UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

NOTE TO: Document Control Desk
Mailstop 05-F-22

FROM: KimBerly Kendall/Michele Burgess
Sealed Source Safety Section

DATE: JAN 23 1995

ASSIGN NO. SSD-

RIDS CODE: (circle the appropriate code)

NE01 - SSD Correspondence
NEX3 - SSD Correspondence (PROPRIETARY)
(NE02 - General SSD Correspondence)

NEX4 - General License Correspondence (PROPRIETARY)
NE03 - General License Correspondence

REGISTRATION NO./LICENSE NO. 42-17358-01

COMPANY: Geolog

ACTION: (FOR CENTRAL FILES USE ONLY)

Information to be added to file
NE02-SSD-2

If you have any questions, please contact me at 415-7857 or Michele Burgess at 415-5868.

****
* please note this is an instruction sheet to allow pre-coding of *
* correspondence and provide specific directions when necessary. *
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Geoley 42-1755-01

RADIATION SAFETY PROCEDURES

RADIATION SAFETY PROCEDURES

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LIST OF FIGURES

Radiation Safety Procedures

Section 1. Radiation Program Management and Responsibilities - Radiation Safety Officer and his Duties.

Mr. M. B. Broome, President of Geo-Log, will both manage the Radiation Program and serve as Radiation Safety Officer. His will be the overall responsibility for the safe handling of the radioisotopes used by Geo-Log. His responsibilities will include:

a. On-the-job training of personnel in the safe handling of radioisotopes.

b. Approval of equipment and techniques for the storage, use and disposal of radioisotopes.

c. Supply the field with TLD badges as required.

d. Maintenance of radiation exposure records.

e. Making sure that Geo-Log complies with the applicable regulations of the State of Texas.

Section 2. Personnel Monitoring Procedures.

TLD Gamma-Neutron badges will be worn by all personnel where working with radioactive materials. These badges will be processed on a quarterly basis.

Section 3. Storing and Securing of Radioactive Materials.

All of our radioactive sources will be kept either in their appropriate shields mounted on the logging trucks or in our source storage facilities, unless actually in use. All radioactive sources will be kept secure while in transit to or from a job.

Section 4. Posting Restricted Areas and Vehicles and Labeling Containers.

All radioactive material used or possessed by the company must be labeled as required by the applicable regulations of the State of Texas.

The labels shall include the words "Caution - Radioactive Material", the radioisotope involved, the amount of radioactivity, the date of measurement and the radiation caution symbol.

Our Radioactive Material Storage will be posted with a sign or label bearing the radiation caution symbol and the words " Caution - Radioactive Material ". If any area used for storage of radioactive material should have a radiation level of five mrem/hr or greater, a label or sign shall be posted reading " Caution - Radiation Area" and the radiation caution symbol.

Our logging trucks will be placarded as required by the U. S. Department of Transportation. That is, they will have a sign reading " Radioactive " on the front, rear and both sides of the truck. This sign will conform to the lettering and size requirements of the D O T.

Section 5. Records Management

Radioactive Material records shall consists of log records for the utilization of radioactive tracers (if tracers are used), receipt and transfer records of all radioactive materials, personnel exposure records, sealed source leak test records and radiation survey records. The Radiation Survey Data Sheet file will serve as a utilization log for sealed sources. These records shall be maintained by the RSO at the Companys' headquarters.

Section 6. Procedures for Transporting Radioactive Material

All shipment of radioactive materials must be made to conform to the Department of Transportation Regulations governing the transportation of hazardous materials.

Section 8. Procedures for Handling Sealed Sources of Radioactive Material

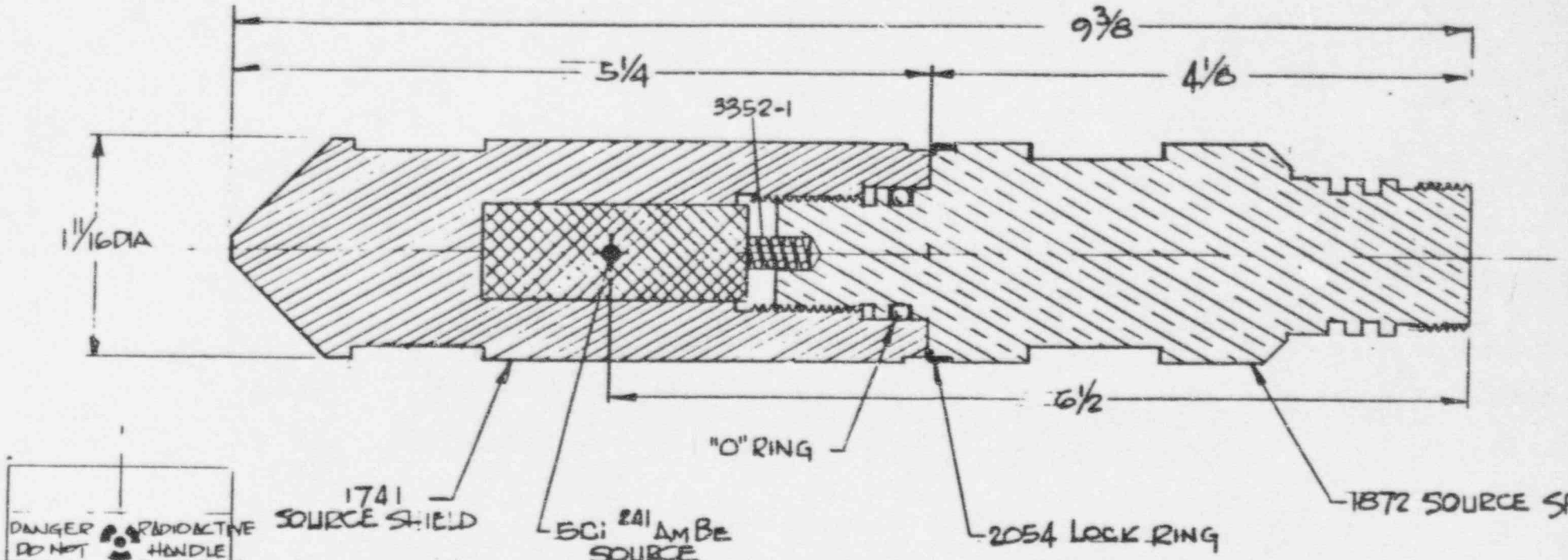
1.0 Radiation Hazard

Geo-Log uses three different types of sealed radioactive sources. A one curie Americium 241-Beryllium neutron source is used for neutron logging. The two density logging sources are a two Millicurie Cobalt 60 and a 100 Millicurie Cesium 137 source. For logging purposes, the neutron source will always be housed in a Remco Neutron Source Holder Assembly (see Figure 1), the Cesium 137 source will be an integral part of the SIE #4027 Source Capsule Carrier (see Figure 2) and the Cobalt 60 source will remain in the SIE #4028 Source Capsule Carrier (see Figure 3). The #4028 Source Capsule Carrier (which includes the ^{60}Co source) will be threaded into the SIE #4045 Bull Plug(see Figure 4) when used for logging. The Source Capsule Carrier will be positioned in the Bull Plug with the Remco HT-1 Source Handling Tool (see Figure 5a) and threaded in with the Remco HT-2 Source Handling Tool (see Figure 5). The dose rates from the sources in these configurations are as follows:

Source	Dose Rate At One Foot
241AmBe	24 Mrem/hr
137Cs	330 Mrem/hr
60Co	30 Mrem/hr

The time distance factors must be used effectively when working with these sources to keep exposures to a minimum. A safe distance is provided when the approved handling tools are used, but care and practice are needed to decrease the handling exposure time. The Safety Chart (see Figure 6) utilizes the proper time distance factors and gives the safe-danger dividing line for the source.

