FACSIMILE TRANSMITTAL
U. S. NRC - RII
ATLANTA, GA

OCT 01 1993

Related TO decommissioning
Financial Assurance

TO: M. Green - Union Carbide 10/4/93 6pm
RSO

CHECK APPROPRIATE BOX:

☐ INPO 9/953-7549	☐ MNBB 492-8185	☐ PHILLIPS 492-8110
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☒ **OTHER:** Union Carbide
OFFICE/LOCATION

FAX NO.: 304-747-5570 **VERIFICATION:** _____

NO. OF PAGES 10 **+ TRANSMITTAL SHEET** [A-2, A-3 B-1 THRU B-8]

FROM: Earl B Wright [404-331-5617]

FAX #841-4449 **VERIFICATION 841-5510**

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5. Possession Limit Worksheet (See Appendix B)

Isotope	(1) Unsealed Byprod. Mat. Act/(10^3xApp.C)	(2) Sealed Byprod. Mat. Act/(10^{10}xApp.C)	(3) Unsealed SNM Act/(10^3xApp.C)	(4) Dispersible Source Mat. Act/(10 mCi)
Total =				
Funds Reqd:				
	if ≤1.0, enter $0 if >1.0, but ≤10.0, enter $150,000 if >10.0, but ≤100.0, enter $750,000 if >100.0, enter "DFP only"	if ≤1.0, enter $0 if >1.0, enter $75,000	if ≤1.0, enter $0 if >1.0, but ≤10.0, enter $150,000 if >10.0 but ≤100.0 enter $750,000 if >100.0, enter "DFP only"	if ≤1.0, enter $0 if >1.0, but ≤10.0, enter $150,000 if >10.0, enter "DFP only"

Instructions for Appendix A.

1. Applicant Information - Enter the name of the applicant and a brief description of the licensing action requested by the application. Indicate whether the application requires a checklist to be completed.

2. Regulations applicable to the license - Indicate which parts of the regulation are applicable to the license.

3. Form of material authorized - Indicate which forms of material covered by the decommissioning requirements are authorized by the license. If the license does not authorize possession of any of the forms listed, no financial assurance is required. However, the licensee remains financially responsible for paying for decommissioning and carrying out decommissioning. See question C1 in appendix D.

4. Overall possession limit - Determine if the license limits the total amount of material the licensee may possess.

5. Possession Limit Worksheet - Complete the worksheet by listing the isotopes authorized in the license that are affected by the regulations. The isotopes in appendix C of 10 CFR Part 20 are listed in appendix B of this SRP with the applicable possession limit thresholds needed to complete the worksheet. Note that byproduct material isotopes with half-lives less than 120 days have no threshold possession limits for establishing decommissioning financial assurance. If the license contains a condition limiting the overall possession of numerous isotopes without listing specific limits, describe the isotopes authorized by the license in the isotope column (i.e., Atomic no. 3 - 83) and enter the fraction obtained using the limit imposed by the license condition in the appropriate material column (i.e, <1.0, <10.0, <100.0, or $\geq$100.0). This worksheet may be duplicated if more room is required to list isotopes. Totals should only be entered on the last copy of the worksheet. After the columns are completed, sum the fractions and enter the total at the bottom of each column. Record the amount of funds required in each column per the notes at the bottom of the worksheet.

6. Financial Assurance Required - indicate what type of financial assurance is required based on the analysis of possession limits in item 5. If a DFP is not mandatory, sum the amount of funds required in each column and enter the total dollar amount needed for the certification of financial assurance.

7. Time of Submittal - indicate when any required financial assurance must be submitted. If the application is for a new license, any required financial assurance must be submitted prior to approving the application. An amendment to an existing license for a new possession limit above a previously unexceeded financial assurance threshold requires submittal before the application is approved also. If an extension has been granted for submitting financial assurance, specify the submittal date. R R R R R

8. License Reviewer - Sign and date the checklist. File the checklist in the decommissioning section of the docket file to document the review.

APPENDIX B

Possession Limit Thresholds for Establishing Financial Assurance
(based on limits in Appendix C of 10 CFR Part 20)

Note: Half-lives were taken from Table of Radioactive Isotopes, E. Browne and R. B. Firestone, 8th Edition, V.S. Shirely, Editor, John Wiley & Sons, Inc. (1986).

