DEFENSE LOGISTICS AGENCY
DEFENSE NATIONAL STOCKPILE CENTER
8725 JOHN J. KINGMAN ROAD, SUITE 3229
FT. BELVOIR, VIRGINIA 22060-6223

IN REPLY

REFER TO **DNSC-C2** **Oct. 14, 2004**

AMENDMENT NUMBER 008
TO
SOLICITATION OF OFFERS DLA-MANGANESE,
METALLURGICAL, CHEMICAL AND SYNTHETIC AND NATURAL DIOXIDE
BATTERY GRADES-002

The above referenced Solicitation is hereby amended to offer metallurgical, synthetic & natural dioxide battery grades of manganese for sale in FY 2005.

1. This modification supercedes all prior modification under this solicitation.

2. Reference to solicitation of offers, DLA-MANGANESE METALLURGICAL, CHEMICAL AND SYNTHETIC AND NATURAL DIOXIDE BATTERY GRADES 002 is hereby amended and should read DLA-MANGANESE, METALLURGICAL, SYNTHETIC & NATURAL DIOXIDE BATTERY GRADES-002.

. 3. Under Section A – Solicitation, Paragraph A.1 Introduction (SEP 02), delete Subparagraph a. and substitute it with the following:

a. The Defense Logistics Agency (DLA), Defense National Stockpile Center (DNSC), is soliciting offers for the sale of approximately:

20,174 SDT of Metauulrgical Grade Manganese Ore,
3,011 SDT of Synthetic Dioxide Battery Grade Manganese and
22,796 SDT of Natural Dioxide Battery Grade

Under DLA-MANGANESE, METALLURGICAL, SYNTHETIC & NATURAL DIOXIDE BATTERY GRADES-002, starting November 01, 2004. Offers may be submitted daily. Offers must be received at the address in Section B.2.a by 2:00 pm, local time, Ft. Belvoir, VA. In the event DNSC is closed at the time set, offers will be received at 2:00 pm, local time, Ft. Belvoir, VA on the next DNSC business day.

The Metallurgical Grade Manganese and Natural Dioxide Battery Grade offered for sale is stored outside in bulk piles. The Synthetic Dioxide Battery Grade Manganese is stored in 10 gallon fiber boards and 35 gallon steel drums.

4. Under Section I – Submittals, add the following:

   I.2.a, Item Offer Page – for Manganese, Metallurgical Grade (OCT 04).
   I.2.b, Item Offer Page – for Manganese, Natural Battery Grade (OCT 04)
   I.2.c, Item Offer Page - For Manganese, Synthetic Battery Grade (Oct 04)

5. Under Section J, add the following attachments:

   J.1.a, Analysis for Manganese, Metallurgical Grade (OCT 04)
   J.1.b, Analysis for Manganese, Natural Battery Grade (OCT 04)
   J.1.c, Analysis for Manganese, Synthetic Battery Grade (Oct 04)

6. Under Section J, add the following to J.3.b, Storage Location (AUG 04), copy attached.

7. Under Section J, add the following to J.4.a, Material Safety Data Sheet for Manganese Metallurgical, Synthetic and Natural Battery Grade, copy attached.

Offerors shall acknowledge receipt of this Amendment by signing in the space provided below. Failure to acknowledge receipt of this Amendment may result in an offeror being ineligible for award. Except as provided herein, all other terms and conditions of DLA-MANGANESE METALLURGICAL, CHEMICAL AND DIOXIDE, SYNTHETIC & NATURAL BATTERY GRADES-002 remain unchanged and in full force and effect. If additional information is needed on the sale of Manganese please contact Mr. Kenrick Sawh at (703) 767-5483 or e-mail address, kenrick.sawh@dla.mil.

NAME OF FIRM _____

ADDRESS _____

TELEPHONE _____

FACSIMILE and Email _____

COMPLETED By and TITLE_____

SIGNATURE and DATE_____

Manganese Metallurgical Grade

Item	Location	Pile	Type	Net weight (SDT)	Origin	Unit Price Per SDT	Quantity (SDT)	Total Offer Price
12	Point Pleasant, WV	A	Lumpy	18,153.39	Domestic	$		$
13	Point Pleasant, WV	B	Lumpy	1,795.62	Domestic	$		$
14	Point Pleasant, WV	C	Lumpy	2,234.44	Domestic	$		$
15	Point Pleasant, WV	D	Fines	2,876.20	Domestic	$		$
16	Point Pleasant, WV	11	Fines	1,899.35	Russia	$		$
18	Point Pleasant, WV	19	Lumpy	114.05	Domestic	$		$
20	Point Pleasant, WV	29	Lumpy	15.50	Peru	$		$
21	Point Pleasant, WV	36	Lumpy	1,790.50	Domestic	$		$
22	Point Pleasant, WV	38A	Lumpy	12.45	Domestic	$		$
25	Batesville, AR	1	Fines	7,797.50	Domestic	$		$
26	Batesville, AR	2	Fines	7,313.50	Domestic	$		$
47	Pueblo, CO	1	Lumpy	2,010.00	Domestic	$		$
48	Pueblo, CO	2A	Lumpy	110.00	Domestic	$		$
49	Pueblo, CO	2B	Lumpy	125.00	Domestic	$		$
50	Pueblo, CO	2C	Fines	809.00	Domestic	$		$
51	Pueblo, CO	2D	Fines	325.00	Domestic	$		$
52	Pueblo, CO	3	Nodules	712.00	Domestic	$		$
53	Pueblo, CO	4	Lumpy	339.00	Domestic	$		$
54	Pueblo, CO	5	Lumpy	416.00	Domestic	$		$
55	Schumaker, AR	3	Fines	2,030.50	Domestic	$		$
57	Tooele, UT	2	Fines	50.40	Domestic	$		$
58	Tooele, UT	3	Fines	49.28	Domestic	$		$
59	Tooele, UT	4	Fines	1,048.32	Domestic	$		$
60	Tooele, UT	5	Nodules	161.28	Domestic	$		$
61	Tooele, UT	6	Fines	77.28	Domestic	$		$
63	Tooele, UT	8	Fines	1,099.84	Domestic	$		$
64	Wenden, AZ	OB9	Lumpy	367,902.69	Domestic	$		$
	Total Offered:			**421,268.09**				

Manganese Natural Battery Grade

Item	Location	Pile	Grade	Net Weight (SDT)	Origin	Unit Price Per SDT	Quantity (SDT)	Total Offer Price
16	Ravenna, OH	11C	B	355.00	Domestic	$		$
18	Ravenna, OH	11E	B	394.42	Domestic	$		$
19	Ravenna, OH	11F	B	416.99	Domestic	$		$
20	Ravenna, OH	11G	B	494.00	Domestic	$		$
21	Ravenna, OH	11H	B	455.00	Domestic	$		$
22	Ravenna, OH	11I	B	291.13	Domestic	$		$
23	Ravenna, OH	11J	B	280.98	Domestic	$		$
24	Ravenna, OH	11K	B	543.00	Domestic	$		$
25	Ravenna, OH	11L	B	516.00	Domestic	$		$
26	Ravenna, OH	11M	B	319.93	Domestic	$		$
27	Ravenna, OH	11N	B	320.97	Domestic	$		$
28	Ravenna, OH	11O	B	333.94	Domestic	$		$
29	Ravenna, OH	11R	B	160.01	Domestic	$		$
30	Ravenna, OH	11T	B	372.99	Domestic	$		$
31	Warren, OH	1	B	17,540.00	Domestic	$		$
		Total:		**22,794.36**				

Manganese Synthetic Battery Grade

Item	Location	Contract #	Lot #	# of Drums	Net Weight (SDT)	Unit Price Per SDT	Quantity (SDT)	Total Offer Price
1	HAMMOND, IN	0104940	001	152	9.4120	$		$
2	HAMMOND, IN	NSP1850	001	92	39.3131	$		$
3	HAMMOND, IN	NSP1850	002	92	39.8575	$		$
4	HAMMOND, IN	0104940	007	488	30.1309	$		$
5	HAMMOND, IN	0107710	030	800	49.2350	$		$
6	HAMMOND, IN	0104940	043	80	4.9675	$		$
7	HAMMOND, IN	NSP1850	787	12	4.9225	$		$
8	HAMMOND, IN	NSP1850	788	12	4.8950	$		$
9	HAMMOND, IN	NSP1850	789	11	4.8950	$		$
10	HAMMOND, IN	NSP1850	790	12	4.9000	$		$
11	HAMMOND, IN	NSP1850	791	11	4.8900	$		$
12	HAMMOND, IN	NSP1850	792	12	4.9300	$		$
13	HAMMOND, IN	NSP1850	831	11	4.9250	$		$
14	HAMMOND, IN	NSP1850	832	12	4.9250	$		$
15	HAMMOND, IN	NSP1850	833	11	4.9250	$		$
16	HAMMOND, IN	NSP1850	834	11	4.9250	$		$
17	HAMMOND, IN	NSP1850	835	12	4.9250	$		$
18	HAMMOND, IN	NSP1850	836	11	4.9250	$		$
		Depot Total:		**1,842**	**231.8985**			

NOTE 1: HAMMOND, IN - ITEM NUMBERS 1 - 6 ARE STORED IN 10 GALLON FIBER BOARD DRUMS ON PALLETS

NOTE 2: HAMMOND, IN - EXCEPT AS INDICATED IN NOTE 1, ITEMS ARE STORED IN 55 GALLON DRUMS AND MATERIAL **IS** STORED ON PALLETS.

Manganese Synthetic Battery Grade

Item	Location	Contract #	Lot #	# of Drums	Net Weight (SDT)	Unit Price Per LB	Quantity (LBS)	Total Offer Price
19	WARREN, OH	0198600	005	59	28.47	$		$
20	WARREN, OH	0105550	007	63	3.46	$		$
21	WARREN, OH	0107710	008	800	49.28	$		$
22	WARREN, OH	0107710	011	800	49.22	$		$
23	WARREN, OH	0198270	013	110	46.34	$		$
24	WARREN, OH	0198270	014	110	46.25	$		$
25	WARREN, OH	0198270	015	110	46.25	$		$
26	WARREN, OH	0198270	016	110	46.25	$		$
27	WARREN, OH	0198270	017	110	46.24	$		$
28	WARREN, OH	0198270	018	110	45.76	$		$
29	WARREN, OH	0198270	019	110	45.81	$		$
30	WARREN, OH	0198270	020	110	45.82	$		$
31	WARREN, OH	0198270	021	110	45.76	$		$
32	WARREN, OH	0198270	022	110	45.80	$		$
33	WARREN, OH	0198270	024	110	45.79	$		$
34	WARREN, OH	0198270	027	110	45.81	$		$
35	WARREN, OH	0198270	046	110	45.64	$		$
36	WARREN, OH	0198270	047	110	45.68	$		$
37	WARREN, OH	0198270	049	110	45.72	$		$
38	WARREN, OH	0198270	050	110	45.67	$		$
39	WARREN, OH	0198270	054	110	45.55	$		$
40	WARREN, OH	0198270	055	110	45.90	$		$
41	WARREN, OH	0198270	057	110	46.00	$		$
42	WARREN, OH	0198270	058	110	45.97	$		$
			Sub Total:	3,922	1,048.44			

Manganese Synthetic Battery Grade

Item	Location	Contract #	Lot #	# of Drums	Net weight (SDT)	Unit Price Per LB	Quantity (LBS)	Total Offer Price
43	WARREN, OH	0198270	059	110	45.99	$		$
44	WARREN, OH	0198270	060	110	45.82	$		$
45	WARREN, OH	0198270	061	110	46.24	$		$
46	WARREN, OH	0198270	062	110	46.16	$		$
47	WARREN, OH	0198270	065	110	46.05	$		$
48	WARREN, OH	0198270	066	110	46.08	$		$
49	WARREN, OH	0198270	067	110	46.09	$		$
50	WARREN, OH	0198270	068	110	46.06	$		$
51	WARREN, OH	0198270	069	110	46.09	$		$
52	WARREN, OH	0198270	070	110	46.06	$		$
53	WARREN, OH	0198270	071	110	46.06	$		$
54	WARREN, OH	0198270	072	110	46.02	$		$
55	WARREN, OH	0198270	073	110	46.09	$		$
			Sub Total:	1,430	598.81			
			Depot Total:	5,352	1,647.25			

NOTE 1: WARREN, OH - ITEM NUMBERS 21 & 22 ARE STORED IN 10 GALLON FIBER BOARD DRUMS ON PALLETS

NOTE 2: WARREN, OH - ITEM NUMBERS 19 & 20, 35 & 36, 39-42 AND 43 & 44 ARE STORED IN 55 GALLON DRUMS AND MATERIAL **IS NOT** STORED ON PALLETS.

NOTE 3: WARREN, OH - ITEM NUMBERS 23-34 AND 45-55 ARE STORED IN 55 GALLON DRUMS, WHICH ARE CORD STACKED OUTSIDE, MATERIAL **IS NOT** ON PALLETS.