The Remco S-2 Source Shield (see Figure 7) will be used for transporting the AmBe source and the SIE #0229 Source Shield (see Figure 8)will be used for the 137Cs and ^{60}Co sources.



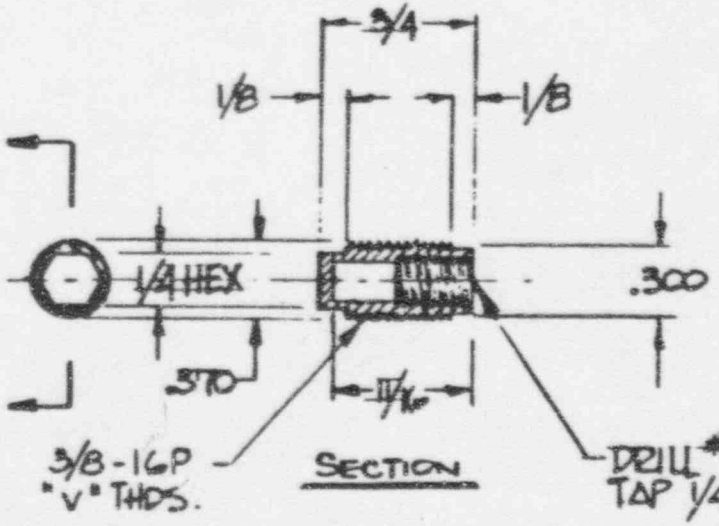
FOR APPLICATION OF THIS NOTE SEE #1741

MATERIAL	TOLERANCES: FRACTIONS ± .015; .XX ± .01; .XXX ± .00	SIE INC. RT. 3, BOX 214, FT. WORTH, TEXAS
FIXTURE:		TITLE: NEUTRON SOURCE HOLDER ASSEMBLY
DRAWN BY: J. MACLAIN	DATE: 5-8-1974	SCALE: 1/1 — DWG NO. 0226

F.g. 1

DWG NO. 4027

REV | DATE



NOTES:

1. USE 1/4-20 x 1/4 STAINLESS STEEL SET SCREW.

MATERIAL: 303 STAIN. LESS STEEL ROD.

HEAT TREAT: ———

FINISH: ———

SIE INC.

RT. 5, BOX 214, FT. WORTH, TEXAS

OFFICES IN

FT. WORTH, HOUSTON, CALGARY, BRISBANE, & PERTH

FIXTURE:

REMOVE BURRS, BREAK ALL SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED

DEC. ± .005, FRA. ± 1/64, ANG. ± 0° 30'

TITLE: CARRIER - SOURCE CAPSULE, 2" DENSITY TOOL.

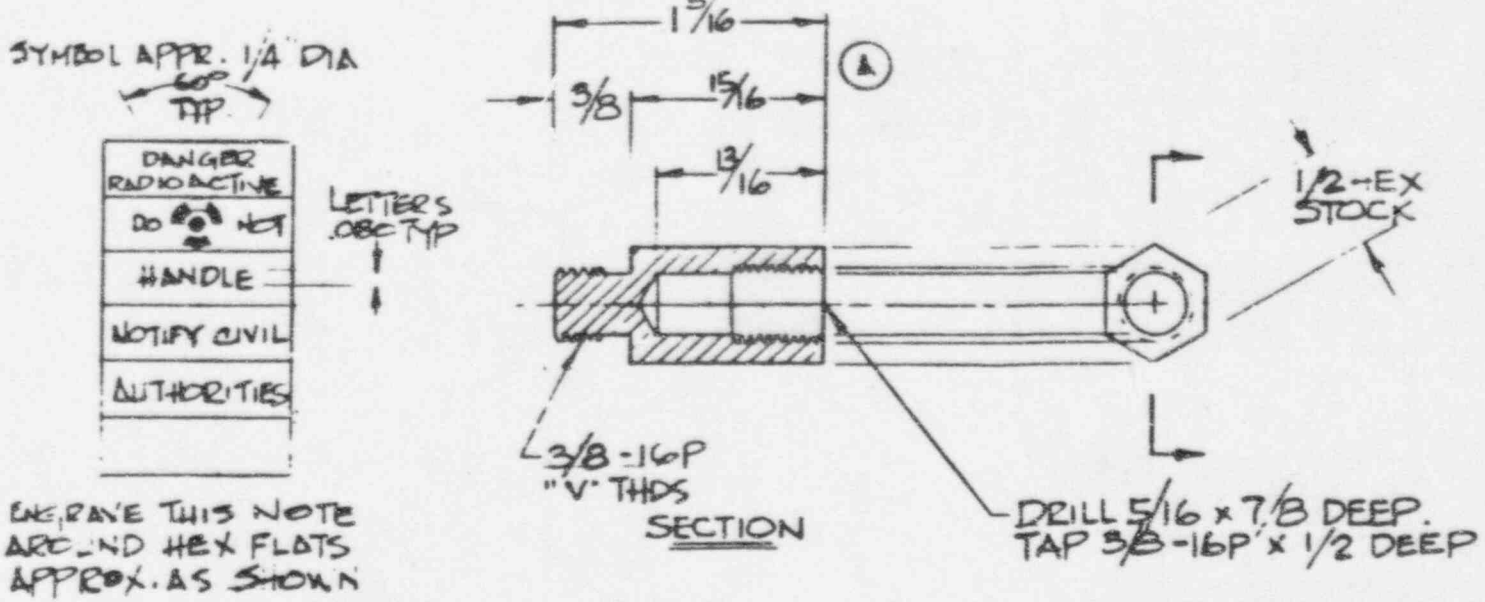
DRAWN BY:	CHECKED BY:	APPROVED:
J. McCLAIN		

