UNION CARBIDE CORPORATION
CHEMICALS AND PLASTICS
P. O. BOX 8361, SOUTH CHARLESTON, W. VA. 25303

Reference File Number: 8015970
Date: March 12, 1980

Mr. Paul R. Guinn
United States Nuclear Regulatory Commission
License Management Branch
Division of Fuel Cycle and Material Safety
Washington, DC 20555

Dear Mr. Guinn,

Enclosed is an application for renewal of USNRC License Number 47-260-9 including supplemental attachments, submitted in duplicate. Although I informed you that our intent was to amend our 47-260-2 license to include these requested activities, we have decided not to jeopardize this work area in the event that the amendment was not acted upon before our existing license expired. At some point in the future, we may amend our 47-260-2 license to include the requested activities.

If you have any questions concerning this application, do not hesitate to call me at (304) 747-4918.

Yours truly,

Fred Straccia

F. P. Straccia, Technical Center
Alternate Radiation Protection Officer
Special Instrumentation Development
ENGINEERING & HYDROCARBONS DIVISION

FPS/ld

Attachments

ATTACHMENT 1

The licensed material shall be used only at the licensee's Technical Center, South Charleston, West Virginia, and at temporary job sites of the licensee anywhere in the United States where the US Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material. (Please note that we may be requested to perform these tests for other companies; therefore, we do not wish to be limited to Union Carbide facilities).

FPStraccia/ld

March 12, 1980

FORM NRC-313 I (1-79)
10 CFR 30

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
INDUSTRIAL

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.

1. APPLICATION FOR: *(Check and/or complete as appropriate)*

	a. NEW LICENSE
	b. AMENDMENT TO: LICENSE NUMBER
X	c. RENEWAL OF: LICENSE NUMBER 47-260-9

2. APPLICANT'S NAME *(Institution, firm, person, etc.)*
Union Carbide Corporation
South Charleston Technical Center
TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

3. NAME OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION
Frederick P. Straccia
TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
(304) 747-4918

4. APPLICANT'S MAILING ADDRESS *(Include Zip Code)*
P. O. Box 8361
South Charleston, WV 25303

5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED *(Include Zip Code)*
See Attachment 1

(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.	See Attachment 2	
b.		
c.		

7. RADIATION PROTECTION OFFICER
J. H. Brubaker - RPO
D. G. Allport & F. P. Straccia Alt.RPO

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.	A ELEMENT AND MASS NUMBER	B CHEMICAL AND/OR PHYSICAL FORM	C NAME OF MANUFACTURER AND MODEL NUMBER *(If Sealed Source)*	D MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME
(1)	Am-241	Sealed Sources	Monsanto Research	Not to exceed
			Corp. Model MRC-N-SS-W-AmBe	5 curies total
			and Model 2722-BT	
(2)	Am-241	Deposited Source		0.1 microcurie

	E DESCRIBE USE OF LICENSED MATERIAL
(1)	See Attachment 3.
(2)	To be used as a calibration source.
(3)	
(4)	

03186

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)	See Attachment 4		
(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)	See Technical	Center Radiological Control Manual, Chapter XI, "Radiation Physics				
(2)	Laboratory"					
(3)						
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☒ a. CALIBRATED BY SERVICE COMPANY neutron meters

NAME, ADDRESS, AND FREQUENCY
Eberline Instrument Corporation
Airport Road, P. O. Box 2108
Santa Fe, NM 87501 (6 mo. frequency)

☒ b. CALIBRATED BY APPLICANT β - γ

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

See Chapter VIII, Radiological Control Manual

12. PERSONNEL MONITORING DEVICES

TYPE (Check and/or complete as appropriate.) A	SUPPLIER (Service Company) B	EXCHANGE FREQUENCY C
☒ (1) FILM BADGE	R. S. Landauer Jr. & Company	☒ MONTHLY
☐ (2) THERMOLUMINESCENCE DOSIMETER (TLD)		☐ QUARTERLY
☐ (3) OTHER (Specify): _____		☐ OTHER (Specify):
_____		_____
_____		_____

13. FACILITIES AND EQUIPMENT (Check were 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. See Tech Center Radiological Control Manual
☐ d. RESPIRATORY PROTECTIVE EQUIPMENT, ETC.

14. WASTE DISPOSAL

a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED
Chem Nuclear Systems, Inc., Barnwell, SC

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.

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.

See Attachment 5 and Technical Center Radiological Control Manual

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.

See Attachment 2

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.

See Attachment 2

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'S *(Signature)*
$110	c. NAME *(Type or print)* R. D. Stief
(1) LICENSE FEE CATEGORY: 3.L.	d. TITLE Director of Engineering
(2) LICENSE FEE ENCLOSED: $ 110	e. DATE 3/12/80

FORM NRC-313 I (1-79)

ATTACHMENT 2

The following persons will use or directly supervise the use of licensed material:

Name	Title
D. G. Allport	Radiation Protection Technician
W. K. Becher	Nucleonics Applications Technician
J. A. Boggess	Nucleonics Applications Technician
M. L. Green	Nucleonics Applications Engineer
C. R. Landfried	Group Leader
F. P. Straccia	Radiation Protection Engineer

Their training and experience are listed on the following pages.

Also enclosed is the training and experience of J. H. Brubaker, Radiation Protection Officer.

FPStraccia/ld

March 12, 1980

D. G. ALLPORT

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB	FORMAL COURSE
a. Principles and practices of radiation protection	Georgia Institute of Technology	2 Weeks	No	Yes
	Union Carbide Technical Center, WV RPO School	1 Week	Yes	Yes
	Morris Harvey College, Charleston, WV	4 Years	No	Yes
b. Radioactivity measurement standardization and monitoring techniques and instruments	Georgia Institute of Technology	2 Weeks	No	Yes
	Union Carbide Technical Center, WV RPO School	1 Week	Yes	Yes
	Morris Harvey College, Charleston, WV	4 Years	No	No
c. Mathematics and calculations basic to the use and measurement of radioactivity	Georgia Institute of Technology	2 Weeks	No	Yes
	Union Carbide Technical Center, WV RPO School	1 Week	Yes	Yes
	Morris Harvey College, Charleston, WV	4 Years	Yes	No
d. Biological effects of radiation	Georgia Institute of Technology	2 Weeks	No	Yes
	Union Carbide Technical Center, WV RPO School	1 Week	Yes	Yes
	Morris Harvey College, Charleston, WV	4 Years	Yes	No

EXPERIENCE

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Cs-137, Ra-226, Co-60, Am-241-Be, C-14, Ni-63	Curies	Union Carbide Corporation	4 Years	Process gauging, tracer

EDUCATION

- Biology - Morris Harvey College, Charleston, WV

Ms. Allport also participates in instructing a one-week short course in radiation protection for Union Carbide Corporation.

