UNION CARBIDE

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

Applicant. 256505
Check No. $150 (3K)
Amount/Fee Category
Type of Fee. Renewal
Date Check Recd MAR 2 1979
Received By Brown

Reference File Number: 7915970
Date: February 15, 1979

RECEIVED BY LFMS
Date. MAR 2 1979
Log MARCH PG 1 Renewal
By. Brown
Orig. To.
Action Compl. 3/5/79

U. S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
Division of Fuel Cycle and Material Safety
License Management Branch
Washington, DC 20555

Attn: Mr. Paul R. Guinn

Gentlemen:

Re: Program Code 03620

This letter contains an application for renewal of By-Product License 47-00260-06. We wish to continue our radioisotope program.

To assure that all governmental regulations are followed and that employee and public safety is assured, the Technical Center has an established, stringently enforced, Radiation Protection Program. This program is described in the enclosed Technical Center Radiological Control Manual.

All aspects of control measures concerning this license will be coordinated by our Radioactive Materials Committee. A list of current Radioactive Materials Committee Members is contained in Attachment 2. Also in Attachment 2 are training requirements for users of radioactive material controlled by this license. Specific functions of the Radioactive Materials Committee are outlined in Chapter I of the Radiological Control Manual.

Also enclosed is NRC Form 313I and supplementary attachments. A check for $150 (License Fee Category: 3K) to cover renewal expenses is included, too.

If there are any questions, or if further information is required, please contact me at (304) 747-4918.

Very truly yours,

Fred P. Straccia

F. P. Straccia
Alternate Radiation Protection Officer

FPS/ld

Attachments

cc: Mr. J. H. Brubaker

COPIES SENT TO OFF. OF
INSPECTION AND ENFORCEMENT 9881

D-5

FORM NRC-313 I (6-78) 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 47-00260-06

2. APPLICANT'S NAME *(Institution, firm, person, etc.)*
Union Carbide Corporation
Chemicals and Plastics Division

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
(304) 747-5333 - Attn: J. H. Brubaker

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)*
Technical Center
Kanawha Turnpike
South Charleston, WV 25303

(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.	Users will be chosen at the discretion	
b.	of the Radioactive Materials Committee	
c.		

7. RADIATION PROTECTION OFFICER
Jay H. Brubaker (RPO)
Frederick P. Straccia (Alt. RPO)
Dianne G. Allport (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.	ELEMENT AND MASS NUMBER A	CHEMICAL AND/OR PHYSICAL FORM B	NAME OF MANUFACTURER AND MODEL NUMBER *(If Sealed Source)* C	MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME D
(1)	See Attachment 1			
(2)				
(3)				
(4)				

	DESCRIBE USE OF LICENSED MATERIAL E
(1)	Research and Development, as defined in 10CFR30.4(g)
(2)	
(3)	
(4)	

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 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 *(Signature)* ✓
	c. NAME *(Type or print)* R. D. Stief
(1) LICENSE FEE CATEGORY: 3K	d. TITLE Director of Engineering
(2) LICENSE FEE ENCLOSED: $ 150.00	e. DATE 2/15/79

ATTACHMENT 1

8.0 LICENSED MATERIAL

	Element and Mass Number	Chemical and/or Physical Form	Maximum Number of Millicuries Possessed at Any One Time
A.	Hydrogen-3	Any	25,000
B.	Carbon-14	Any	1,000
C.	Phosphorus-32	Any	100
D.	Sulphur-35	Any	150
E.	Iron-57	Any	100
F.	Nickel-63	Any	250
G.	Krypton-85	Gas	100,000
H.	Cesium-131	Any	100
I.	Iodine-131	Any	200
J.	Cesium-137	Any	10

FPStraccia/ld

2/26/79

ATTACHMENT 2

Radioactive Materials Committee

The following people are current members of the Radioactive Materials Committee. An amendment to this license will be required to alter this list.

Radiation Protection Officer	J. H. Brubaker
Radiation Protection	F. P. Straccia
Radiation Protection	D. G. Allport
Agricultural Chemicals	C. G. Holsing
Industrial Hygiene	G. F. Hurley
Safety	C. W. Carman
Purchasing	R. H. Johnson
Research & Development	R. L. Meeker

Each person's training and experience are on the following pages.