DATE:	SCALE:	DWG NO.
6-5-74	1/1	4027

Fig. 2

DWG NO. 4028

REV		DATE
A	15/16 WAS 1 3/8 15/16 " 1 13/16 " 7/8	8-10-76



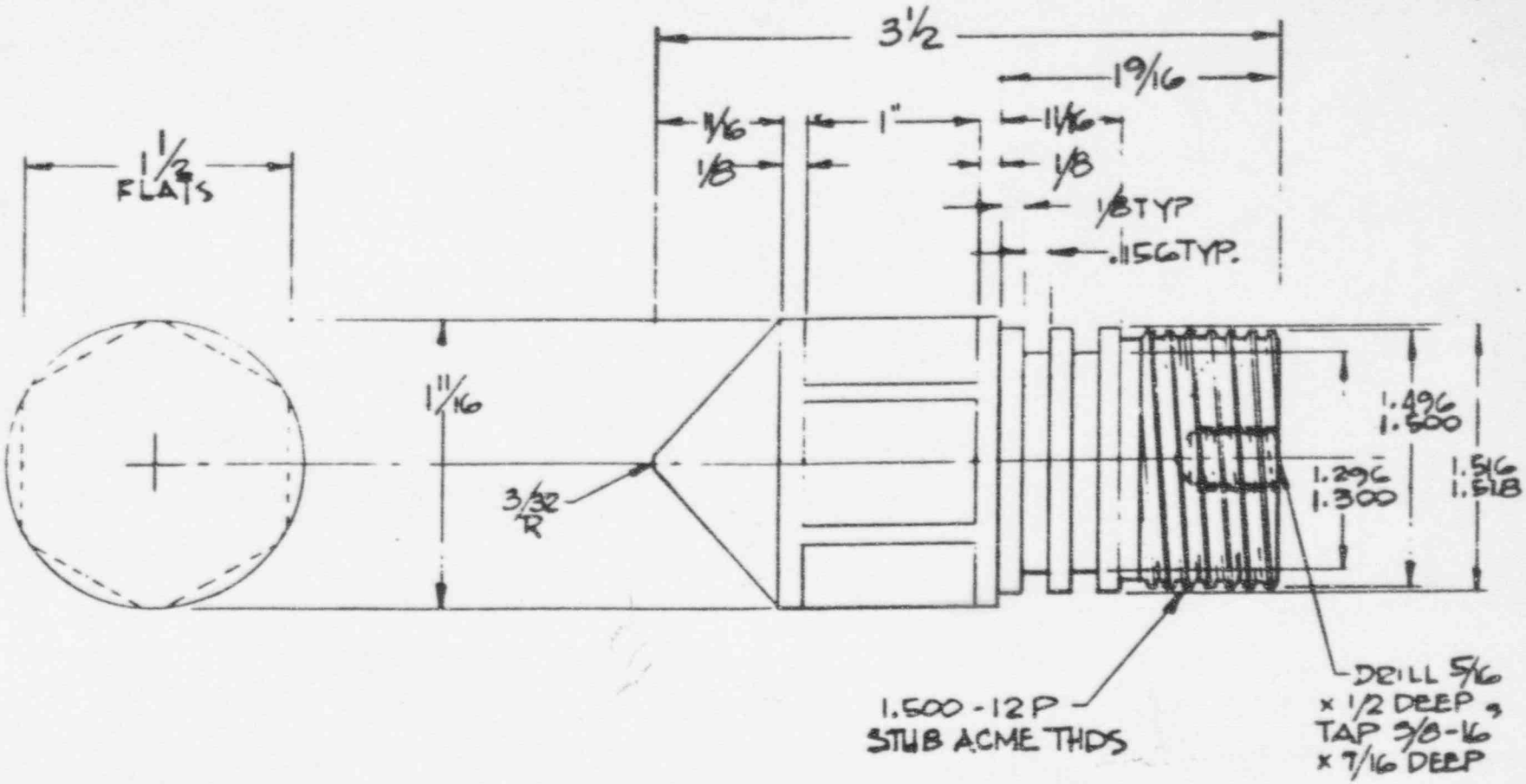
NOTE:

1. USE 3/8-16 x 1/4 ST. STL SET SCREW.

MATERIAL: 1/2" HEX BRASS ROD.	**SIE INC.** RT. 3, BOX 214, FT. WORTH, TEXAS OFFICES IN FT. WORTH, HOUSTON, CALGARY, BRISBANE, & PERTH	TITLE: CARRIER - SOURCE CAPSULE, 1 1/16 DENSITY TOOL
HEAT TREAT: —		DRAWN BY: J. McCLAIN / CHECKED BY: / APPROVED:
FINISH: —	FIXTURE:	DATE: 6-5-74 / SCALE: 1/1 / DWG NO. 4028
	REMOVE BURRS, BREAK ALL SHARP EDGES TOLERANCES UNLESS OTHERWISE SPECIFIED DEC. ± .005, FRA. ± 1/64, ANG. ± 0° 30	