NOTE 4: WARREN, OH - ITEM NUMBERS 37 & 38 ARE STORED IN 55 GALLON DRUMS AND MATERIAL **IS** STORED ON PALLETS.

Manganese Synthetic Battery Grade

Item	Location	Contract #	Lot #	# of Drums	Net Weight (SDT)	Unit Price Per LB	Quantity (LBS)	Total Offer Price
56	NEW HAVEN, IN	0107710	032	800	49.1800	$		$
57	NEW HAVEN, IN	0107710	033	800	49.3000	$		$
58	NEW HAVEN, IN	0107710	034	800	49.2550	$		$
59	NEW HAVEN, IN	0107710	035	800	49.3150	$		$
60	NEW HAVEN, IN	0107710	036	800	49.3430	$		$
61	NEW HAVEN, IN	0107710	037	800	49.3900	$		$
62	NEW HAVEN, IN	0107710	039	800	49.4300	$		$
63	NEW HAVEN, IN	0107710	041	800	49.4155	$		$
64	NEW HAVEN, IN	0107710	042	800	49.4350	$		$
65	NEW HAVEN, IN	0107710	043	801	49.3700	$		$
66	NEW HAVEN, IN	0107710	045	800	49.4250	$		$
67	NEW HAVEN, IN	0107710	046	800	49.2931	$		$
68	NEW HAVEN, IN	0107710	047	800	49.5200	$		$
69	NEW HAVEN, IN	0107710	048	800	49.5400	$		$
70	NEW HAVEN, IN	0107710	049	800	49.5500	$		$
71	NEW HAVEN, IN	0107710	050	800	49.5300	$		$
72	NEW HAVEN, IN	0107710	051	800	49.4100	$		$
73	NEW HAVEN, IN	0107710	052	800	49.5400	$		$
74	NEW HAVEN, IN	0107710	053	800	49.3880	$		$
75	NEW HAVEN, IN	0107710	055	130	48.3312	$		$
76	NEW HAVEN, IN	0107710	056	130	48.3843	$		$
77	NEW HAVEN, IN	0107710	057	130	48.3258	$		$
78	NEW HAVEN, IN	0107710	058	130	48.3556	$		$
		Depot Total:		**15,721**	**1,132.0265**			
		Total Offered:		**22,915**	**3,011.1750**			

NOTE 1: NEW HAVEN, IN - ITEM NUMBERS 56-74 ARE STORED IN 10 GALLON FIBER BOARD DRUMS ON PALLETS

NOTE 2: NEW HAVEN, IN - ITEM NUMBERS 75-78 ARE STORED IN 55 GALLON DRUMS AND MATERIAL **IS** STORED ON PALLETS.

NOTE 3: NEW HAVEN, IN - ITEM NUMBER 79 IS STORED IN A BURLAP BAG.

NOTE 4: NEW HAVEN, IN - ITEM NUMBER 79 IS STORED IN A BURLAP BAG.

Manganese Metallurgical Grade

							SiO2+	CuPb+	% Thru
Item	Location	Pile	Type	Mn	Fe	P	Al203	Zn	20 Sieve
12	Point Pleasant, WV	A	Lumpy	32.20%	16.19%	0.19%	10.56%	0.24%	1.40%
13	Point Pleasant, WV	B	Lumpy	38.16%	9.08%	0.22%	10.13%	0.15%	3.01%
14	Point Pleasant, WV	C	Lumpy	33.80%	10.79%	0.40%	6.51%	0.03%	0.56%
15	Point Pleasant, WV	D	Fines	38.74%	10.97%	0.31%	9.31%	0.09%	3.82%
16	Point Pleasant, WV	11	Fines	49.33%	1.18%	0.16%	12.79%	0.03%	10.60%
18	Point Pleasant, WV	19	Lumpy	41.36%	7.37%	0.19%	14.12%	0.14%	3.73%
20	Point Pleasant, WV	29	Lumpy	43.21%	8.43%	0.04%	6.92%	0.01%	1.20%
21	Point Pleasant, WV	36	Lumpy	42.56%	9.99%	0.41%	7.35%	0.09%	3.16%
22	Point Pleasant, WV	38A	Lumpy	42.00%	9.50%	0.52%	14.33%	0.15%	
25	Batesville, AR	1	Fines	36.49%	13.67%	0.34%	11.43%		
26	Batesville, AR	2	Fines	26.10%	15.10%	1.18%	31.13%		
47	Pueblo, CO	1	Lumpy	42.12%	1.51%	0.04%	7.90%	0.04%	4.52%
48	Pueblo, CO	2A	Lumpy	48.74%	1.62%	0.04%	6.53%	0.07%	4.74%
49	Pueblo, CO	2B	Lumpy	49.68%	2.12%	0.09%	5.54%	0.15%	2.69%
50	Pueblo, CO	2C	Fines	42.83%	2.20%	0.02%	6.20%		
51	Pueblo, CO	2D	Fines	44.23%	1.82%	0.03%	7.72%	0.02%	7.50%
52	Pueblo, CO	3	Nodules	43.06%	2.97%	0.04%	12.91%	0.13%	0.57%
53	Pueblo, CO	4	Lumpy	47.23%	1.90%	0.04%	13.64%	0.19%	
54	Pueblo, CO	5	Lumpy	43.64%	2.78%	0.02%	14.48%	0.51%	
55	Schumaker, AR	3	Fines	41.00%	5.61%	0.06%	14.03%	0.44%	
57	Tooele, UT	2	Fines	40.00%	0.86%	0.05%	17.00%	0.03%	
58	Tooele, UT	3	Fines	43.00%	3.22%	0.07%	75.00%	0.04%	
59	Tooele, UT	4	Fines	45.80%	1.11%	0.03%	17.51%	0.41%	
60	Tooele, UT	5	Nodules	43.80%	2.96%	0.04%	14.16%	0.14%	
61	Tooele, UT	6	Fines	35.20%	0.90%	0.05%	6.05%		
63	Tooele, UT	8	Fines	33.60%	2.02%	0.04%	44.29%	0.03%	
64	Wenden, AZ	OB9	Lumpy	23.56%	4.00%	0.20%	40.00%	0.90%	

Manganese Natural Battery Grade

Item	Location	Pile	Origin	MN02	MN	FE	PB	INSOL	SI	AL	MAGFE	AS	CU	P	ZN
16	Ravenna, OH	11C	Domestic	68.86%		1.50%	0.31%								
18	Ravenna, OH	11E	Domestic	69.25%		1.62%	0.35%								
19	Ravenna, OH	11F	Domestic	69.26%		1.65%	0.45%								
20	Ravenna, OH	11G	Domestic	68.93%		1.59%	0.38%								
21	Ravenna, OH	11H	Domestic	68.57%		1.29%	0.17%								
22	Ravenna, OH	11I	Domestic	69.06%		1.62%	0.41%								
23	Ravenna, OH	11J	Domestic	68.45%		1.46%	0.36%								
24	Ravenna, OH	11K	Domestic	68.57%		1.26%	0.21%								
25	Ravenna, OH	11L	Domestic	68.10%		1.22%	0.26%								
26	Ravenna, OH	11M	Domestic	69.35%		1.69%	0.39%								
27	Ravenna, OH	11N	Domestic	69.27%		1.61%	0.18%								
28	Ravenna, OH	11O	Domestic	69.24%		1.63%	0.25%								
29	Ravenna, OH	11R	Domestic	69.41%		1.65%	0.45%								
30	Ravenna, OH	11T	Domestic	68.99%		1.52%	0.41%								
31	Warren, OH	1	Domestic	60.84%	41.70%	1.81%	0.31%	19.76%	18.16%	1.32%	0.06%	0.06%	0.03%	0.08%	0.93%

Manganese Synthetic Battery Grade

Item	Location	Contract #	Lot #	# of Drums	Net Weight (SDT)	Mn	O2	Fe	Pb	Insolubles	Total Heavy Metals	Total Alkali Metals	Total Alkali Earth Metals
1	HAMMOND, IN	0104940	001	152	9.41		87.10%	0.130%	0.020%	2.500%	0.030%	0.500%	
2	HAMMOND, IN	NSP1850	001	92	39.31	56.18%	88.90%	0.200%	0.060%		0.300%		0.500%
3	HAMMOND, IN	NSP1850	002	92	39.85	55.92%	88.50%	0.200%	0.050%		0.300%		0.500%
4	HAMMOND, IN	0104940	007	488	30.13	59.50%	88.90%	0.070%	0.020%	1.980%	0.030%	0.500%	0.500%
5	HAMMOND, IN	0107710	030	800	49.23	60.92%	88.28%	0.100%	0.020%	2.690%	0.030%	0.700%	0.350%
6	HAMMOND, IN	0104940	043	80	4.96								
7	HAMMOND, IN	NSP1850	787	12	4.92	56.80%	88.50%	0.210%	0.020%				0.670%
8	HAMMOND, IN	NSP1850	788	12	4.89	57.70%	88.60%	0.130%	0.020%				0.670%
9	HAMMOND, IN	NSP1850	789	11	4.89	58.30%	88.70%	0.150%	0.060%				0.780%
10	HAMMOND, IN	NSP1850	790	12	4.90	57.00%	88.50%	0.140%	0.020%				0.770%
11	HAMMOND, IN	NSP1850	791	11	4.89	58.10%	88.80%	0.100%	0.020%				0.750%
12	HAMMOND, IN	NSP1850	792	12	4.93	58.20%	87.80%	0.120%	0.020%				0.750%
13	HAMMOND, IN	NSP1850	831	11	4.92		90.30%	0.080%	0.020%		0.030%		0.500%
14	HAMMOND, IN	NSP1850	832	12	4.92	59.60%	90.30%	0.080%	0.020%		0.030%		0.500%
15	HAMMOND, IN	NSP1850	833	11	4.92	59.60%	90.30%	0.080%	0.020%		0.030%		0.500%
16	HAMMOND, IN	NSP1850	834	11	4.92	59.60%	90.30%	0.080%	0.020%		0.030%		0.500%
17	HAMMOND, IN	NSP1850	835	12	4.92	59.60%	90.30%	0.080%	0.020%		0.030%		0.500%
18	HAMMOND, IN	NSP1850	836	11	4.92	59.60%	90.30%	0.080%	0.020%		0.030%		0.500%

Manganese Synthetic Battery Grade

Item	Location	Contract #	Lot #	# of Drums	Net Weight (SDT)	Mn	O2	Fe	Pb	Insolubles	Total Heavy Metals	Total Alkali Metals	Total Alkali Earth Metals
19	WARREN, OH	0198600	005	59	28.47	59.50%	87.00%	0.100%	0.020%	2.140%	0.030%	0.300%	0.150%
20	WARREN, OH	0105550	007	63	3.46	59.30%	88.80%	0.080%	0.060%	0.960%	0.030%	0.500%	0.500%
21	WARREN, OH	0107710	8-1713	800	49.28	56.70%	86.70%	0.100%	0.020%	1.170%	0.020%	0.500%	0.500%
22	WARREN, OH	0107710	11-1731	800	49.22	57.20%	87.80%	0.200%	0.020%	1.110%	0.020%	0.500%	0.500%
23	WARREN, OH	0198270	013	110	46.34	59.70%	91.10%	0.070%	0.010%	1.170%	0.011%	0.320%	0.480%
24	WARREN, OH	0198270	014	110	46.25	60.20%	91.70%	0.070%	0.010%	0.850%	0.009%	0.320%	0.420%
25	WARREN, OH	0198270	015	110	46.25	59.90%	92.00%	0.100%	0.010%	1.420%	0.009%	0.320%	0.450%
26	WARREN, OH	0198270	016	110	46.25	60.20%	91.80%	0.070%	0.010%	1.000%	0.008%	0.320%	0.280%
27	WARREN, OH	0198270	017	110	46.24	59.70%	91.40%	0.080%	0.010%	1.250%	0.011%	0.330%	0.410%
28	WARREN, OH	0198270	018	110	45.76	59.60%	91.50%	0.090%	0.010%	1.060%	0.009%	0.320%	0.450%
29	WARREN, OH	0198270	019	110	45.81	60.00%	91.30%	0.080%	0.010%	1.180%	0.007%	0.320%	0.430%
30	WARREN, OH	0198270	020	110	45.82	60.20%	91.60%	0.060%	0.010%	0.860%	0.009%	0.320%	0.470%
31	WARREN, OH	0198270	021	110	45.76	60.40%	91.40%	0.070%	0.010%	1.150%	0.010%	0.320%	0.480%
32	WARREN, OH	0198270	022	110	45.80	60.60%	91.70%	0.080%	0.010%	1.060%	0.010%	0.320%	0.460%
33	WARREN, OH	0198270	024	110	45.79	59.70%	91.20%	0.110%	0.010%	1.140%	0.013%	0.320%	0.470%
34	WARREN, OH	0198270	027	110	45.81	59.50%	91.00%	0.130%	0.010%	0.920%	0.009%	0.320%	0.410%
35	WARREN, OH	0198270	046	110	45.64	59.40%	91.40%	0.080%	0.010%	1.170%	0.010%	0.210%	0.260%
36	WARREN, OH	0198270	047	110	45.68	59.90%	91.10%	0.070%	0.010%	1.430%	0.010%	0.210%	0.250%
37	WARREN, OH	0198270	049	110	45.72	59.70%	91.50%	0.100%	0.010%	1.090%	0.010%	0.220%	0.270%
38	WARREN, OH	0198270	050	110	45.67	59.50%	91.00%	0.100%	0.010%	1.800%	0.005%	0.220%	0.320%
39	WARREN, OH	0198270	054	110	45.55	60.50%	91.10%	0.100%	0.010%	1.370%	0.010%	0.210%	0.380%
40	WARREN, OH	0198270	055	110	45.90	60.20%	91.90%	0.060%		1.180%	0.001%	0.210%	0.160%
41	WARREN, OH	0198270	057	110	46.00	60.20%	91.60%	0.060%		1.280%	0.010%	0.210%	0.460%
42	WARREN, OH	0198270	058	110	45.97	60.70%	91.90%	0.060%		0.780%	0.011%	0.210%	0.470%