(b)(6)

3/12/80

W. K. BECHER

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB	FORMAL COURSE
a. Principles and practices of radiation protection	Electric Corp.			
	Westinghouse	4 Years	Yes	Yes
	CGR Medical Corp.	5 Years	Yes	No
	Union Carbide Technical Center, WV RPO School	1 Week	Yes	Yes
	USAF Keesler AFB	2 Weeks	No	Yes
b. Radioactivity measurement standardization & monitoring techniques & instruments	Electric Corp.			
	Westinghouse	4 Years	Yes	Yes
	CGR Medical Corp.	5 Years	Yes	No
	Union Carbide Technical Center, WV RPO School	1 Week	Yes	Yes
	USAF Keesler AFB	2 Weeks	No	Yes
c. Mathematics & calculations basic to the use & measurement of radioactivity	Electric Corp.			
	Westinghouse	4 Years	Yes	Yes
	CGR Medical Corp.	5 Years	Yes	No
	Union Carbide Technical Center, WV RPO School	1 Week	Yes	Yes
	USAF Keesler AFB	2 Weeks	No	Yes
d. Biological effects of radiation	Electric Corp.			
	Westinghouse	4 Years	Yes	Yes
	CGR Medical Corp.	5 Years	Yes	No
	Union Carbide Technical Center, WV RPO School	1 Weeks	Yes	Yes
	USAF Keesler AFB	2 Weeks	No	Yes

EXPERIENCE

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Co-60	Curies	Westinghouse Electric	4 Years	Medical
Co-60	Curies	CGR Medical Corp.	5 Years	Medical
Cs-137	Curies	Union Carbide Corp.	3 Years	Density & Level Gauge
Cs-137	Milli-curies	Union Carbide Corp.	3 Years	Density & Level Gauge
Am-241-Be	Curies	Union Carbide Corp.	3 Years	Carbon Measurement

3/12/80

J. A. BOGGESS

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB	FORMAL COURSE
a. Principles & practices of radiation protection	Union Carbide Corp.	8 Years	Yes	No
	Union Carbide Technical Center, WV RPO School	1 Week	Yes	Yes
	Army CBR Training, Ft. Eustis	2 Weeks	No	Yes
b. Radioactivity measurement standardization & monitoring techniques & instruments.	Union Carbide Corp.	8 Years	Yes	No
	Union Carbide Technical Center, WV PRO School	1 Week	Yes	Yes
	Army CBR Training, Ft. Eustis	2 Weeks	No	Yes
c. Mathematics & calculations basic to the use & measurement of radioactivity	Union Carbide Corp.	8 Years	Yes	No
	Union Carbide Technical Center, WV RPO School	1 Week	Yes	Yes
	Army CBR Training,	2 Weeks	No	Yes
d. Biological effects of radiation	Union Carbide Corp.	8 Years	Yes	No
	Union Carbide Technical Center, WV RPO School	1 Week	Yes	Yes
	Army CBR Training, Ft. Eustis	2 Weeks	No	Yes

EXPERIENCE

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Cs-137	Curies	Union Carbide Corp.	13 Years	Density & Level Gauge, Tracer
Co-60	Curies	Union Carbide Corp.	11 Years	Density & Level Gauge
Ra-226 & daughters	Milli-curies	Union Carbide Corp.	11 Years	Density & Level Gauge, R&D
C-14	Millicuries	Union Carbide Corp.	6 Years	R&D Tracer
H-3	Millicuries	Union Carbide Corp.	6 Years	Tracer
Xe-133	Millicuries	Union Carbide Corp.	3 Months	Tracer
Kr-79	Millicuries	Union Carbide Corp.	3 Months	Tracer
Sr-90	Millicuries	Union Carbide Corp.	8 Years	R&D
Au-198	Millicuries	Union Carbide Corp.	1 Year	Tracer
I-131	Millicuries	Union Carbide Corp.	3 Months	Tracer
Cs-131	Millicuries	Union Carbide Corp.	3 Months	Tracer
Rb-86	Millicuries	Union Carbide Corp.	3 Months	Tracer
Am-241-Be	Millicuries	Union Carbide Corp.	5 Years	Carbon Measurement

3/12/80

J. H. BRUBAKER

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB	FORMAL COURSE
a. Principles and practices of radiation protection	Union Carbide Technical Center, WV RPO School	2 Weeks	Yes	Yes
b. Radioactivity measurement standardization and monitoring techniques and instruments.	Union Carbide Technical Center, WV RPO School	2 Weeks	Yes	Yes
c. Mathematics and calculations basic to the use and measurement of radioactivity	Union Carbide Technical Center, WV RPO School	2 Weeks	Yes	Yes
	University of Florida	9 Months	No	Yes
d. Biological effects of radiation	Union Carbide Technical Center, WV RPO School	2 Weeks	Yes	Yes

EXPERIENCE

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Cs-137	Curies	Union Carbide Corp.	8 Years	Process Gauging
Ra-226	Millicuries	Union Carbide Corp.	8 Years	Carbon Measurement

EDUCATION

DEGREE	COLLEGE OR UNIVERSITY	DATE ACQUIRED	MAJOR
AA	Hershey Junion College		Science
BS	University of Florida		Physics
MS	University of Florida		Astronomy-Physics

3/12/80

(b)(6)

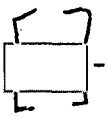
M. L. GREEN

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB	FORMAL COURSE
a. Principles and practices of radiation protection	University of Kentucky	9 Months	No	Yes
	University of Kentucky	3 Months	Yes	No
	Mound Lab. (AEC)	39 Months	Yes	No
	University of Cincinnati	8 Months	No	Yes
	Union Carbide Corp.	6 Months	Yes	No
b. Radioactivity measurement standardization and monitoring techniques and instruments.	University of Kentucky	9 Months	No	Yes
	University of Kentucky	3 Months	Yes	No
	Mound Lab. (AEC)	39 Months	Yes	No
	University of Cincinnati	8 Months	Yes	No
	Union Carbide Corp.	6 Months	Yes	No
c. Mathematics and calculations basic to the use and measurement of radioactivity	University of Kentucky	9 Months	No	Yes
	University of Cincinnati	8 Months	No	Yes
	Union Carbide Corp.	3 Months	Yes	No
d. Biological effects of radiation	University of Kentucky	5 Days	No	Yes
	Mound Lab. (AEC)	39 Months	Yes	No

EXPERIENCE

ISOTOPE	AMOUNT	WHERE EXPERIENCE GAINED	DURATION OF EXPERIENCE	TYPE OF USE
U-238	Kilograms	Univ. of Kentucky	3 Months	Sub-Critical Reactor
Classified	Classified	Monsanto Research Corp.	39 Months	Classified
Cs-137	Curies	Union Carbide Corp.	5 Years	Gauging
Ra-226	Millicuries	Union Carbide Corp.	3 Years	Gauging
Xe-133	Millicuries	Union Carbide Corp.	6 Months	Tracer
Cs-137	Millicuries	Union Carbide Corp.	6 Months	Tracer
Am-241-Be	Curies	Union Carbide Corp.	5 Years	Carbon Measurement

EDUCATION

BS  - Physics - University of Kentucky

(b)(6)