DWG NO. 45

REV	DATE

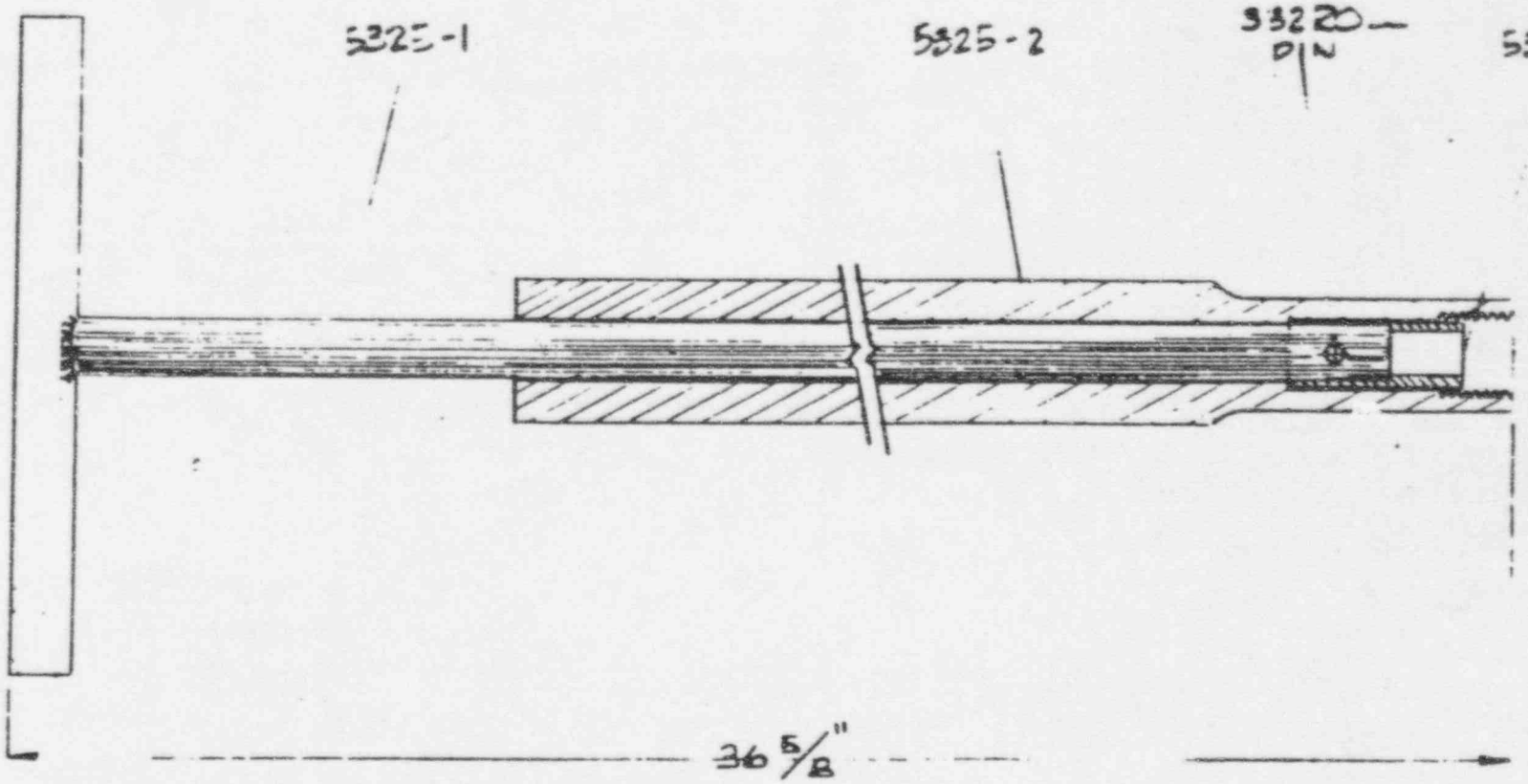


4.4.4

MATERIAL: 4145 STR. TEMP.	**SIE INC.** RT. 3, BOX 214, FT. WORTH, TEXAS OFFICES IN FT. WORTH, HOUSTON, CALGARY, BRISBANE, & PERTH	TITLE: BULL PLUG - 1 1/16 LOGGING TOOL
HEAT TREAT: ———		DRAWN BY: J. McCLAIN / CHECKED BY: / APPROVED:
FINISH: ———	FIXTURE: / REMOVE BURRS, BREAK ALL SHARP EDGES TOLERANCES UNLESS OTHERWISE SPECIFIED DEC. ± .005, FRA. ± 1/64, ANG. ± 0° 30'	DATE: 5-30-74 / SCALE: 1/1 / DWG NO. 4045

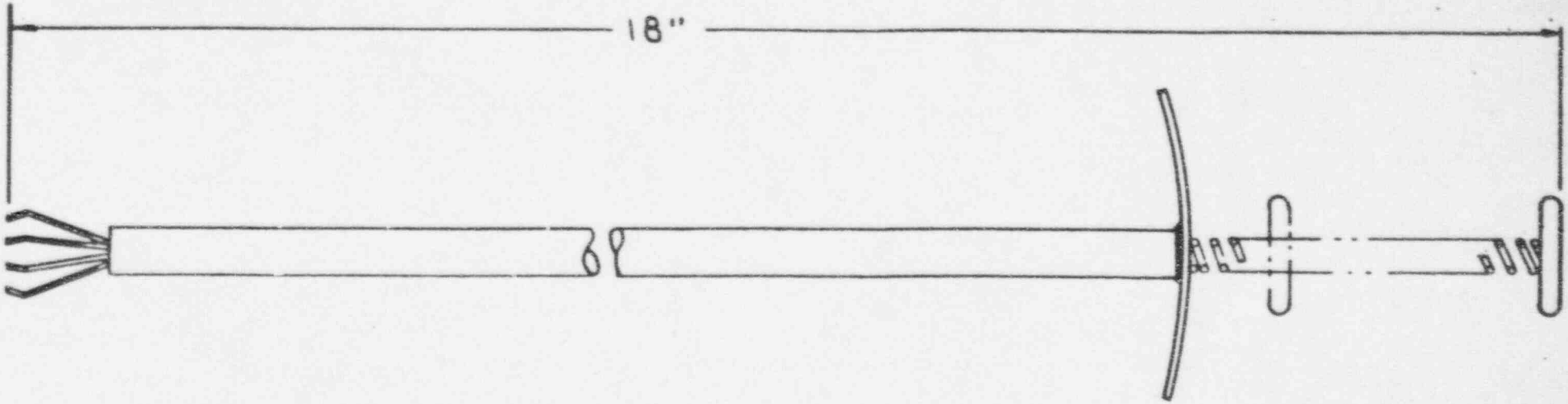
DWG NO. 5325

REV | DAT



MATERIAL:	**SIE INC.** RT. 9, BOX 214, FT. WORTH, TEXAS OFFICES IN FT. WORTH, HOUSTON, CALGARY, BRISBANE, & PERTH	TITLE: SOURCE HANDLING TOOL 2¼ DENSITY TOO_
HEAT TREAT:		DRAWN BY: J. McCLAIN / CHECKED BY: / APPROVED:
FINISH: RED ENAMEL	FIXTURE:	REMOVE BURRS, BREAK ALL SHARP EDGES TOLERANCES UNLESS OTHERWISE SPECIFIED DEC. ± .005, FRA. ± 1/64, ANG. ± 0° 30'
		DATE: 10-18-76 / SCALE: 1 / DWG NO. 5325

F.4.5.



NEXT ASSY	REQD	MATERIAL	TOLERANCES	RADIATION ENG. & MFG. CO. FORT WORTH, TEXAS
			FRACTIONS ±.015 .XX ±.01 .XXX ±.00	TITLE: SOURCE HANDLING TOOL—SIE HT-1
		FIXTURE:		
		DRAWN BY: COO	DATE: 2-10-71	SCALE: FULL DWG NO

f4.5a

It is considered that a person will be safe from radiation damage for any number of years if he does not remain closer to any logging source than is indicated by the appropriate curve on the chart for the corresponding number of hours daily.

The region of local exposure corresponds with the doses which are necessarily non-uniform, because of the size of the human body. In such cases, the seriousness of a radiation dose depends on the tissue receiving the greater part of the radiation.

This safety chart provides safe working distances broadside to the sources. Endwise radiation of the sources is weaker than that from the sides, and a margin of safety is obtained by avoiding exposure to the sides of the source as much as possible.

This chart is based on a 96 millirem per seven-day week per tolerance and supersedes all earlier safety charts for encapsulated sources.