Manganese Synthetic Battery Grade

Item	Location	Contract #	Lot #	# of Drums	Net Weight (SDT)	Mn	O2	Fe	Pb	Insolubles	Total Heavy Metals	Total Alkali Metals	Total Alkali Earth Metals
43	WARREN, OH	0198270	059	110	45.99	59.90%	92.20%	0.060%		0.910%	0.013%	0.210%	0.380%
44	WARREN, OH	0198270	060	110	45.82	58.80%	91.10%	0.060%		1.020%	0.014%	0.210%	0.470%
45	WARREN, OH	0198270	061	110	46.24	59.90%	91.40%	0.050%	0.010%	1.120%	0.020%	0.210%	0.410%
46	WARREN, OH	0198270	062	110	46.16	60.10%	91.10%	0.070%	0.010%	1.450%	0.020%	0.210%	0.440%
47	WARREN, OH	0198270	065	110	46.05	60.30%	92.40%	0.060%	0.010%	0.830%	0.021%	0.120%	0.380%
48	WARREN, OH	0198270	066	110	46.08	60.00%	92.30%	0.060%	0.010%	1.100%	0.030%	0.110%	0.420%
49	WARREN, OH	0198270	067	110	46.09	60.00%	91.50%	0.060%	0.010%	1.080%	0.030%	0.200%	0.400%
50	WARREN, OH	0198270	068	110	46.06	60.00%	91.98%	0.060%	0.010%	1.110%	0.020%	0.220%	0.480%
51	WARREN, OH	0198270	069	110	46.09	59.90%	91.20%	0.060%	0.010%	1.000%	0.016%	0.120%	0.440%
52	WARREN, OH	0198270	070	110	46.06	60.50%	92.20%	0.060%	0.010%	0.950%	0.020%	0.120%	0.410%
53	WARREN, OH	0198270	071	110	46.06	59.70%	92.20%	0.060%	0.010%	1.020%	0.020%	0.120%	0.390%
54	WARREN, OH	0198270	072	110	46.02	60.30%	91.80%	0.040%	0.010%	1.200%	0.015%	0.110%	0.410%
55	WARREN, OH	0198270	073	110	46.09	60.30%	91.60%	0.050%	0.010%	0.980%	0.012%	0.110%	0.420%

Manganese Synthetic Battery Grade

Item	Location	Contract #	Lot #	# of Drums	Net Weight (SDT)	Mn	O2	Fe	Pb	Insolubles	Total Heavy Metals	Total Alkali Metals	Total Alkali Earth Metals
56	NEW HAVEN, IN	0107710	032	800	49.18	59.25%	88.60%	0.200%	0.020%	2.230%	0.020%	0.400%	0.460%
57	NEW HAVEN, IN	0107710	033	800	49.30	59.57%	88.60%	0.200%	0.020%	1.530%	0.020%	0.500%	0.460%
58	NEW HAVEN, IN	0107710	034	800	49.25	59.00%	88.24%	0.200%	0.020%	1.660%	0.010%	0.400%	0.460%
59	NEW HAVEN, IN	0107710	035	800	49.31	59.21%	88.38%	0.200%	0.020%	1.910%	0.020%	0.500%	0.350%
60	NEW HAVEN, IN	0107710	036	800	49.34	58.94%	88.40%	0.100%	0.020%	1.950%	0.020%	0.500%	0.360%
61	NEW HAVEN, IN	0107710	037	800	49.39	58.65%	87.70%	0.100%	0.020%	2.570%	0.020%	0.500%	0.360%
62	NEW HAVEN, IN	0107710	039	800	49.43	58.87%	88.28%	0.080%	0.020%	1.510%	0.010%	0.600%	0.350%
63	NEW HAVEN, IN	0107710	041	800	49.41	59.27%	88.25%	0.100%	0.020%	2.090%	0.020%	0.050%	0.360%
64	NEW HAVEN, IN	0107710	042	800	49.43	58.60%	87.90%	0.100%	0.020%	2.730%	0.020%	0.400%	0.460%
65	NEW HAVEN, IN	0107710	043	801	49.37	58.76%	88.49%	0.100%	0.020%	2.450%	0.010%	0.600%	0.360%
66	NEW HAVEN, IN	0107710	045	800	49.42	58.98%	87.07%	0.050%	0.020%	2.670%	0.020%	0.200%	0.350%
67	NEW HAVEN, IN	0107710	046	800	49.29	58.84%	86.91%	0.080%	0.020%	3.170%	0.020%	0.800%	0.350%
68	NEW HAVEN, IN	0107710	047	800	49.52	59.46%	88.50%	0.040%	0.020%	2.140%	0.010%	0.500%	0.340%
69	NEW HAVEN, IN	0107710	048	800	49.54	58.87%	87.94%	0.030%	0.020%	2.510%	0.010%	0.500%	0.340%
70	NEW HAVEN, IN	0107710	049	800	49.55	58.45%	87.89%	0.040%	0.020%	1.970%	0.010%	0.600%	0.350%
71	NEW HAVEN, IN	0107710	050	800	49.53	58.59%	87.80%	0.050%	0.020%	1.780%	0.010%	0.600%	0.350%
72	NEW HAVEN, IN	0107710	051	800	49.41	58.49%	87.68%	0.030%	0.020%	2.620%	0.010%	0.600%	0.250%
73	NEW HAVEN, IN	0107710	052	800	49.54	58.08%	87.97%	0.030%	0.020%	2.220%	0.010%	0.600%	0.350%
74	NEW HAVEN, IN	0107710	053	800	49.38	60.20%	90.20%	0.050%	0.010%	1.720%	0.014%	0.220%	0.420%
75	NEW HAVEN, IN	0107710	055	130	48.33	59.10%	88.70%	0.080%	0.010%	2.750%	0.012%	0.240%	0.420%
76	NEW HAVEN, IN	0107710	056	130	48.38	59.00%	89.10%	0.070%	0.010%	2.580%	0.014%	0.230%	0.400%
77	NEW HAVEN, IN	0107710	057	130	48.32	58.80%	88.80%	0.070%	0.010%	1.650%	0.010%	0.240%	0.440%
78	NEW HAVEN, IN	0107710	058	130	48.35	59.00%	88.80%	0.080%	0.010%	1.920%	0.012%	0.240%	0.410%

DLA – MANGANESE ORES
J.3.b STORAGE LOCATIONS (OCT 04)

Location	Operational Status	Days	Hours	Accessibility	Responsible Depot	Depot Manager
Point Pleasant, WV	Staffed	Monday - Friday	0700 - 1430	Truck / Rail	Point Pleasant, WV	David Taylor Phone: (304) 675-3410
Batesville, AR	Un-Staffed	Tuesday - Thursday - -	0730 - 1500 - -	Truck /	Hammond, IN	John Olszewski Phone: (219) 937-5284 Ext 104
Note 1: Prior arrangements required before material can be shipped						
Batesville, AR	Un-Staffed	Monday - Friday	0730 - 1500	Truck /	Hammond, IN	John Olszewski Phone: (219) 937-5383 x104 .
Note 1: Prior arrangements must be made before shipping.						**Storage Specialist** Nikki Horther Lois Huddlestun Phone: (260) 749-9544
Pueblo, CO	Un-Staffed	Monday - Friday	0700 - 1500	Truck / Rail	Hammond, IN	John Olszewski Phone: (219) 937-5383 x104 .
Note 1: Prior arrangements must be made before shipping. **Note 2:** This location is a secure site and D.O.D security regulations apply.						**Storage Specialist** Wilfred Clavell Gary Porter Phone: (801) 825-2749
Shumaker, AR	Un-Staffed	Monday - Friday	0730 - 1500	Truck /	Hammond, IN	John Olszewski Phone: (219) 937-5383 x104 .
Note 1: Prior arrangements must be made before shipping.						**Storage Specialist** Nikki Horther Lois Huddlestun Phone: (260) 749-9544

DLA – MANGANESE ORES
J.3.b STORAGE LOCATIONS (OCT 04)

Location	Operational Status	Days	Hours	Accessibility	Responsible Depot	Depot Manager
Tooele, UT	Un-Staffed	Monday - Friday	0700 - 1500	Truck / Rail	Hammond, IN	John Olszewski Phone: (219) 937-5383 x104 . **Storage Specialist** Wilfred Clavell Gary Porter Phone: (801) 825-2749
Note 1: Prior arrangements must be made before shipping. **Note 2:** This location is a secure site and D.O.D security regulations apply.						
Wenden, AZ	Un-Staffed	Monday - Friday	0700 - 1500	Truck /	Hammond, IN	John Olszewski Phone: (219) 937-5383 x104 . **Storage Specialist** Wilfred Clavell Gary Porter Phone: (801) 825-2749
Note 1: Prior arrangements must be made before shipping.						
Ravenna, OH	Un-Staffed	Monday - Friday	0800 - 1430	Truck /	Warren, OH	John Pittano Phone: (330) 652-1456 . **Storage Specialist** Andrew Johnson Leon Morrison Sally Tryon Phone: (330) 652-1456
Note 1: Prior arrangements must be made before shipping. **Note 2:** This location is a secure site and D.O.D security regulations apply.						
Warren, OH	Staffed	Monday - Friday	0730 - 1430	Truck / Rail	Warren, OH	John Pittano Phone: (330) 652-1456 . **Storage Specialist** Andrew Johnson Leon Morrison Sally Tryon Phone: (330) 652-1456
Note 1: Prior arrangements must be made before shipping. **Note 2:** Truck & Rail Scale is available (Weight Capacity - 300,000 Lbs)						

DLA – MANGANESE ORES
J.3.b STORAGE LOCATIONS (OCT 04)

Location	Operational Status	Days	Hours	Accessibility	Responsible Depot	Depot Manager
Hammond, IN	Staffed	Monday - Friday	0730 - 1530	Truck / Rail	Hammond, IN	John Olszewski Phone: (219) 937-5383 x104 . **Storage Specialist** Eric Deal Phone: (219) 937-5383 x109 Frank Falgier Phone: (219) 937-5383 x110
Note 1: Prior arrangements must be made before shipping. **Note 2:** Truck & Rail Scale is available (Weight Capacity - 400,000 Lbs)						
New Haven, IN	Staffed	Monday - Thursday Friday -	0730 - 1500 0730 - 1430	Truck / Rail	Hammond, IN	John Olszewski Phone: (219) 937-5383 x104 . **Storage Specialist** Nikki Horther Lois Huddlestun Phone: (260) 749-9544
Note 1: Prior arrangements must be made before shipping. **Note 2:** Truck & Rail Scale is available (Weight Capacity - 360,000 Lbs)						

Point of Contact

Defense Logistics Agency
Defense National Stockpile Center
Attn: Robert F Clark
8725 John J Kingman Road, Suite 3229
Fort Belvoir, VA 22060-6223

Telephone Number: (703) 767-7614
Facsimile Number: (703) 767-7608

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

DEFENSE LOGISTICS AGENCY

DEFENSE NATIONAL STOCKPILE CENTER

8725 JOHN J. KINGMAN ROAD

SUITE 3339

FORT BELVOIR, VA 22060-6223

EMERGENCY TELEPHONE NUMBER:

1-800-424-9300 (NORTH AMERICA)

1-703-527-3887 (INTERNATIONAL)

SUBSTANCE: MANGANESE, METALLURGICAL

TRADE NAMES/SYNONYMS:
DLA13623

CREATION DATE: Jul 01 1992
REVISION DATE: Jun 17 2004

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: MANGANESE
CAS NUMBER: 7439-96-5
EC NUMBER (EINECS): 231-105-1
PERCENTAGE: >48.00

COMPONENT: IRON
CAS NUMBER: 7439-89-6
EC NUMBER (EINECS): 231-096-4
PERCENTAGE: <4.00

COMPONENT: ALUMINUM OXIDE
CAS NUMBER: 1344-28-1
EC NUMBER (EINECS): 215-691-6
PERCENTAGE: <15.00

COMPONENT: SILICON DIOXIDE
CAS NUMBER: 7631-86-9

EC NUMBER (EINECS): 231-545-4
PERCENTAGE: <9.00

COMPONENT: LEAD
CAS NUMBER: 7439-92-1
EC NUMBER (EINECS): 231-100-4
PERCENTAGE: <0.20

COMPONENT: PHOSPHORUS, WHITE
CAS NUMBER: 7723-14-0
EC NUMBER (EINECS): 231-768-7
PERCENTAGE: <0.05

COMPONENT: ARSENIC
CAS NUMBER: 7440-38-2
EC NUMBER (EINECS): 231-148-6
PERCENTAGE: <0.05

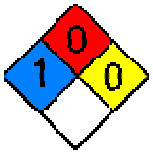
COMPONENT: COPPER
CAS NUMBER: 7440-50-8
EC NUMBER (EINECS): 231-159-6
PERCENTAGE: <0.20

COMPONENT: CHROMIUM
CAS NUMBER: 7440-47-3
EC NUMBER (EINECS): 231-157-5
PERCENTAGE: <0.30

COMPONENT: ZINC
CAS NUMBER: 7440-66-6
EC NUMBER (EINECS): 231-175-3
PERCENTAGE: <0.20

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=0 REACTIVITY=0



EMERGENCY OVERVIEW:
PHYSICAL DESCRIPTION: Reddish-gray or silvery, brittle, metallic solid
MAJOR HEALTH HAZARDS: nerve damage, cancer
PHYSICAL HAZARDS: Negligible fire and explosion hazard in bulk form. Dust/air mixtures may ignite or explode.

