

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

a. NEW LICENSE

b. AMENDMENT TO
LICENSE NUMBER
27-17597-02

c. RENEWAL OF
LICENSE NUMBER

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.)

U.S. Geological Survey, WRD, Nevada St. Off.

TELEPHONE NUMBER: AREA CODE - NUMBER EXTENSION
702-882-1388

3. NAME AND TITLE OF PERSON TO BE CONTACTED
REGARDING THIS APPLICATION

Douglas K. Maurer

TELEPHONE NUMBER: AREA CODE - NUMBER EXTENSION
702-882-1388

4. APPLICANT'S MAILING ADDRESS (Include Zip Code)
(Address to which NRC correspondence, notices, bulletins, etc., should be sent.)

Rm229 Federal Bldg.
705 N. Plaza St. Carson City, Nv.89701

5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED
(Include Zip Code)

2151 Lone Mt. Dr. Carson City
Nv89701-Permanent storage, also used at
temporary job sites throughout the U.S.

(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

a. Rita L. Carman

Logger

b.

c.

7. RADIATION PROTECTION OFFICER

Douglas K. Maurer

Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15.

8. LICENSED MATERIAL

LINE NO.	ELEMENT AND MASS NUMBER	CHEMICAL AND/OR PHYSICAL FORM	NAME OF MANUFACTURER AND MODEL NUMBER (If Sealed Source)	MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTI- VITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME
(1)	Americium 241: Beryllium	Sealed Neutron Source	Campbell Pacific Nuclear-503 Hydroprobe	50 millicuries
(2)				
(3)				
(4)				

DESCRIBE USE OF LICENSED MATERIAL
E

(1) Measuring soil moisture

70196

(2)

(3)

8507160283 850530
REGS LIC30
27-17595-02 PDR

FEE EXEMPT

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)	Source housing: Metal	CPN Corp.	503 Hydroprobe
(2)			
(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)	Gieger tube	Victorene	493	1	Gamma, Beta	0.1 to 50mRem/hr
(2)	Geiger tube	Eberline	PNR-4	1	Neutron	0 to 5000mRem/hr
(3)						
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

<input checked="" type="checkbox"/> a. CALIBRATED BY SERVICE COMPANY NAME, ADDRESS, AND FREQUENCY Once per year Gulf Nuclear Inc. 100 Nasa Rd. one Suite 411 Webster, Tx 77598	<input type="checkbox"/> 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 type="checkbox"/> (1) FILM BADGE <input checked="" type="checkbox"/> (2) THERMOLUMINESCENCE DOSIMETER (TLD) <input type="checkbox"/> (3) OTHER (Specify): _____ _____ _____	Gulf Nuclear Inc. 100 Nasa Rd. One Suite 411 Webster, Tx 77598	<input checked="" type="checkbox"/> MONTHLY <input 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
N/A
- 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
Will be returned to manufacturer.

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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)

N/A

b. CERTIFYING OFFICIAL *(Signature)*

c. NAME *(Type or print)*

Acting District Chief 70196

(1) LICENSE FEE CATEGORY

d. TITLE

5/14/85

(2) LICENSE FEE ENCLOSED \$

e. DATE

Certificate Of Completion

This is to certify that RITA L. CARMAN has completed the basic training
course on *Radiation Safety and Use of Nuclear Soil Gauges*, held
this 10TH day of APRIL 1985, held at AIRPORTER INN City of IRVINE
State of CALIFORNIA by Campbell Pacific Nuclear Corporation.

DAVID R. HART

INSTRUCTOR

WILLIAM MANCUSO

RADIATION SAFETY OFFICER

FORMAL TRAINING IN RADIATION SAFETY

-- RESUME for Rita L. Carman

- A. Principles and practices of radiation protection:
 - 1. Basic training course on radiation safety and nuclear soil gages, 8 hours of training from CPN Corp., 4/10/85.
- B. Radioactivity measurement, monitoring techniques and instruments:
 - 1. Basic training course on radiation safety and nuclear soil gages, 8 hours of training, CPN, Corp., 4/10/85.
- C. Mathematics basic to use and measurement of radioactivity:
 - 1. College math and calculus, 16.5 credits, American River College, Sacramento, CA, 9/72 to 1/75.
 - 2. College Chemistry, 21 credits, American River College, 9/72 to 1/75.
 - 3. College physics, 12 credits, American River College, 9/72 to 1/75.

WORK EXPERIENCE WITH RADIATION

- 1. Conducted down-hole soil moisture measurements with a CPN neutron moisture gage at Franklin Lake in the Amargosa Desert, CA, 1/84.
- 2. Planning to conduct down-hole moisture measurements at the Nevada Test Site, Nye County, NV, using a neutron probe.

RADIATION SAFETY MANUAL

by

Douglas K. Maurer

(Radiation Safety Officer)

U.S. Geological Survey

Water Resources Division

Nevada State Office

Carson City, Nevada

1984

In case of an Emergency contact:

State Office Chief

U. S. Geological Survey

702-882-1388

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I Introduction

Greater understanding of the water-bearing properties of subterranean rock strata requires information obtained by logging the physical characteristics of that strata. The Nevada State Office will purchase a borehole logger capable of obtaining neutron scatter logs. The Nuclear Regulatory Commission (NRC) requires that the personnel handling the gamma and neutron emitters have special training, use special equipment, and follow special techniques.

This manual provides information on radioactive emitters, their storage, transport, and use, emergency procedures that may be required, the equipment used for normal and emergency procedures, and the radiation safety program of the Nevada State Office. Copies of this manual will be kept in all vehicles used to transport the sources, and should be read by all personnel who use or supervise the use of radioactive sources.

The Nevada State Office will purchase a 50 millicurie americium-241, beryllium neutron emitter. This radioactive source is encapsulated in stainless steel cylinders designed to withstand pressures and temperatures much greater than would be encountered in normal use. These capsules are approximately 3/8 inch in diameter and 3/4 to 1 inch long. They meet Department of Transportation (DOT) standards, 7A-container (49 CFR 178.350).

