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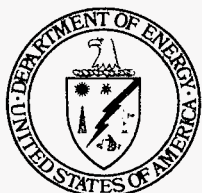
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**Test Results of Chemical Reactivity
Test (CRT) Analysis of Structural
Materials and Explosives**

**Paul S. Back, Brady V. Barnhart, Ronald R.
Walters, Lowell D. Haws and Louis W. Collins**

March 21, 1980



Monsanto

MOUND FACILITY
Miamisburg, Ohio 45342

operated by

MONSANTO RESEARCH CORPORATION
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for the

U. S. DEPARTMENT OF ENERGY

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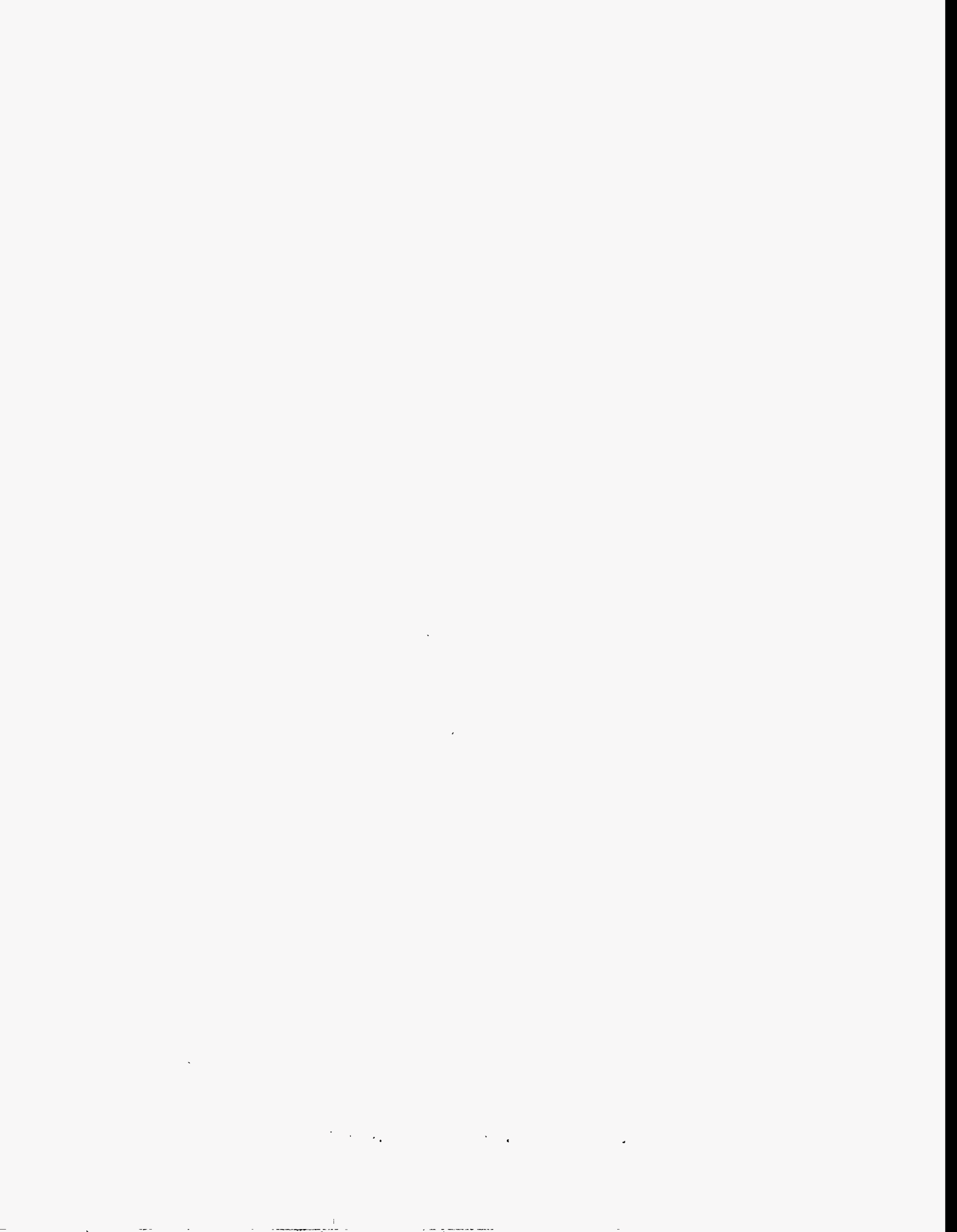
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Contents

	<u>Page</u>
ABSTRACT.	3
INTRODUCTION.	3
EXPERIMENTAL.	4
INFORMATION RETRIEVAL	4
CRT DATA.	4
APPENDIX A	
Definition of Explosive Acronyms	13
APPENDIX B	
Description of Inert Materials Acronyms.	14
DISTRIBUTION.	15

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Abstract

The chemical reactivity test, CRT, is a procedure used to screen the compatibility of component structural materials with explosives. This report contains the results of CRT materials evaluations conducted at Mound Facility. Data about materials combinations are catalogued both under the name of the explosive and the nonexplosive.

Introduction

Chemical reactivity test (CRT) data were generated during the examination of the compatibility of structural materials and explosives. The data may be used to obtain a first estimate of the compatibility of two materials; however, apparent compatibility in these short-term tests should not be assumed to imply long-term stability. The long-term (years) aging characteristics of a material mixture can be evaluated only through long-term (months to a few years) aging studies employing several temperatures and additional evaluation procedures. It is also important to note that the reported gases usually represent only the major decomposition products of the explosive. Other compounds formed or released during aging are generally not reported. This is not a unique feature of the Mound CRT, but applies to all DOE CRT analyses. Another question that must

be addressed when CRT data are accessed. Does the CRT aging atmosphere (dry helium) represent the real atmosphere under which the materials will be stored? If the system is maintained in an inert atmosphere (e.g., N₂, Ar), then the CRT data are directly applicable; however, exposure to a reactive atmosphere (air or high humidity conditions) may accelerate or reduce the reactions observed by CRT analysis. Unfortunately, CRT analysis employing anything but an inert atmosphere is currently impossible.