POTENTIAL HEALTH EFFECTS:
INHALATION:

SHORT TERM EXPOSURE: irritation, changes in body temperature, metal fume fever, nausea, vomiting, diarrhea, chest pain, difficulty breathing, headache
LONG TERM EXPOSURE: irritation, loss of appetite, weight loss, chest pain, difficulty breathing, disorientation, difficulty speaking, sleep disturbances, emotional disturbances, hallucinations, mood swings, tremors, muscle cramps, loss of coordination, hearing loss, visual disturbances, lung congestion, lung damage, blood disorders, kidney damage, liver damage, nerve damage, cancer
SKIN CONTACT:
SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: irritation, skin disorders
EYE CONTACT:
SHORT TERM EXPOSURE: irritation, eye damage
LONG TERM EXPOSURE: irritation, eye damage
INGESTION:
SHORT TERM EXPOSURE: irritation, nausea, vomiting, diarrhea
LONG TERM EXPOSURE: drowsiness

CARCINOGEN STATUS:
OSHA: No
NTP: Yes
IARC: Yes

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If a large amount is swallowed, get medical attention.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Negligible fire and explosion hazard in bulk form. Dust/air mixtures may ignite or explode.

EXTINGUISHING MEDIA: dolomite, dry powder for metal fires, dry sand, graphite, soda ash, sodium chloride

FIRE FIGHTING: Move container from fire area if it can be done without risk. Cool

containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Use extinguishing agents appropriate for surrounding fire. Avoid inhalation of material or combustion by-products.

6. ACCIDENTAL RELEASE MEASURES

WATER RELEASE:
Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

OCCUPATIONAL RELEASE:
Collect spilled material in appropriate container for disposal. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. See original container for storage recommendations. Keep separated from incompatible substances.

HANDLING: Use methods to minimize dust.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
MANGANESE, METALLURGICAL:
If an employee is exposed to lead for more than 8 hours in any work day, the permissible exposure limit, as a time weighted average (TWA) for that day, shall be reduced according to the following formula: Maximum permissible limit (in ug/m3) = 400 divided by hours worked in the day.

MANGANESE AND COMPOUNDS (as Mn):
5 mg/m3 OSHA ceiling (metal) (fume) (compounds)
1 mg/m3 OSHA TWA (particulate) (vacated by 58 FR 35338, June 30, 1993)
3 mg/m3 OSHA STEL (particulate) (vacated by 58 FR 35338, June 30, 1993)
0.2 mg/m3 ACGIH TWA (metal and inorganic compounds)
1 mg/m3 NIOSH recommended TWA 10 hour(s) (metal) (fume) (compounds)

3 mg/m3 NIOSH recommended STEL (metal) (fume) (compounds)
0.5 mg/m3 DFG MAK (peak limitation category - I, with excursion factor of 1) (inhalable fraction) (metal and inorganic compounds)
1 mg/m3 UK OES TWA (metal) (fume) (Chemical Hazard Alert Notice issued)
5 mg/m3 UK OES TWA (compounds) (Chemical Hazard Alert Notice issued)
3 mg/m3 UK OES STEL (metal) (fume) (Chemical Hazard Alert Notice issued)
0.5 mg/m3 UK MEL TWA (metal and inorganic compounds)

MEASUREMENT METHOD: Particulate filter; Acid; Inductively coupled plasma; NIOSH IV # 7300, Elements

IRON OXIDE DUST AND FUME (as Fe):
10 mg/m3 OSHA TWA
5 mg/m3 ACGIH TWA
5 mg/m3 NIOSH recommended TWA 10 hour(s) (total particulate)
1.5 mg/m3 DFG MAK (respirable dust fraction)
5 mg/m3 UK OES TWA
10 mg/m3 UK OES STEL

MEASUREMENT METHOD: Particulate filter; Acid; Inductively coupled plasma; NIOSH IV # 7300, Elements

ALUMINUM OXIDE (ALUMINA):
5 mg/m3 OSHA TWA (respirable dust fraction)
15 mg/m3 OSHA TWA (total dust)
10 mg/m3 OSHA TWA (total particulate) (vacated by 58 FR 35338, June 30, 1993)
10 mg/m3 ACGIH TWA
1.5 mg/m3 DFG MAK (respirable fraction) (peak limitation category - II, with excursion factor of 8) (fume)
0.25 fibers/cc AGS TRK (fibrous forms)
10 mg/m3 UK OES TWA (total inhalable dust)
4 mg/m3 UK OES TWA (respirable dust)

MEASUREMENT METHOD: Particulate filter; Gravimetric; NIOSH IV # 0500, Nuisance Dust (total), # 0600 (respirable)

SILICON DIOXIDE, AMORPHOUS (SILICA, AMORPHOUS):
20 mppcf OSHA TWA (
OSHA TWA (
10 mg/m3 ACGIH TWA (inhalable fraction) (no asbestos and
3 mg/m3 ACGIH TWA (respirable fraction) (no asbestos and
6 mg/m3 NIOSH recommended TWA 10 hour(s)
4 mg/m3 DFG MAK (inhalable dust fraction)
6 mg/m3 UK OES TWA (total inhalable dust)
2.4 mg/m3 UK OES TWA (respirable dust)

MEASUREMENT METHOD: Particulate filter; Low-temperature ashing; X-ray diffraction spectrometry; NIOSH IV # 7501

LEAD, INORGANIC FUMES AND DUST (as Pb):
50 ug/m3 OSHA TWA 8 hour(s)
30 ug/m3 OSHA action level 8 hour(s)
0.05 mg/m3 ACGIH TWA
0.100 mg/m3 NIOSH recommended TWA 10 hour(s)
0.1 mg/m3 DFG MAK (peak limitation category - II, with excursion factor of 8) (inhalable fraction)

MEASUREMENT METHOD: Particulate filter; Nitric acid/Hydrogen peroxide; Atomic absorption spectrometry; NIOSH III # 7082, ALSO # 7105

VENTILATION: Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use.
Any dust, mist, and fume respirator.
Any air-purifying respirator with a high-efficiency particulate filter.
Any powered, air-purifying respirator with a dust, mist, and fume filter.
Any powered, air-purifying respirator with a high-efficiency particulate filter.
For Unknown Concentrations or Immediately Dangerous to Life or Health -
Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.
Any self-contained breathing apparatus with a full facepiece.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DESCRIPTION: Reddish-gray or silvery, brittle, metallic solid
BOILING POINT: Not applicable
MELTING POINT: Not available
VAPOR PRESSURE: Not applicable
VAPOR DENSITY: Not applicable
SPECIFIC GRAVITY: Not available
WATER SOLUBILITY: insoluble

PH: Not applicable
VOLATILITY: Not applicable
ODOR THRESHOLD: Not available
EVAPORATION RATE: Not applicable
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available
SOLVENT SOLUBILITY:
Soluble: mineral acids

10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: None reported.

INCOMPATIBILITIES: metals, oxidizing materials, halogens, peroxides, combustible materials, acids, bases, halo carbons, metal salts

MANGANESE:
ALUMINUM (DUST): Forms explosive mixtures with air.
AMMONIUM NITRATE (FUSED): Violent or explosive reaction.
BROMINE PENTAFLUORIDE: Violent reaction and possible ignition.
CARBON DIOXIDE: Ignites.
CHLORINE: Ignites.
FLUORINE: Incandescent reaction.
HYDROGEN PEROXIDE: Violent decomposition and/or ignition.
NITRIC ACID: Incandescent reaction and feeble explosion.
NITROGEN DIOXIDE: Ignition.
OXIDIZERS (STRONG): Fire and explosion hazard.
PHOSPHORUS: Incandescent reaction when heated.
SULFUR DIOXIDE: Burns brilliantly on warming.

IRON:
ACETALDEHYDE: Polymerizes readily.
AMMONIUM NITRATE: Violent or explosive reaction.
AMMONIUM PEROXODISULFATE: Violent reaction.
BROMINE PENTAFLUORIDE: Violent reaction and possible ignition.
CHLORIC ACID: Forms explosive compound.
CHLORINE (GAS): Ignites.
CHLORINE TRIFLUORIDE: Violent reaction and possible ignition.
CHLOROFORMAMIDINIUM NITRATE: Explosive ignition.
DINITROGEN TETRAOXIDE: Ignites.
FLUORINE: Ignites.
HYDROGEN PEROXIDE: Violent decomposition.
MINERAL ACIDS: Readily attacked.
NITROGEN DIOXIDE: Incandescent reaction.

NITRYL FLUORIDE: Incandesces when heated.
ORGANIC ACIDS: Attacked or dissolved.
PEROXYFORMIC ACID: Incompatible.
PHOSPHORUS: Incandesces when heated.
POLYSTYRENE BEADS: Possible static ignition.
POTASSIUM DICHROMATE: Ignites on contact.
POTASSIUM PERCHLORATE + MANGANESE DIOXIDE: Ignites.
SODIUM ACETYLIDE: Possible violent reaction.
SODIUM PEROXIDE: Ignites under friction @ 240 C.
SULFURIC ACID: Possible explosion hazard.

ALUMINUM OXIDE (ALUMINA):
CHLORINATED RUBBER (HOT): Incompatible.
CHLORINE TRIFLUORIDE: Violent reaction and possible ignition.
ETHYLENE OXIDE: May initiate explosive polymerization.
HALOCARBONS: Exothermic reaction above 200 C.
HALOCARBONS + METALS: Exothermic reaction at ambient temperatures.
OXYGEN DIFLUORIDE: Exothermic reaction.
SODIUM NITRATE: May form explosive mixture.
VINYL ACETATE: Possible vigorous reaction.

SILICON DIOXIDE:
CHLORINE TRIFLUORIDE: Fire hazard.
FLUORINE: Fire hazard.
HYDROCHLORIC ACID + WATER: Explosion hazard with gel form.
HYDROFLUORIC ACID: Dissolves, releasing silicon tetrafluoride.
HYDROGEN FLUORIDE: Incompatible.
HYDROGENATED VEGETABLE OILS: Incompatible.
MAGNESIUM (POWDERED): Explosion hazard on heating in the presence of moisture.
MANGANESE TRIFLUORIDE: May react violently on heating, releasing silicon tetrafluoride.
OXIDIZERS (STRONG): Fire and explosion hazard.
OXYGEN DIFLUORIDE: Explosion hazard under certain conditions and in the presence of moisture.
OZONE: Potential explosion hazard at low temperatures if organic material is present.
PHOSPHORIC ACID (CONCENTRATED): Attacks on heating.
SODIUM (BURNING): Reacts with finely divided silica.
VINYL ACETATE (VAPOR): May react vigorously with gel form.
XENON HEXAFLUORIDE: May react explosively by forming xenon trioxide.