3/12/80

C. R. LANDFRIED

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB	FORMAL COURSE
a. Principles and practices of radiation protection	Union Carbide Corp.	15 Years	Yes	No
b. Radioactivity measurement standardization and monitoring techniques and instruments.	Union Carbide Corp.	15 Years	Yes	No
c. Mathematics and calculations basic to the use and measurement of radioactivity	Union Carbide Corp.	15 Years	Yes	No
d. Biological effects of radiation	Union Carbide Corp.	15 Years	Yes	No

EXPERIENCE

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Cs-137	Curies	Union Carbide Corp.	18 Years	Density & Level Gauge Tracer
Co-60	Curies	Union Carbide Corp.	18 Years	Density & Level Gauge
Ra-226 & Daughters	Millicuries	Union Carbide Corp.	18 Years	Density & Level Gauge
C-14	Millicuries	Union Carbide Corp.	10 Years	R&D Tracer
H-3	Millicuries	Union Carbide Corp.	8 Years	Tracer
Xe-133	Millicuries	Union Carbide Corp.	12 Months	Tracer
Kr-79	Millicuries	Union Carbide Corp.	5 Months	Tracer
Po-210-Be	Curies	Union Carbide Corp.	2 Years	Gauging
Sr-90	Millicuries	Union Carbide Corp.	15 Years	R&D
Am-241-Be	Curies	Union Carbide Corp.	5 Years	Gauging

F. P. STRACCIA

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB	FORMAL COURSE
a. Principles and practices of radiation protection	Univ.of Lowell,Lowell,MA	4 Years	No	Yes
	CIS Radiopharmaceuticals, Bedford, MA	1.5 Years	Yes	No
	Vermont Yankee Nuclear Power Corp., Vernon, VT	3 Months	Yes	No
b. Radioactivity practices of standardization and monitoring techniques and instruments	Univ.of Lowell,Lowell,MA	4 Years	No	Yes
	CIS Radiopharmaceuticals Bedford, MA	1.5 Years	Yes	No
	Vermont Yankee Nuclear Power Corp., Vernon, VT	3 Months	Yes	No
c. Mathematics and calculations basic to the use & measurement of radioactivity	Univ.of Lowell, Lowell, MA	4 Years	No	Yes
	CIS Radiopharmaceuticals Bedford, MA	1.5 Years	Yes	No
	Vermont Yankee Nuclear Power Corp., Vernon, VT	3 Months	Yes	No
d. Biological effects of radiation	Univ. of Lowell, Lowell, MA	4 Years	No	Yes
	CIS Radiopharmaceuticals Bedford, MA	1.5 Years	Yes	No
	Vermont Yankee Nuclear Power Corp., Vernon, VT	3 Months	Yes	No

EXPERIENCE

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Ra-226, Cs-137, Mixed Fission Products	Millicuries	University of Lowell	3 Years	School Labs
Tc-99m, I-131, H-3, C-14, Mo-99	Curies	CIS Radiopharmaceuticals	1.5 Years	Preparing Radioisotopes
Mixed Fission Products	Curies	Vermont Yankee Nuclear Power Corporation	3 Months	Contamination Control HP Monitoring
Cs-137, Ra-226, Co-60	Curies	Union Carbide Corp.	3 Years	Process Gauging
Am-241-Be	Curies	Union Carbide Corp.	2 Years	Carbon Measurement

EDUCATION

BS,  - Radiological Health Physics, University of Lowell, Lowell, Massachusetts

(b)(6) Mr. Straccia also participates in instructing a one-week short course in radiation protection for Union Carbide Corporation.

3/12/80

ATTACHMENT 3

PURPOSE FOR WHICH BY-PRODUCT MATERIAL WILL BE USED

These sources will be used for testing steel vessels for carbon buildup. These vessels are 25 feet high with a diameter of about 10 feet. The source is lowered in a tube through a 6" to 8" thick steel plate. The nominal shielding is approximately 16" of steel and a distance of 12 feet. The average exposure rate is 8 n/sec/cm^2. The exposure rate exists for approximately 2 hours for each test. A single individual would not normally be exposed for more than six hours per month. An area 20 foot square will be roped off and posted with signs stating "Caution - Radioactive Materials" at the top and bottom of the vessel. Only individuals having both film badges and dosimeters will be allowed in these areas during the time tests are being made.

The test is made by removing the source from its storage container and bolting it to the detector probe. The source is handled with chanel lock pliers.

Total exposure time during this transfer is approximately 30 seconds. Trunk exposure rate is about 100 n/cm^2/sec during this time, while exposure to the operator's hands is about 400 n/cm^2/sec. This is an exposure rate of approximately 3.2 and 12.8 millirem/hr. The normal exposure rate during the tests is 8 n/sec/cm^2 or 0.26 millirem/hr. The estimated total neutron exposure is 0.52 millirem. The gamma field associated with a 5 curie Am-Be source is 50.8 mr/hr at one meter. The total neutron and gamma dose would be less than 3 millirem for each test.

If this type measurement becomes necessary on different type vessels, revised operating procedures and exposure estimates would have to be reviewed and voted on by the Radiation Safety Committee before any testing can take place.

FPStraccia/ld

3/11/80

ATTACHMENT 4

TEC-76-1

Technical Report

ENGINEERING DEPARTMENT
CHEMICALS AND PLASTICS
UNION CARBIDE CORPORATION
SOUTH CHARLESTON, WEST VIRGINIA

SUBJECT: Specification Testing of Neutron Source Storage-Shipping Cask

WRITTEN BY: M. L. Green DATE: January 5, 1976

REVIEWED BY: T. M. Austin

Summary:

An SID designed shipping cask for radioactive material was tested and shown to be able to meet the criteria for a DOT 7A, Type A shipping container.

Introduction:

Hazardous Materials Regulations Board Notice of Proposed Rule Making; DOT No. HM-111, Notice No. 73-7, stated that the present listing of various authorized DOT specifications in paragraphs 173.394 and 173.395 (Type A containers) of DOT Tariff No. 27 would be deleted. Instead, complete reliance would be placed on the use of DOT-7A, Type A general packaging specification. In addition, each user of a Specification 7A package would be required to document and maintain on file for one year, after latest shipments, a written record of his determination of compliance with the DOT Specification 7A performance requirements for the specific package design. Prior to this Rule Making testing of Specification 7A containers were not required.

For several years SID has been using and shipping special form encapsulated neutron sources between their various plants in the continental United States, England, Canada, and Puerto Rico. These sources were shipped in a specially designed cask which was felt to meet the DOT 7A specification and was convenient and safe to carry. This cask is described in UCC drawing A-277-MAI (Figure 1). To comply with the new requirement, one of these casks was subjected to the tests required for a DOT specification 7A package. These tests are specified in paragraph 173.398 of Title 49, Code of Federal Regulations. The applicable portions of 49CFR are reproduced in Appendix A.

Description:

This cask consists of a ten inch diameter cylinder of borated polyethylene encased in a 20 gauge steel cover. The cylinder is held centered inside an aluminum suitcase by a wooden frame work. The neutron source is located in the center of the cylinder and is held by a spring steel clasp attached to the steel lid of the cylinder by a polyethylene filled steel step wedge. The lid on this cylinder can only be removed by rotating the lid about 20° and lifting the lid straight up. The lid is secured from rotating by a padlock. The matching padlock ears on the lid and cylinder also have a provision for attaching a lead wire seal. The aluminum suitcase also has provision for a lead seal to comply with paragraph 173.393(b) of 49CFR.