Possession and use of these sources by the Nevada State Office is governed by NRC license No. expiration date,

II. RADIATION PROGRAM MANAGEMENT AND RESPONSIBILITIES

A. Direction

The well-logging unit is under the jurisdiction of the Nevada State Office Chief, who may be contacted at:

Room 227, Federal Building
705 North Plaza Street
Carson City, NV 89701

He has final authority and jurisdiction for operating the well logging program in the Nevada State Office. He will follow the rules of the Nuclear Regulatory Commission, the needs of the well logging program, the Nevada Radiation Safety Program, and the needs and concerns of the general public.

Actual operation of the program will be accomplished by those who are delegated by him to do so and who are trained and qualified to meet the requirements of NRC, the well logging program and the Nevada Radiation Safety Program.

B. Duties of Logger Operator (LO)

The duties of the Logger Operator, with regard to the radioactive sources, include:

1. The safe and legal transport of the sources from permanent storage to the job site(s), temporary storage in transit, and return to permanent storage.
2. The safe and legal handling of the sources at the job site.
3. Conducting surveys to determine levels of radioactivity:
 - a. Of the transport vehicles before, during, and after transport
 - b. At the job site
4. The filing of reports concerning items 1-3 above with the Radiation Safety Officer for permanent records.
5. Taking immediate actions in the event of an emergency.
6. Supervising the actions of the logger assistants to ensure their compliance with NRC regulations and the procedures outlined in this manual.
7. To make sure that the gage is kept locked within its case and the case well secured in the transporting vehicle at all times except when in use at temporary job sites, and is stored within its shield and placed in the designated, locked, permanent storage facility when not in use.

C. Duties of Radiation Safety Officer (RSO)

These duties include:

1. The responsibility of conducting or initiating:
 - a. job-site surveys
 - b. transport vehicle surveys
 - c. permanent storage area surveys
2. Compiling and maintaining personnel monitoring records.
3. Maintaining vehicle and job site survey records.

4. Monitoring and reviewing training records to ensure compliance with NRC regulations and to advise the training officer of specific needs.
5. Performing or initiating periodic calibration checks of radiation survey meters.
6. Performing periodic wipe tests of radioactive sources to detect leaks.
7. Maintaining a continuous inventory of the quantity and intensity of radioactive sources.
8. Developing a radioactive safety program for the Nevada State Office and ensuring compliance with it.
9. To make sure that the gage is kept locked within its case, stored in the shield, well secured in the transporting vehicle at all times except when in use at temporary job sites, and is locked within its case and placed in the designated, locked, permanent storage facility when not in use.

III. NEVADA RADIATION SAFETY PROGRAM

A. The program purpose

The purpose of a radiation safety program is to prevent exposure of living tissue to penetrating radioactive radiation or to control the amount of radiation absorbed (dose rate) to limits below those affecting the regenerative power of living tissue. Penetrating radiation has the greatest effect on the regenerative power of the living tissue which grows or changes most rapidly such as bone marrow, gonads, eyes, etc. For this reason, occupational dose limits for these type tissues are much lower than for tissues such as hair, fingernails or skin extremities which do not change rapidly. Also for this reason, persons under the age of 18 years are not permitted, by NRC regulations, to handle radioactive sources or work in high dose rate areas. Radiation absorbed by living tissue is measured by REMs (Radiation Equivalent Man) and millirems (1/1000 REM).

Since the long-term effects of low specific activity (LSA) radiation exposure are largely unknown, any exposure should be considered dangerous and kept to a minimum. This may be accomplished in three ways:

1. Controlling the length of time of exposure
2. Controlling the distance between the source of radiation and the living tissue
3. Introducing a shield between the source of radiation and the living tissue.

The permissible occupational dose levels for humans for various time periods are given below, in millirems:

Part of body	Seven consecutive days	Thirty consecutive days	Three * consecutive months	Annual *
Gonads and blood-forming organs	300	1,000	3,000	12,000
Eyes and most individual body organs	400	1,500	4,000	15,000
Thyroid, bones, and skin of whole body	600	2,500	7,500	30,000
Skin of hands, forearms, feet, ankles, and other body extremities	1,400	6,000	18,750	75,000

* These are the only limits actually specified in NRC and State regulations.

The average annual occupational exposure per person must not exceed 5 REM, and the accumulated dose must not exceed 5 (N-18) where N = age in years greater than 18. A single accidental dose of 25 REM may be received once in a lifetime or a planned emergency dose of 12 REM may be received once. (A planned emergency dose is not permitted women in the reproductive age.) Exposure to persons in the vicinity is limited to 1/10 of the occupational limits. Exposure to the population-at-large is restricted to 1/30 of the occupational limits.

B. The program definition and implementation

The definition and implementation of the Radiation Safety program of the Nevada State Office USGS-WRD will be based on the maintenance of various types of logs. The completion of various data which will satisfy these logs will also satisfy the aforementioned purpose of the safety program and insure compliance with NRC regulations and the requirements of our radioactive materials license. These logs are as follows:

1. Utilization log

This log will contain the master file of the source used by the Nevada State Office and will be maintained by the Radiation Safety Officer at the State Office in Carson City. This log will contain:

- a. copy of the lease agreement listing type and strength (activity) of the source, the model, serial number, and manufacturer,

- b. packing slip and receipt of delivery,
- c. source storage record containing the date the source is removed and returned to permanent storage as well as its location of use. (fig. 1),
- d. emergency reports (fig. 2),
- e. records receipt of disposal (fig. 3).

This log will be maintained at least five (5) years after the source is disposed.

2. License log

This log will contain copies of the Nevada State Office NRC license with all updates, copies of registration with interested state and local agencies, and all related correspondence. This log will be maintained by the Radiation Safety Officer and will be located in the State Office in Carson City.

3. Survey log

This log will contain the following reports:

- a. results of survey of source storage areas (fig. 4),
- b. results of job-site and vehicle surveys, list of holes logged (figs. 5 and 6).