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: miscellaneous decomposition products

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

MANGANESE:
IRRITATION DATA:
500 mg/24 hour(s) skin-rabbit mild; 500 mg/24 hour(s) eyes-rabbit mild
TOXICITY DATA:
2300 ug/m3 inhalation-man TCLo; 9 gm/kg oral-rat LD50; 3709 mg/m3/6 hour(s)-13 week(s) intermittent inhalation-rat TCLo; 180 mg/kg/30 day(s) intermittent intraperitoneal-rat TDLo; 210 ug/m3/5 year(s) intermittent inhalation-man TCLo; 0.3 mg/m3/5 hour(s)-26 week(s) intermittent inhalation-rat TCLo; 0.3 mg/m3/5 hour(s)-26 week(s) intermittent inhalation-monkey TCLo; 0.7 mg/m3/24 hour(s)-22 week(s) continuous inhalation-rat TCLo; 0.7 mg/m3/24 hour(s)-22 week(s) continuous inhalation-mouse TCLo; 250 mg/m3/1 year(s) intermittent inhalation-human TCLo; 0.5 mg/m3/39 week(s) intermittent inhalation-human TCLo
ACUTE TOXICITY LEVEL:
Slightly Toxic: ingestion
TARGET ORGANS: nervous system
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: history of alcoholism, blood system disorders, liver disorders, nervous system disorders, respiratory disorders
TUMORIGENIC DATA:
400 mg/kg intramuscular-rat TDLo/1 year(s) intermittent
MUTAGENIC DATA:
dominant lethal test - rat intraperitoneal 25 mg/kg
ADDITIONAL DATA: Symptoms may depend on a combination of contributing factors including genetic predisposition, age, nutrition, anemia or alcohol.

IRON:
TOXICITY DATA:
77 mg/kg oral-child TDLo; 30 gm/kg oral-rat LD50; 20 mg/kg intraperitoneal-rabbit LDLo; 20 gm/kg oral-guinea pig LD50; 200 mg/kg oral-human LD50; 63 gm/kg/6 week(s) continuous oral-rat TDLo; 250 mg/m3/6 hour(s)-4 week(s) intermittent inhalation-rat TCLo; 105 mg/kg/5 week(s) continuous oral-rat TDLo
CARCINOGEN STATUS: Iron itself has not been evaluated by IARC. However iron and steel founding has been evaluated as IARC Group 1 (Human Sufficient Evidence). Studies have shown that certain exposures in iron and steel founding can cause lung cancer in humans. Excesses of leukemia and urogenital and digestive system cancers have also been reported.
ACUTE TOXICITY LEVEL:
Relatively Non-toxic: ingestion
TUMORIGENIC DATA:
450 mg/kg intratracheal-rat TDLo/15 week(s) intermittent

ALUMINUM OXIDE:
TOXICITY DATA:
>3600 mg/kg intraperitoneal-mouse LD50; 200 mg/m3/5 hour(s)-28 week(s) intermittent inhalation-rat TCLo; 200 mg/m3/5 hour(s)-28 week(s) intermittent inhalation-rabbit

TCLo
CARCINOGEN STATUS: ACGIH: A4 -Not Classifiable as a Human Carcinogen
ACUTE TOXICITY LEVEL: Insufficient Data.
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: respiratory disorders
TUMORIGENIC DATA:
90 mg/kg intrapleural-rat TDLo; 200 mg/kg implant-rat TDLo; 200 mg/kg implant-rat TD

SILICON DIOXIDE:
CARCINOGEN STATUS: IARC: Human Inadequate Evidence, Animal Inadequate Evidence, Group 3 (Amorphous silica)
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: respiratory disorders

QUARTZ:
TOXICITY DATA:
16 mppcf/8 hour(s)-17.9 year(s) intermittent inhalation-human TCLo; 300 ug/m3/10 year(s) intermittent inhalation-human LCLo; 90 mg/kg intravenous-rat LDLo; 200 mg/kg intratracheal-rat LDLo; 40 mg/kg intravenous-mouse LDLo; >20 mg/kg intratracheal-mouse LD; 20 mg/kg intravenous-dog LDLo; 200 mg/kg inhalation-rat TCLo; 250 mg/kg intratracheal-rat LDLo; 240 mg/kg/1 hour(s) intratracheal-rat TDLo; 1.5 mg/kg intratracheal-rat TDLo; 120 gm/kg oral-rat TDLo; 15.69 mg/kg intratracheal-rat TDLo; 16.7 mg/kg intratracheal-mouse TDLo; 40 mg/kg inhalation-mouse TCLo; 25 mg/kg intratracheal-rat TDLo; 80 mg/m3/26 week(s) intermittent inhalation-rat TCLo; 108 mg/m3/6 hour(s)-3 day(s) intermittent inhalation-rat TCLo; 58 mg/m3/13 week(s) intermittent inhalation-rat TCLo; 1475 ug/m3/8 hour(s)-21 week(s) intermittent inhalation-mouse TCLo; 4932 ug/m3/24 hour(s)-39 week(s) continuous inhalation-mouse TCLo; 28 mg/m3/3 week(s) intermittent inhalation-guinea pig TCLo; 3 mg/m3/6 hour(s)-78 week(s) intermittent inhalation-hamster TCLo; 1000 gm/m3/10 day(s) intermittent inhalation-domestic animal TCLo; 2.88 mg/kg/12 week(s) intermittent intratracheal-rat TDLo; 11.52 mg/kg/12 week(s) intermittent intratracheal-rat TDLo; 15 mg/m3/26 week(s) intermittent inhalation-rat TCLo; 0.74 mg/m3/2 year(s) intermittent inhalation-rat TCLo; 10 mg/m3/75 day(s) intermittent inhalation-rat TCLo; 10 mg/m3/818 day(s) intermittent inhalation-monkey TCLo
CARCINOGEN STATUS: NTP: Known Human Carcinogen; IARC: Human Sufficient Evidence, Animal Sufficient Evidence, Group 1; ACGIH: A2 -Suspected Human Carcinogen; EC: Category 2
Adenocarcinomas and squamous-cell carcinomas of the lung in rats were produced after inhalation or repeated intratracheal instillation of various forms of crystalline silica. Malignant lymphomas developed in rats after intrapleural and intraperitoneal injections of quartz suspensions and intrapleural injection of cristobalite and tridymite. Epidemiologic studies indicate lung cancer occurs more frequently among silicotics than in the general population.
ACUTE TOXICITY LEVEL: Insufficient Data.
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: respiratory disorders
TUMORIGENIC DATA:
50 mg/m3 inhalation-rat TCLo/6 hour(s)-71 week(s) intermittent; 45 mg/kg

intraperitoneal-rat TDLo; 90 mg/kg intravenous-rat TDLo; 90 mg/kg intrapleural-rat TDLo; 111 mg/kg intratracheal-rat TDLo; 100 mg/kg intratracheal-rat TDLo/19 week(s) intermittent; 900 mg/kg implant-rat TDLo; 4000 mg/kg implant-mouse TDLo; 83 mg/kg intrapleural-hamster TDLo; 90 mg/kg intraperitoneal-rat TD/4 week(s) intermittent; 450 mg/kg intraperitoneal-rat TD/4 week(s) intermittent; 4554 mg/kg implant-rat TD; 200 mg/kg intrapleural-rat TD; 100 mg/kg intrapleural-rat TD; 100 mg/kg intrapleural-rat TD; 100 mg/kg intrapleural-rat TD

MUTAGENIC DATA:

micronucleus test - human lung 40 ug/cm2; micronucleus test - hamster lung 160 ug/cm2; DNA damage - rat intratracheal 6 mg/kg

ADDITIONAL DATA: Smoking may enhance the toxic effects.

LEAD:

TOXICITY DATA:

450 mg/kg/6 year(s) oral-woman TDLo; 10 ug/m3 inhalation-human TCLo; 1 gm/kg intraperitoneal-rat LDLo; 160 mg/kg oral-pigeon LDLo; 271 mg/m3 inhalation-human LCLo; 155 mg/kg oral-human LDLo; 1050 ug/kg/30 week(s) intermittent oral-rat TDLo; 6879 mg/kg/5 week(s) continuous oral-mouse TDLo; 20 mg/m3/6 hour(s)-30 day(s) intermittent inhalation-guinea pig TCLo; 200 ug/m3/6 hour(s)-26 week(s) intermittent inhalation-guinea pig TCLo; 582 mg/kg/30 day(s) continuous oral-non-mammalian specie TDLo; 4099.2 mg/kg/8 week(s) intermittent oral-mouse TDLo; 10248 mg/kg/20 week(s) intermittent oral-mouse TDLo; 9.9 mg/m3/122 day(s) intermittent inhalation-human TCLo; 0.011 mg/m3/26 week(s) intermittent inhalation-human TCLo; 0.012 mg/kg/10 day(s) intermittent unreported-rat TDLo; 0.012 mg/kg/10 day(s) intermittent unreported-rat TDLo; 120 mg/kg/60 day(s) intermittent unreported-horse, donkey TDLo; 93.6 mg/kg/30 day(s) continuous oral-rat TDLo; 0.03 mg/m3/1 year(s) intermittent inhalation-man TCLo; 0.03 mg/m3/5 year(s) intermittent inhalation-man TCLo; 0.109 mg/m3/5 year(s) intermittent inhalation-man TCLo

CARCINOGEN STATUS: IARC: Human Inadequate Evidence, Animal Sufficient Evidence, Group 2B (Lead and inorganic lead compounds); ACGIH: A3 -Animal Carcinogen (Lead and inorganic lead compounds)

Renal tumors were produced in animals by lead acetate, subacetate and phosphate given orally, subcutaneously or intraperitoneally. No evaluation could be made of the carcinogenicity of powdered lead.

ACUTE TOXICITY LEVEL: Insufficient Data.

TARGET ORGANS: nervous system, kidneys, teratogen

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: blood system disorders, gastrointestinal disorders, nervous system disorders, respiratory disorders

MUTAGENIC DATA:

cytogenetic analysis - human unreported 50 ug/m3; cytogenetic analysis - rat inhalation 23 ug/m3 16 week(s); cytogenetic analysis - monkey oral 42 mg/kg 30 week(s)

REPRODUCTIVE EFFECTS DATA:

790 mg/kg oral-rat TDLo multigenerations; 1140 mg/kg oral-rat TDLo 14 day(s) pre pregnancy/21 day(s) post pregnancy continuous; 520 mg/kg oral-rat TDLo 7-22 day(s) pregnant female/10 day(s) post pregnancy continuous; 1100 mg/kg oral-rat TDLo 1-22 day(s) pregnant female continuous; 10 mg/m3 inhalation-rat TCLo/24 hour(s) 1-21 day(s)

pregnant female continuous; 3 mg/m3 inhalation-rat TCLo/24 hour(s) 1-21 day(s) pregnant female continuous; 1120 mg/kg oral-mouse TDLo multigenerations; 6300 mg/kg oral-mouse TDLo 1-21 day(s) pregnant female continuous; 300 mg/kg oral-mouse TDLo 1-2 day(s) pregnant female continuous; 4800 mg/kg oral-mouse TDLo 1-16 day(s) pregnant female continuous; 662 mg/kg oral-domestic animal TDLo 1-21 week(s) pregnant female continuous; 814 mg/kg oral-domestic animal TDLo 5 week(s) pre pregnancy/1-21 week(s) pregnant female continuous; 2118 mg/kg oral-mammal TDLo 15 day(s) post pregnancy continuous; 4099.2 mg/kg oral-mouse TDLo 56 day(s) male
ADDITIONAL DATA: May cross the placenta. Smoking may result in higher blood lead levels. May be excreted in breast milk.

HEALTH EFFECTS:
INHALATION:
ALUMINUM OXIDE (ALUMINA): Inhalation of high concentrations may cause coughing, shortness of breath, respiratory tract irritation due to mechanical action, unpleasant deposits in the nasal passages, and exacerbation of symptoms in persons with impaired pulmonary function. Humans exposed chronically to aluminum oxide, particle size approximately 1.2 microns, did not experience either systemic or respiratory adverse effects. Hydrated aluminum oxide, injected intratracheally, produced dense and numerous nodules of advanced fibrosis in rats, a reticulin network with occasional collagen fibers in mice and guinea pigs, and only a slight reticulin network in rabbits. A production process in which aluminum oxide (bauxite), iron, coke, and silica are fused at 2000 C poses a threat of Shaver's disease, a rapidly progressive and often fatal interstitial fibrosis of the lungs. See information on metal fume fever.

ACUTE EXPOSURE:
MANGANESE: Dust or fumes may be irritating to the mucous membranes. Occupational exposure to dust or fumes has been reported to cause upper respiratory tract problems, black mucous membrane discharge from the nose, and neurological damage. Metal fume fever, an influenza-like illness, may occur due to the inhalation of freshly formed metal oxide particles sized below 1.5 microns and usually between 0.02-0.05 microns. Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. Tolerance to fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours.

IRON: Dust may cause mucous membrane and respiratory irritation due to mechanical action. Metal fume fever, an influenza-like illness, may occur due to the inhalation of freshly formed iron oxide particles sized below 1.5 microns and usually between 0.02-0.05 microns. Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes. Lassitude and a generalized feeling of malaise. Fever, chills, muscular pain,

mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. Tolerance to fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours.

METAL FUME FEVER: Metal fume fever, an influenza-like illness, may occur due to the inhalation of freshly formed metal oxide particles sized below 1.5 microns and usually between 0.02-0.05 microns. Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. Tolerance to fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours.