Tests:

To test this package design, one of the two existing casks was subjected to the required tests specified in § 173.398. The criteria for passing the tests were:

(i) There would be no release of radioactive material from the package

(ii) The effectiveness of the packaging would not be substantially reduced, and

(iii) There would be no mixture of gases or vapors in the package which could, through any credible increase of pressure or an explosion, significantly reduce the effectiveness of the package.

Since the source is a special form encapsulation, criteria i and iii are met by this requirement for special form certification of the source encapsulation. Therefore, the only criteria of real concern is that the effectiveness of the packaging not be substantially reduced.

The package was subjected to the specified tests for "Free drop", "Penetration", and "Compression" consecutively.

Test Results:

As can be seen in Figures 2 through 7, the shipping cask did not suffer any major damage from the test sequence. Damage was limited to denting and some distortion of the outer aluminum suitcase. The case did not open nor did the lead seal on the suitcase rupture. The inner container was not damaged in any way.

Conclusion:

As a result of the tests performed, it is felt that this package design fully meets the criteria for a DOT 7A, Type A package and is suitable for shipping special form encapsulated radioactive materials.

MLG:sgm

APPENDIX

Subpart K - Specifications for General Packagings

§ 178.350 Specification 7A; General Packaging, Type A. (Amd. 178-1, 33 F.R. 14935, Oct. 4, 1968)

§ 178.350-1 General Requirements

a) Each packaging must meet all applicable requirements of § 173.24 of this chapter.

§ 178.350-2

a) Each packaging must be so designed and constructed that it meets the standards for Type A packaging (see § 173.389(j) and 173.398(b) of this chapter.) (Amd. 178-1, 33 F.R. 14935, Oct. 4, 1968)

§ 178.350-3 Marking

a) Marking on the outside of each packaging as follows: "USA DOT 7A type A" and "Radioactive Material."

b) Marking to conform with § 173.24 of this chapter (Amd. 178-1, 33 F.R. 14935, Oct. 4, 1968.)

Sections 173.24, 173.389(j), 173.393 and 173.398(b) are given below.

§ 173.24 Standard Requirements for all Packages

(a) Each package used for shipping hazardous materials under this chapter shall be so designed and constructed, and its contents so limited, that under conditions normally incident to transportation-

(1) There will be no significant release of the hazardous materials to the environment;

(2) The effectiveness of the packaging will not be substantially reduced; and

(3) There will be no mixture of gases or vapors in the package which could, through any credible spontaneous increase of heat or pressure, or through an explosion, significantly reduce the effectiveness of the packaging.

(b) Materials for which detailed specifications for packaging are not set forth in this part must be securely packaged in strong, tight packages meeting the requirements of this section.

(c) Packaging used for the shipment of hazardous materials under this chapter shall, unless otherwise specified or exempted therein, meet all of the following design and construction criteria:

(1) Each specification container shall be marked in an unobstructed area with letters and numerals identifying that specification (e.g., ICC-6J, DOT-6L, DOT MC 306, DOT-105A200-F);

(i) The marking is a certification that the packaging complies with all specification requirements.

(ii) The name and address or the symbol of the manufacturer, or the user, who assumes responsibility for compliance with the specification requirements, shall be included. Symbol letters must be registered with the Bureau of Explosives. Duplicate symbols are not authorized.

(iii) The markings shall be stamped, embossed, burned, printed, or otherwise marked on the packaging to provide adequate accessibility, permanency, and contrast so as to be readily apparent and understood.

(iv) Unless otherwise specified, letters and numerals shall be at least 1/2-inch high.

(v) Packaging which does not comply with the applicable specification listed in Parts 178 and 179 of this chapter must not be marked to indicate such compliance.

(2) Steel used shall be low-carbon, commercial quality steel. Stainless, open hearth, electric, basic oxygen, or other similar quality steels are acceptable. Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal Thickness (in.)	Minimum Thickness (in.)
12	0.1046	0.0946
13	0.0897	0.0817
14	0.0747	0.0677
15	0.0673	0.0603
16	0.0598	0.0533
17	0.0538	0.0478
18	0.0478	0.0428
19	0.0418	0.0378
20	0.0359	0.0324
22	0.0299	0.0269
23	0.0269	0.0239
24	0.0239	0.0209
26	0.0179	0.0159
28	0.0149	0.0129
30	0.0120	0.0110

(3) Lumber used shall be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

(4) Welding and brazing shall be performed in a workmanlike manner using suitable and appropriate techniques, materials, and equipment.

(5) Packaging materials and contents shall be such that there will be no significant chemical or galvanic reaction among any of the materials in the package.

(6) Closures shall be adequate to prevent inadvertent leakage of the contents under normal conditions incident to transportation. Gasketed closures shall be fitted with gaskets of efficient material which will not be deteriorated by the contents of the container.

(7) Nails, staples, and other metallic devices shall not protrude into the interior of the outer packaging in such a manner as to be likely to cause failures.

(8) The nature and thickness of the packaging shall be such that friction during transport does not generate any heating likely to decrease the chemical stability of the contents.

(9) Polyethylene used must be of a type compatible with the lading and must not be permeable to an extent that a hazardous condition could be caused during transportation and handling.

(d) For specification containers, compliance with the applicable specifications in Parts 178 and 179 of this chapter shall be required in all details, except as otherwise provided in this chapter. (Amd. 173.33 F.R. 14921, Oct. 4, 1968, as amended by Amd. 173.11, 34 F.R. 12589, Aug. 1, 1969, Amd. 173-20, 35 F.R. 5550 Apr. 3, 1970.)

§ 173.389 Radioactive Materials, Definitions

(j) "Type A packaging" means packaging which is designed in accordance with the general packaging requirements of § 173.24 and 173.393, and which is adequate to prevent the loss or dispersal of the radioactive contents and to retain the efficiency of its radiation shielding properties if the package is subject to the tests prescribed in § 173.398(b).

§ 173.393 General Packaging Requirements

(a) Unless otherwise specified, all shipments of radioactive materials must meet all requirements of this section, and must be packaged as prescribed in § 173.391 through 173.396.

(b) The outside of each package must incorporate a feature such as a seal, which is not readily breakable and which, while intact, will be evidence that the package has not been illicitly opened.

(c) The smallest outside dimension of any package must be 4 inches or greater.

(d) Each radioactive material must be packaged in a packaging which has been designed to maintain shielding efficiency and leak tightness, so that, under conditions normally incident to transportation, there will be no release of radioactive material. If necessary, additional suitable inside packaging must be used. Each package must be capable of meeting the standards in § 173.398(b) and 173.24.

(1) Internal bracing or cushioning, where used, must be adequate to assure that, under the conditions normally incident to transportation, the distance from the inner container or radioactive material to the outside wall of the package remains within the limits for which the package design was based, and the radiation dose rate external to the package does not exceed the transport index number shown on the label. Inner shield closures must be positively secured to prevent loss of the contents.