The interpretation of CRT data to assign a label of "incompatible" to an H.E./inert mixture varies with the agency viewing the data. As a general rule, however, a mixture may be considered suspect when the total volume of gas evolved from the aging mixture is two times greater than the sum of the gases measured over the materials aged separately, as shown in the following word equation:

COMPATIBLE	INCOMPATIBLE
gas vol. mixture $\leq 2x$ (gas vol. HE + gas vol. inert)	$> 2x$ gas vol. mixture

Experimental

Samples of H.E. (0.250 ± 0.001 g), inert material (0.250 ± 0.001 g), and H.E./inert mixture (0.500 ± 0.001 g, 50/50 wt %) were placed in individual Mound CRT cells ($\sim 10.0 \pm 0.1$ cm³ volume, Mound Drawing No. AYD760504), evacuated (<0.100 torr), and backfilled several times with 99.9999% helium. The final internal helium pressure used for aging was 7.129×10^6 Pa (1034 torr at room temperature). Samples were aged 22 hr at 393 ± 1 K ($120 \pm 1^\circ\text{C}$) unless a special aging time and sequence were requested. Decomposition products were analyzed by sweeping the gases from the hot CRT cell into a cryogenic gas chromatograph equipped with a 3-m, 3-mm o.d. stainless steel column packed with 80/100 mesh Porapak Q. Following volatiles analysis, the residual materials were available for further examination.

Information retrieval

Data in this report are indexed both by the name of the explosive and the inert material. For example, information about an HMX/SCOTCHCAST 8 mixture is indexed under headings HMX and SCOTCHCAST 8. The data for these two materials (HMX, SCOTCHCAST 8) aged independently are reported only under the heading for the specific material.

CRT test data

The data generated during the tests are given in Table 1. Abbreviations used in the table are:

ND - Not Detected

<0.001 - Gas volume measured was less than 0.001 cm³ at STP; however, a value of 0.001 was added to determine the total volume of gas generated in the experiment.

Table 1 - CHEMICAL REACTIVITY TEST DATA

Material Evaluated	Aging Environment (hr at temp.)	Weight (g)	Decomposition Products (cm ³ at STP)						Total
			N	O ₂ /Ar	CO	NO	CO ₂	N ₂ O	
Adiprene-MOCA	22/353K	0.2500	ND	ND	ND	ND	<0.001	ND	0.001
Adiprene-MOCA	22/353K	0.2500	ND	ND	ND	ND	<0.001	ND	0.001
Adiprene-MOCA	22/373K	0.2500	ND	ND	ND	ND	0.002	ND	0.002
Adiprene-MOCA	22/373K	0.2500	ND	ND	ND	ND	0.002	ND	0.002
Adiprene-MOCA	22/393K	0.2500	ND	ND	ND	ND	0.012	<0.001	0.013
Adiprene-MOCA	22/393K	0.2500	ND	ND	ND	ND	0.014	<0.001	0.015
Adiprene-MOCA/PETN Type 8	22/353K	0.2500/0.2500	0.003	ND	ND	ND	<0.001	ND	0.004
Adiprene-MOCA/PETN Type 8	22/353K	0.2500/0.2500	0.003	ND	ND	ND	<0.001	ND	0.004
Adiprene-MOCA/PETN Type 8	22/373K	0.2500/0.2500	0.018	ND	<0.001	0.002	0.011	<0.001	0.033
Adiprene-MOCA/PETN Type 8	22/373K	0.2500/0.2500	0.022	ND	<0.001	<0.001	0.012	<0.001	0.037
Adiprene-MOCA/PETN Type 8	22/393K	0.2500/0.2500	1.044	ND	0.073	0.047	0.933	0.085	2.182
Adiprene-MOCA/PETN Type 8	22/393K	0.2500/0.2500	0.836	ND	0.059	0.039	0.760	0.071	1.765
AF111	22/353K	0.2510	0.003	ND	ND	ND	0.013	ND	0.016
AF111	22/353K	0.2497	0.002	ND	ND	ND	0.013	ND	0.015
AF111	22/373K	0.2496	ND	ND	ND	ND	0.024	ND	0.024
AF111	22/373K	0.2500	0.003	ND	<0.001	ND	0.025	ND	0.029
AF111	22/393K	0.2499	0.003	ND	<0.001	ND	0.037	ND	0.041
AF111	22/393K	0.2496	ND	ND	<0.001	ND	0.035	ND	0.036
AF111/LX10-1	22/353K	0.2500/0.2497	0.004	ND	ND	ND	0.014	0.001	0.019
AF111/LX10-1	22/353K	0.2500/0.2497	0.006	ND	ND	ND	0.014	0.001	0.021
AF111/LX10-1	22/373K	0.2503/0.2508	0.005	ND	ND	ND	0.033	0.005	0.043
AF111/LX10-1	22/373K	0.2505/0.2501	0.005	ND	ND	ND	0.034	0.005	0.044
AF111/LX10-1	22/393K	0.2502/0.2502	0.009	ND	0.001	ND	0.045	0.069	0.124
AF111/LX10-1	22/393K	0.2494/0.2510	0.007	ND	0.001	ND	0.044	0.061	0.113
AF111/PETN Type 8	22/353K	0.2507/0.2500	0.003	ND	ND	ND	0.015	<0.001	0.019
AF111/PETN Type 8	22/393K	0.2502/0.2501	0.652	ND	0.044	0.158	0.629	0.174	1.657
AF111/PETN Type 8	22/393K	0.2498/0.2510	0.582	ND	0.041	0.148	0.555	0.155	1.481
Apocure L100-602	22/393K	0.2500	0.002	<0.001	<0.001	<0.001	0.028	ND	0.033
Apocure L100-602	22/393K	0.2500	<0.001	<0.001	<0.001	ND	0.021	ND	0.024
Apocure L100-602/HNS	22/393K	0.2500/0.2500	0.003	ND	ND	0.001	0.055	<0.001	0.060
Apocure L100-602/HNS	22/393K	0.2500/0.2500	0.003	ND	ND	0.001	0.047	<0.001	0.052
Apocure L100-602/HNAB	22/393K	0.2500/0.2500	1.684	ND	0.018	0.398	0.960	0.015	3.075
Apocure L100-602/HNAB	22/393K	0.2500/0.2500	1.969	ND	ND	0.444	1.165	0.006	3.584
Apocure L100-602/PBX9407	22/393K	0.2500/0.2500	0.018	ND	0.001	ND	0.051	0.028	0.097
Apocure L100-602/PBX9407	22/393K	0.2500/0.2500	0.015	ND	0.001	ND	0.051	0.025	0.091
EN-7	22/393K	0.2500	<0.001	ND	0.001	0.005	0.068	<0.001	0.076
EN-7	22/393K	0.2500	<0.001	ND	0.001	0.005	0.066	<0.001	0.074