4. Personnel monitoring log

All personnel directly related to activity involving radioactive materials will wear a film badge to monitor and furnish permanent record of gamma, beta, and neutron exposure. Film badge service will be provided by Gulf Nuclear Inc., 100 Nasa Road One, Suite 411, Webster, Texas 77598. Film badge monitoring reports will be determined and filed on a monthly basis.

All personnel indirectly related to activity involving radioactive material (e.g., as well drilling crews, incidental observers or assistants) will not be allowed in areas with an exposure level of 2 mRem/hr or greater.

This log will be maintained by the Radiation Safety Officer in the USGS-WRD Nevada State Office located in Carson City, Nev. Current cumulative personnel records will be available on request. If directly involved personnel leave this state office, copies of their records will be sent to them within 90 days of their leaving.

5. Training Log

This log will contain records of formal and informal training received by those personnel involved in the use, handling or supervision of the sources. This log will be maintained by the Radiation Safety Officer in the State Office in Carson City. The RSO will periodically, or on call, review this file and recommend needs to the training officer to satisfy the requirements of the well logging program, the Nevada State Office NRC license and the Nevada State Office Radiation Safety Program.

6. Radiation-Monitoring Instruments and Calibration Log.

This log will contain records of radiation-monitoring instruments used by the Nevada State Office (fig. 7) and will include the type of instrument, its maker and the model and serial numbers of each one. The radiation-monitoring instruments will be calibrated every twelve (12) months by the Health Physicist at the Denver Federal Center nuclear reaction facility or by a private company licensed to do so. Records of each calibration will be maintained (fig. 8 or copy of calibration results) in this log and appropriate copies kept with each instrument.

7. Leak-Test Log

This log will contain records of all radioactive-source leak tests (wipe tests) (fig. 9 or copy of test results).

- a. Wipe tests will be performed with a kit manufactured by Gulf Nuclear Inc., Model #-LTK-1, consisting of:

1. a detergent solution,

Permanent Storage Location _____

Month of _____ 19____ WRD District _____

[illegible]

Figure 2.--EMERGENCY REPORT

Date and Time of Emergency _____

Location of Emergency _____

Name and Title of Person in Charge on Site When Emergency Occurred _____

Cause of Emergency _____

Name, Title, and Agency of Other Federal Employees Involved _____

Figure 2.--EMERGENCY REPORT--Continued

Description of Federal Employee Involvement _____

Name, Title and Company(s) of Civilian Employees Involved _____

Description of Civilian Employee Involvement _____

Source or Isotope Involved in Emergency _____

Source or Isotope Strength _____

Safety Measures Taken Immediately _____

Figure 2.--EMERGENCY REPORT--Continued

Sketch of Emergency Location (Mark Exact Spot With X.)

Results of Radiation Survey in mR/hr

Personnel: _____ Date _____ Time _____

Name	Head	Face	Body	Arms	Hands	Legs	Feet
------	------	------	------	------	-------	------	------

[illegible]

Figure 2.--EMERGENCY REPORT--Continued

Area: _____ Date _____ Time _____

Site _____ Dose Rate _____

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Results of Wipe Test After Emergency

Date _____

Source _____ Dose Rate _____

_____	_____
_____	_____

Figure 3.--MASTER RECEIPT AND DISPOSAL LOG

WRD District

[illegible]

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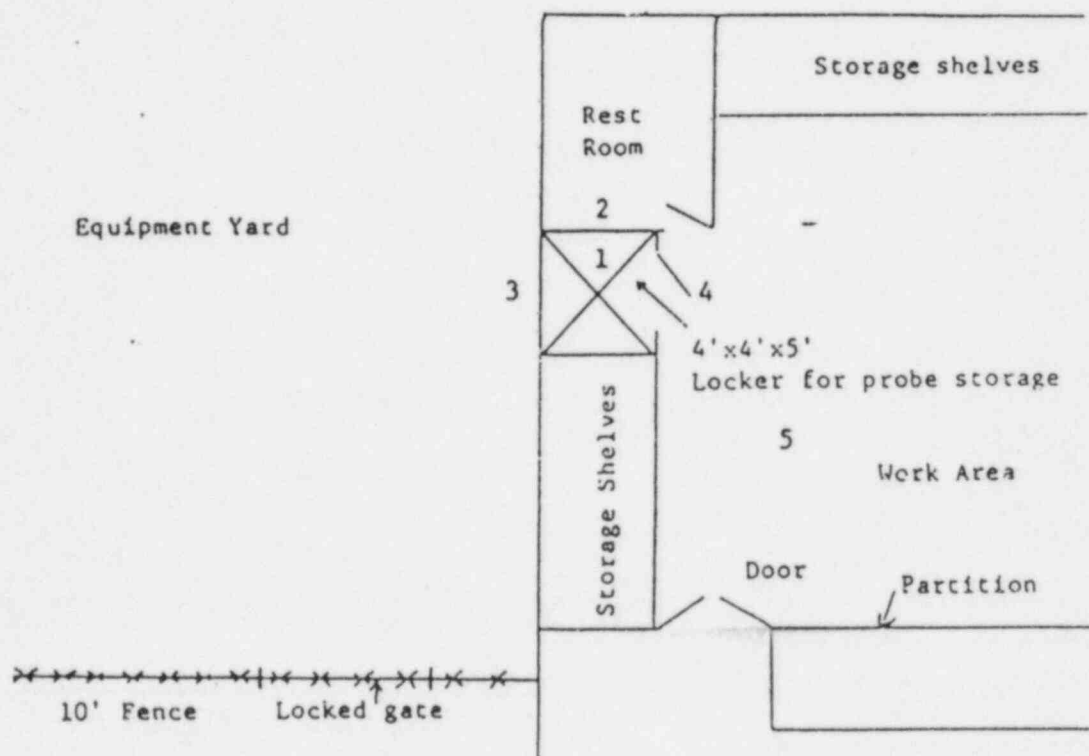
Figure 4.--SURVEY OF PERMANENT STORAGE AREA

Date _____ By _____ WRD District _____

Instrument Used _____

Probe Used _____

Date Calibrated _____



Site Number	Neutron		Beta-Gamma		
	c/m	mR/hr	mR/hr	c/m	mR/hr
1	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____
4	_____	_____	_____	_____	_____
5	_____	_____	_____	_____	_____
6	_____	_____	_____	_____	_____

FIGURE 5.