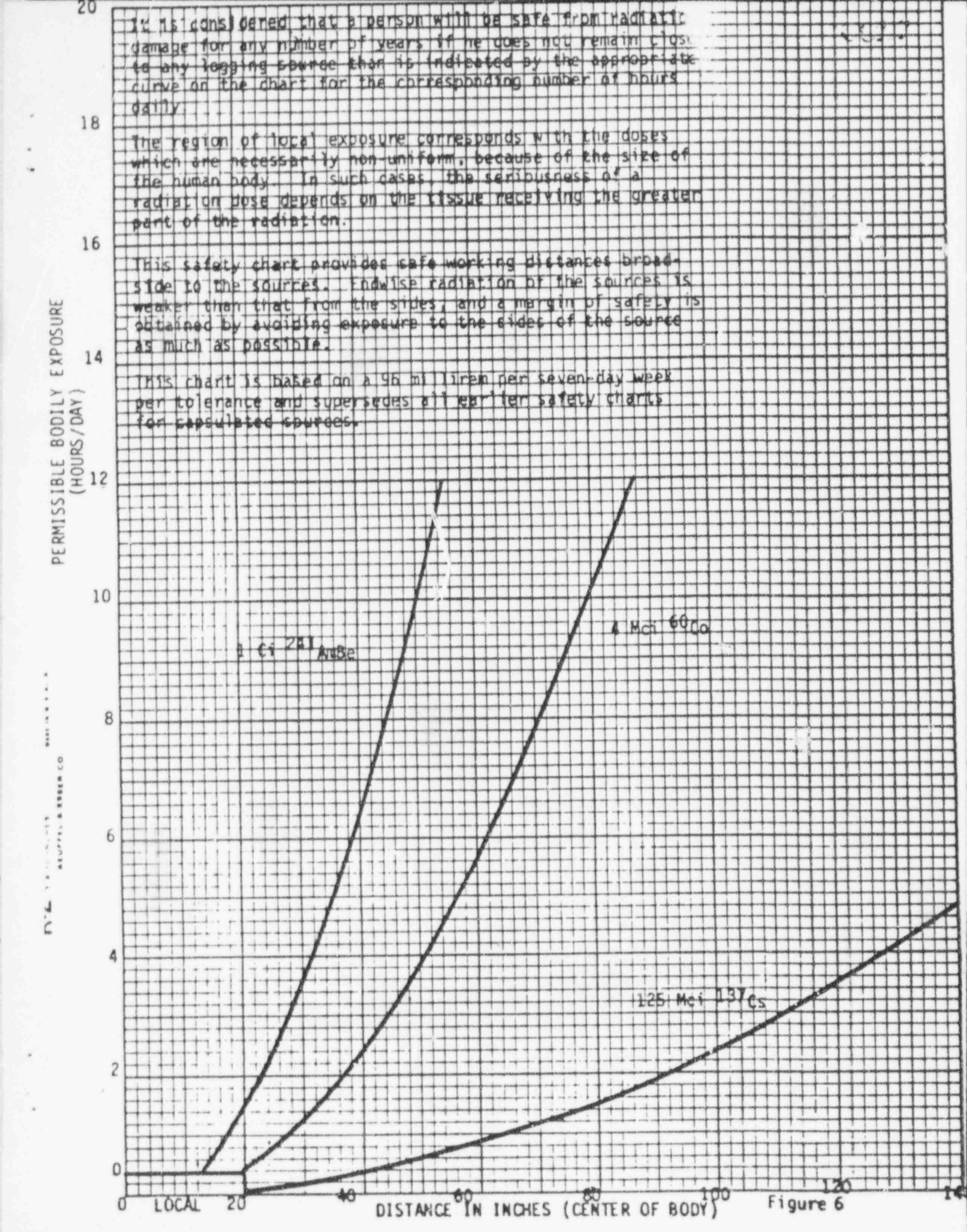
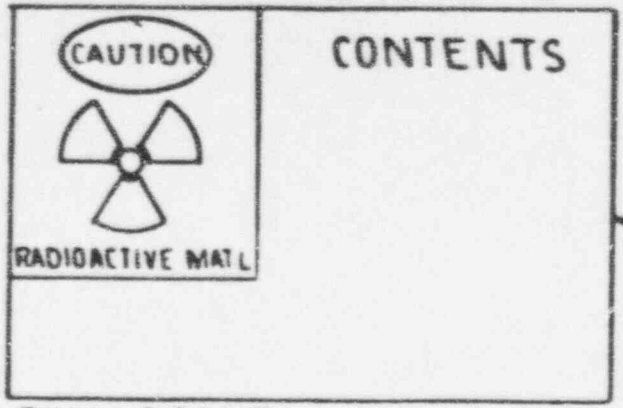
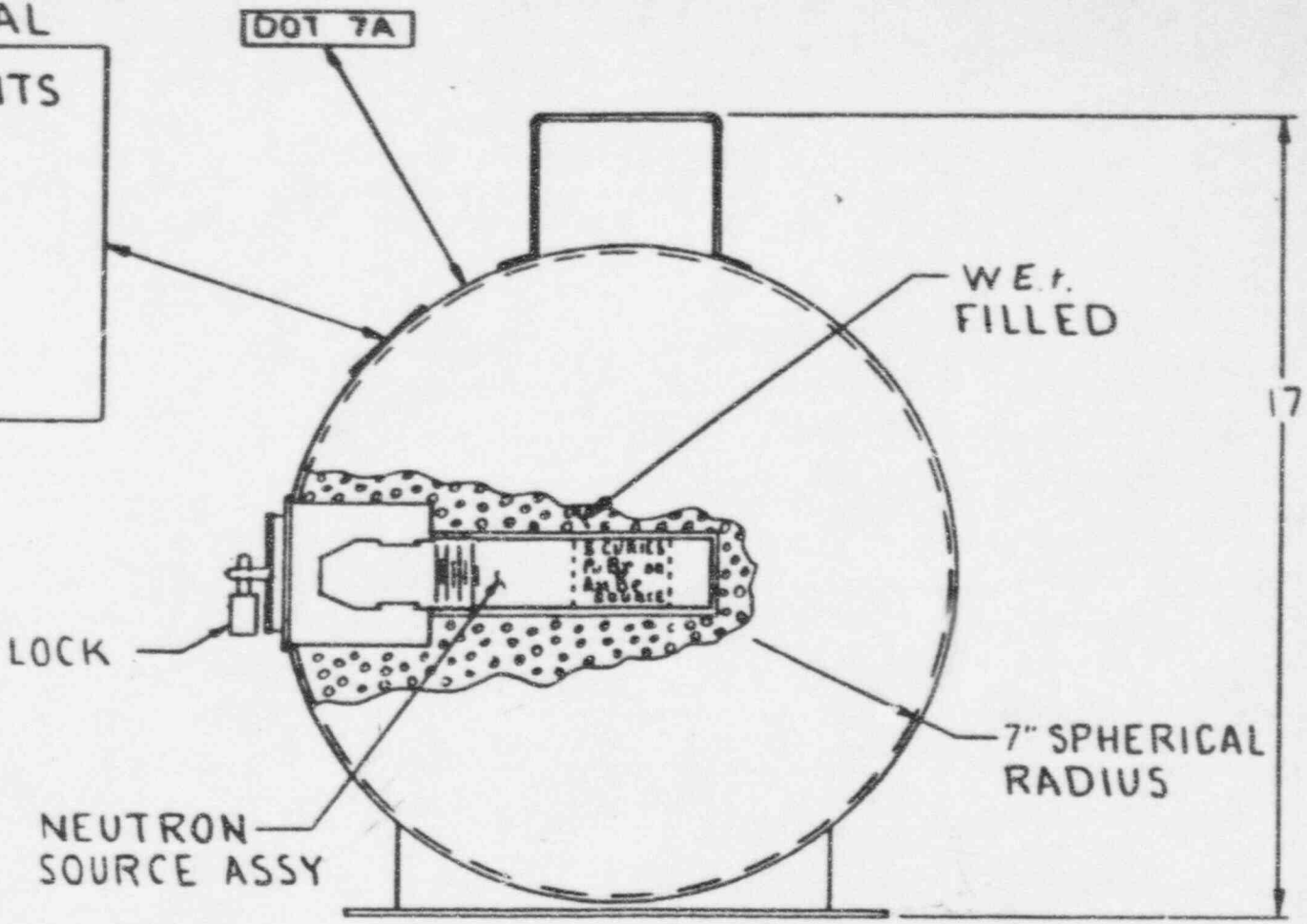