continued.....

Table 1 - continued

Material Evaluated	Aging Environment (hr at temp.)	Weight (g)	Decomposition Products (cm ³ at STP)						Total
			N	O ₂ /Ar	CO	NO	CO ₂	N ₂ O	
EN-7/HMX	22/393K	0.2500/0.2500	<0.001	ND	0.001	0.005	0.043	0.006	0.056
EN-7/XO211	22/393K	0.2500/0.2500	0.002	ND	0.002	0.005	0.080	0.010	0.099
EN-7/XO211	22/393K	0.2500/0.2500	0.002	ND	0.002	0.005	0.085	0.010	0.104
EN-8	22/393K	0.2500/0.2500	<0.001	ND	0.001	ND	0.113	ND	0.115
EN-8	22/393K	0.2500/0.2500	0.002	ND	0.001	ND	0.116	ND	0.119
EN-8/PBX9407	22/393K	0.2500/0.2500	0.312	ND	0.077	0.033	0.776	0.040	1.238
EN-8/PBX9407	22/393K	0.2500/0.2500	0.564	ND	0.138	0.070	1.382	0.094	2.248
EN-8/PETN Type 8	22/393K	0.2500/0.2500	0.064	ND	0.004	<0.001	0.247	0.181	0.499
EN-8/PETN Type 8	22/393K	0.2500/0.2500	0.063	ND	0.004	<0.001	0.246	0.164	0.477
Epon-Versamid 60:40	22/393K	0.2500	0.001	ND	ND	0.018	0.005	0.059	0.084
Epon-Versamid 60:40	22/393K	0.2500	0.001	ND	0.001	0.011	0.001	0.020	0.035
Epon-Versamid 60:40/HMX	22/393K	0.2500/0.2500	0.117	ND	0.031	0.047	0.275	1.481	1.951
Epon-Versamid 60:40/HMX	22/393K	0.2500/0.2500	0.247	ND	0.030	0.089	0.292	2.454	3.112
Epon-Versamid 60:40/XO211	22/393K	0.2500/0.2500	0.006	ND	0.001	0.014	0.006	0.060	0.087
EpoxyLite 8882	22/393K	0.2500	0.002	ND	ND	0.001	0.011	ND	0.014
EpoxyLite 8882	22/393K	0.2500	0.001	ND	ND	0.001	0.011	ND	0.013
EpoxyLite 8822/HNAB	22/393K	0.2500/0.2500	0.016	ND	<0.001	0.001	0.014	<0.001	0.033
EpoxyLite 8822/HNAB	22/393K	0.2500/0.2500	0.007	ND	ND	0.003	0.012	<0.001	0.023
FM1000	22/353K	0.2500	ND	ND	ND	ND	0.001	ND	0.001
FM1000	22/353K	0.2500	ND	ND	ND	ND	0.001	ND	0.001
FM1000	22/373K	0.2500	ND	ND	0.001	ND	0.015	<0.001	0.017
FM1000	22/373K	0.2500	ND	ND	0.001	ND	0.014	<0.001	0.016
FM1000	22/393K	0.2500	ND	ND	0.004	ND	0.015	<0.001	0.020
FM1000	22/393K	0.2500	ND	ND	0.004	ND	0.014	<0.001	0.019
FM1000/LX10-1	22/353K	0.2500/0.2500	ND	ND	ND	ND	0.004	0.001	0.005
FM1000/LX10-1	22/353K	0.2500/0.2500	ND	ND	ND	ND	0.004	0.001	0.005
FM1000/LX10-1	22/373K	0.2500/0.2500	ND	ND	<0.001	ND	0.006	0.005	0.012
FM1000/LX10-1	22/373K	0.2500/0.2500	ND	ND	<0.001	ND	0.006	0.005	0.012
FM1000/LX10-1	22/393K	0.2500/0.2500	0.003	ND	<0.001	ND	0.030	0.032	0.066
FM1000/LX10-1	22/393K	0.2500/0.2500	0.004	ND	<0.001	ND	0.030	0.030	0.065
FM1000/PETN Type 8	22/353K	0.2500/0.2502	0.002	ND	<0.001	ND	0.003	ND	0.006
FM1000/PETN Type 8	22/353K	0.2500/0.2500	0.005	ND	ND	ND	0.006	ND	0.011
FM1000/PETN Type 8	22/373K	0.2500/0.2500	0.012	ND	0.001	0.012	0.012	0.002	0.039
FM1000/PETN Type 8	22/373K	0.2500/0.2500	0.005	ND	0.001	0.016	0.012	0.002	0.036
FM1000/PETN Type 8	22/393K	0.2500/0.2500	0.198	ND	0.053	0.213	0.318	0.099	0.881
FM1000/PETN Type 8	22/393K	0.2500/0.2500	0.240	ND	0.060	0.223	0.382	0.122	1.027

continued.....