SILICON DIOXIDE: Dusts may cause irritation of the respiratory tract and coughing.

QUARTZ: Exposure to high concentrations may cause physical discomfort of the upper respiratory tract.

CHRONIC EXPOSURE:
MANGANESE: If sufficient quantities of manganese dust or fumes are inhaled and absorbed, systemic poisoning known as "manganism", a Parkinsonian-like syndrome may occur. It is characterized initially by anorexia, asthenia, headache, insomnia or somnolence, irritability, restlessness, and spasm or pain in the muscles. Manganese psychosis may follow with uncontrollable behavior, unaccountable laughing or crying, visual hallucinations, confusion and euphoria. Sexual excitement followed by impotence may occur. These symptoms may disappear with the onset of true neurological manifestations of slow, slurred and irregular speech, monotonous tone, double vision, impaired hearing, difficulty with fine motor movements, and disturbances in gait and balance with frequent propulsion or retropulsion. Mask-like face, decreased movement of the eyelids and eyes and tremors of the upper extremities and head may also occur. Other signs and symptoms may include urinary bladder disturbances, excessive salivation and sweating, hematological changes, vasomotor disorders, decreased pulmonary function, kidney and possibly liver damage. Removal from exposure shortly after onset of symptoms usually results in improvement, although there may be residual disturbances in gait and speech. Once manganism is well established it becomes irreversible and progressive, but not fatal. An increased incidence of bronchitis and pneumonitis has been reported in studies of workers exposed to manganese dust and fume, and although these effects have been confirmed by animal experiments, they may represent an aggravation of a pre-existing condition. Allergic diseases of the respiratory tract have also been reported in one study.

IRON: Prolonged or repeated exposure may cause a mottling of the lungs, a condition called siderosis which is considered to be a benign pneumoconiosis that does not cause

significant physiologic impairment. Symptoms may include chronic bronchitis, emphysema, and dyspnea on exertion.

METAL FUME FEVER: There is no form of chronic metal fume fever, however, repeated bouts with symptoms as described above are quite common. Resistance to the condition develops after a few days of exposure, but is quickly lost in 1 or 2 days.

SILICON DIOXIDE: Exposure to dusts of crystalline or amorphous silica for 6 months to 30 years may result in silicosis with symptoms of cough, chest pain, dyspnea, tachypnea, marked weakness and weight loss. This pulmonary insufficiency may be characterised by diffuse nodular fibrosis, distortion of bronchi, diminished chest expansion, decreased vital capacity and compensatory and bullous emphysema. Although pulmonary fibrosis has been reported from workers exposed to amorphous silica, the crystalline form is the established cause of fibrotic response in the lung. However, the amorphous form has been reported fibrogenic to a lesser extent. As the disease progresses, cor pulmonale, cardiorespiratory failure, and death may occur. Various forms and preparations of crystalline silica produced adenocarcinomas and squamous cell carcinomas of the lungs in rats.

QUARTZ: Inhalation of very high concentrations of finely divided crystalline silica dust, exposure ranging from a few weeks to 4-5 years, may cause a rapidly developing silicosis, characterized by pulmonary insufficiency with severe dyspnea, violent coughing, tachypnea, weight loss, and cyanosis leading to the development of cor pulmonale and death within a relatively short period of time. A slowly developing silicosis may result from exposure for 6 months-30 years to relatively low levels of the dust. The first symptom is usually a slowly increasing, non-disabling, exertional dyspnea due to pulmonary fibrosis and the emphysema associated with it. Continued exposure may increase the rate of progression of the disease. Also, the fibrogenic action may continue when exposure ceases. As the fibrosis advances, other symptoms may include shortness of breath, productive cough, wheezing, chest tightness or pain, marked weakness, decreased capacity for work, and repeated non-specific chest illnesses. Cyanosis, clubbing of digits, orthopnea, or serious weight loss are not usually evident until the disease is advanced. Pulmonary infections, which may be indicated by hemoptysis, and cardiac decompensation may exacerbate the symptoms. Three major complications, which are the most frequent causes of death, are pulmonary tuberculosis, respiratory insufficiency which is due to the massive emphysematous and fibrotic changes and is sometimes accompanied by chronic cor pulmonale, and acute bronchopulmonary infection. A number of studies have shown that persons diagnosed as having silicosis have an increased risk for dying from lung cancer. This increase has been seen among miners, quarry workers, foundry workers, ceramic workers, granite workers, and stone cutters. In some of these studies, the risk of lung cancer increased with the duration of employment. Various forms and preparations of crystalline silica produced adenocarcinomas and squamous cell carcinomas of the lungs in rats.

SKIN CONTACT:
ACUTE EXPOSURE:

MANGANESE: 500 mg applied to the skin of rabbits caused mild irritation.

IRON: Dust may cause irritation. Penetration of iron particles in the skin may cause an exogenous siderosis which may be characterized by a red-brown pigmentation of the affected area.

ALUMINUM OXIDE (ALUMINA): Contact may cause an irritant dermatitis accompanied by pruritis.

SILICON DIOXIDE: Prolonged skin contact with dry particulate may cause drying of the skin.

QUARTZ: May cause irritation of intact skin due to mechanical abrasion. If the skin is abraded, a heavy growth of scar tissue may be induced.

CHRONIC EXPOSURE:
MANGANESE: Sensitization has been reported in guinea pigs.

IRON: May cause same effects as reported in acute exposure.

ALUMINUM OXIDE (ALUMINA): No data available.

SILICON DIOXIDE: No data available.

QUARTZ: No data available.

EYE CONTACT:
ACUTE EXPOSURE:
MANGANESE: Dust or fumes may be irritating to the eyes. 500 mg applied to the eyes of rabbits caused mild irritation.

IRON: May cause irritation due to mechanical action. Iron particles imbedded in the eye may cause ocular siderosis. Effects may include discoloration of the cornea and iris, and pupillary effects including poor reaction to light and accomodation. If a particle enters the lens there may be cataract formation. Glaucoma occurs rarely in some cases of ocular siderosis.

ALUMINUM OXIDE (ALUMINA): Dust may cause mechanical irritation with redness and possibly swelling of the conjunctiva.

SILICON DIOXIDE: Dusts may cause irritation with redness and pain.

QUARTZ: May cause irritation due to mechanical action. Particles of silica in the range of 2-3 micrometers introduced into the corneal stroma of rabbit eyes caused very little reaction. These same particles introduced into the anterior chamber resulted in an inflammatory reaction in 3-5 weeks with the formation of fibrotic nodules in the

iridocorneal angle. Finely divided silica injected into the vitreous of rabbit eyes has caused necrosis of the retina and atrophy of the choroid.

CHRONIC EXPOSURE:
MANGANESE: Fumes may cause conjunctivitis.

IRON: Repeated and prolonged contact may cause conjunctivitis and other effects reported in acute exposure.

ALUMINUM OXIDE (ALUMINA): No data available.

SILICON DIOXIDE: No data available.

QUARTZ: An abnormally high silicon content in the cornea, and a gradual decrease in visual acuity due to corneal opacities in the pupillary area, have been reported in a group of foundry workers.

INGESTION:
ACUTE EXPOSURE:
MANGANESE: Extremely large doses may cause gastrointestinal irritation and possibly systemic toxicity.

IRON: There are no reports available on poisoning from metallic iron, which is poorly absorbed. The principal manifestations of poisoning with iron compounds are vomiting, diarrhea, and circulatory collapse.

ALUMINUM OXIDE (ALUMINA): No data available.

SILICON DIOXIDE: The effects of ingestion are purely mechanical as the substance is inert chemically and biologically.

QUARTZ: Effects of ingestion are due to mechanical action as crystalline silicas are biologically inert.

CHRONIC EXPOSURE:
MANGANESE: Manganese poisoning has been reported in persons drinking manganese-contaminated well water. Prolonged ingestion of manganese in water has produced lethargy, edema, and decreased movement of the eyes and eyelids.

IRON: Repeated or prolonged exposure may cause hemosiderosis or hemochromatosis.

ALUMINUM OXIDE (ALUMINA): Some aluminum compounds cause constipation.

SILICON DIOXIDE: No data available.

QUARTZ: No data available.

12. ECOLOGICAL INFORMATION

Not available

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Hazardous Waste Number(s): D008. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level. Regulatory level- 5.0 mg/L.

14. TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION: No classification assigned.

CANADIAN TRANSPORTATION OF DANGEROUS GOODS: No classification assigned.

LAND TRANSPORT ADR: No classification assigned.

LAND TRANSPORT RID: No classification assigned.

AIR TRANSPORT IATA: No classification assigned.

AIR TRANSPORT ICAO: No classification assigned.

MARITIME TRANSPORT IMDG: No classification assigned.

15. REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
LEAD: 10 LBS RQ (solid metal particles < 100 micrometer diameter (0.004 inches))

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):
ACUTE: Yes

CHRONIC: Yes
FIRE: No
REACTIVE: No
SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65):
MANGANESE AND COMPOUNDS (as Mn)
ALUMINUM OXIDE (ALUMINA): fibrous forms
LEAD
LEAD COMPOUNDS

OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.

STATE REGULATIONS:
California Proposition 65:
Known to the state of California to cause the following:
LEAD
Cancer (Oct 01, 1992)
Developmental toxicity (Feb 27, 1987)
Male reproductive toxicity (Feb 27, 1987)
Female reproductive toxicity (Feb 27, 1987)
LEAD COMPOUNDS
Cancer (Oct 01, 1992)
Developmental toxicity (Feb 27, 1987)
Male reproductive toxicity (Feb 27, 1987)
Female reproductive toxicity (Feb 27, 1987)

CANADIAN REGULATIONS:
WHMIS CLASSIFICATION: Not determined.

EUROPEAN REGULATIONS:
EC CLASSIFICATION (CALCULATED): Not determined.

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

16. OTHER INFORMATION

MSDS SUMMARY OF CHANGES
11. TOXICOLOGICAL INFORMATION

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

DEFENSE LOGISTICS AGENCY

DEFENSE NATIONAL STOCKPILE CENTER

8725 JOHN J. KINGMAN ROAD

SUITE 3339

FORT BELVOIR, VA 22060-6223

EMERGENCY TELEPHONE NUMBER:

1-800-424-9300 (NORTH AMERICA)

1-703-527-3887 (INTERNATIONAL)

SUBSTANCE: MANGANESE DIOXIDE, NATURAL

TRADE NAMES/SYNONYMS:
MANGANESE OXIDE; MANGANESE SUPEROXIDE; MANGANESE BLACK; BLACK MANGANESE OXIDE; BOG MANGANESE; CEMENT BLACK; MANGANESE BINOXIDE; MANGANESE PEROXIDE; PYROLUSITE BROWN; MANGANESE OXIDE (MnO2); MANGANESE DIOXIDE; MANGANESE (IV) OXIDE; MnO2; 00229894; RTECS OP0350000

CHEMICAL FAMILY: metal oxides

CREATION DATE: May 27 2003
REVISION DATE: Mar 18 2004

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: MANGANESE DIOXIDE
CAS NUMBER: 1313-13-9
EC NUMBER (EINECS): 215-202-6
EC INDEX NUMBER: 025-001-00-3
PERCENTAGE: 100

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=0 REACTIVITY=0

EMERGENCY OVERVIEW:
COLOR: gray, brown or black
PHYSICAL FORM: solid or powder
ODOR: odorless
MAJOR HEALTH HAZARDS: skin irritation, eye irritation, nerve damage
PHYSICAL HAZARDS: Strong oxidizer. May ignite combustibles.

POTENTIAL HEALTH EFFECTS:
INHALATION:
SHORT TERM EXPOSURE: irritation, metal fume fever, lung damage
LONG TERM EXPOSURE: loss of appetite, headache, difficulty speaking, sleep disturbances, mood swings, loss of coordination, hearing loss, visual disturbances, lung damage, blood disorders, kidney damage, nerve damage
SKIN CONTACT:
SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: irritation
EYE CONTACT:
SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: irritation
INGESTION:
SHORT TERM EXPOSURE: nausea, vomiting, diarrhea
LONG TERM EXPOSURE: loss of appetite, headache, difficulty speaking, sleep disturbances, mood swings, loss of coordination, hearing loss, visual disturbances, lung damage, blood disorders, kidney damage, nerve damage

CARCINOGEN STATUS:
OSHA: No
NTP: No
IARC: No

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If a large amount is swallowed, get medical attention.

ANTIDOTE: calcium disodium edetate/dextrose, intravenous; calcium disodium edetate/procaine, intramuscular.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Negligible fire hazard. Oxidizer. May ignite or explode on contact with combustible materials.

EXTINGUISHING MEDIA: water

Large fires: Flood with water. Apply water from a protected location or from a safe distance.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Flood with water. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Evacuate if fire gets out of control or containers are directly exposed to fire. Evacuation radius: 800 meters (1/2 mile).

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:
Avoid contact with combustible materials. Do not touch spilled material. Small dry spills: Move containers away from spill to a safe area. Small liquid spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Keep unnecessary people away, isolate hazard area and deny entry.