Isotope	Half-Life	10^3 X App.C (mCi)	10^{10} x App.C (Ci)
Americium-241	432.7 y	0.01	100
Antimony-122	2.7 d	*	*
-124	60.2 d	*	*
-125	2.7 y	10	100,000
Arsenic-73	80.3 d	*	*
-74	17.8 d	*	*
-76	1.1 d	*	*
-77	1.6 d	*	*
Barium-131	11.8 d	*	*
-133	10.5 y	10	100,000
-140	12.8 d	*	*
Bismuth-210	5.0 d	*	*
Bromine-82	1.5 d	*	*
Cadmium-109	1.3 y	10	100,000
-115m	44.6 d	*	*
-115	2.2 d	*	*
Calcium-45	163.8 d	10	100,000
-47	4.5 d	*	*
Carbon-14	5730 y	100	1,000,000
Cerium-141	32.5 d	*	*
-143	1.4 d	*	*
-144	284.9 d	1	10,000

* - Half-life less than 120 days

Isotope	Half-Life	10^3 X App.C (mCi)	10^{10} X App.C (Ci)
Cesium-131	9.7 d	*	*
-134m	2.9 h	*	*
-134	2.1 y	1	10,000
-135	$3.0X10^6$ y	10	100,000
-136	13.2 d	*	*
-137	30.0 y	10	100,000
Chlorine-36	$3.0X10^5$ y	10	100,000
-38	37.2 m	*	*
Chromium-51	27.7 d	*	*
Cobalt-58m	9.2 h	*	*
-58	70.9 d	*	*
-60	5.3 y	1	10,000
Copper-64	12.7 h	*	*
Dysprosium-165	2.3 h	*	*
-166	3.4 d	*	*
Erbium-169	9.4 d	*	*
-171	7.5 h	*	*
Europium-152	9.3 h	*	*
-152	13.3 y	1	10,000
-154	8.8 y	1	10,000
-155	5.0 y	10	100,000
Fluorine-18	1.8 h	*	*
Gadolinium-153	241.6 d	10	100,000
-159	18.6 h	*	*
Gallium-72	14.1 h	*	*

* - half-life less than 120 days

Isotope	Half-Life	10^3 X App.C (mCi)	10^{10} x App.C (Ci)
Germanium-71	11.2 d	*	*
Gold-198	2.7 d	*	*
-199	3.1 d	*	*
Hafnium-181	42.4 d	*	*
Holmium-166	1.1 d	*	*
Hydrogen-3	12.3 y	1,000	10,000,000
Indium-113m	1.7 h	*	*
-114m	49.5 d	*	*
-115m	4.5 h	*	*
-115	$4.4X10^{14}$ y	10	100,000
Iodine-125	60.1 d	*	*
-126	13.0 d	*	*
-129	$1.6X10^{7}$ y	0.1	1,000
-131	8.0 d	*	*
-132	2.3 h	*	*
-133	20.8 h	*	*
-134	52.6 m	*	*
-135	6.6 h	*	*
Iridium-192	73.8 d	*	*
-194	19.1 h	*	*
Iron-55	2.7 y	100	1,000,000
-59	44.5 d	*	*
Krypton-85	10.7 y	100	1,000,000
-87	1.3 h	*	*
Lanthanum-140	1.7 d	*	*

* - half-life less than 120 days

Isotope	Half-Life	10^3 X App.C (mCi)	10^{10} x App.C (Ci)
Lutetium-177	6.7 d	*	*
Manganese-52	5.6 d	*	*
-54	312.2 d	10	100,000
-56	2.6 h	*	*
Mercury-197m	23.8 h	*	*
-197	2.7 d	*	*
-203	46.6 d	*	*
Molybdenum-99	2.7 d	*	*
Neodymium-147	11.0 d	*	*
-149	1.7 h	*	*
Nickel-59	$7.5X10^4$ y	100	1,000,000
-63	100.1 y	10	100,000
-65	2.5 h	*	*
Niobium-93m	13.6 y	10	100,000
-95	35.0 d	*	*
-97	1.2 h	*	*
Osmium-185	93.6 d	*	*
-191m	13.1 h	*	*
-191	15.4 d	*	*
-193	1.3 d	*	*
Palladium-103	17.0 d	*	*
-109	13.7 h	*	*
Phosphorus-32	14.3 d	*	*
Platinum-191	2.9 d	*	*
-193m	4.3 d	*	*
-193	50.9 y	100	1,000,000
-197m	1.6 h	*	*
-197	18.3 h	*	*