Figure 6

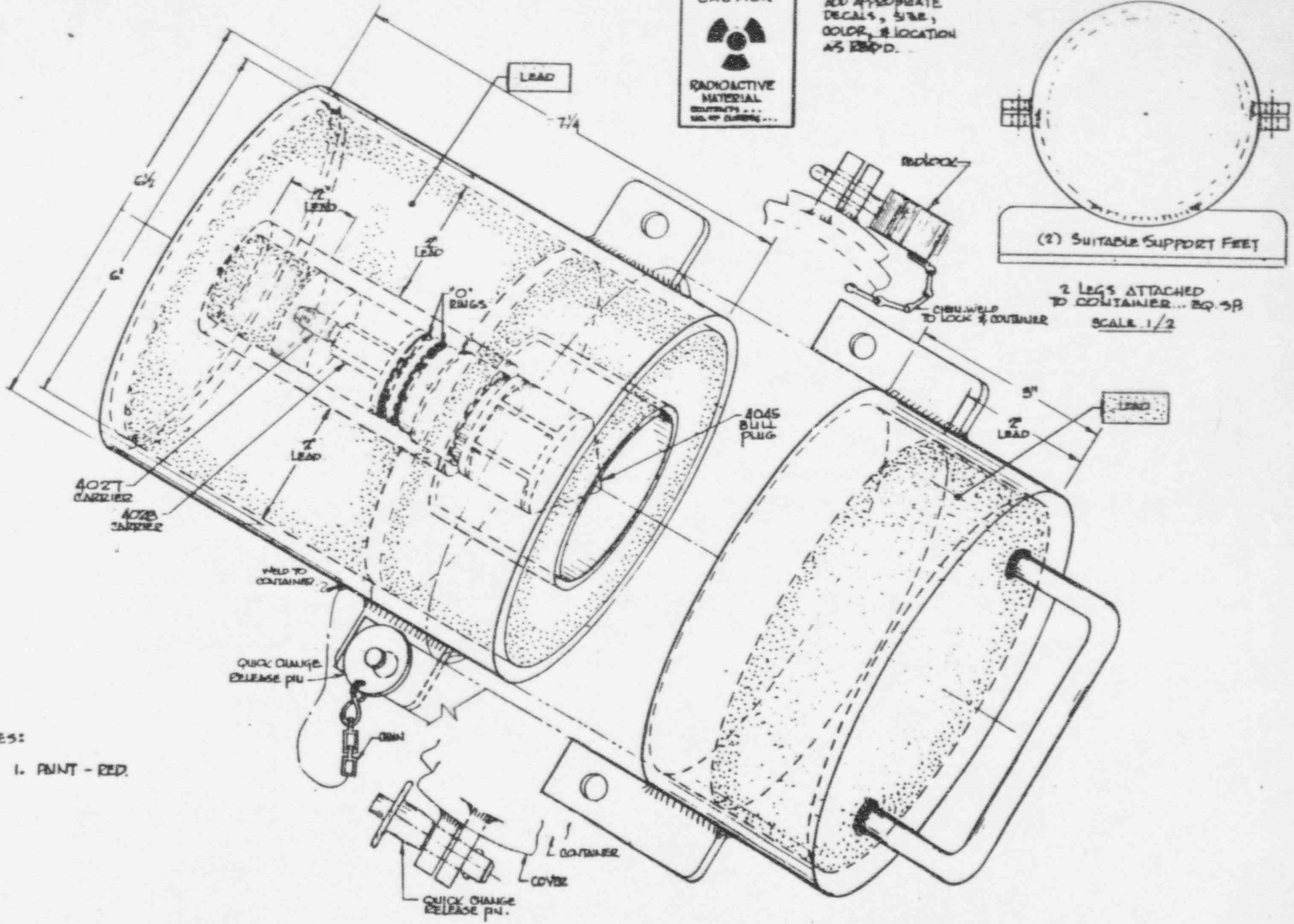
RADIOACTIVE DECAL



FULL SCALE



NEXT ASSY	REQD	MATERIAL	TOLERANCES	RADIATION ENG. & MFG. CO. FORT WORTH, TEXAS
			FRACTIONS ±.015 .XX ±.01 .XXX ±.00	TITLE: NEUTRON SOURCE SHIELD – SIE S-2
		FIXTURE:		
		DRAWN BY: COD	DATE: 2-11-71	SCALE: 1/1 DWG NO



NOTES:

1. PAINT - RED.

MATERIAL:	SIE INC.	TITLE: SOURCE SHIELD - GAMMA RAY. (G.I.I.)
HEAT TREAT:	ST. 8, BOX 514, FT. WORTH, TEXAS OFFICES IN FT. WORTH, HOUSTON, CALGARY, BRISBANE, & PERTH	
FINISH:		DRAWN BY: J. SHERIDAN / CHECKED BY: / APPROVED:

2.0 Handling Tool

Figure 9 shows the approved source handling tool for the neutron and density (^{60}Co) sources. Figures 5 and 5a show the density (^{137}Cs) source handling tools. The operation of the neutron and density (^{60}Co) handling tool is simple and merely requires the placement of one hand on the end grip and the other hand on the grip on the slide. By moving the slide, the source is either locked on or released from the tool. The handling tool illustrated on Figure 5 is used to thread the (^{137}Cs) density source in and out while the tool shown on Figure 5a is used for handling the source.