INITIAL SITE SURVEY
BEFORE ANY LOGGING BEGINS

LOCATION _____ DATE _____

WELL LOCATION AND NUMBER _____

SURVEY METER SERIAL NUMBER Victoreen
4035 DATE CALIBRATED _____



mR/hr

NORTH _____
SOUTH _____
EAST _____
WEST _____
WELL-
HEAD _____

OPERATOR

FIGURE 6. JOB SITE AND VEHICLE SURVEYS

LOCATION _____ DATE _____

WELL LOCATION AND NUMBER _____

SOURCE NUMBER CPN MOD.503, SN H34045351

SURVEY METER SERIAL NUMBER ^{victoreen} 4035 DATE CALIBRATED _____

Truck Survey before leaving: Front _____ mR/hr

Rear _____ mR/hr

Left Side _____ mR/hr

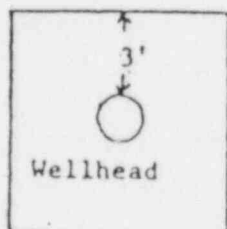
Right Side _____ mR/hr

Cab _____ mR/hr

	C
	A
	B

SURVEY OF LAST WELL OF THE DAY

mR/hr



NORTH _____

SOUTH _____

EAST _____

WEST _____

WELL- _____

HEAD _____

Truck Survey after Job:

Front _____ mR/hr

Rear _____ mR/hr

Left Side _____ mR/hr

Right Side _____ mR/hr

Cab _____ mR/hr

	C
	A
	B

OPERATOR _____

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1

Instrument Type _____

Model Number _____ Serial Number _____

Date Purchased _____

Condition _____ Date _____

Record

What Was Done? _____ Date _____

100

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Figure 8.--INSTRUMENT CALIBRATION RECORD

Instrument Type _____

Model Number _____ Serial Number _____

Probe Type _____

Date _____ Time _____

Calibration Source _____

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Record

[illegible]

Calibration By _____

Title _____

Figure 9.--STATEMENT OF SOURCE WIPE TEST

Identification

Source Form _____ Model No. _____

Source Manufacturer _____

Isotope _____ Strength _____

Source Owner _____

Address _____

By Product License Number _____

Date of Test _____

WIPE Test By _____

Results

Gross Counts _____

Background Count _____

Disintegrations Per Minute _____

Efficiency _____

Removable Contamination _____

Counted By _____ Date _____

Title _____

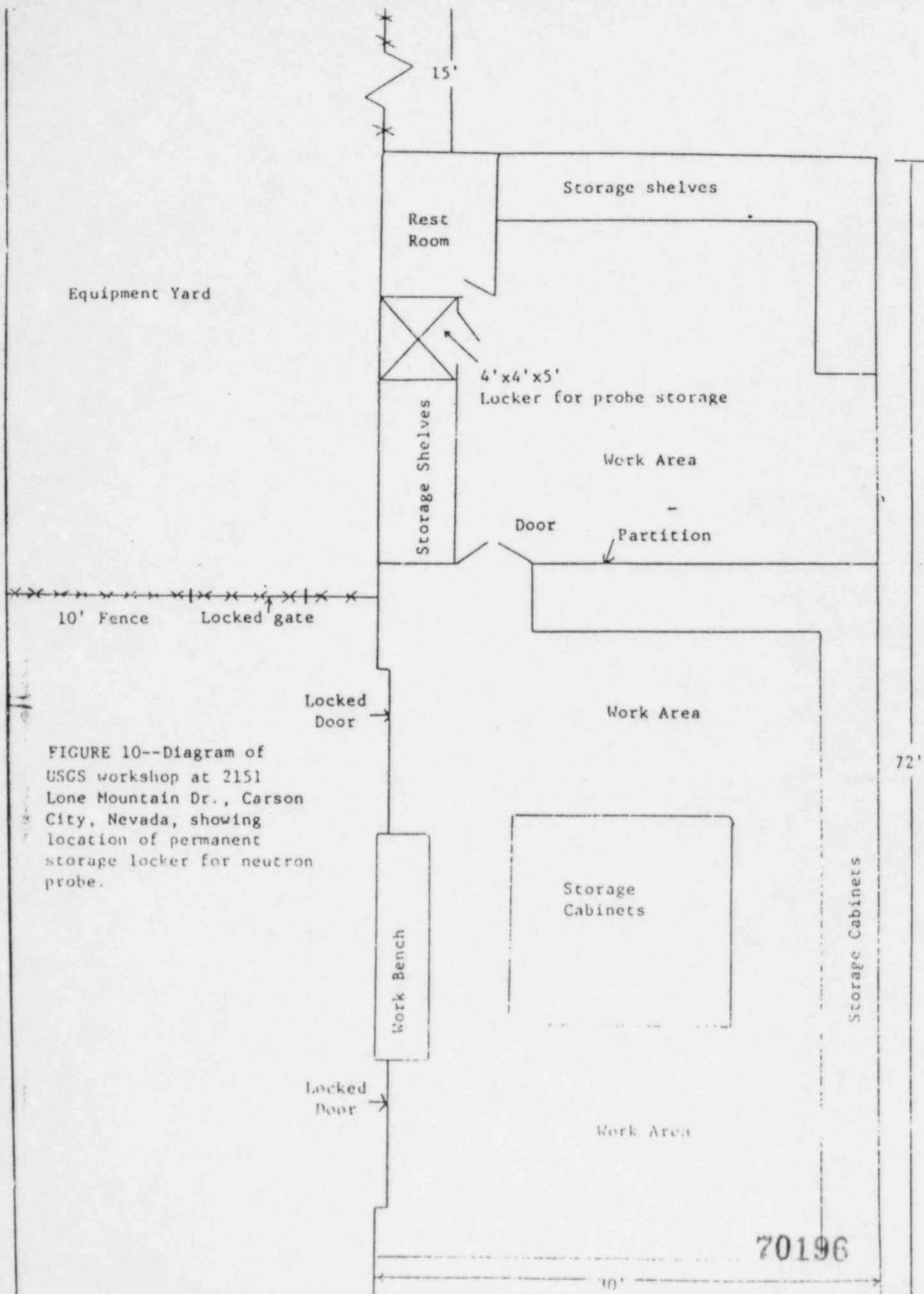
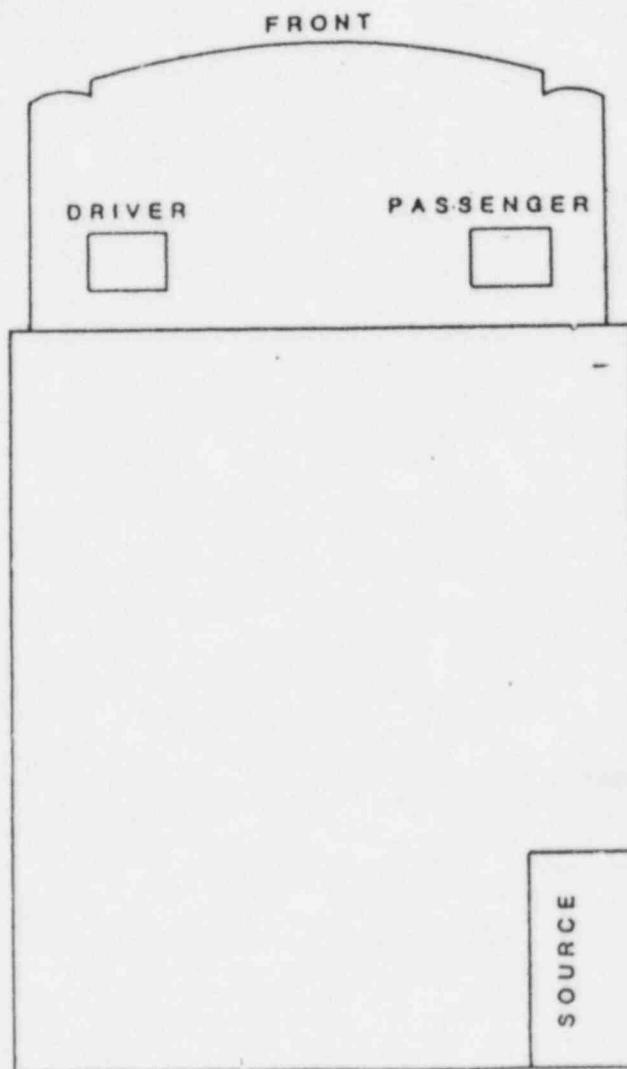