User Training

Proposed users of radioactive material controlled by this license must undergo, as a minimum, a one-day short course in Radiation Safety for unencapsulated isotope use. This formal training may be supplemented with additional specific training, as determined by the Radioactive Materials Committee. All users are required to attend refresher courses in Radiation Safety for unencapsulated isotopes on an annual basis.

A copy of the handout entitled "Principles and Handling Procedures of Radioactive Materials" is enclosed for your review.

FPStraccia/ld

2/26/78

TYPE OF TRA[illegible]G	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB	FORMAL COURSE
a. Princip[illegible] and practic[illegible] of radiati[illegible] 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
^{137}Cs	Curies	Union Carbide Corporation	8 Years	Process Gauging
^{226}Ra	m Curies	Union Carbide Corporation	8 Years	Carbon Detectior

EDUCATION

Degree	College or University	Date Acquired	Major
A.A.	Hershey Junior College		Science
B.S.	University of Florida		Physics
M.S.	University of Florida		Astronomy-Physics

(b)(6)

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

EXPERIENCE

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE GAINED	DURATION OF EXPERIENCE	TYPE OF USE
^{226}Ra, ^{137}Cs, Mixed Fission Products	m Curies	University of Lowell	3 Years	School Labs
^{99m}Tc, ^{131}I, ^{3}H, ^{14}C, ^{99}Mo	Curies	CIS Radiopharmaceuticals	1.5 Years	Preparing Radioisotopes
Mixed Fission Products	Curies	Vermont Yankee Nuclear Power Corporation	3 Months	Contamination Control HP Monitoring
^{137}Cs, ^{226}Ra, ^{60}Co	Curies	Union Carbide Corporation	18 Months	Process Gauging
^{241}Am-Be	Curies	" " "	2 Months	Carbon Detectior

EDUCATION

B.S. [redacted] - Radiological Health Physics University of Lowell, Lowell, Massachusetts

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

(b)(6)

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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
^{137}Cs, ^{226}Ra, ^{60}Co, AmBe, ^{14}C, ^{63}Ni	Curies	Union Carbide Corporation	2.5 Years	Process Gauging

EDUCATION

B.S. - Biology - Morris Harvey College, Charleston, West Virginia

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

(b)(6)

Dr. G. C. Holsing

Dr. Holsing received his PhD in Biochemistry from Rutgers University in [redacted] He has no formal training in the use of radioactive material.

Dr. Holsing has been employed by Union Carbide since 1976 as a Group Leader in the Agricultural Products Division. The majority of radio-isotope usage in the Agricultural Products Area is under the auspices of Dr. Holsing. As a member of the committee, Dr. Holsing will represent the Agricultural Products Division.

DGAllport/ld

2/26/79

(b)(6)

G. F. Hurley

Mr. Hurley has no formal training with radioactive material. He is currently the Industrial Hygienist for the Technical Center, and has been a member of the Radioactive Materials Committee for one year.

Mr. Hurley is available to advise proposed users of radioactive material of specific proceedures to be used in a project. His background with handling other hazardous materials enables him to offer constructive advice in the formulation of Operating and Emergency Procedures for each specific project.

FPStraccia/ld

2/26/79

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C. W. Carman

Mr. Carman has no formal training with radioactive material. He is currently Safety Director for the Technical Center, and has been a member of the Radioactive Materials Committee for one year.

Mr. Carman's capacity as member regards advising the Committee concerning specific conditions and equipment at the Technical Center. This allows Committee members to have a full understanding of all hazards concerning a proposed project and how these hazards interrelate to consider a "worst-case situation."

FPStraccia/ld

2/26/79

R. H. Johnson

Mr. Johnson has no formal training or experience with radioactive materials. His sole purpose for sitting on the Committee is to provide a direct link between the Committee and the Purchasing Department. He has all responsibility for processing purchase orders for radioactive material controlled by this license.

FPStraccia/ld

2/26/79

Dr. R. L. Meeker

Dr. Meeker received his PhD in Analytical Chemistry from the University of California, Los Angeles. He has no formal training in the use of radioactive material.

He is currently an Associate Director for Research & Development in the Analytical Section. As a member of the committee, Dr. Meeker will act as a liaison between R&D and the committee.

