SAND2016-5096D

Solid Waste Management Unit 502

Part 2

Summary of Analytical Data used for Risk Assessment

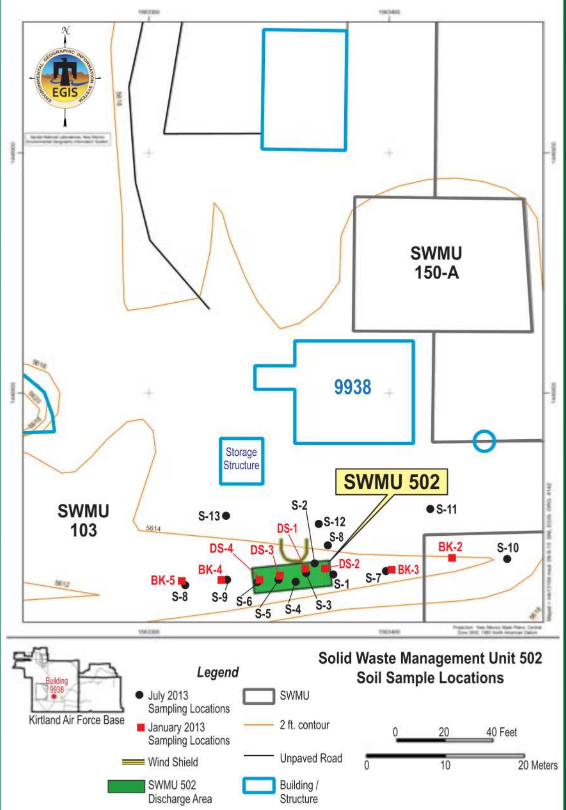
- Three HE compounds were detected; including octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), RDX, and pentaerythritol tetranitrate (PETN). HMX was detected in only one surface sample at a concentration of 380 micrograms per kilogram (µg/kg). PETN was detected at concentrations ranging from 445 µg/kg to 142000 µg/kg. RDX was detected at concentrations ranging from 156 µg/kg to 8830 µg/kg. All maximum HE values were detected in surface samples, and concentration levels decreased with depth and distance from the discharge area. There are no established background concentrations for HE compounds in soil.
- VOCs and SVOCs were analyzed in surface samples only. Compounds detected were; acetone, 2-butanone, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chloroform, chrysene, di-n-butyl phthalate, 2,4 dinitrophenol, bis(2-Ethylhexyl)phthalate, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene, pyrene, and styrene. There are no established background concentrations for VOCs and SVOCs in soil.
- NPN was reported in surface samples at concentrations ranging from 4 milligrams per kilogram (mg/kg) to 6460 mg/kg. There is no established background concentration for nitrate in soil.
- Perchlorate was reported at concentrations ranging from 0.019 mg/kg to 6.48 mg/kg. Detections were specific to the discharge area, as only two samples outside the discharge area reported perchlorate concentrations above the analytical detection limits. There is no established background concentration for perchlorate in soil.
- Antimony, arsenic, barium, cobalt, copper, nickel, silver, vanadium, and zinc were detected above established background concentrations.

Results of Risk Assessment

A risk assessment for the SWMU was provided to NMED in an Investigation Report for the VCA.

- Potential COCs may have been released into the vadose zone via infiltration of rain water and surface water runoff. However, the primary COCs (HE compounds) are relatively immobile and transport though the vadose zone is unlikely. Contamination at the site resulted from wastewater, generated from processes associated with the production, isolation, and purification of materials used in explosive synthesis activities, discharged to the ground surface. Although some residual COCs remain in the soil at SWMU 502, gross contamination (i.e., HE compounds) was not discovered. The collection of soil samples and analysis of the associated analytical data is sufficient to characterize residual contamination present (i.e. current conditions).
- Significant leaching into the subsurface soil is unlikely, and leaching into the groundwater at this site is assumed to be non-existent. The depth to groundwater at the site is approximately 350 ft bgs. The potential for transformation of COCs is low.
- For the COCs under the NMED guidelines for residential land-use scenario, the incremental risk calculations indicate slight risk to human health.
  - Though both the Hazardous Index (HI) and estimated excess cancer risk are above the NMED guideline for the residential land-use scenario, maximum concentrations were used in the risk calculation.
  - Because the site has been adequately characterized, average concentrations are more representative of actual site conditions.
  - The 95th percentile upper confidence limit (UCL) of the mean concentrations for the main contributors to excess cancer risk and hazards provide more realistic concentrations in the risk calculations that more accurately depict actual site conditions. These incremental risk calculations using UCL indicate insignificant risk to human health from COCs considering a residential land-use scenario.
  - Therefore, it is concluded that this site poses insignificant risk to human health under both the industrial and residential land-use scenarios.
- Using the SNL/NM ecological risk assessment methodology, the potential for ecological risks associated with SWMU 502 is expected to be low.
- The current and proposed land use at SWMU 502 and the surrounding area is industrial.