FIGURE 10--Diagram of USGS workshop at 2151 Lone Mountain Dr., Carson City, Nevada, showing location of permanent storage locker for neutron probe.

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FIGURE 11--SKETCH OF LOGGING VEHICLE SHOWING LOCATION OF POINTS OF INTEREST.



2. cotton swabs,

3. plastic bags.

b. The testing procedure is as follows:

Caution: Wear disposable vinyl or rubber gloves when making this wipe test.

Wipe the container holding the source with cotton swab wetted with the detergent solution. Wipe all around the container (sonde) concentrating on rusty, worn, or cracked places, along seams, and around vent parts or components which slide in or out of shields.

All disposed material such as gloves will be saved and tested for radioactivity. If radioactivity is found, disposal will be through the Reactor Center at the Denver Federal Center. If none is found, normal disposal will be used.

After wiping is complete, place swab into a plastic zip lock bag. Repeat the wipe test with a dry cotton swab, and place into zip lock bags.

Label the bags wet and dry and add serial number of probe and date of wipe test with a permanent marker. Place bags and cover letter in an envelope. Seal with tape. Do not lick the envelope to seal. Send this envelope to:

Gulf Nuclear Inc.
100 Nasa Road One, Suite 411
Webster, Texas 777598
Telephone: 713-332-3581

The swabs will be evaluated and the results returned to the Radiation Safety Officer Nevada State Office in Carson City, for inclusion in this log.

If a wipe test indicates a leaking source, a second test will be performed immediately. If the second test is also positive, the source will be disposed of through the Nuclear Reactor Facility at the Denver Federal Center in Lakewood, CO., or returned to the manufacturer.

A source is not to be used without proof that it was leak tested within the last six (6) months and found to be secure. A copy of the most recent leak test will be with the source at all times.

