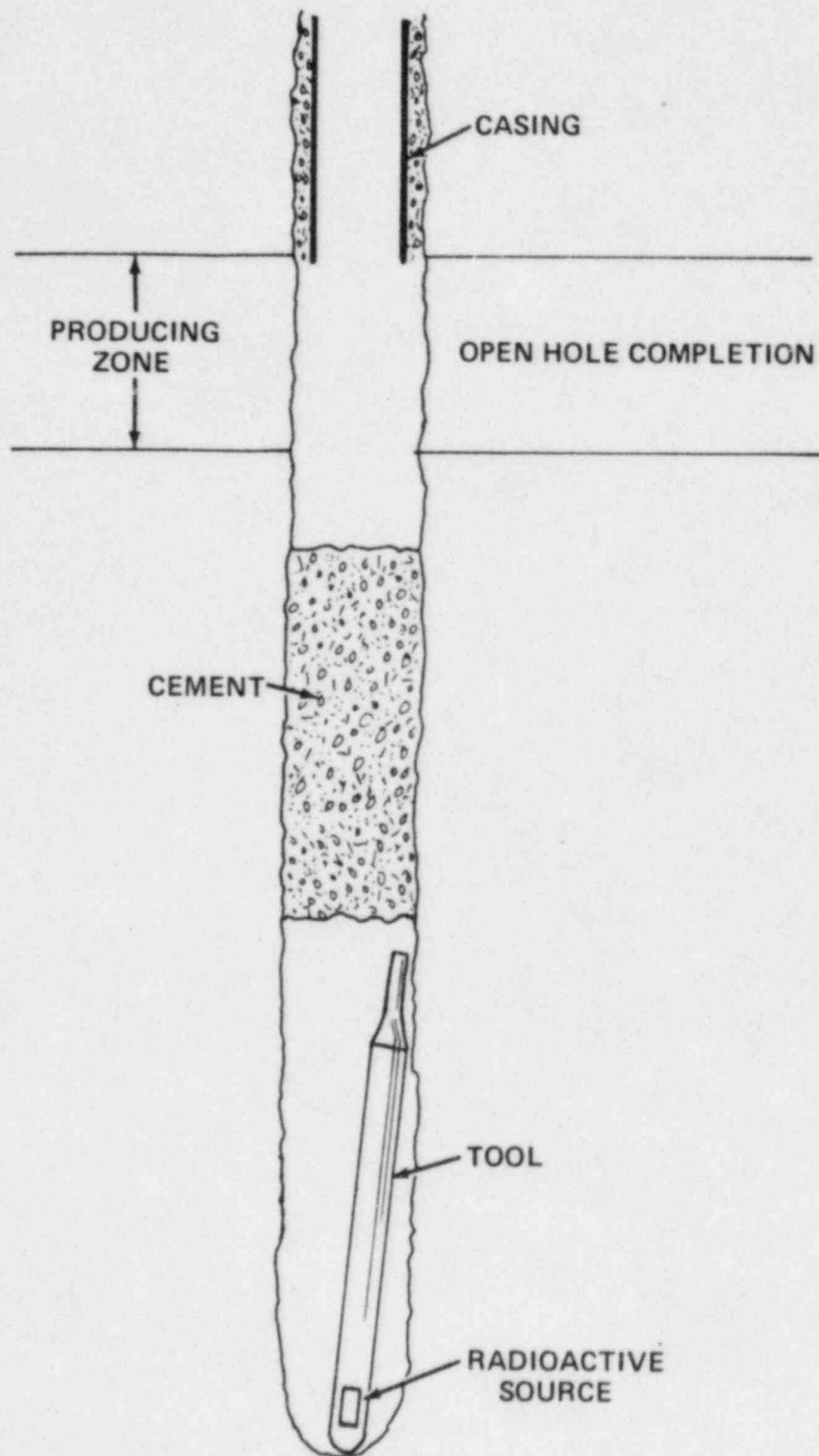
- a. All precautions should be taken to avoid rupture of a radioactive source during fishing operation. Although each source has been individually pressure tested to 25,000 psi, it is small and will not withstand milling, drilling, or pounding fishing operations.
- b. A radioactive source which is intact may be safely abandoned in the well. The decision as to whether to abandon a tool with a source would be based on the accepted considerations for abandoning any other type tool. Added guide lines are the safety aspect, the proper placarding of the well and entering the information in the well records.

- c. There should be no costly delay in obtaining approval to abandon a radioactive source in as much as the Company keeps the agencies well advised of the progress of the fishing operations as events develop.
- d. Responsibility for notifying the regulatory agencies and making all reports is the Company's.
- e. It is the client's responsibility to deal with the State agencies issuing permits for drilling oil and gas wells and to furnish that agency with any information which may be required.

APPENDIX D-1



APPENDIX D-2



APPENDIX D-3