(e) The packaging must be designed, constructed, and loaded so that during transport:

(1) The heat generated within the package because of the radioactive materials present will not, at any time during transportation, affect the efficiency of the package under the conditions normally incident to transportation, and

(2) The temperature of the accessible external surfaces of the package will not exceed 122°F in the shade when fully loaded, assuming still air at ambient temperature. If the package is transported in a transport vehicle consigned for the sole use of the consignor, the maximum accessible external surface temperature shall be 180°F.

(f) Pyrophoric materials, in addition to the packaging prescribed in this subpart, must also meet the packaging requirements of § 173.134 or 173.154. Pyrophoric radioactive liquids may not be shipped by air.

(g) Liquid radioactive material in Type A quantities must be packaged in or within a leak-resistant and corrosion-resistant inner containment vessel. In addition:

(1) The packaging must be adequate to prevent loss or dispersal of the radioactive contents from the inner containment vessel if the package were subjected to the 9-meter (30-foot) drop test prescribed in § 173.398(c) (2) (i); and either -

(2) Enough absorbent material must be provided to absorb at least twice the volume of radioactive liquid contents. The absorbent material may be located outside the radiation shield only if it can be shown that if the radioactive liquid contents were taken up by the absorbent material the resultant dose rate at the surface of the package would not exceed 1,000 millirem per hour; or

(3) A secondary leak-resistant and corrosion-resistant containment vessel must be provided to retain the radioactive contents under the normal conditions of transport as prescribed in § 173.398(b), assuming the failure of the inner primary containment vessel.

(h) There must be no significant removable radioactive surface contamination on the exterior of the package (see § 173.397).

(i) Except for shipments described in paragraph (j) of this section, all radioactive materials must be packaged in suitable packaging (shielded, if necessary) so that at any time during the normal conditions incident to transportation the radiation dose rate does not exceed 200 millirem per hour at any point on the external surface of the package, and the transport index does not exceed 10.

(j) Packages for which the radiation dose rate exceeds the limits specified in paragraph (i) of this section, but does not exceed at any time during transportation any of the limits specified in paragraphs (j) (1) through (4) of this section may be transported in a transport vehicle which has been consigned as exclusive use (except aircraft). Specific instructions for maintenance of the exclusive use (sole use) shipment controls must be provided by the shipper to the carrier. Such instructions must be included with the shipper paper information.

(1) 1,000 millirem per hour at 3 feet from the external surface of the package (closed transport vehicle only);

(2) 200 millirem per hour at any point on the external surface of the car or vehicle (closed transport vehicle only);

(3) Ten milliren per hour at any point 2 meters (6 feet) from the vertical planes projected by the outer lateral surface of the car or vehicle; or if the load is transported in an open transport vehicle, at any point 2 meters (6 feet) from the vertical planes projected from the outer edges of the vehicle.

(4) Two millirem per hour in any normally occupied position in the car or vehicle, except that this provision does not apply to private motor carriers.

(k) (Reserved)

(l) Packages consigned for export are also subject to the regulations of the foreign governments involved in the shipment. See § 171.8, 173.9 and 173.393(b).

(m) Prior to the first shipment of any package, the shipper shall determine by examination or appropirate test that:

(1) The packaging meets the specified quality of design and construction; and

(2) The effectiveness of the shielding and containment, and, where necessary, the heat transfer characteristics of the package are within the limits applicable to or specified for the package design. (Responsibility of shipper to assure compliance.)

(n) Prior to each shipment of any package, the shipper shall ensure by examination or appropriate test that:

(1) The package is proper for the contents to be shipped;

(2) The packaging is/in unimpaired physical condition except for superficial marks;

(3) Each closure device of the packaging, including any required gasket, is properly installed and secured and free of defects;

(4) For a fissile material, any moderator and neutron absorber, if required, is present in proper condition;

(5) Any special instructions for filling, closing, and preparation of the package for shipment have been followed;

(6) Each closure, valve, and any other opening of the containment system through which the radioactive content might escape is properly closed and sealed;

(7) Each package containing liquid in excess of a Type A quantity and destined for air shipment is tested to demonstrate that it is leak tight under an ambient atmospheric pressure differential of at least 0.5 atmosphere (absolute) (7.3 psia or 0.5 kg/cm^2); the test may be conducted on the entire containment system or on any receptacle or vessel within the containment system, as appropriate to determine compliance with the requirement;

(8) If the maximum normal operating pressure of a package is likely to exceed 0.35 kg/cm^2 (gage), the internal pressure of the containment system will not exceed the design pressure during transportation; and

(9) External radiation and contamination levels are within the allowable limits. (Responsibility of shipper to assure compliance.)

(o) No person may offer for transportation a package of radioactive materials until the temperature of the packaging system has reached equilibrium (see also paragraph (e) of this section) unless, for the specific contents, he has ascertained that the maximum applicable surface temperature limits cannot be exceeded.

§ 173.398 Special Tests

(b) Standards for Type A Packaging

(1) Type A packaging must be so designed and constructed that, if it were subject to the environmental and test conditions prescribed in this paragraph:

(i) There would be no release of radioactive material from the package:

(ii) The effectiveness of the packaging would not be substantially reduced; and

(iii) There would be no mixture of gases or vapors in the package which could, through any credible increase of pressure or an explosion, significantly reduce the effectiveness of the package.

(2) Environmental conditions:

(i) Heat - Direct sunlight, at an ambient temperature of 130°F in still air.

(ii) Cold - An ambient temperature of -40°F in still air, and shade.

(iii) Reduced pressure - Ambient atmospheric pressure of 0.5 atmosphere (absolute) (7.3 psia).

(iv) Vibration - Vibration normally incident to transportation.

(3) Test Conditions - The packaging shall be subject to all of the following tests unless specifically exempted therefrom, and also to the consecutive application of at least two of the following tests from which it is not specifically exempted:

(i) Water spray - A water spray heavy enough to keep the entire exposed surface of the package except the bottom continuously wet during a period of 30 minutes. Packages for which the outer layer consists entirely of metal, wood, ceramic, or plastic, or combinations thereof, are exempt from the water spray test.

(ii) Free drop - Between 1-1/2 to 2-1/2 hours after the conclusion of the water spray test, a free drop through a distance of 4 feet onto a flat essentially unyielding horizontal surface, striking the surface in a position for which maximum damage is expected.

(iii) Corner drop - A free drop onto each corner of the package in succession, or in the case of a cylindrical package onto each quarter of each rim, from a height of 1 foot onto a flat essentially unyielding horizontal surface. This test applies only to packages which are constructed primarily of wood or fiberboard, and do not exceed 110 pounds gross weight, and to all Fissile Class II packagings.

(iv) Pentration - Impact of the hemispherical end of a vertical steel cylinder 1-1/4 inches in diameter and weighing 13 pounds, dropped from a height of 40 inches onto the exposed surface of the package which is expected to be most vulnerable to puncture. The long axis of the cylinder shall be perpendicular to the package surface.