Table 1 - continued

Material Evaluated	Aging Environment (hr at temp.)	Weight (g)	Decomposition Products (cm ³ at STP)						
			N	O ₂ /Ar	CO	NO	CO ₂	N ₂ O	Total
Green glue/PBX9407	22/Ambient	0.2500/0.2500	0.002	ND	ND	ND	ND	0.040	0.042
Green glue/PBX9407	22/Ambient	0.2500/0.2500	0.002	ND	ND	ND	ND	0.050	0.052
Green glue/PBX9407	22/353K	0.2500/0.2500	0.212	ND	0.011	0.013	ND	2.620	2.856
Green glue/HNAB	22/393K	0.2500/0.2500	0.230	ND	0.005	0.073	0.062	0.208	0.578
Green glue/HNAB	22/373K	0.2500/0.2500	0.016	ND	ND	0.001	ND	0.003	0.020
Green glue/HNAB	22/373K	0.2500/0.2500	0.017	ND	ND	0.001	ND	0.003	0.021
Halthane 73-18	22/393K	0.2500	0.003	ND	ND	ND	0.005	ND	0.008
Halthane 73-18	22/353K	0.2500	0.002	ND	ND	ND	0.004	ND	0.006
Halthane 73-18	22/373K	0.2500	ND	ND	ND	ND	0.004	ND	0.004
Halthane 73-18	22/373K	0.2500	ND	ND	ND	ND	0.004	ND	0.004
Halthane 73-18	22/393K	0.2500	ND	ND	ND	ND	0.085	ND	0.085
Halthane 73-18	22/393K	0.2500	ND	ND	ND	ND	0.068	0.001	0.069
Halthane 73-18/PETN Type 8	22/353K	0.2500/0.2500	0.002	ND	ND	ND	0.002	ND	0.004
Halthane 73-18/PETN Type 8	22/353K	0.2500/0.2500	0.002	ND	ND	ND	0.003	ND	0.005
Halthane 73-18/PETN Type 8	22/373K	0.2500/0.2500	0.010	ND	<0.001	0.011	0.025	0.002	0.049
Halthane 73-18/PETN Type 8	22/373K	0.2500/0.2500	0.013	ND	<0.001	0.013	0.034	0.002	0.063
Halthane 73-18/PETN Type 8	22/393K	0.2500/0.2500	1.003	ND	0.220	0.099	1.806	0.769	3.924
Halthane 73-18/PETN Type 8	22/393K	0.2500/0.2500	0.998	ND	0.215	0.091	1.777	0.766	3.837
Halthane 73-18/HNAB	22/393K	0.2500/0.2500	0.957	ND	ND	1.180	0.610	0.014	2.761
Halthane 73-18/HNAB	22/393K	0.2500/0.2500	0.920	ND	ND	1.138	0.589	0.010	2.656
Halthane 73-18 (uncured) /PBX9407	22/393K	0.2500/0.2500	0.048	ND	<0.001	ND	0.119	0.050	0.219
Halthane 73-18 (uncured) /PBX9407	22/393K	0.2500/0.2500	0.039	ND	0.004	ND	0.165	0.050	0.258
Halthane 73-18 (uncured)/HNS	22/393K	0.2500/0.2500	0.014	ND	<0.001	ND	0.102	0.003	0.120
Halthane 73-18 (uncured)/HNS	22/393K	0.2500/0.2500	0.015	ND	<0.001	ND	0.092	<0.001	0.104
Halthane 73-18 (uncured)	22/393K	0.2500/0.2500	<0.001	ND	ND	ND	0.118	ND	0.119
HMX	22/393K	0.2500	<0.001	ND	0.002	0.004	<0.001	0.001	0.009
HMX	22/393K	0.2500	<0.001	ND	0.002	ND	<0.001	ND	0.004
HMX/EN-7	22/393K	0.2500/0.2500	<0.001	ND	0.001	0.005	0.043	0.006	0.056
HMX/Scotchcast 8	22/393K	0.2500/0.2500	0.026	ND	0.001	0.016	0.031	0.273	0.347
HMX/Scotchcast 8	22/393K	0.2500/0.2500	0.026	ND	0.008	0.038	0.137	0.171	0.379
HMX/Epon-Versamid 60:40	22/393K	0.2500/0.2500	0.117	ND	0.031	0.047	0.275	1.481	1.951
HMX/Epon-Versamid 60:40	22/393K	0.2500/0.2500	0.247	ND	0.030	0.089	0.292	2.454	3.112

continued.....

