DETONATION SPHERE

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DEVELOPMENT DIVISION

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MASTER

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Mason & Hanger-Silas Mason Co., Inc.

Pantex Plant

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AMARILLO, TEXAS 79105
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operated for the
ATOMIC ENERGY COMMISSION
under

U. S. GOVERNMENT Contract DA-11-173-AMC-487 (A)

During the past fiscal year, testing in the 4-foot detonation sphere was limited to the investigation of four TNT charges. A heavier testing program had been envisioned; consequently, purchase of the essential hardware for the proposed HE studies was made. The following major items are in stock:

5 Stainless steel tubes - (44.125 x 7.35-inch OD; 0.345-inch wall)

4 Copper cylinders * - (6-1/2 x 3-1/2 OD x 1-1/2-inch ID)

3 Copper cylinders * - (11-1/2 x 3 OD x 1-inch ID)

3 Copper cylinders * - (19.5 x 2.25 OD x 0.95-inch ID)

*With respective bottom plug and detonator adapter.

The extent or direction of future experimental endeavor at Pantex is indefinite at this time. Investigation will be in collaboration with and guided by the research in progress at LRL.

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Section E

DETONATION SPHERE

The final HE test for the fiscal year was conducted in the 4-foot detonation sphere in May. A 200 g charge of 2-4-6 trinitrotoluene (1 1/2-inch diameter x 4 1/2-inch long) was initiated. On initiation, the TNT charge failed to detonate but instead partial deflagration of the HE took place.

The ensuing pressure rise (54 torr vs. $\sim$ 120 torr expected) implied a partial detonation; nevertheless, sampling and evaluation at the detonation products was continued.

After removal of the products, the sphere was opened for inspection. The interior of the sphere was covered with a heavy carbon deposit adhering to a viscous film. Closer observation revealed granules of TNT embedded in the residual layer and also smeared on the surfaces of the involved hardware. Scrubbing with soap and water had no effect on the film; consequently, all the contamination was removed with acetone.

Of the related hardware, only the copper cylinder suffered any damage. The cylinder was not fragmented; however, the internal diameter (1 1/2-inch) was found to have been enlarged by ≤ 0.450 inch. The partitioned stainless steel tube suffered no distortion although the sections were propelled against the sphere wall.

The data obtained for this test along with the test conditions are listed below.

Charge Data:

HE: TNT = 199.3320 g (ρ = 1.53 g/cc) Lot 15647F 2401-12 (1 1/2-inch long) $199.3320 \text{ g} / 227.134 = 0.8776$ moles

Detonator: PETN = 0.2483 g / 316.14 = 0.00078 moles

Sphere Volume: 947.7 L - 8.6 L (hardware) = 939.1 L

Volume (water-free gas): $n = PV/RT$

Volume = 939.1 L

Press (corr.) = 54.2 torr

Temp (corr.) = 21.73 C

VP H_2O @ 21.73 C = 19.504 torr

$n = 1.7720$ moles

Product Analysis:

$\text{H}_2\text{O} = 14.3168 / 18.016 = 0.7947$ moles

$\text{NH}_3 = 0.5890 / 17 = 0.0346$ moles

Product Analysis Mass Spec (PX)

<u>Species</u>	<u>Mole %</u>	<u>Mole</u>	<u>PETN Corr</u>	<u>Moles</u>	<u>Mole/Mole TNT</u>
CO ₂	10.61	0.188	0.003	0.185	0.211
N ₂ O	1.34	0.024	--	0.024	0.027
NO	20.18	0.358	--	0.358	0.408
N ₂	15.39	0.273	0.002	0.271	0.309
CO	36.36	0.644	0.001	0.643	0.733
CH ₄	0.70	0.012	--	0.012	0.014
H ₂	6.02	0.107	0.0004	0.106	0.121
UnK.	9.40	0.167	--	0.167	0.190
H ₂ O	14.3168 g	0.795	0.0027	0.792	0.90
NH ₃	0.5890 g	0.035	--	0.035	0.04
HCN	1.0143 g	0.019	--	0.019	0.02

Moles Fired

	<u>C</u>	<u>H</u>	<u>N</u>	<u>O</u>
TNT (0.8776)	6.1432	4.3880	2.6328	5.2656
PETN (0.00078)	<u>0.0039</u>	<u>0.0062</u>	<u>0.0031</u>	<u>0.0094</u>
	6.1471	4.3942	2.6359	5.2750

Material Balance

<u>Element</u>	<u>Moles Fired</u>	<u>Moles Recovered</u>	<u>% Mole Recovery</u>
C	6.1471	0.859	13.97
H	4.3942	1.968	44.79
N	2.6359	1.002	38.01
O	5.2750	2.187	41.45

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