(v) Compression - For packages not more than 10,000 pounds in weight, a compressive load equal to either five times the weight of the package or 2 pounds per square inch multiplied by the maximum horizontal cross section of the package, which ever is greater. The load shall be applied during a period of 24 hours, uniformly against the top and bottom of the package in the position in which the package would normally be transported.

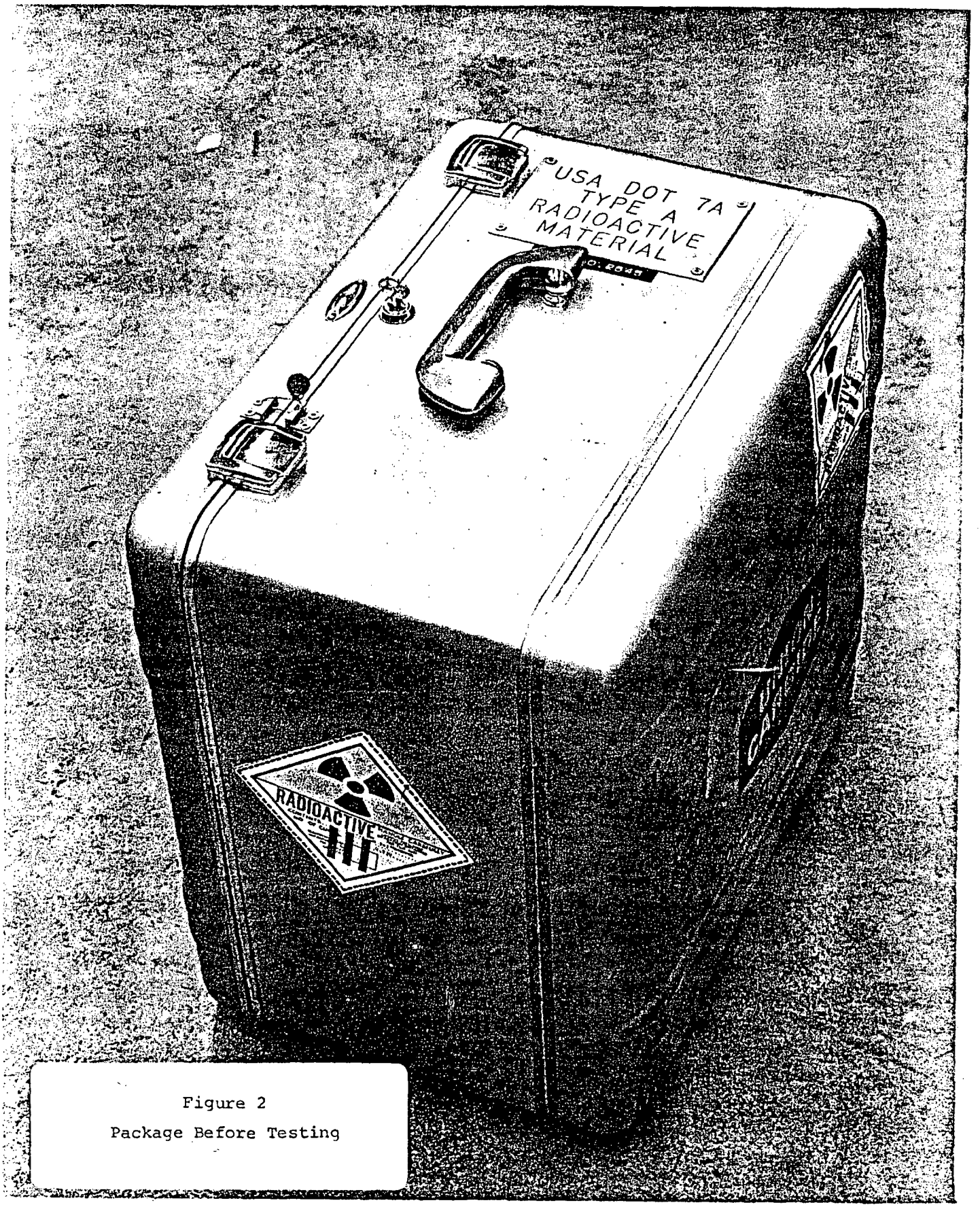


Figure 2

Package Before Testing

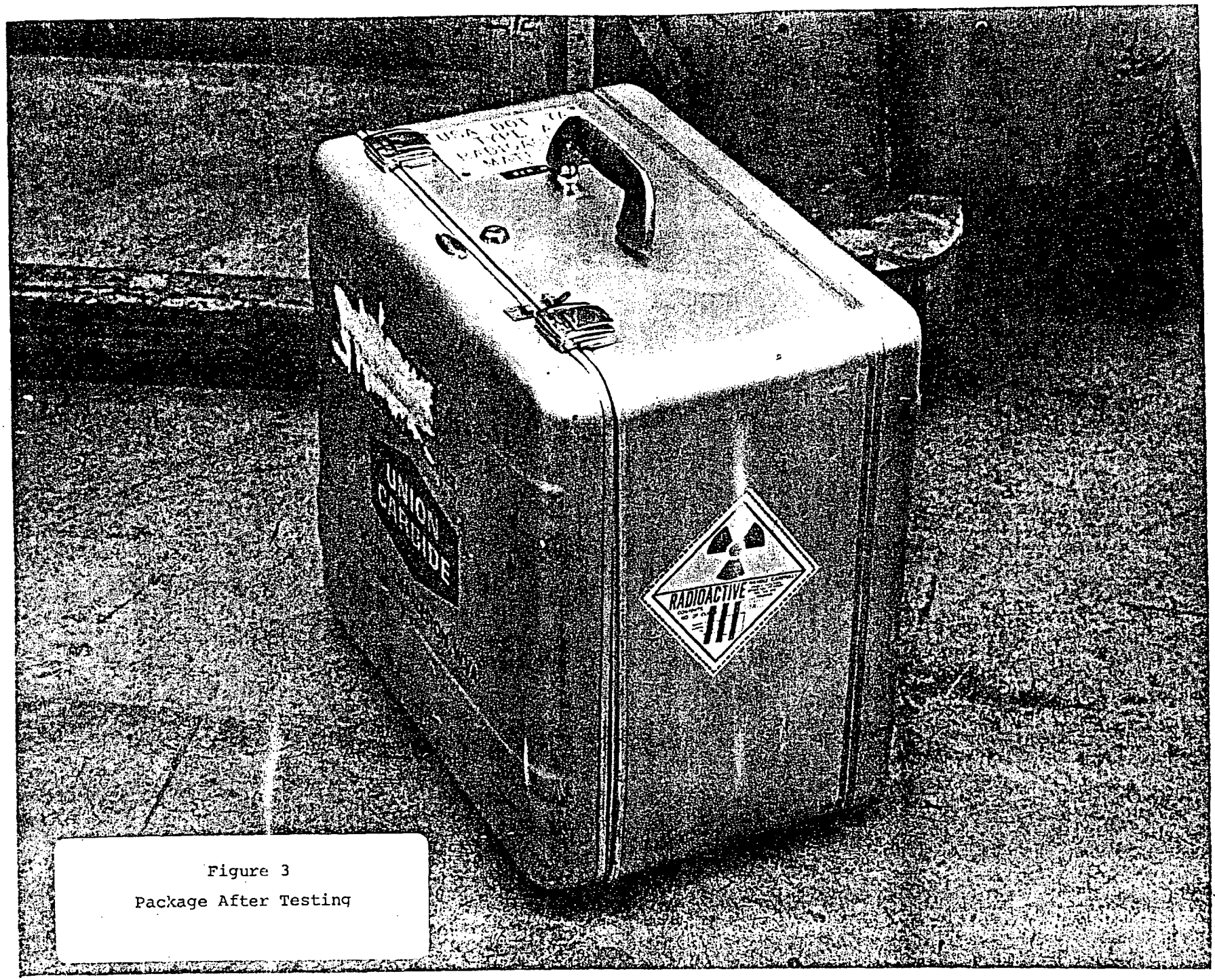


Figure 3

Package After Testing

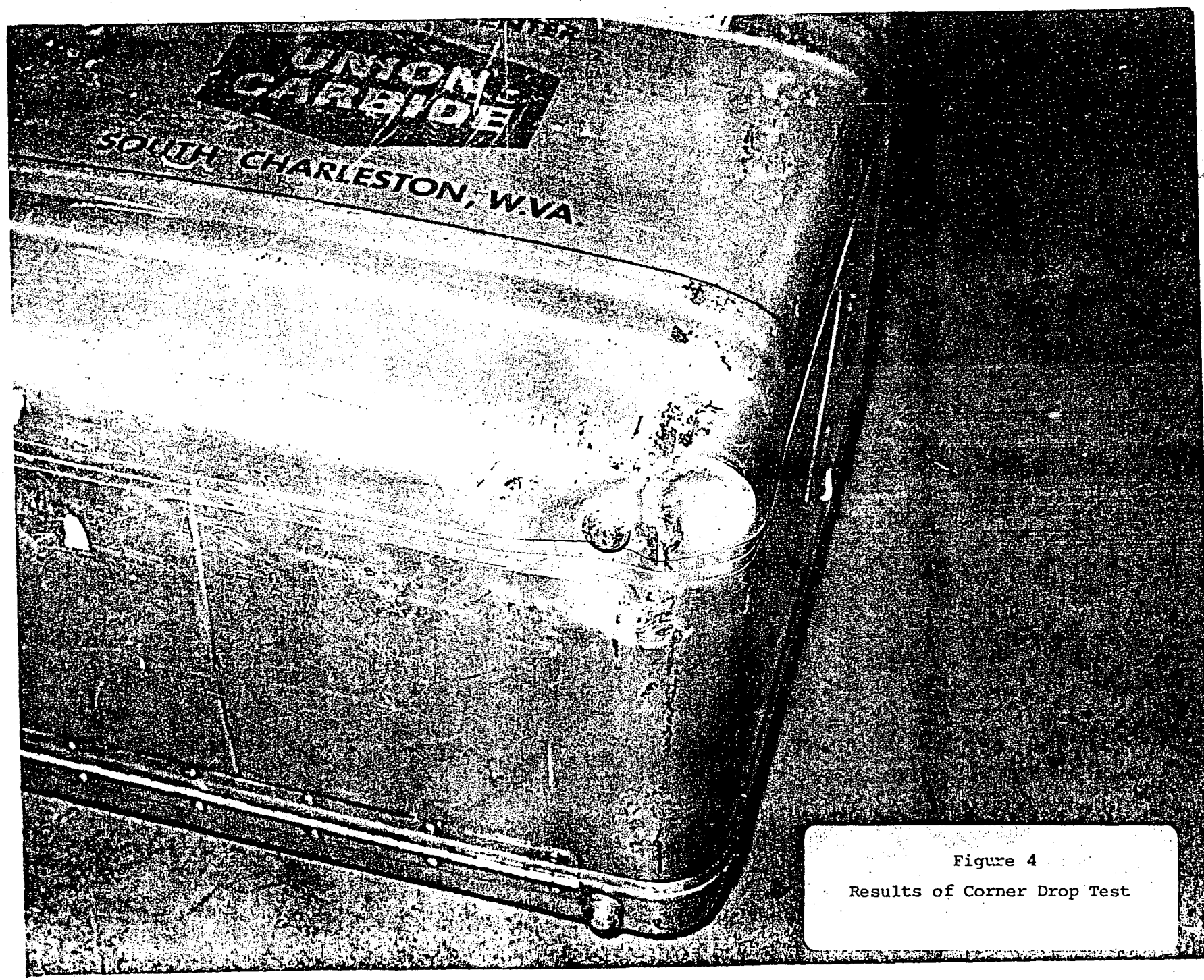


Figure 4

Results of Corner Drop Test

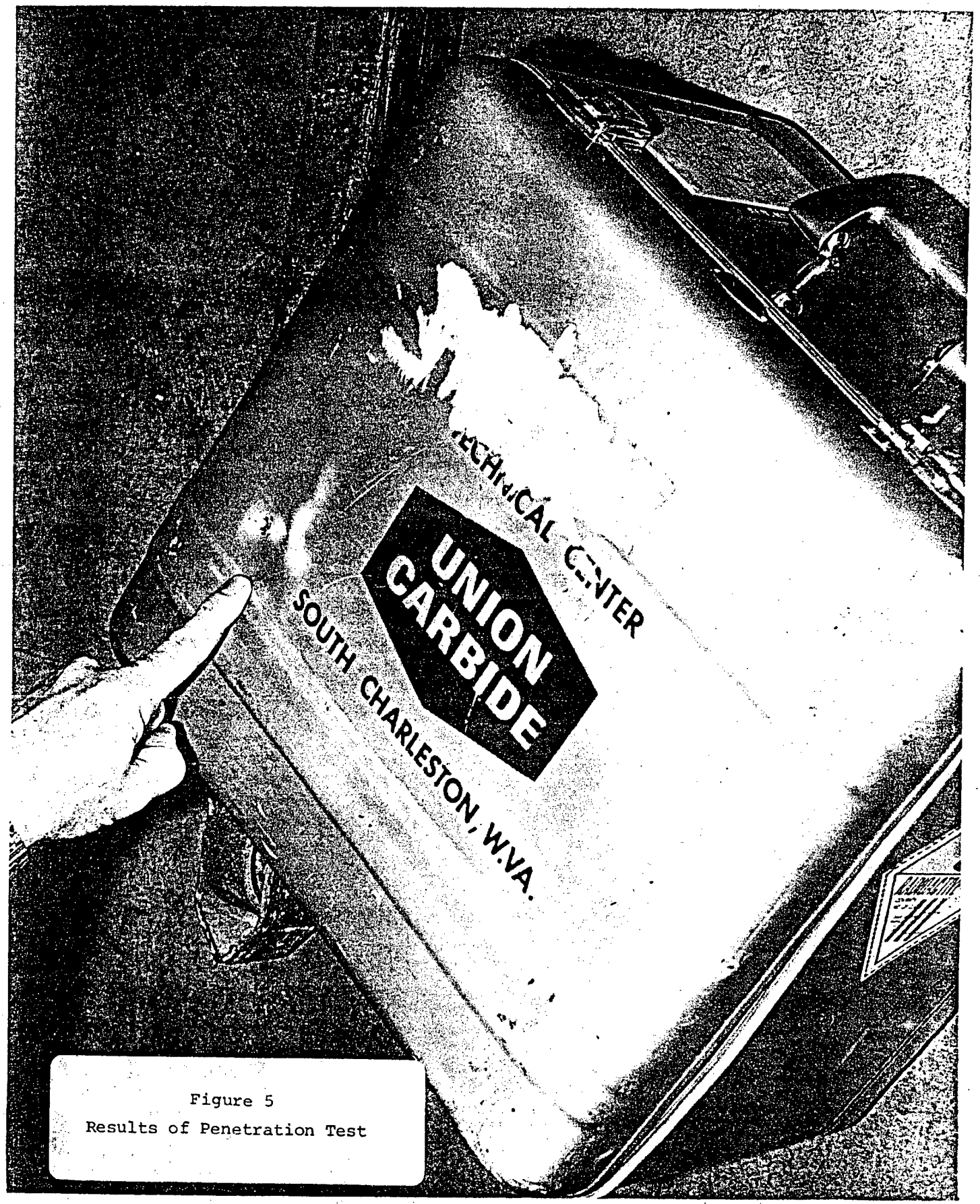


Figure 5
Results of Penetration Test

Figure 6
Inside of Cask After Testing

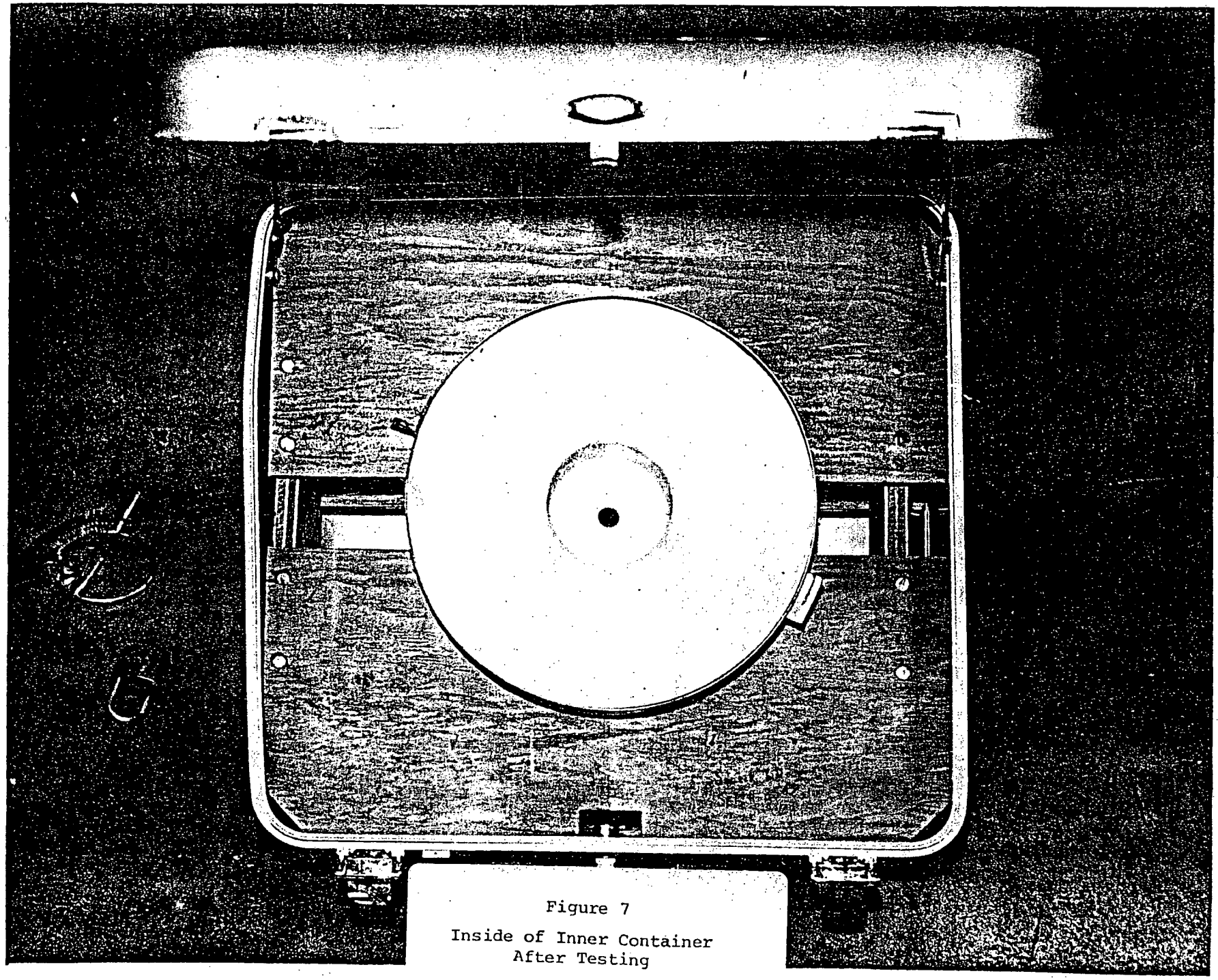


Figure 7

Inside of Inner Container
After Testing

ATTACHMENT 5

OPERATING AND EMERGENCY PROCEDURES

FOR CARBON BUILDUP TESTS USING Am241-Be

OPERATING PROCEDURES