Table 1 - continued

Material Evaluated	Aging Environment (hr at temp.)	Weight (g)	Decomposition Products (cm ³ at STP)						Total
			N	O ₂ /Ar	CO	NO	CO ₂	N ₂ O	
HNAB	22/393K	0.2500	0.002	ND	<0.001	<0.001	0.006	0.001	0.011
HNAB	22/393K	0.2500	0.001	ND	ND	<0.001	0.002	<0.001	0.005
HNAB/EpoxyLite 8822	22/393K	0.2500/0.2500	0.016	ND	<0.001	0.001	0.014	<0.001	0.031
HNAB/EpoxyLite 8822	22/393K	0.2500/0.2500	0.007	ND	ND	0.003	0.012	<0.001	0.005
HNAB/Apocure L100/602	22/393K	0.2500/0.2500	1.684	ND	0.018	0.398	0.960	0.015	3.075
HNAB/Apocure L100/602	22/393K	0.2500/0.2500	1.969	ND	ND	0.444	1.165	0.006	3.584
HNAB/green glue	22/393K	0.2500/0.2500	0.230	ND	0.005	0.073	0.062	0.208	0.578
HNAB/green glue	22/373K	0.2500/0.2500	0.016	ND	ND	0.001	ND	0.003	0.020
HNAB/green glue	22/373K	0.2500/0.2500	0.017	ND	ND	0.001	ND	0.003	0.021
HNAB/Halthane 73-18	22/393K	0.2500/0.2500	0.957	ND	ND	1.180	0.610	0.014	2.761
HNAB/Halthane 73-18	22/393K	0.2500/0.2500	0.920	ND	ND	1.138	0.589	0.010	2.656
HNAB/87-MDIPA	22/393K	0.2500/0.2500	5.989	ND	ND	2.155	2.298	0.057	10.500
HNS	22/393K	0.2500	0.003	ND	ND	0.002	0.007	0.002	0.014
HNS	22/393K	0.2500	0.017	ND	0.002	0.001	0.004	ND	0.024
HNS/Apocure L100/602	22/393K	0.2500/0.2500	0.003	ND	ND	0.001	0.055	<0.001	0.060
HNS/Apocure L100/602	22/393K	0.2500/0.2500	0.003	ND	ND	0.001	0.047	<0.001	0.052
HNS/Halthane 73-18 (uncured)	22/393K	0.2500/0.2500	0.014	ND	<0.001	ND	0.102	0.003	0.120
HNS/Halthane 73-18 (uncured)	22/393K	0.2500/0.2500	0.015	ND	<0.001	ND	0.092	<0.001	0.104
LX10-1	22/353K	0.2500	ND	ND	ND	ND	<0.001	<0.001	0.002
LX10-1	22/353K	0.2500	ND	ND	ND	ND	<0.001	<0.001	0.002
LX10-1	22/373K	0.2500	ND	ND	ND	ND	<0.001	0.001	0.002
LX10-1	22/373K	0.2500	ND	ND	ND	ND	<0.001	0.001	0.002
LX10-1	22/393K	0.2500	ND	ND	ND	ND	0.001	0.005	0.006
LX10-1	22/393K	0.2500	ND	ND	ND	ND	0.002	0.004	0.006
LX10-1/AF111	22/353K	0.2500/0.2500	0.004	ND	ND	ND	0.014	0.001	0.019
LX10-1/AF111	22/353K	0.2500/0.2500	0.006	ND	ND	ND	0.014	0.001	0.021
LX10-1/AF111	22/373K	0.2500/0.2500	0.005	ND	ND	ND	0.033	0.005	0.043
LX10-1/AF111	22/373K	0.2500/0.2500	0.005	ND	ND	ND	0.034	0.005	0.044
LX10-1/AF111	22/393K	0.2500/0.2500	0.009	ND	0.001	ND	0.045	0.069	0.124
LX10-1/AF111	22/393K	0.2500/0.2500	0.007	ND	0.001	ND	0.044	0.061	0.113
LX10-1/FM1000	22/353K	0.2500/0.2500	ND	ND	ND	ND	0.004	0.001	0.005
LX10-1/FM1000	22/353K	0.2500/0.2500	ND	ND	ND	ND	0.004	0.001	0.005
LX10-1/FM1000	22/373K	0.2500/0.2500	ND	ND	<0.001	ND	0.006	0.005	0.012
LX10-1/FM1000	22/373K	0.2500/0.2500	ND	ND	<0.001	ND	0.006	0.005	0.012
LX10-1/FM1000	22/393K	0.2500/0.2500	0.003	ND	<0.001	ND	0.030	0.032	0.066
LX10-1/FM1000	22/393K	0.2500/0.2500	0.004	ND	<0.001	ND	0.030	0.030	0.065

continued.....