IV. STORAGE FACILITY AND PROCEDURES

A. Permanent

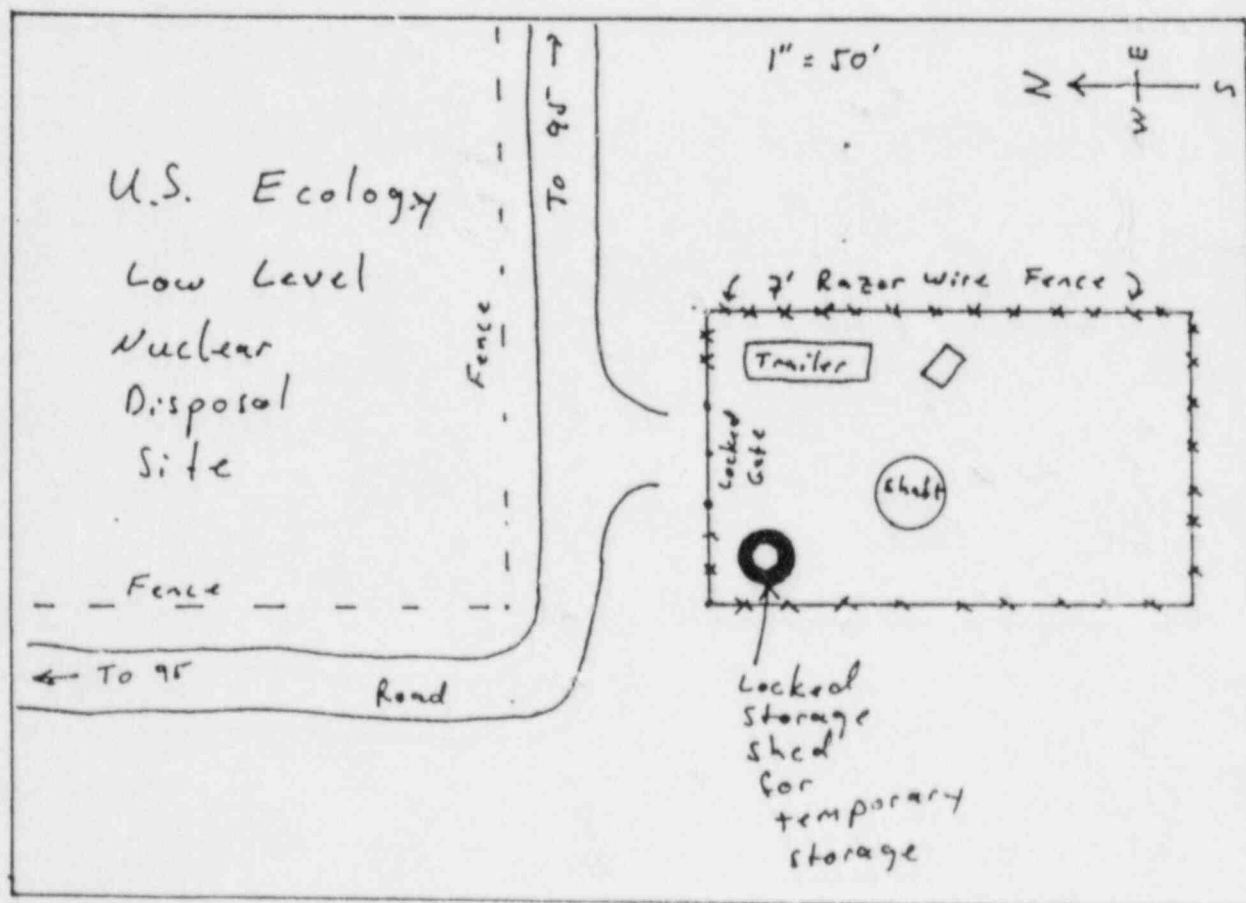
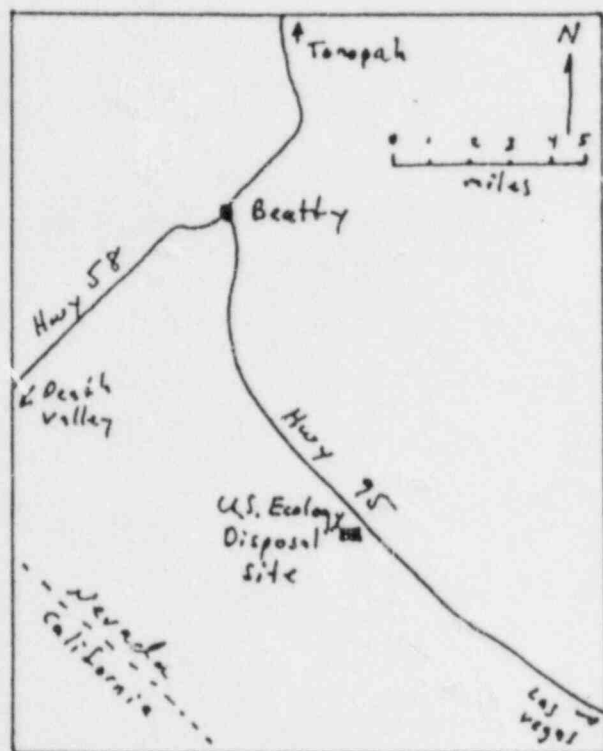
The permanent storage facility for the source is in the USGS Workshop located at 2151 Lone Mountain Drive, Carson City, Nevada 89701. This facility is illustrated by fig. 10 and its use is described as follows:

The source will be stored in its shielding container and kept in a locked storage locker inside the USGS Workshop. The source will remain locked within its case at all times when in permanent storage except when leak tests are being performed. Access to the locker is limited to those persons named on the Nevada State Office NRC license. Penetrating radiation in the work area is less than two milliroentgens per hour, hence it is not a restricted area and no warning signs will be posted. However, a sign bearing the words "CAUTION RADIO-ACTIVE MATERIAL" will be posted on the locker door. The workshop is kept locked and only USGS personnel who use the area have a key.

B. Temporary

Temporary storage of the source is anticipated during its use in well logging. During those times, a logging truck will be used as the storage facility. The source will be locked inside its case (see next section) and the case well secured at the rear of the logging truck (fig. 11). The shield is constructed and placed so that radiation detected at the surface of the logging truck will be 2mR/hr or less. For temporary storage at the U.S. Ecology Site in Beatty, Nevada (fig. 12), the source will be placed in a locked shed. The shed is inside a six foot high locked fence topped with razor wire. The source will remain locked within its case at all times during temporary storage, except when being used in logging operations. Since the source is of low specific activity and will usually be locked in its case, the truck is not considered a restricted area and no warning signs are posted.

FIGURE 11. Temporary storage site at U.S. Ecology, Beatty, Nevada.



C. Shields

The storage shield for the neutron source while in permanent storage, is the same one used while the source is in transit. This shield, supplied by CPN, is a 7 inch x 14 inch surface instrument unit filled with silicon-based paraffin. The source, in its sonde attached to the neutron logging tool is kept within this unit. A locking device is attached to the tool preventing removal of the source.

V. TRAINING

A. Personnel needs

Persons who will directly use or supervise the use of the sources or who have radiological safety responsibilities will be required to attend a formal school to equip them to do their job. This school will give sufficient training to permit inclusion of this trainee's name on the Nevada State Office NRC license, to satisfy the needs of the Nevada State Office well-logging program, to comply with NRC rules and regulations, and to comply with the Nevada State Office radiation safety program. A certificate will be issued by the school to confirm individual training.

B. Record keeping

Records of all radiological training will be maintained by the Radiation Safety Officer in the file identified as the "Training Log."

C. Training review

The Radiation Safety Officer will periodically review the "Training Log," to determine if needs of the Nevada State Office well-logging program and the requirements of the Nevada State Office Radiation Safety Program are met. The RSO will make recommendations to the training officer toward correcting any deficiencies which may be found.