1. Areas at least 20 foot square at both the top and bottom of the reactor will be roped off and posted with "Caution - Radioactive Materials" signs. No one will be allowed inside this area unless equipped with proper dosimetry equipment (film badges and pocket dosimeters).

2. The neutron source will be kept in its shielded container until all personnel are prepared for testing.

3. Personnel will have an operable and calibrated portable neutron survey meter available.

4. The source will be transferred to the detector probe over a flat surface using channel lock pliers. One person will perform the transfer and one person will observe the transfer. The observer should remain close enough to the transferer to locate the source if it is accidentally dropped.

5. The observer will then proceed to place the source in predetermined locations within the vessel while his partner observes the printed readout.

6. Upon completion of the test, personnel will remove the source from the detector probe and place it in its shielded container.

EMERGENCY PROCEDURES

While transferring the source, it may accidentally be dropped. The source is an encapsulated sealed source and the spread of contamination is highly improbable; however, it will present a radiation hazard. If the source is dropped:

1. Locate the source. If the transfer was attempted over a flat surface and the source is readily available, pick up the source with the pliers and attach it to the detector probe.

2. If the source is out of sight, attempt to locate it with your survey meter. If you find it, transfer the source to the detector probe.

3. If you cannot locate the source with your survey meter, rope off an area at least 100 foot square and do not let anyone inside. Contact the Plant Radiation Protection Officer.
   NOTE: NEVER LEAVE THE AREA UNATTENDED!!

Remember, in any radiation hazard, use these simple concepts to minimize your dose:

TIME: Minimize your time near the source.

DISTANCE: Maximize your distance from the source.

FPS/ld

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