3.0 Regulations Governing Sealed Source Handling, Storage Etc.

Logging personnel directly in charge of logging operations utilizing the sealed sources are responsible for the health protection of all personnel associated with the sources and the general public who may become so associated, at all times. The above described personnel must personally supervise all source handling operations, transportation, storage, and shipping according to the following regulations:

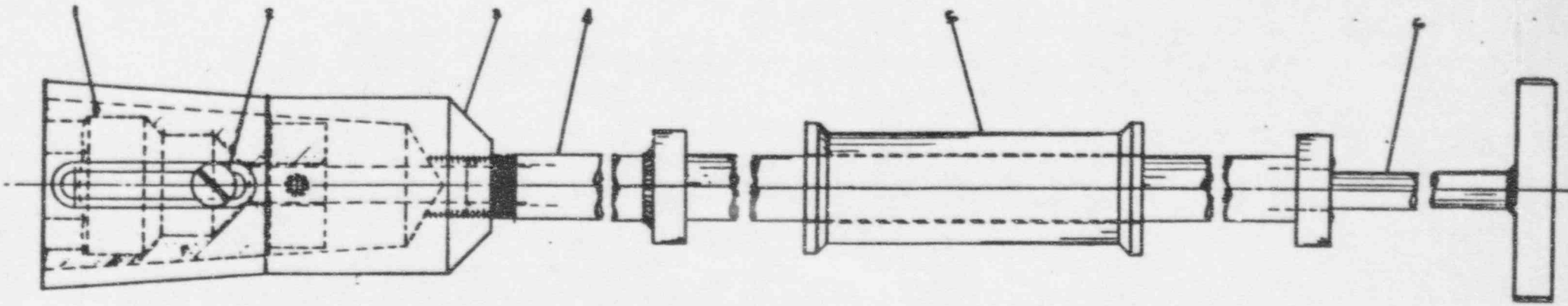
3.1 Only personnel who have been trained in handling sealed sources shall perform operations involving the sources.

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

3.2 Only the approved handling tools shall be used.

3.3 Sealed sources shall be transported only in the approved source shields (see Figures 7 and 8).

3.4 Sealed sources are to be stored in the Radioactive Materials Storage Facilities of SIE, Inc. when not in use for logging operations or being transferred.



ITEM NO.	PART NO.	REQ'D.	DESCRIPTION
1	1406	1 SET	JAWS
1A	4528	1 SET	JAWS FOR ROAD LOGGER ONLY
2	3015	2	SHOULDER SCREW.
3	1408	1	SLEEVE
4	1407	1	TUBE
5	1409	1	SLIDING HANDLE
6	1404	1	T-BAR ASSY

MATERIAL:	SIE INC.	TITLE: ASSY OF SOURCE HANDLING TOOL
HEAT TREAT:		DRAWN BY: J. PEDERSEN
FINISH:		DRAWING NO. 0254

6 1/4

3.5 Sealed sources will be leak tested every six months or less. An approved commercial leak test service will be used.

4.0 Procedures to be followed if a Source is lost in the Borehole

4.1 When a source and tool become stuck, the Radiological Safety Officer should be notified immediately and he will, at this time, determine whether normal fishing operations can be initiated or if special radiological safety precautions are necessary.

4.2 Initially the "stuck tool" and source will be treated just as any other stuck tool. The procedures are those normally for stuck tools.

4.3 If the cable is pulled free from the tool, over-shots may be run on a wireline or on pipe in the normal manner. However, as soon as the cable is pulled free from the tool, the Radiological Safety Officer should procede to the well, equipped with a survey meter. If the source is recovered by using an overshot, there is very little possibility of radioactive contamination. Nevertheless, the wellhead equipment, derrick floor, etc., should be checked with the Geiger Counter for contamination.

4.4 Should there be any evidence of physical damage to the source, or to the tool in the vicinity of the source, the source should be wipe tested in the same manner as wipe tests are made for leak testing.

4.5 If no wipe test kit is available, use a rag to wipe the source. Check the wipe immediately with a survey meter for contamination. Check the tool and the location thoroughly with the survey meter for contamination.

4.5 (Con't) If the tool and source are not recovered by normal or shot fishing methods, the Radiological Safety Officer will notify the appropriate authorities (NRC and/or State) by telephone and apprise them of the situation and the anticipated course of action. The Radiological Supervisor should inform the customer's representative that no action should be taken that might result in a ruputured source capsule until agreement to the proposed course of action is received from the Nuclear Regulatory Commission and/or the State agency. Normally this will not entail much delay as the RSO can handle this matter by telephone.

After receiving agreement from the proper authorities, the representatives of the customer may at this time decide to resort to methods of removing the obstacle by means that could rupture the source capsule, such as bypassing, wash over procedures, drilling through, etc., but at the customer's own risk. Our company will aid and advise in the protection of personnel and property damage provided sufficient time is allowed for our radiological safety personnel and equipment to arrive on location before action is taken that might result in a ruptured capsule.

It is normally better to abandon the source and tool if it appears that further action may result in a damaged source. The contamination of the personnel, mud and well equipment can result in a very expensive decontamination problem and perhaps the complete loss of the well. However, clearance must be given by the State or NRC before the source can be abandoned

In almost all instances a well can be produced after a source and tool have been abandoned. Cementing in the tool (with source) is the normal procedure with a minimum of ten feet of cement cover. However, before the well can be produced, agreement must be obtained from the proper authorities. The Radiological Safety Officer will obtain the agreements from the authorities and give the customer written confirmation of these agreements.

4.6 Companys' Responsibilities when a Source has been lost in a well.

4.6.1 Remain in contact with the customer and offer advice and recommendations regarding safe fishing procedures.

4.6.2 The Radiological Safety Officer equipped with a survey meter, will report to the well location immediately upon hearing that normal overshot or rope spear fishing techniques will not recover the source.

4.6.3 The Radiological Safety Officer will handle all contacts with the State and Federal authorities and obtain permission for proposed recovery efforts. He will also make the necessary arrangements with the authorities if the source must be abandoned.

4.6.4 Perform monitoring service and advise an the protection of personnel and equipment from radiation damage.

4.6.5 Furnish the customer with an engraved stainless steel plaque to mark the wellhead should the source be abandoned.

4.6.5 The Radiological Supervisor will make all reports regarding the incident to the Federal and/or State authorities.

4.7 The Customer's Responsibilities when a Source has been Lost in a Well.

4.7.1 Perform all recovery efforts.

4.7.2 Make the decision whether or not to abandon the source.

4.7.3 Deal with State agencies issuing permits for drilling and furnish that agency with any information it requires.

4.7.4 Furnish our Company with all the information necessary to prepare the required reports.

5.0 ON THE JOB RADIATION SURVEY PROCEDURES

5.1 A radiation survey of the job site will be performed before and after each job.

5.2 Normal background readings will be made and the Logging Unit and Rig Floor surveyed before and after each job. The Logging Tool and Storage Container will be surveyed at the end of each day of logging. The Storage Container will be surveyed both empty and with the Source installed.