VI. PROCEDURES FOR USE OF THE RADIOACTIVE SOURCES

A. Normal Operations

U.S. Geological Survey personnel in charge of well logging with radioactive sources are responsible for the health protection of personnel associated with the sources and the general public

who may be associated at times. These personnel must personally supervise all source handling operations, transportation, storage and shipping according to the following regulations:

1. Only those USGS personnel who have reached the age of 18 years or more, who are properly trained, and who have been authorized to do so will be permitted to handle the source. Drivers of vehicles used to transport radioactive source must be 21 years of age or older.
2. Only approved tools or methods will be used when handling the source.
3. The source will be stored in the shield and transported in a locked, placarded case. In transport, the locked case will be fastened securely to the floor at the rear of the logging truck. At the job site, the shield may be left in the logging truck or may be set far enough away from any occupied area so that measured radiation exposure rates at the immediate job site or other occupied areas is less than 1 mR/hr over background count.
4. The Logger Operator or the Radiation Safety Officer will be present at all times when the source is removed from its shield and lowered into the well. They shall remain at the site until the source is returned to its shield (this latter may be overruled when emergency procedures prevail).

Procedures to follow in a typical normal operating situation are as follows: (These steps may be modified to match conditions; however, no modification may be made which contradicts Nuclear Regulatory Commission (NRC) rules, Department of Transportation (DOT) regulations, or the Nevada State Office Radiation Safety Program).

- a. Notify District Chief or RSO of intent to remove sources from permanent storage.
- b. Initiate "Source Storage Record" (fig. 1), "Vehicle and Job Site Survey" (fig. 5 and 6).
- c. Load shield containing the source into the truck and fasten them securely to the truck floor. Conduct a radioactive exposure survey of the truck as designated on "Vehicle Survey" (fig. 6).

- d. Drive to job site, set up equipment and prepare for logging operations.
- e. If the hole has not been previously logged, conduct initial site survey (fig. 5).
- f. The sealed source owned by the Nevada State Office is a fast neutron emitter composed of americium 241: beryllium. It is always kept inside its sonde source holder and the source holder attached to the neutron tool and stored within its shield. This assembly is removed from its shield only when actually used for well logging. When ready to log the well, the shield and once attached, the sonde and tool are removed from the shield and quickly placed down the access tube.

When logging operations are completed, return the sonde and tool to its shield immediately, reversing the handling procedures. When obtaining standard counts with the source in its shield, the operator moves as far away as is practical.

- g. Measure the radiation level at the well head and three feet from the well head in all four directions. Do this prior to logging any new hole or before storing at any temporary job site (the last hole logged during that day). Record all readings on Job Site Survey form (fig. 5 and 6). If a positive leak test is obtained, all storage and job sites used since last leak test will be resurveyed.
- h. When all logging operations are complete, return the sources to their permanent storage locations, complete "Source Storage Record" (fig. 1) and "Vehicle and Job Site Survey" (fig. 6) and file with the RSO. These records will be placed in the files under their appropriate log file designations.
- i. Notify the State Office chief and RSO that the sources have been returned to permanent storage. This will include an oral report on activities pertinent to the handling of the sources if all went well and a written report if they did not.

B. Emergencies

Emergencies may involve vehicular accidents, thefts, spills, fires, explosions, leaking sources, or down hole loss of the sources. In the following, the handling of each of these general types of emergency is treated in a separate paragraph. The National Bureau of Standards Handbook #48, "Emergency Guides" was used as a general reference. These procedures are general and each specific emergency may involve additional procedures not covered in this outline. In all cases, an Emergency Report (fig. 3) will be completed and filed with the RSO in Carson City for inclusion in the permanent file labeled "Utilization Log."

1. Vehicular Accidents

If an accident involving a vehicle transporting sources occurs, the operator should:

- (a) remain at the accident scene until safe disposition of the sources is complete,
- (b) do those things required by Nevada law when a wreck occurs,
- (c) notify the investigating officer that the vehicle carries radioactive material, the kind, activities (Curies), and type of shielding,
- (d) notify the immediate supervisor, the Radiation Safety Officer and the State Office Chief,
- (e) make a visual inspection of the ~~shields~~ to determine if they are damaged, then check them with the radioactive survey meter. If the shields are intact, the sources may be left in them. If the logging truck is disabled by the accident and the shields are intact transfer the shields to the rear of another vehicle, fill out another "Vehicle Survey Report" (fig. 6) and transport the shields and sources to their permanent Carson City storage location. In the case of extensive damage to either of the shields, the sources should not be removed because the source capsules may be ruptured. People should be kept clear of the area and a Health Physicist should be contacted through the RSO. At that point, the Health Physicist can recommend further actions. If damage to the shields appears extensive enough to call in the Health Physicist, also notify Radiological Consumer Health Protection Agency, 505 E. King Street, Room 103, Carson City, Nevada 89710, telephone, 702-885-4750.

2. Theft

If the sources are stolen, the operator in charge will notify (a) who will, in turn, notify a., b., c., d., as deemed necessary.

- a. State Office Chief and RSO in Carson City
Telephone: (702) 882-1388
- b. Federal Bureau of Investigation
Telephone: (702) 882-1258 or (702) 323-7143
- c. The Sheriff of the county involved.
- d. The Nevada Highway Patrol, telephone: (702) 784-4081

3. Fire

If a fire occurs that involves the shields and sources, the operator will:

- a. notify the State Office Chief and RSO in Carson City
- b. when the fire has subsided and access to the shields be gained, make a visual inspection of them to determine if they are damaged. This will be supplemented by a survey of shields with the radiation survey meter. If the shields are intact, leave the sources in them, transfer the shields to another vehicle, fill out another "Vehicle Survey Report" (fig. 6) and transport the shields and sources to their permanent storage in Carson City. If the shields are found to be extensively damaged, the sources should not be removed because the source capsules may be ruptured. People should be kept clear of the area and a Health Physicist contacted through the RSO. Further procedure, at the point, will be upon the Health Physicist's recommendation. If damage to the shields appears to be extensive enough to call in the Health Physicist, the Nevada Department of Health and Social Services should also be notified.