Table 1 - continued

Material Evaluated	Aging Environment (hr at temp.)	Weight (g)	Decomposition Products (cm ³ at STP)						
			N	O ₂ /Ar	CO	NO	CO ₂	N ₂ O	Total
LX10-1/Pyralux	22/393K	0.2500/0.2500	<0.001	ND	0.001	ND	0.005	0.004	0.010
LX10-1/Pyralux	22/393K	0.2500/0.2500	<0.001	ND	0.001	ND	0.007	0.004	0.012
3M-75/PBX9407	22/393K	0.2500/0.2500	0.009	ND	0.001	ND	0.010	0.026	0.046
3M-75/PBX9407	22/393K	0.2500/0.2500	0.011	ND	0.001	ND	0.009	0.024	0.045
3M-75/PETN Type 8	22/393K	0.2500/0.2500	0.166	ND	0.039	0.076	0.089	0.084	0.456
3M-75/PETN Type 8	22/393K	0.2500/0.2500	0.188	ND	0.047	0.078	0.119	0.113	0.548
87-MDIPA	22/393K	0.2500	<0.001	ND	<0.001	ND	0.008	ND	0.010
87-MDIPA	22/393K	0.2500	0.008	ND	<0.001	ND	0.012	0.002	0.031
87-MDIPA/HNAB	22/393K	0.2500/0.2500	5.989	ND	ND	2.155	2.298	0.057	10.500
PBX9407	22/393K	0.2500	0.005	ND	ND	0.001	0.001	0.007	0.014
PBX9407	22/393K	0.2500	0.005	ND	ND	<0.001	0.001	0.007	0.014
PBX9407/Apocure L100-602	22/393K	0.2500/0.2500	0.018	ND	0.001	ND	0.051	0.028	0.097
PBX9407/Apocure L100-602	22/393K	0.2500/0.2500	0.015	ND	0.001	ND	0.051	0.025	0.091
PBX9407/EN-8	22/393K	0.2500/0.2500	0.312	ND	0.077	0.033	0.776	0.040	1.238
PBX9407/EN-8	22/393K	0.2500/0.2500	0.564	ND	0.138	0.070	1.382	0.094	2.248
PBX9407/green glue	22/Ambient	0.2500/0.2500	0.002	ND	ND	ND	ND	0.040	0.042
PBX9407/green glue	22/Ambient	0.2500/0.2500	0.002	ND	ND	ND	ND	0.050	0.052
PBX9407/green glue	22/353K	0.2500/0.2500	0.212	ND	0.011	0.013	ND	2.620	2.856
PBX9407/Halthane 73-18 (uncured)	22/393K	0.2500/0.2500	0.048	ND	<0.001	ND	0.119	0.050	0.219
PBX9407/Halthane 73-18 (uncured)	22/393K	0.2500/0.2500	0.039	ND	0.004	ND	0.165	0.050	0.258
PBX9407/Sheldahl GT130	22/353K	0.2500/0.2500	0.009	ND	<0.001	0.002	0.004	0.034	0.050
PBX9407/Sheldahl GT130	22/353K	0.2500/0.2500	0.006	ND	<0.001	0.001	0.003	0.027	0.038
PBX9407/Sheldahl GT130	22/373K	0.2500/0.2500	0.222	ND	0.003	0.029	0.043	0.390	0.687
PBX9407/Sheldahl GT130	22/373K	0.2500/0.2500	0.231	ND	0.003	0.032	0.045	0.411	0.722
PBX9407/Sheldahl GT130	22/393K	0.2500/0.2500	0.888	ND	0.022	0.118	0.340	1.734	3.102
PBX9407/Sheldahl GT130	22/393K	0.2500/0.2500	0.815	ND	0.020	0.122	0.313	1.604	2.874
PBX9407/3M-75	22/393K	0.2500/0.2500	0.009	ND	0.001	ND	0.010	0.026	0.046
PBX9407/3M-75	22/393K	0.2500/0.2500	0.011	ND	0.001	ND	0.009	0.024	0.045
PETN Type 1/EN-8	22/393K	0.2500/0.2500	0.064	ND	0.004	<0.001	0.247	0.181	0.497
PETN Type 8	22/353K	0.2500	0.003	ND	ND	ND	<0.001	ND	0.004
PETN Type 8	22/353K	0.2500	0.002	ND	ND	ND	<0.001	ND	0.003
PETN Type 8	22/373K	0.2500	0.003	ND	<0.001	0.007	0.001	<0.001	0.013

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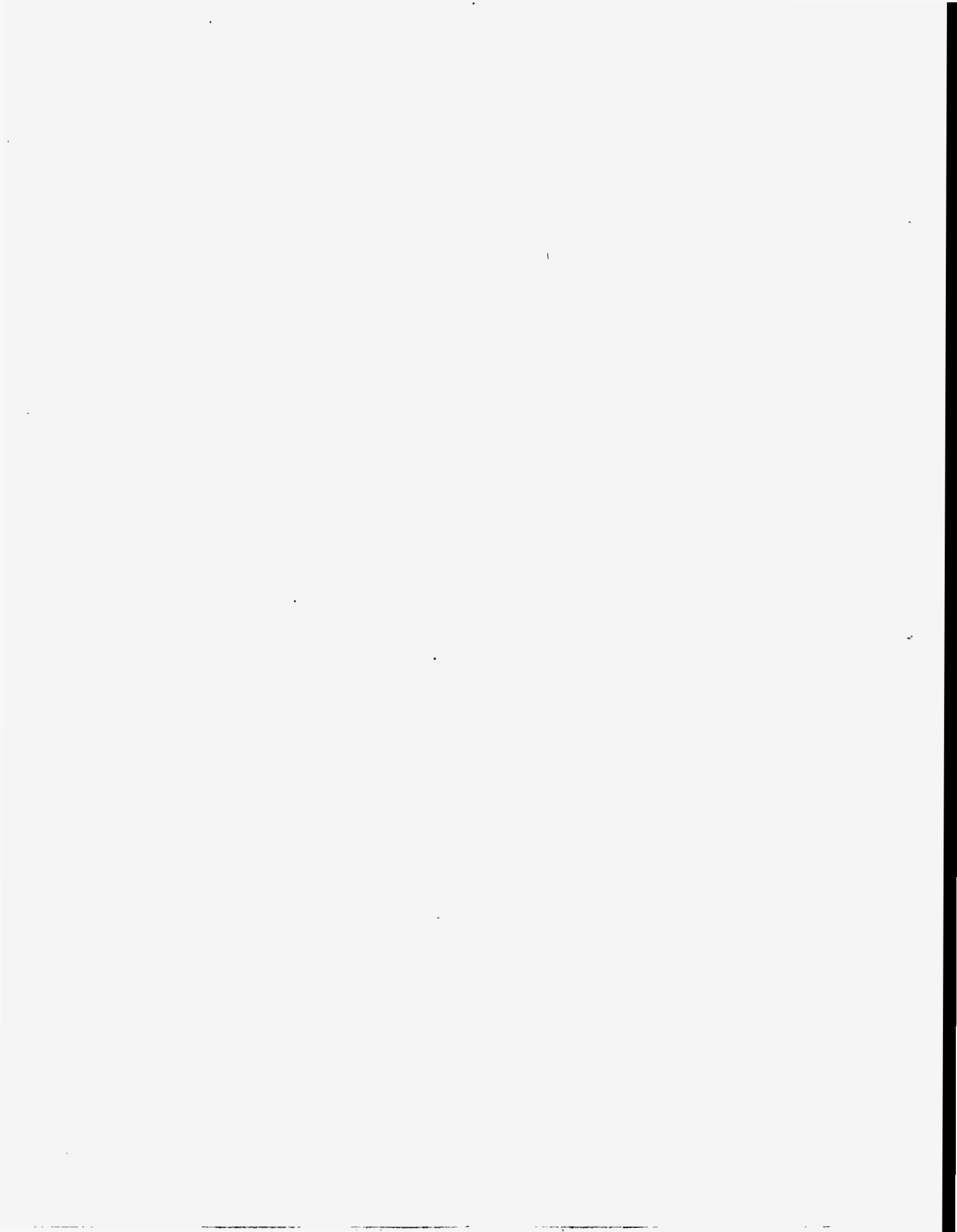
Table 1 - continued