5.3 The results of the survey will be recorded on the Radiation Survey Data Sheet (see figure 10).

GEO-LOG, INC.
Plano, Tx.

UNIT NO. _____
OPERATOR _____
SOURCE NO. _____

BORE HOLE RADIATION SURVEY

DATE	BORE HOLE	LOGGING		SHIELD (SURFACE)	
		BEFORE	AFTER	MORNING-SOURCE OUT	EVENING-SOURCE IN

Fig. 10

Section 9. Emergency Procedures

1.0 Road Accidents Involving Radioactive Materials

The possibility of radioactive materials creating a hazardous situation as the result of a road accident involving a Company vehicle carrying such material is remote, but must be considered. Regulations and recommended safety procedures to be followed in the event of such a situation are presented in this section.

1.1 Potential Hazards

Both unsealed and sealed radioactivity must be considered in the event of a road accident. If our sealed sources are undamaged and the seal of the source is still intact, then the hazard is limited to possible external radiation exposure. However, with unsealed tracer material or a source in which the seal has been broken, the spreading of contamination resulting in possible internal exposure must be considered.

A quick survey of the situation will normally reveal the source of hazard, if any. If there is a doubt as to whether or not a seal on a sealed source is broken, a quick wipe test made with a wet rag and measured with a survey meter should detect any leakage.

If contamination is found, the contaminated area should be "roped off" and posted as contaminated until cleaned up.

1.2 Specific Instructions and Regulations

If an accident occurs involving a Company vehicle carrying radioactive material and the situation indicates a possible radiation hazard then the following must be observed:

1.2.1 Keep all unauthorized persons away from the scene of the accident.

1.2.2 See that local authorities concerned (state police, local police, health authorities, etc) are alerted to the potential hazard.

1.2
(Con't)

1.2.3 Notify the Radiological Safety Officer, who will in turn notify the NRC and/or the State Health officials concerned.

1.2.4 If the radioactive material (either sealed source or tracer material) is intact, remove it from immediate area to a safe (either locked or guarded) place.

1.2.5 If there is the slightest possibility of contamination, use a survey meter to carefully survey the area and equipment.

1.2.6 Decontaminate area, if necessary.

1.2.7 Isolate and label radioactive waste and contaminated materials.

1.2.8 Prepare a complete report of the incident, including items contaminated, radiation levels, decontamination methods used, etc.

2.0 Radiation Over-exposure

Exceeding the Quarterly (13 week) Tolerance of 1250 mrem would be classified as an over-exposure. The type and magnitude of our sources as well as out mode of operation make the possibility of being over-exposed, a remote one. However, the Radiological Safety Officer should be immediately notified if there is any possibility of an over-exposure.

Each employee should be thoroughly familiar with the safety curves on Figure 6. Adherence to these curves will help to keep exposure to a minimum.

3.0 Lost Radioactive Material

Radioactive material, either tracers or sealed sources, can become lost in either shipment or in transit to and from a job location. Immediately after becoming aware of such a loss, the individual involved will notify the Radiological Safety Officer who will, in turn, notify the appropriate NRC and/or State officials by telephone and a confirming telegram.

Section 10. Emergency Notification

1.0 Company Notification

Radiological Safety Officer - M. B. Broome

Office Telephone No. - AC 214 542-9333

Home Telephone No. - AC 214 596-9168

2.0 State Notification

Telephone Information

Radiation Control Program

Texas State Department of Health

Monday - Friday (8:00 A.M. to 5:00 P.M.) 512-454-3781 Ext. 241
Holiday, nights and weekends (order of call)

1. Edgar D. Bailey ----------512-926-1405
   Chief, Compliance & Inspection

2. Larry J. Stephenson----------512-451-4806
   Supervisor, Compliance

3. Joseph M. Nanus----------512-926-0498
   Chief, Licensing & Registration

4. David K. Lacker----------512-295-3026
   Administrator, Radiation Control
   Program or----------512-442-1871

5. Martin C. Wukasch---------- 512-465-5437
   Director, Division of Occupational
   Health & Radiation Control

If necessary, you may request that one of the above individuals be located by contacting:

Texas Dept. of Public Safety--------512-452-0331

Date _____

Source Identification Number _____

Source Shipped to _____

CAPSULE SPECIFICATION

Inner Capsule Reference Drawing Number _____

Outer Capsule Reference Drawing Number _____

DECONTAMINATION AND CLOSURE TESTS

Method - Both inner and outer capsules are decontaminated after closure in an ultrasonic bath until the flush solution contains less than 50 d/m per ml total alpha activity. The outer capsule is further decontaminated, if necessary, until all exterior surfaces are free of contamination as determined by a wipe test. After decontamination, each capsule is pressurized in helium to at least 30 psig for a period of 30 minutes, then transferred to a helium leak detector. The leak detector has a minimum sensitivity of _____ standard cubic centimeters of helium per second.

Tests - The finished source was found free of contamination and detectable leaks, as determined by these methods.

SOURCE STRENGTH

Assay - The neutron emission rate of the finished assembly is determined by comparing its strength to that of a ^{252}Cf source calibrated at the National Bureau of Standards. The comparison is made by inserting the capsule assembly in an array of fission tube counters and measuring the subsequent induced electric current by a sensitive ammeter. The ^{252}Cf content given below is the effective or net californium content calculated from the neutron emission rate and is given in equivalent weight units assuming 2.311×10^{6} neutrons per second per microgram of ^{252}Cf. Corrections are made, when necessary, for the ^{254}Cf contribution to the total neutron emission rate. The ^{252}Cf present is assumed to decay with an effective half-life of 2.646 years; the ^{254}Cf, if present, is assumed to decay with a 60.5-day half-life.

Contents - The total neutron emission rate of this assembly was found to be _____ neutrons per second with a standard error of _____ on _____. The ^{254}Cf contribution to the total was calculated to be _____ per second on the same date. The effective ^{252}Cf content was calculated to be _____ µg equivalent with a standard error of _____.

T. H. Scott, Chief
Planning and Development Branch
Savannah River Operations Office
U. S. Atomic Energy Commission
Aiken, South Carolina 29801

S. Mirshak, Director
Nuclear Engineering and
Materials Section
Savannah River Laboratory
E. I. du Pont de Nemours and Co.
Aiken, South Carolina 29801

FIG. II-11 ^{252}Cf NEUTRON SOURCE INFORMATION