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. NFPA 430 Code for the Storage of Liquid and Solid Oxidizing Materials. Keep separated from incompatible substances.

HANDLING: Use methods to minimize dust.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
MANGANESE DIOXIDE, NATURAL:
MANGANESE AND COMPOUNDS (as Mn):

5 mg/m3 OSHA ceiling (metal) (fume) (compounds)
1 mg/m3 OSHA TWA (particulate) (vacated by 58 FR 35338, June 30, 1993)
3 mg/m3 OSHA STEL (particulate) (vacated by 58 FR 35338, June 30, 1993)
0.2 mg/m3 ACGIH TWA (metal and inorganic compounds)
1 mg/m3 NIOSH recommended TWA 10 hour(s) (metal) (fume) (compounds)
3 mg/m3 NIOSH recommended STEL (metal) (fume) (compounds)
0.5 mg/m3 DFG MAK (peak limitation category - I, with excursion factor of 1) (inhalable fraction) (metal and inorganic compounds)
1 mg/m3 UK OES TWA (metal) (fume) (Chemical Hazard Alert Notice issued)
5 mg/m3 UK OES TWA (compounds) (Chemical Hazard Alert Notice issued)
3 mg/m3 UK OES STEL (metal) (fume) (Chemical Hazard Alert Notice issued)
0.5 mg/m3 UK MEL TWA (metal and inorganic compounds)

MEASUREMENT METHOD: Particulate filter; Acid; Inductively coupled plasma; NIOSH IV # 7300, Elements

VENTILATION: Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.
Measurement Element:
Manganese (Mn)
10 mg/m3
Any dust and mist respirator except single-use and quarter-mask respirators.
Any supplied-air respirator.
25 mg/m3
Any supplied-air respirator operated in a continuous-flow mode.
Any powered, air-purifying respirator with a dust and mist filter.
50 mg/m3
Any air-purifying respirator with a full facepiece and a high-efficiency particulate filter.
Any supplied-air respirator with a tight-fitting facepiece that is operated in a continuous-flow mode.
Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter.
Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.
500 mg/m3
Any supplied-air respirator operated in a pressure-demand or other positive-pressure

mode.
Escape -
Any air-purifying respirator with a full facepiece and a high-efficiency particulate filter.
Any appropriate escape-type, self-contained breathing apparatus.
For Unknown Concentrations or Immediately Dangerous to Life or Health -
Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.
Any self-contained breathing apparatus with a full facepiece.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: solid
COLOR: gray, brown or black
PHYSICAL FORM: solid or powder
ODOR: odorless
MOLECULAR WEIGHT: 86.94
MOLECULAR FORMULA: Mn-O2
BOILING POINT: Not applicable
MELTING POINT: Not available
DECOMPOSITION POINT: 995 F (535 C)
VAPOR PRESSURE: Not applicable
VAPOR DENSITY: Not applicable
SPECIFIC GRAVITY: Not available
DENSITY: 5.026 g/cc
WATER SOLUBILITY: insoluble
PH: Not applicable
VOLATILITY: Not applicable
ODOR THRESHOLD: Not available
EVAPORATION RATE: Not applicable
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available
SOLVENT SOLUBILITY:
Insoluble: nitric acid, sulfuric acid, acetone

10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid contact with combustible materials. May ignite or explode on contact with combustible materials. Keep out of water supplies and sewers.

INCOMPATIBILITIES: metals, oxidizing materials, halogens, acids, peroxides, reducing agents, amines, combustible materials, metal carbide, bases

MANGANESE DIOXIDE:

ALUMINUM: Violent reaction when heated.
ANILINIUM PERCHLORATE: Explodes.
BARIUM CHLORATE: May explode.
CALCIUM CHLORATE: May explode.
CALCIUM HYDRIDE: Incandesces when warmed.
CHLORATES: May explode.
CHLORINE TRIFLUORIDE: Incandescent reaction.
COMBUSTIBLE MATERIALS: May increase the burning rate or cause ignition on contact; contact with finely divided materials may result in an explosion.
DIBORON TETRAFLUORIDE: Violent reaction at 15 C.
HYDROCHLORIC ACID: Releases chlorine fumes.
HYDROGEN PEROXIDE: May explode.
HYDROGEN SULFIDE: May ignite.
HYDROXYLAMINIUM CHLORIDE (20% SOLN): Vigorous reaction.
HYPOPHOSPHITES: Fire and explosion hazard.
ORGANIC MATERIALS: May increase the burning rate or cause ignition on contact; finely divided materials may result in an explosion.
PERMONOSULFURIC ACID (92%): Explosive decomposition.
PHOSPHIDES: Fire and explosion hazard.
POTASSIUM AZIDE: Violent reaction when heated.
REDUCING MATERIALS: Fire and explosion hazard.
RUBIDIUM CARBIDE: Incandescent reaction at 350 C.
SODIUM PEROXIDE: Violent decomposition.
SULFIDES: Fire and explosion hazard.
SULFUR: Fire and explosion hazard.

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: oxides of manganese

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

MANGANESE DIOXIDE, NATURAL:
TOXICITY DATA:
>3478 mg/kg oral-rat LD50; 50 mg/kg intratracheal-rat LDLo; 422 mg/kg subcutaneous-mouse LD50; 45 mg/kg intravenous-rabbit LDLo; 1800 ug/m3/24 hour(s)-35 day(s) continuous inhalation-rat TCLo; 21 ug/m3/5.3 year(s) intermittent intramuscular-human TDLo; 6000 mg/kg/12 day(s) intermittent subcutaneous-mouse TDLo; 150 mg/kg/3 week(s) intermittent subcutaneous-monkey TDLo; 7 mg/m3/24 hour(s)-34 week(s) continuous inhalation-rat TCLo; 0.6 mg/m3/1 hour(s)-17 week(s) intermittent inhalation-monkey TCLo
LOCAL EFFECTS:
Irritant: skin, eye
ACUTE TOXICITY LEVEL: Insufficient Data.

TARGET ORGANS: nervous system
REPRODUCTIVE EFFECTS DATA:
49 mg/m3 inhalation-mouse TCLo/7 hour(s) 75 day(s) pre pregnancy/1-18 day(s) pregnant female continuous

HEALTH EFFECTS:
INHALATION:
MANGANESE DIOXIDE: See information on metal fume fever and manganese compounds.

ACUTE EXPOSURE:
METAL FUME FEVER: Metal fume fever, an influenza-like illness, may occur due to the inhalation of freshly formed metal oxide particles sized below 1.5 microns and usually between 0.02-0.05 microns. Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. Tolerance to fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours.

MANGANESE COMPOUNDS: No data available.

CHRONIC EXPOSURE:
METAL FUME FEVER: There is no form of chronic metal fume fever, however, repeated bouts with symptoms as described above are quite common. Resistance to the condition develops after a few days of exposure, but is quickly lost in 1 or 2 days.

MANGANESE COMPOUNDS: Repeated or prolonged exposure to manganese compounds may result in systemic poisoning known as "manganism", a Parkinsonian-like syndrome. It is characterized initially by anorexia, asthenia, headache, insomnia or somnolence, irritability, restlessness, and spasm or pain in the muscles. Manganese psychosis may follow with uncontrollable behavior, unaccountable laughing or crying, visual hallucinations, confusion and euphoria. Sexual excitement followed by impotence may occur. These symptoms may disappear with the onset of true neurological manifestations of slow, slurred and irregular speech, monotonous tone, double vision, impaired hearing, difficulty with fine motor movements, and disturbances in gait and balance with frequent propulsion or retropulsion. Mask-like face, decreased movement of the eyelids and eyes and tremors of the upper extremities and head may also occur. Other signs and symptoms may include urinary bladder disturbances, excessive salivation and sweating, hematological changes, vasomotor disorders, decreased pulmonary function, kidney and possibly liver damage. Removal from exposure shortly after onset of symptoms usually results in improvement, although there may be residual disturbances in gait and speech. Once manganism is well established it becomes irreversible and progressive, but not fatal. An increased incidence of bronchitis and pneumonitis has been

reported in studies of workers exposed to manganese dust and fume, and although these effects have been confirmed by animal experiments, they may represent an aggravation of a pre-existing condition. Allergic diseases of the respiratory tract have also been reported in one study.

SKIN CONTACT:
ACUTE EXPOSURE:
MANGANESE DIOXIDE: May cause irritation with redness and pain.

CHRONIC EXPOSURE:
MANGANESE DIOXIDE: Repeated or prolonged contact may cause dermatitis.

EYE CONTACT:
ACUTE EXPOSURE:
MANGANESE DIOXIDE: May cause redness, pain, tearing and irritation.

CHRONIC EXPOSURE:
MANGANESE DIOXIDE: Repeated or prolonged contact may cause conjunctivitis.

INGESTION:
MANGANESE DIOXIDE: See information on manganese compounds.

ACUTE EXPOSURE:
MANGANESE COMPOUNDS: Ingestion of extremely large doses of manganese compounds may cause gastrointestinal irritation, resulting in nausea, vomiting, and diarrhea, so that less is available for absorption.

CHRONIC EXPOSURE:
MANGANESE COMPOUNDS: Manganese poisoning, as described in chronic inhalation, has been reported in persons drinking manganese-contaminated well water.

12. ECOLOGICAL INFORMATION

Not available

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001.

14. TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION: No classification assigned.

CANADIAN TRANSPORTATION OF DANGEROUS GOODS: No classification assigned.

LAND TRANSPORT ADR: No classification assigned.

LAND TRANSPORT RID: No classification assigned.

AIR TRANSPORT IATA: No classification assigned.

AIR TRANSPORT ICAO: No classification assigned.

MARITIME TRANSPORT IMDG: No classification assigned.

15. REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):
ACUTE: Yes
CHRONIC: Yes
FIRE: Yes
REACTIVE: No
SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65):
MANGANESE AND COMPOUNDS (as Mn)

OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.

STATE REGULATIONS:
California Proposition 65: Not regulated.

CANADIAN REGULATIONS:
WHMIS CLASSIFICATION: Not determined.

EUROPEAN REGULATIONS:
EC CLASSIFICATION (ASSIGNED):

Xn	Harmful

EC Classification may be inconsistent with independently-researched data.

DANGER/HAZARD SYMBOL:

EC RISK AND SAFETY PHRASES:

R 20/22	Harmful by inhalation and if swallowed.
S 2	Keep out of reach of children.
S 25	Avoid contact with eyes.

GERMAN REGULATIONS:
WATER HAZARD CLASS (WGK):
STATE OF CLASSIFICATION: Annex 3
CLASSIFICATION UNDER HAZARD TO WATER: 1

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

16. OTHER INFORMATION

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

DEFENSE LOGISTICS AGENCY

DEFENSE NATIONAL STOCKPILE CENTER

8725 JOHN J. KINGMAN ROAD

SUITE 3339

FORT BELVOIR, VA 22060-6223

EMERGENCY TELEPHONE NUMBER:

1-800-424-9300 (NORTH AMERICA)

1-703-527-3887 (INTERNATIONAL)

SUBSTANCE: MANGANESE DIOXIDE, SYNTHETIC BATTERY GRADE

TRADE NAMES/SYNONYMS:
MANGANESE OXIDE; MANGANESE DIOXIDE; MANGANESE OXIDE (MnO2); MANGANESE SUPEROXIDE; MANGANESE BLACK; MANGANESE(IV) OXIDE; BLACK MANGANESE OXIDE; BOG MANGANESE; CEMENT BLACK; MANGANESE BINOXIDE; MANGANESE PEROXIDE; PYROLUSITE BROWN; MnO2; DLA13610; RTECS OP0350000

CHEMICAL FAMILY: metal oxides

CREATION DATE: Jul 01 1992
REVISION DATE: Mar 18 2004

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: MANGANESE DIOXIDE
CAS NUMBER: 1313-13-9
EC NUMBER (EINECS): 215-202-6
PERCENTAGE: 100

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=0 REACTIVITY=0

EMERGENCY OVERVIEW:
COLOR: gray, brown or black
PHYSICAL FORM: powder, solid
ODOR: odorless
MAJOR HEALTH HAZARDS: skin irritation, eye irritation, nerve damage
PHYSICAL HAZARDS: May ignite combustibles.

POTENTIAL HEALTH EFFECTS:
INHALATION:
SHORT TERM EXPOSURE: irritation, metal fume fever, lung damage
LONG TERM EXPOSURE: loss of appetite, headache, difficulty speaking, sleep disturbances, mood swings, loss of coordination, hearing loss, visual disturbances, lung damage, blood disorders, kidney damage, nerve damage
SKIN CONTACT:
SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: irritation
EYE CONTACT:
SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: irritation
INGESTION:
SHORT TERM EXPOSURE: nausea, vomiting, diarrhea
LONG TERM EXPOSURE: loss of appetite, headache, difficulty speaking, sleep disturbances, mood swings, loss of coordination, hearing loss, visual disturbances, lung damage, blood disorders, kidney damage, nerve damage

CARCINOGEN STATUS:
OSHA: No
NTP: No
IARC: No

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If a large amount is swallowed, get medical attention.

