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OFFICE MEMORANDUM

TO : Tom Keenan, H-7 Group Leader DATE: July 1, 1976

THRU : R. D. Baker, CMB-Division Leader, MS 756

FROM : G. R. Waterbury & Al Zerwekh

SUBJECT: TRANSURANIC WASTE RESEARCH & DEVELOPMENT PROGRAM (A412) SEMI-ANNUAL REPORT FOR THE PERIOD FROM JANUARY 1 TO JUNE 30, 1976

SYMBOL : CMB-1

1513 Report

Analytical Chemistry

1. Studies of Corrosion

Electron microprobe examinations of coated and uncoated mild steel samples that were exposed to 50 and 100% relative humidity in air for 16 and 24 months showed that at the present corrosion rate some containers will be breached in less than 20 years. As the containers must be retrievable in 20 years, uncontaminated and capable of being handled and transported, any corrosion which mechanically weakens or threatens containment of radioactivity cannot be tolerated. Based on these criteria, mild steel protected with asphalt or hot-dip galvanize, or USS-100 binary alloy, are the materials shown to be acceptable in the laboratory tests (Table I). The asphalt-coated steel is undesirable because the coating slowly flows off the metal, and the containers are messy to handle. For these reasons, investigations of only hot-dipped galvanized mild steel and USS-100 alloy are continuing.

not appropriate

Galvanized mild steel drums have been placed in intermediate storage cell No. 2 against the instrumentation and inspection shaft for ready observation for an extended period of time. The cost of drums fabricated from USS-100, a ferritic type 409 stainless steel, was estimated to be competitive with current waste packages, and US Steel predicted on the basis of calculations for compressibility and data from limited corrosion studies that drums fabricated from 18 gauge USS-100 should be satisfactory for interim storage. A dozen of these drums are being fabricated for testing.

Margaret Ann - I have excerpted portions of which deal with our sampling program at trenches A and B at Area G. I'm sure V

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Entire Report, or if you want more, call me - AP

2. Studies Radiolysis

Two of 10 instrumented drums (approximately 5% of the total in storage), that are being monitored for temperature and gas content in 2 covered trenches of retrievable ^{238}Pu-contaminated waste at the LASL disposal area, have generated significant quantities of hydrogen. Drum No. 301 generated an explosive gas mixture in 36 days, but at the end of 64 days the percentage of hydrogen had increased and the oxygen had decreased so that the mixture was no longer explosible. The mol percentages of gases in the mixtures are shown in Table II:

TABLE II

ANALYSES OF GAS SAMPLES FROM DRUM NO. 301
(containing 18.7 g ^{238}Pu in 23.6 Kg waste)

Days in Storage	Explosible	Gas Composition (mol %)					
		H_2	O_2	CH_4	CO_2	CO	N_2
36	YES	11.0	10.0	0.5	11.0	4.0	62.0
64	NO	15.1	7.0	0.7	14.4	6.5	55.6

Pressure has not built up in this or any other drum in LASL interim storage. This fact emphasizes the importance of standard seals which are particle and liquid tight but permit diffusion of gases slowly and harmlessly to the atmosphere. Laboratory explosimeter tests have shown that there is a range of explosible gas mixtures when the hydrogen mol percentage is high (25 to 50%) and the oxygen is 10% or greater. Where the mol percentage of hydrogen and oxygen are approximately equal, the mixtures can be explosible down to just over 6% hydrogen and oxygen. Fortunately, in interim storage the mixtures do not stay in the explosive range very long because the hydrogen increases and the oxygen decreases, as shown in the example of Drum No. 301. Table III shows the gas compositions for a number of explosible and non-explosible mixtures. Currently available data indicate that hydrogen generation will not create an insurmountable problem.

TABLE III

SELECTED EXPLOSIMETER TESTS ON VARIOUS GAS MIXTURES

EXPL Test No.	Gas Composition (Mol %) H_2	CH_4	O_2	CO_2	CO	N_2	EXPLOSIBLE	MATRIX
49	5.0	<0.1	11.7	2.0	0.9	43.3	No	Water-Soaked Cellulosics
48	5.6	<0.1	6.8	1.9	0.9	24.4	No	Water-Soaked Cellulosics
42	6.1	0.2	6.5	3.6	1.9	23.6	Yes	Cellulosics
44	6.2	<0.1	6.0	2.1	0.9	21.0	No	Water-Soaked Cellulosics
46	6.3	<0.1	6.7	<0.1	0.3	24.3	No	Polyethylene
45	6.6	0.2	6.5	<0.1	0.2	24.1	No	Duoseal On Vermiculite
43	6.8	0.2	7.9	0.1	0.2	29.2	Yes	Duoseal On Vermiculite
40	6.9	0.3	9.0	6.0	2.0	34.0	Yes	Cellulosics
47	7.1	0.3	6.9	5.4	2.0	25.2	Yes	Cellolosics
41	7.3	0.2	7.0	4.0	1.0	26.0	Yes	Cellulosics, Plastics, Rubber
27	8.7	0.2	10.7	0.1	0.2	40.0	Yes	Duoseal On Vermiculite
39	8.8	<0.1	9.0	3.0	1.0	32.0	Yes	Water-Soaked Cellulosics
38	8.9	<0.1	9.1	0.2	0.2	33.0	Yes	Polyethylene
1	9.0	0.5	6.0	17.0	6.0	61.0	No	Hydrogenous Solid Trash
35	9.2	0.4	9.2	5.4	2.9	34.0	Yes	Cellulosics
32	9.8	0.2	9.4	0.1	0.2	36.0	Yes	Duoseal On Vermiculite
29	9.9	0.4	10.2	6.6	2.2	38.1	Yes	Cellulosics, Plastics, Rubber
37	10.1	<0.1	8.8	2.9	1.4	32.5	Yes	Water-Soaked Cellulosics
30	10.2	<0.1	9.8	0.2	0.2	37.5	Yes	Polyethylene
28	11.0	0.5	10.2	10.9	4.2	62.4	Yes	Hydrogenous Solid Trash
36	11.1	0.4	9.1	7.0	3.3	33.6	Yes	Cellulosics
31	13.5	<0.1	9.3	4.0	2.0	35.0	Yes	Water-Soaked Cellulosics
34	15.1	0.7	7.0	14.4	6.5	55.6	No	Hydrogenous Solid Trash
23	24.9	1.0	9.9	16.8	7.4	37.3	No	Cellulosics
8	25.8	0.8	11.1	15.8	4.1	41.5	Yes	Cellulosics, Plastics, Rubber
9	26.0	1.0	10.0	19.0	8.0	36.0	No	Cellulosics
18	27.1	0.8	8.8	21.3	7.9	33.5	No	Cellulosics
22	29.0	1.0	9.0	18.0	8.0	34.0	No	Cellulosics
16	36.4	0.1	7.9	7.6	3.3	29.2	No	Water-Soaked Cellulosics
4	40.5	0.1	10.6	6.0	3.0	39.0	Yes	Water-Soaked Cellulosics
12	42.8	1.0	11.6	0.3	0.2	43.6	No*	Duoseal On Vermiculite
13	47.2	0.3	10.0	0.6	0.3	40.2	Yes	Polyethylene
19	48.7	0.2	10.4	0.5	0.4	39.1	Yes	Polyethylene

*Apparently Anomalous Behavior