DGAllport/ld

2/26/79

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June 22, 1978

SID Number: #8146

PRINCIPLES AND HANDLING PROCEDURES OF RADIOACTIVE MATERIALS

Radioactivity

Radioactivity is defined as the spontaneous disintegration of unstable nuclei with the resulting emission of nuclear radiation.

Radiation

Radiation is the propagation of energy through space or a material medium. Nuclear radiation may be in the form of electromagnetic waves (gamma rays and X-rays) or particles (alpha particles, beta particles, and neutrons.)

Ionizing Radiation

When nuclear radiation has sufficient energy, it may produce ions in atoms or molecules. Electromagnetic waves remove electrons from a system by one of three mechanisms; Compton effect, photoelectric effect, and pair production. Particles remove electrons by coulombic collisions. The net result of the interaction at ionizing radiation and matter is ion pairs.

Dose

Dose is a term which denotes the quantity of radiation absorbed. If the energy is absorbed in any matter, dose is measured in rads (radiation absorbed dose). One rad equals 100 ergs/gram of absorbent material. If the energy is absorbed by humans, dose is measured in rems (Roentgen equivalent, man). The number of rems is equal to the number of rads multiplied by the appropriate modifying factor. Modifying factors are used because certain types of radiation are more effective at producing biological damage than other types.

Some Biological Effects of Radiation

Some of the biological effects that are caused by radiation will appear in a short time, maybe days or weeks; some effects may not be seen for perhaps 20 (or more) years. These are referred to as short-term and long-term effects. Some short term effects for different doses are shown below:

Acute Dose (rem)	Effect
10,000	Death in hours
1,200	Death in days
600	Death in weeks
450	LD 50/30 (50% chance of death in 30 days)
50-100	Decrease in red blood cells
<50	No observable effect
0.08	Average chest X-ray

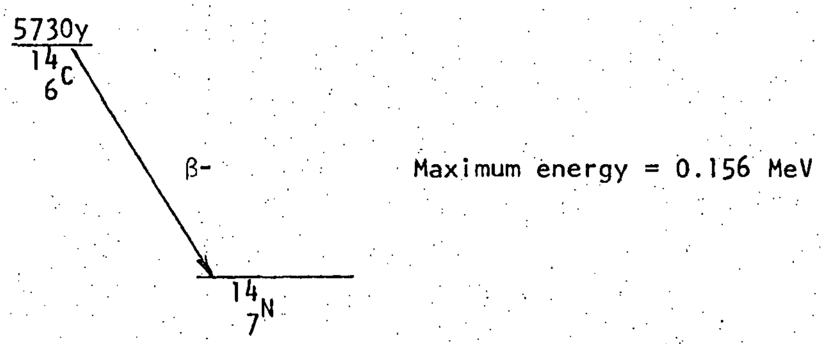
Along with these short term effects, ionizing radiation may induce chromosomal aberrations and genetic mutations. These long term effects may not manifest themselves for several generations.

Applications of Radiation

Since the discovery of X-rays in 1896, the number of applications of radiation has increased steadily. The one application most exploited is power production via commercial nuclear reactors. To date, approximately 11 percent of all power generated in the U.S. is by nuclear reactors. Other applications include therapeutic and diagnostic treatment in the medical profession, density and level gauging in industry, and tracing studies in research and development.

Carbon - 14

Carbon-14 (C-14) is a radioactive isotope of carbon. It decays to stable nitrogen-14 by beta emission, with the beta particles having a maximum energy of 156 keV (average energy = 45 keV). C-14 has a half-life of about 5730 years, and its decay scheme is as follows:



C-14 occurs widely in nature. There are approximately 110 million curies distributed throughout the world.

Carbon is one of the most commonly encountered elements in living matter. The fact that radioactive carbon acts chemically identical to stable carbon makes C-14 an attractive tool for research. Radioisotope tracing with C-14 has been performed since 1946, and its popularity is increasing continuously.

Radiological Hazards of C-14

All radioactive elements may damage a living organism through external and internal exposure. External exposure results when the radioactive source is located outside the body. The radiation must pass through some distance of air before it encounters the body. Internal exposure results when the radioactive source is inhaled, ingested, or absorbed through the skin. In this case, the radiation need not travel far before it is absorbed by the body.