Material Evaluated	Aging Environment (hr at temp.)	Weight (g)	Decomposition Products (cm ³ at STP)							Total
			N	O ₂ /Ar	CO	NO	CO ₂	N ₂ O		
PETN Type 8	22/373K	0.2500	0.004	ND	<0.001	0.004	0.001	<0.001	0.011	
PETN Type 8	22/393K	0.2500	0.009	ND	0.017	0.051	0.017	0.007	0.101	
PETN Type 8	22/393K	0.2500	0.009	ND	0.018	0.040	0.016	0.007	0.090	
PETN Type 8/FM1000	22/353K	0.2500/0.2500	0.002	ND	<0.001	ND	0.003	ND	0.006	
PETN Type 8/FM1000	22/353K	0.2500/0.2500	0.002	ND	ND	ND	0.003	ND	0.005	
PETN Type 8/FM1000	22/373K	0.2500/0.2500	0.012	ND	0.001	0.012	0.012	0.002	0.039	
PETN Type 8/FM1000	22/373K	0.2500/0.2500	0.005	ND	0.001	0.016	0.012	0.002	0.036	
PETN Type 8/FM1000	22/393K	0.2500/0.2500	0.198	ND	0.053	0.213	0.318	0.099	0.881	
PETN Type 8/FM1000	22/393K	0.2500/0.2500	0.240	ND	0.060	0.223	0.382	0.122	1.027	
PETN Type 8/Adiprene-MOCA	22/353K	0.2500/0.2500	0.003	ND	ND	ND	<0.001	ND	0.004	
PETN Type 8/Adiprene-MOCA	22/353K	0.2500/0.2500	0.003	ND	ND	ND	<0.001	ND	0.004	
PETN Type 8/Adiprene-MOCA	22/373K	0.2500/0.2500	0.018	ND	<0.001	0.002	0.011	<0.001	0.033	
PETN Type 8/Adiprene-MOCA	22/373K	0.2500/0.2500	0.022	ND	<0.001	<0.001	0.012	<0.001	0.037	
PETN Type 8/Adiprene-MOCA	22/393K	0.2500/0.2500	1.044	ND	0.073	0.047	0.933	0.085	2.182	
PETN Type 8/Adiprene-MOCA	22/393K	0.2500/0.2500	0.836	ND	0.059	0.039	0.760	0.071	1.765	
PETN Type 8/AF111	22/353K	0.2500/0.2500	0.003	ND	ND	ND	0.015	<0.001	0.019	
PETN Type 8/AF111	22/393K	0.2500/0.2500	0.652	ND	0.044	0.158	0.629	0.174	1.657	
PETN Type 8/AF111	22/393K	0.2500/0.2500	0.582	ND	0.041	0.148	0.555	0.155	1.481	
PETN Type 8/Halthane 73-18	22/353K	0.2500/0.2500	0.002	ND	ND	ND	0.002	ND	0.004	
PETN Type 8/Halthane 73-18	22/353K	0.2500/0.2500	0.002	ND	ND	ND	0.003	ND	0.005	
PETN Type 8/Halthane 73-18	22/373K	0.2500/0.2500	0.010	ND	<0.001	0.011	0.025	0.002	0.049	
PETN Type 8/Halthane 73-18	22/373K	0.2500/0.2500	0.013	ND	<0.001	0.013	0.034	0.002	0.063	
PETN Type 8/Halthane 73-18	22/393K	0.2500/0.2500	1.003	ND	0.220	0.099	1.806	0.796	3.924	
PETN Type 8/Halthane 73-18	22/393K	0.2500/0.2500	0.988	ND	0.215	0.091	1.777	0.776	3.837	
PETN Type 8/Pyralux	22/393K	0.2500/0.2500	0.133	ND	0.083	0.158	0.213	0.170	0.758	
PETN Type 8/Pyralux	22/393K	0.2500/0.2500	0.122	ND	0.078	0.155	0.204	0.157	0.718	
Pyralux	22/393K	0.2500	<0.001	ND	0.001	ND	0.005	0.001	0.007	
Pyralux/LX10-1	22/393K	0.2500/0.2500	<0.001	ND	0.001	ND	0.005	0.004	0.011	
Pyralux/LX10-1	22/393K	0.2500/0.2500	<0.001	ND	0.001	ND	0.007	0.004	0.013	
Pyralux/PETN Type 8	22/393K	0.2500/0.2500	0.133	ND	0.083	0.158	0.213	0.170	0.758	
Pyralux/PETN Type 8	22/393K	0.2500/0.2500	0.122	ND	0.078	0.155	0.204	0.157	0.718	
Scotchcast 8	22/393K	0.2500	0.002	ND	0.004	ND	0.015	0.012	0.033	
Scotchcast 8	22/393K	0.2500	0.020	ND	0.001	0.014	0.005	0.030	0.060	
Scotchcast 8/HMX	22/393K	0.2500/0.2500	0.026	ND	0.001	0.016	0.031	0.273	0.347	
Scotchcast 8/HMX	22/393K	0.2500/0.2500	0.026	ND	0.008	0.038	0.137	0.171	0.397	

continued.....