* - half-life less than 120 days

Isotope	Half-Life	10^3 X App.C (mCi)	10^{10} x App.C (Ci)
Plutonium-239	SNM	0.01	100
Polonium-210	138.4 d	0.1	1,000
Potassium-42	12.4 h	*	*
Praseodymium-142	19.1 h	*	*
-143	13.6 d	*	*
Promethium-147	2.6 y	10	100,000
-149	2.2 d	*	*
Radium-226	1600 y	0.01	100
Rhenium-186	3.8 d	*	*
-188	17.0 h	*	*
Rhodium-103m	56.1 m	*	*
-105	1.5 d	*	*
Rubidium-86	18.7 d	*	*
-87	$4.8X10^{10}$ y	10	100,000
Ruthenium-97	2.9 d	*	*
-103	39.3 d	*	*
-105	4.4 h	*	*
-106	1.0 y	1	10,000
Samarium-151	90.6 y	10	100,000
-153	1.9 d	*	*
Scandium-46	83.8 d	*	*
-47	3.3 d	*	*
-48	1.8 d	*	*
Selenium-75	119.8 d	*	*
Silicon-31	2.6 h	*	*

* - half-life less than 120 days

Isotope	Half-Life	10^3 X App.C (mCi)	10^{10} x App.C (Ci)
Silver-105	41.3 d	*	*
-110m	249.8 d	1	10,000
-111	7.5 d	*	*
Sodium-24	14.7 h	*	*
Strontium-85	64.8 d	*	*
-89	50.6 d	*	*
-90	28.5 y	0.1	1,000
-91	9.5 h	*	*
-92	2.7 h	*	*
Sulphur-35	87.5 d	*	*
Tantalum-182	115.0 d	*	*
Technetium-96	4.3 d	*	*
-97m	90.5 d	*	*
-97	$2.6X10^6$ y	100	1,000,000
-99m	6.0 h	*	*
-99	$2.1X10^5$ y	10	100,000
Tellurium-125m	58.1 d	*	*
-127m	109.2 d	*	*
-127	9.4 h	*	*
-129m	33.6 d	*	*
-129	1.2 h	*	*
-131m	1.2 d	*	*
-132	3.3 d	*	*
Terbium-160	72.3 d	*	*

* - half-life less than 120 days

Isotope	Half-Life	10^3 X App.C (mCi)	10^{10} x App.C (Ci)
Thallium-200	1.1 d	*	*
-201	3.1 d	*	*
-202	12.2 d	*	*
-204	3.8 y	10	100,000
Thorium (natural)	See end of this table		
Thulium-170	128.6 d	10	100,000
-171	1.9 y	10	100,000
Tin-113	115.1 d	*	*
-125	9.6 d	*	*
Tungsten-181	121.2 d	10	100,000
-185	75.1 d	*	*
-187	23.9 h	*	*
Uranium (natural)	See end of this table		
Uranium-233	SNM	0.01	100
-234/235	SNM	0.01	100
Vanadium-48	16.0 d	*	*
Xenon-131m	11.9 d	*	*
-133	5.2 d	*	*
-135	9.1 h	*	*
Ytterbium-175	4.2 d	*	*
Yttrium-90	2.7 d	*	*
-91	58.5 d	*	*
-92	3.5 h	*	*
-93	10.3 h	*	*
Zinc-65	244.1 d	10	100,000
-69m	13.8 h	*	*
-69	55.6 m	*	*

* - half-life less than 120 days

Isotope	Half-Life	10^3 X App.C (mCi)	10^{10} x App.C (Ci)
Zirconium-93	$1.5X10^6$ y	10	100,000
-95	64.0 d	*	*
-97	16.9 h	*	*
Any alpha emitter not listed or unknown mixture of alpha emitters	--	0.01	100
Any non-alpha emitter not listed or unknown mixture of beta emitters	--	0.1	1,000

* - half-life less than 120 days

Activity to Mass Conversion for Source Material

	10 mCi	100 mCi
Natural Uranium ($6.77X10^{-7}$ Ci/gm)	15 kg	150 kg
Natural Thorium ($2.2X10^{-7}$ Ci/gm)	45 kg	450 kg
Depleted Uranium ($3.6X10^{-7}$ Ci/gm)	28 kg	280 kg