Beta particles interact with matter by electromagnetic collisions. This electromagnetic interaction does not permit the betas to travel very far before their energy is absorbed. In air, the most energetic beta particles from C-14 will travel only two feet. A beta particle requires at least 70 keV to penetrate the dead layer of skin, which is 0.07 mm thick. Only about 30% of the betas emitted from C-14 will have sufficient energy to penetrate this dead layer of skin and reach living tissue.

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C-14 presents a slight external hazard, but the internal hazard is much more critical. C-14 becomes an internal hazard when contaminatation exists. If the contaminatation is in the form of small particles, it may become airborne and then inhaled. Otherwise, the contamination may spread to one's body, and be absorbed or ingested. Once in the body, the structure of the molecule containing the C-14 will determine its path. In the "worst case" situation, the C-14 is absorbed into the blood. From the bloodstream, most of the C-14 accumulates in body fat. The remaining activity goes to the bone. The C-14 will then deposit its energy into living tissue, resulting in ionized molecules and possible chromosomal aberrations and genetic mutations. This accrued dose will continue until the radioactive material is eliminated as waste by the biological processes of the body.

Control Techniques in the Laboratory

Contamination can be controlled by proper laboratory procedures. Lab benches should all be covered with absorbent papers. When working with small concentrations, lab coats and plastic gloves should be worn. More stringent protective measures may be necessary if high concentrations are being handled. When transporting C-14, it should be in at least two containers to avoid accidental spillage. If, for any reason, you suspect contamination, notify the radiation protection personnel. They will measure and evaluate the area for contamination.

Good radioactive waste disposal practices are also important in controlling contamination. Solid and liquid wastes should be kept separate. The liquid waste should be stored in five-gallon plastic containers that are labeled as liquid radioactive waste. Once filled, each such container will be packed in a 30-gallon drum and overpacked with absorbent material. Solid waste will be contained in a 55-gallon drum, lined with a plastic bag. Both liquid and solid waste will be disposed of via licensed radioactive waste disposal agencies.

Government Regulations

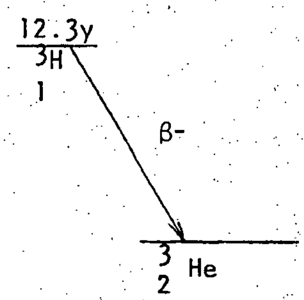
The United States agency which controls radioactive material is the Nuclear Regulatory Commission (NRC). They exhibit control via licensing. The Technical Center license for unencapsulated C-14 is 47-00260-06.

Before the NRC will grant a license, they request a comprehensive application, defining the radiation protection program. The program must contain measures such that all regulations contained in Title 10 CFR 19 and 20 are adhered to. A copy of these regulations are contained in the Technical Center Radiological Control Manual.

H-3, P-32, and S-35

Various other isotopes can be used for tracing studies. Some commonly used isotopes include tritium (H-3), phosphorus (P-32), and sulpher (S-35). All decay by beta emission, but with different energies and half-lives than C-14. Radiological hazards are almost identical; little external hazard but critical internal hazard. Their decay schemes are shown below:

H-3



Maximum Energy = 0.0186 MeV
$MPC_a = 5 \times 10^{-3}$ uCi/cc

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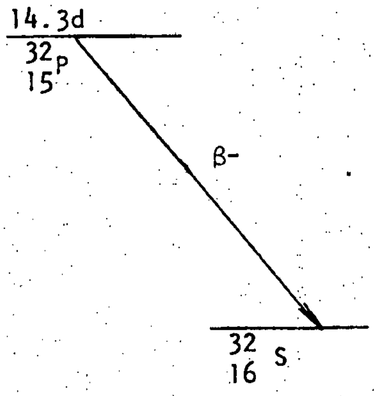
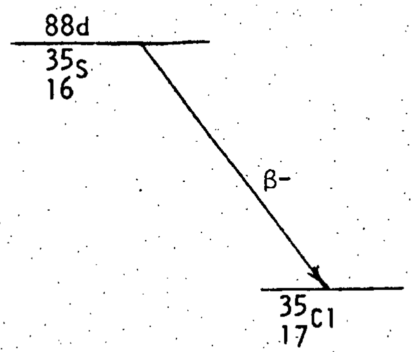
P-32



Maximum Energy = 1.710 MeV
MPC_a = 7 x 10 $^{-8}$ uCi/cc

S-35



Maximum Energy = 0.167 MeV
MPC_a = 3 x 10^{-7} uCi/cc