4. Explosions

If an explosion occurs in which the shields and sources are involved, the procedures to follow will be similar to those outlined for vehicular accidents or fire.

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5. Leaking Sources

Wipe tests must be performed at least every 6 months to detect if the stainless steel capsules have ruptured or cracked, exposing the raw radioactive material. This procedure is described in section III G. of this manual. If the shields containing the sources are involved in a wreck, fire, or explosion, the sources will be given a wipe test immediately upon their return to permanent storage in Carson City. If the sources are stolen, a leak test will be performed immediately upon their recovery.

If the results of the wipe test are returned with negative results, no further leak testing will be done for 6 months except in the cases listed above. If the results of the wipe test are returned with positive results, a second wipe test will be performed immediately. If that second test also has positive results, the sources will be removed from service and disposed of through:

U.S. Geological Survey, Nuclear Reactor Center
Bldg. 15, MS 424
Denver Federal Center,
Lakewood, CO 80225;
Telephone: (303) 234-2608,
 FTS 234-2608,
Bill Smith, Health Physicist.

6. Source Lost Downhole

- a. If a source is lost (or stuck) downhole, notify the well owner of the type and activity (Curies) and the efforts that are being made to retrieve the source.
- b. Contact the Radiation Safety Officer of the situation so that he may notify the proper agency or agencies that a source has been lost and keep them informed of progress being made in recovering the source.
- c. Keep unnecessary personnel away from the site. Monitor the well head area; if radiation levels indicate this is a restricted area (2 mr/hr or greater), furnish film badges or dosimeters to those involved in the recovery operation.
- d. The Nuclear Regulatory Commission (NRC) must be informed by telephone within 24 hours of the loss telling them how you plan to retrieve the source.

The NRC must then have a written confirmation of the telephone conversation. If the source is irretrievably lost, the loser is required, within 30 days to:

- (1) Immobilize and seal the source in place in the well with a cement plug.
- (2) Mount a permanent identification plaque with appropriate information at the wellhead.
- (3) Report the event in writing to the NRC and appropriate state agencies, providing information listed in 6.a. of this section.

Note: If the source capsules are intact, the sealed radioactive sources used in the Carson City State Office well logging activities may be safely abandoned in a well. A gamma-ray source abandoned in a well cannot "induce" radioactivity in the well or water. For all practical purposes, this is also true for an americium 241: beryllium neutron source.

7. Techniques for Retrieving a Lost Radioactive Source

a. Large diameter cased holes

A radioactive source lost permanently in a borehole can be a very expensive proposition. For this reason, a probe containing a radioactive source should not be put down a well until it has been determined that the hole is "clean". The first logging run should be made slowly using a "non-source" tool, a "rabbit", or a weight on a steel tape, to determine if the hole is blocked or if any caving has or is occurring downhole. If a radioactive source does become stuck in a borehole, the following "fishing" procedures should be tried immediately.

1. Obtain about a 10-foot (or longer) length of black iron pipe or any other type of relatively heavy tubing having an inside diameter just lightly larger than the outside diameter of the tool or "fish." Have the length of tubing spirally cut for the entire length and thread it over the logging cable and attach the upper end to another wireline. After threading the logging cable through the tubing, place wraps of nylon tape spaced about 2 feet apart around

the spirally cut tubing so that the tubing will not come off of the logging cable as the fishing tool is lowered downhole. The fishing tool is lowered until it contacts the stuck probe. Then, while keeping tension on the logging cable, the fishing tool should be raised several inches to perhaps several feet and allowed to drop, striking the probe. Continue this procedure until the probe is free or until this method appears futile. In most cases, this technique will work and the probe can be retrieved by winding in both wirelines simultaneously to avoid entanglement and further logging wireline damage.

2. If the stuck probe becomes detached from the logging wireline, the probe might be retrieved using a drilling-type fishing tool called an overshot. This type of tool is available commercially from drilling or logging supply places. The overshot is usually run into the borehole on drill steel using a drilling rig to perform the fishing operation. Various type grapples are also available if the overshot method should fail to retrieve the probe. Like the overshot, most grapples also utilize a drilling rig to do the fishing. Wireline overshots, made to fit the lost probe, have also been used successfully.
3. A down-hole television camera may be useful in determining the status of the stuck tool, and may provide insight to the best method for retrieving the tool. This procedure should be utilized before abandoning the tool in the hole.

These techniques are just a few of the more successful methods to try for retrieving a lost or stuck probe. All efforts and means should be expended before giving up and cementing the probe in the hole.

b. Small diameter cased holes

Holes logged by the Nevada State Office will be 2 inch diameter access tubes installed and sealed for the sole purpose of neutron logging. These holes are usually fairly shallow, less than 100 feet deep. In the event of a stuck probe, a hoist or drilling rig will be used to pull the casing string from the ground while keeping tension on the logging cable. If this fails, fishing procedures outlined in section 7. 1. or 7. 2. will be used to free the probe. If both procedures fail to retrieve the probe the hole will be sealed according to procedures outlined in Section 6. a-d.

VII. NOTES

- A. The employer must display on a bulletin board accessible to all employees, a notice of employer responsibility in the event of radioactive exposure. A prominent display of a copy of the employer's NRC license is also desirable.
- B. A fine of from \$10,000 to \$25,000 per violation of NRC regulation is possible. This fine may be assessed against the individual such as the Logging Operator, the Radiation Safety Officer, or the State Office Chief.
- C. An "agreement" state is one in which its own regulatory agency establishes and enforces its own regulations concerning radioactive materials and their handling.
- D. An "NRC" state is one in which the Nuclear Regulatory Commission establishes and enforces regulations concerning radioactive materials and their handling.
- E. The NRC license owned by the Nevada State Office, WRD, permits authorized and trained personnel, as named on the license, to work in either type of state provided:
 - 1. The proper authorities are notified, in writing, prior to the work being performed.
 - 2. The operations do not last more than 180 working days.