ANTIDOTE: calcium disodium edetate/dextrose, intravenous; calcium disodium edetate/procaine, intramuscular.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Negligible fire hazard. Oxidizer. May ignite or explode on contact with combustible materials.

EXTINGUISHING MEDIA: water

Large fires: Flood with water. Apply water from a protected location or from a safe distance.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Flood with water. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Evacuate if fire gets out of control or containers are directly exposed to fire. Evacuation radius: 800 meters (1/2 mile).

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:
Avoid contact with combustible materials. Do not touch spilled material. Small dry spills: Move containers away from spill to a safe area. Small liquid spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Keep unnecessary people away, isolate hazard area and deny entry.

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. NFPA 430 Code for the Storage of Liquid and Solid Oxidizing Materials. See original container for storage recommendations. Keep separated from incompatible substances.

HANDLING: Use methods to minimize dust.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
MANGANESE DIOXIDE, SYNTHETIC BATTERY GRADE:
MANGANESE AND COMPOUNDS (as Mn):

5 mg/m3 OSHA ceiling (metal) (fume) (compounds)
1 mg/m3 OSHA TWA (particulate) (vacated by 58 FR 35338, June 30, 1993)
3 mg/m3 OSHA STEL (particulate) (vacated by 58 FR 35338, June 30, 1993)
0.2 mg/m3 ACGIH TWA (metal and inorganic compounds)
1 mg/m3 NIOSH recommended TWA 10 hour(s) (metal) (fume) (compounds)
3 mg/m3 NIOSH recommended STEL (metal) (fume) (compounds)
0.5 mg/m3 DFG MAK (peak limitation category - I, with excursion factor of 1) (inhalable fraction) (metal and inorganic compounds)
1 mg/m3 UK OES TWA (metal) (fume) (Chemical Hazard Alert Notice issued)
5 mg/m3 UK OES TWA (compounds) (Chemical Hazard Alert Notice issued)
3 mg/m3 UK OES STEL (metal) (fume) (Chemical Hazard Alert Notice issued)
0.5 mg/m3 UK MEL TWA (metal and inorganic compounds)

MEASUREMENT METHOD: Particulate filter; Acid; Inductively coupled plasma; NIOSH IV # 7300, Elements

VENTILATION: Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.
Measurement Element:
Manganese (Mn)
10 mg/m3
Any dust and mist respirator except single-use and quarter-mask respirators.
Any supplied-air respirator.
25 mg/m3
Any supplied-air respirator operated in a continuous-flow mode.
Any powered, air-purifying respirator with a dust and mist filter.
50 mg/m3
Any air-purifying respirator with a full facepiece and a high-efficiency particulate filter.
Any supplied-air respirator with a tight-fitting facepiece that is operated in a continuous-flow mode.
Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter.
Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.
500 mg/m3
Any supplied-air respirator operated in a pressure-demand or other positive-pressure

mode.
Escape -
Any air-purifying respirator with a full facepiece and a high-efficiency particulate filter.
Any appropriate escape-type, self-contained breathing apparatus.
For Unknown Concentrations or Immediately Dangerous to Life or Health -
Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.
Any self-contained breathing apparatus with a full facepiece.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: solid
COLOR: gray, brown or black
PHYSICAL FORM: powder, solid
ODOR: odorless
MOLECULAR WEIGHT: 86.94
MOLECULAR FORMULA: Mn-O2
BOILING POINT: Not applicable
MELTING POINT: Not available
DECOMPOSITION POINT: 995 F (535 C)
VAPOR PRESSURE: Not applicable
VAPOR DENSITY: Not applicable
SPECIFIC GRAVITY (water=1): 5.026
WATER SOLUBILITY: insoluble
PH: Not applicable
VOLATILITY: Not applicable
ODOR THRESHOLD: Not available
EVAPORATION RATE: Not applicable
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available
SOLVENT SOLUBILITY:
Insoluble: nitric acid, sulfuric acid, acetone

10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid contact with combustible materials. May ignite or explode on contact with combustible materials. Keep out of water supplies and sewers.

INCOMPATIBILITIES: metals, oxidizing materials, halogens, acids, peroxides, reducing agents, amines, combustible materials, metal carbide, bases

MANGANESE DIOXIDE:
ALUMINUM: Violent reaction when heated.

ANILINIUM PERCHLORATE: Explodes.
BARIUM CHLORATE: May explode.
CALCIUM CHLORATE: May explode.
CALCIUM HYDRIDE: Incandesces when warmed.
CHLORATES: May explode.
CHLORINE TRIFLUORIDE: Incandescent reaction.
COMBUSTIBLE MATERIALS: May increase the burning rate or cause ignition on contact; contact with finely divided materials may result in an explosion.
DIBORON TETRAFLUORIDE: Violent reaction at 15 C.
HYDROCHLORIC ACID: Releases chlorine fumes.
HYDROGEN PEROXIDE: May explode.
HYDROGEN SULFIDE: May ignite.
HYDROXYLAMINIUM CHLORIDE (20% SOLN): Vigorous reaction.
HYPOPHOSPHITES: Fire and explosion hazard.
ORGANIC MATERIALS: May increase the burning rate or cause ignition on contact; finely divided materials may result in an explosion.
PERMONOSULFURIC ACID (92%): Explosive decomposition.
PHOSPHIDES: Fire and explosion hazard.
POTASSIUM AZIDE: Violent reaction when heated.
REDUCING MATERIALS: Fire and explosion hazard.
RUBIDIUM CARBIDE: Incandescent reaction at 350 C.
SODIUM PEROXIDE: Violent decomposition.
SULFIDES: Fire and explosion hazard.
SULFUR: Fire and explosion hazard.

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: oxides of manganese

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

MANGANESE DIOXIDE, SYNTHETIC BATTERY GRADE:
TOXICITY DATA:
>3478 mg/kg oral-rat LD50; 50 mg/kg intratracheal-rat LDLo; 422 mg/kg subcutaneous-mouse LD50; 45 mg/kg intravenous-rabbit LDLo; 1800 ug/m3/24 hour(s)-35 day(s) continuous inhalation-rat TCLo; 21 ug/m3/5.3 year(s) intermittent intramuscular-human TDLo; 6000 mg/kg/12 day(s) intermittent subcutaneous-mouse TDLo; 150 mg/kg/3 week(s) intermittent subcutaneous-monkey TDLo; 7 mg/m3/24 hour(s)-34 week(s) continuous inhalation-rat TCLo; 0.6 mg/m3/1 hour(s)-17 week(s) intermittent inhalation-monkey TCLo
LOCAL EFFECTS:
Irritant: skin, eye
ACUTE TOXICITY LEVEL: Insufficient Data.
TARGET ORGANS: nervous system

REPRODUCTIVE EFFECTS DATA:
49 mg/m3 inhalation-mouse TCLo/7 hour(s) 75 day(s) pre pregnancy/1-18 day(s) pregnant female continuous

HEALTH EFFECTS:
INHALATION:
MANGANESE DIOXIDE: See information on metal fume fever and manganese compounds.

ACUTE EXPOSURE:
METAL FUME FEVER: Metal fume fever, an influenza-like illness, may occur due to the inhalation of freshly formed metal oxide particles sized below 1.5 microns and usually between 0.02-0.05 microns. Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. Tolerance to fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours.

MANGANESE COMPOUNDS: No data available.

CHRONIC EXPOSURE:
METAL FUME FEVER: There is no form of chronic metal fume fever, however, repeated bouts with symptoms as described above are quite common. Resistance to the condition develops after a few days of exposure, but is quickly lost in 1 or 2 days.

MANGANESE COMPOUNDS: Repeated or prolonged exposure to manganese compounds may result in systemic poisoning known as "manganism", a Parkinsonian-like syndrome. It is characterized initially by anorexia, asthenia, headache, insomnia or somnolence, irritability, restlessness, and spasm or pain in the muscles. Manganese psychosis may follow with uncontrollable behavior, unaccountable laughing or crying, visual hallucinations, confusion and euphoria. Sexual excitement followed by impotence may occur. These symptoms may disappear with the onset of true neurological manifestations of slow, slurred and irregular speech, monotonous tone, double vision, impaired hearing, difficulty with fine motor movements, and disturbances in gait and balance with frequent propulsion or retropulsion. Mask-like face, decreased movement of the eyelids and eyes and tremors of the upper extremities and head may also occur. Other signs and symptoms may include urinary bladder disturbances, excessive salivation and sweating, hematological changes, vasomotor disorders, decreased pulmonary function, kidney and possibly liver damage. Removal from exposure shortly after onset of symptoms usually results in improvement, although there may be residual disturbances in gait and speech. Once manganism is well established it becomes irreversible and progressive, but not fatal. An increased incidence of bronchitis and pneumonitis has been reported in studies of workers exposed to manganese dust and fume, and although these

effects have been confirmed by animal experiments, they may represent an aggravation of a pre-existing condition. Allergic diseases of the respiratory tract have also been reported in one study.

SKIN CONTACT:
ACUTE EXPOSURE:
MANGANESE DIOXIDE: May cause irritation with redness and pain.

CHRONIC EXPOSURE:
MANGANESE DIOXIDE: Repeated or prolonged contact may cause dermatitis.

EYE CONTACT:
ACUTE EXPOSURE:
MANGANESE DIOXIDE: May cause redness, pain, tearing and irritation.

CHRONIC EXPOSURE:
MANGANESE DIOXIDE: Repeated or prolonged contact may cause conjunctivitis.

INGESTION:
MANGANESE DIOXIDE: See information on manganese compounds.

ACUTE EXPOSURE:
MANGANESE COMPOUNDS: Ingestion of extremely large doses of manganese compounds may cause gastrointestinal irritation, resulting in nausea, vomiting, and diarrhea, so that less is available for absorption.

CHRONIC EXPOSURE:
MANGANESE COMPOUNDS: Manganese poisoning, as described in chronic inhalation, has been reported in persons drinking manganese-contaminated well water.

12. ECOLOGICAL INFORMATION

Not available

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: Oxidizing solid, n.o.s. (MANGANESE

DIOXIDE)
ID NUMBER: UN1479
HAZARD CLASS OR DIVISION: 5.1
PACKING GROUP: III
LABELING REQUIREMENTS: 5.1

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
SHIPPING NAME: Oxidizing solid, n.o.s. (MANGANESE DIOXIDE)
UN NUMBER: UN1479
CLASS: 5.1
PACKING GROUP/RISK GROUP: III

LAND TRANSPORT ADR:
PROPER SHIPPING NAME: Oxidizing solid, n.o.s. (MANGANESE DIOXIDE)
UN NUMBER: UN1479
CLASS: 5.1
CLASSIFICATION CODE: O2
PACKING GROUP: III
LABELS: 5.1

LAND TRANSPORT RID:
PROPER SHIPPING NAME: Oxidizing solid, n.o.s. (MANGANESE DIOXIDE)
UN NUMBER: UN1479
CLASS: 5.1
CLASSIFICATION CODE: O2
PACKING GROUP: III
LABELS: 5.1

AIR TRANSPORT IATA:
PROPER SHIPPING NAME: Oxidizing solid, n.o.s. (MANGANESE DIOXIDE)
UN/ID NUMBER: UN1479
CLASS OR DIVISION: 5.1
HAZARD LABELS: 5.1
PACKING GROUP: III

AIR TRANSPORT ICAO:
PROPER SHIPPING NAME: Oxidizing solid, n.o.s. (MANGANESE DIOXIDE)
UN NUMBER: UN1479
CLASS OR DIVISION: 5.1
LABELS: 5.1
UN PACKING GROUP: III

MARITIME TRANSPORT IMDG:
PROPER SHIPPING NAME: Oxidizing solid, n.o.s. (MANGANESE DIOXIDE)
UN NUMBER: UN1479

CLASS OR DIVISION: 5.1
PACKING GROUP: III

15. REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):
ACUTE: Yes
CHRONIC: Yes
FIRE: Yes
REACTIVE: No
SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65):
MANGANESE AND COMPOUNDS (as Mn)

OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.

STATE REGULATIONS:
California Proposition 65: Not regulated.

CANADIAN REGULATIONS:
WHMIS CLASSIFICATION: Not determined.

EUROPEAN REGULATIONS:
EC CLASSIFICATION (ASSIGNED):

Xn	Harmful

EC Classification may be inconsistent with independently-researched data.

DANGER/HAZARD SYMBOL:

EC RISK AND SAFETY PHRASES:

R 20/22	Harmful by inhalation and if swallowed.
S 2	Keep out of reach of children.
S 25	Avoid contact with eyes.

GERMAN REGULATIONS:
WATER HAZARD CLASS (WGK):
STATE OF CLASSIFICATION: Annex 3
CLASSIFICATION UNDER HAZARD TO WATER: 1

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

16. OTHER INFORMATION