Table 1 - continued

Material Evaluated	Aging Environment (hr at temp.)	Weight (g)	Decomposition Products (cm ³ at STP)						
			N	O ₂ /Ar	CO	NO	CO ₂	N ₂ O	Total
Scotchcast 8/XO211	22/393K	0.2500/0.2500	0.081	ND	<0.001	0.010	0.015	0.026	0.133
Scotchcast 8/XO211	22/393K	0.2500/0.2500	0.010	ND	0.007	0.004	0.112	0.013	0.148
Sheldahl GT130	22/353K	0.2500/0.2500	0.003	ND	<0.001	ND	0.002	0.001	0.007
Sheldahl GT130	22/353K	0.2500/0.2500	ND	ND	<0.001	ND	0.002	0.001	0.004
Sheldahl GT130	22/393K	0.2500/0.2500	ND	ND	0.010	ND	0.012	0.001	0.023
Sheldahl GT130	22/393K	0.2500/0.2500	ND	ND	0.010	ND	0.012	0.001	0.023
Sheldahl GT130/PBX9407	22/353K	0.2500/0.2500	0.009	ND	<0.001	0.002	0.004	0.034	0.050
Sheldahl GT130/PBX9407	22/353K	0.2500/0.2500	0.006	ND	<0.001	0.001	0.003	0.027	0.038
Sheldahl GT130/PBX9407	22/373K	0.2500/0.2500	0.222	ND	0.003	0.029	0.043	0.390	0.687
Sheldahl GT130/PBX9407	22/373K	0.2500/0.2500	0.231	ND	0.003	0.032	0.045	0.411	0.722
Sheldahl GT130/PBX9407	22/393K	0.2500/0.2500	0.888	ND	0.022	0.118	0.340	1.734	3.102
Sheldahl GT130/PBX9407	22/393K	0.2500/0.2500	0.815	ND	0.020	0.112	0.313	1.604	2.874
XO211	22/393K	0.2500/0.2500	<0.001	ND	0.001	0.005	<0.001	0.005	0.013
XO211	22/393K	0.2500/0.2500	0.008	ND	ND	ND	<0.001	0.005	0.014
XO211/EN-7	22/393K	0.2500/0.2500	0.002	ND	0.002	0.005	0.080	0.010	0.099
XO211/EN-7	22/393K	0.2500/0.2500	0.002	ND	0.002	0.005	0.085	0.010	0.104
XO211/Scotchcast 8	22/393K	0.2500/0.2500	0.081	ND	<0.001	0.010	0.015	0.026	0.132
XO211/Scotchcast 8	22/393K	0.2500/0.2500	0.010	ND	0.007	0.004	0.112	0.013	0.148
XO211/Epon-Versamid	22/393K	0.2500/0.2500	0.006	ND	0.001	0.014	0.006	0.060	0.087
Extex	48/373K	0.2500	0.003	ND	<0.001	0.001	0.003	<0.001	0.009
Extex	24/333K then 48/373K	0.2500	0.002	ND	0.001	0.001	0.002	<0.001	0.007
Extex/Dow 3140	24/333K then 48/373K	0.2500/0.2500	0.003	ND	0.001	ND	0.002	0.004	0.010
Extex/Dow 3140	24/333K then 48/373K	0.2500/0.2500	0.008	ND	0.001	ND	0.003	0.003	0.015
Dow 3140	24/333K then 48/373K	0.2500	0.002	ND	<0.001	ND	<0.001	ND	0.004



Appendix A

Definition of explosive acronyms

<u>Acronym</u>	<u>Description</u>
EXTEx	XTX-8003; 80% PETN; 20% SYLGARD silicone rubber
HMX	1,3,5,7-tetranitro-1,3,5,7-tetrazacylooctane
HNAB	2,2',4,4',6,6'-hexanitroazobenzene
HNS	2,2',4,4',6,6'-hexanitrostilbene
LX10-1	HMX, 94.5%; Viton A, 5.5%
PBX-9407	RDX, 94%; Exon 461, 6%
PETN	Pentaerythritoltetranitrate
RDX	1,3,5-trinitro-1,3,5-triazacylohexane
X0211	HMX, 90%; Viton A, 10%

Appendix B

Description of inert materials acronyms

Adiprene-MOCA	Urethane Adhesive	DuPont
AF111	Modified Epoxy Film Adhesive	3M
Apocure L100/602 ^a	Urethane Adhesive	DuPont/M&T Chem.
EN-7	Urethane Adhesive	Conap Co.
EN-8	Urethane Adhesive	Conap Co.
Epon-Versamid	Epoxy Adhesive	Shell/General Mills
EpoxyLite 8822	Epoxy Adhesive	EpoxyLite Corp.
FM1000	Nylon Epoxy Film Adhesive	American Cyanamid
Green Glue ^b	Epoxy Adhesive	Special T Formulation
Halthane 73-18	Urethane Adhesive	Bendix Kansas City
3M-75	Elastomer Spray Adhesive	3M
87-MDIPA	Urethane Adhesive	Bendix Kansas City
Pyralux	Modified Acrylic Film Adhesive	DuPont
Scotchcast 8	Epoxy Adhesive	3M
Sheldahl GT130	Nylon Epoxy Film Adhesive	Sheldahl Co.
Dow 3140	Silicon Rubber Encapsulant	Dow

^aAdiprene L100/Apocure 602

^bEpon 828, Versamid 140, triphenylphosphite, Cav-o-sil, Yellow and Blue Pigment.

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