Solid Waste Management Unit 502 Soil Sample Locations



Summary of Detected SWMU 502 VCA Soil Sample Results

Analyte	SNL/NM Background Concentration	Total Samples	Number of Detections	Minimum Concentration	Maximum Concentration
HE Compounds in µg/kg					
HMX	NE	44	1	380	380
PETN	NE	44	22	445	142000
RDX	NE	44	27	156	8830
VOCs and SVOCs in µg/kg					
Acetone	NE	10	6	1.72	10.4
2-Butanone	NE	10	2	1.97	2.56
Chloroform	NE	10	5	0.43	6.86
Styrene	NE	10	1	0.453	0.453
Benzo(a)anthracene	NE	10	1	20.9	20.9
Benzo(a)pyrene	NE	10	1	22.7	22.7
Benzo(b)fluoranthene	NE	10	2	16.7	39.4
Benzo(ghi)perylene	NE	10	1	11.9	11.9
Benzo(k)fluoranthene	NE	10	1	24.1	24.1
Chrysene	NE	10	1	15.4	15.4
Di-n-butyl phthalate	NE	10	2	103	1890
2,4-Dinitrophenol	NE	10	2	1210	10900
bis(2-Ethylhexyl)phthalate	NE	10	3	146	177
Fluoranthene	NE	10	2	17.7	27.6
Indeno(1,2,3-c,d)pyrene,	NE	10	1	13.6	13.6
Phenanthrene	NE	10	1	10.8	10.8
Pyrene	NE	10	2	13.6	23.4
Inorganics in mg/kg					
NPN	NE	10	10	4.29	6460
Perchlorate	NE	44	27	0.019	6.48
Aluminum	NE	44	44	3620	12400
Antimony	3.9	44	27	0.425	13.3
Arsenic	5.6	44	44	1.85	9.91
Barium	130	44	44	95.9	854
Beryllium	0.65	44	44	0.118	0.532
Cadmium	< 1.0	44	44	0.0996	0.527
Calcium	NE	44	44	12200	157000
Chromium	17.3	44	44	2.94	13.4
Cobalt	5.2	44	44	1.50	8.57
Copper	15.4	44	44	2.41	36.4
Iron	NE	44	44	3520	10700
Lead	21.4	44	44	3.31	19.5
Magnesium	NE	44	44	1910	15900
Manganese	NE	44	44	61.3	286
Mercury	< 0.25	44	23	0.00369	0.0439
Nickel	11.5	44	44	3.23	14.8
Potassium	NE	44	44	792	11100
Silver	< 1.0	44	1	1.31	1.31
Sodium	NE	44	44	83.3	11000
Thallium	< 1.1	44	28	0.0637	0.202
Vanadium	20.4	44	44	12.5	53.1
Zinc	62	44	44	12.2	124

Notes:
HE = High explosive.
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.
µg/kg = Microgram(s) per kilogram.
mg/kg = Milligram(s) per kilogram.
NE = Not established.
PETN = Pentaerythritol tetranitrate.
RDX = 1,3,5-Trinitroperhydro-1,3,5-triazine.
SNL/NM = Sandia National Laboratories New Mexico.

Risk Assessment Values for SWMU 502 Nonradiological COCs

COC	Maximum Concentration (All Samples) (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Antimony	13.3	0.03	-	0.44	-
Arsenic	9.91	0.04	6.23E-06	0.46	2.55E-05
Barium	854	0.01	-	0.16	-
Cobalt	8.57	0.00	4.32E-09	0.01	9.19E-09
Copper	36.4	0.00	-	0.01	-
Nickel	14.8	0.00	-	0.01	-
Nitrate	6460	0.01	-	0.07	-
Silver	1.31	0.00	-	0.00	-
Vanadium	53.1	0.01	-	0.10	-
Zinc	124	0.00	-	0.01	-
Organics					
Acetone	0.0104	0.00	-	0.00	-
Benzo(a)anthracene	0.0209	-	9.91E-09	-	3.37E-08
Benzo(a)pyrene	0.0227	-	1.08E-07	-	3.66E-07
Benzo(b)fluoranthene	0.0394	-	1.87E-08	-	6.35E-08
Benzo(ghi)perylene	0.0119	-	5.64E-08	-	1.92E-07
Benzo(k)fluoranthene	0.0241	-	1.14E-09	-	3.88E-09
Bis 2-(Ethylhexyl)phthalate	0.177	0.00	9.23E-10	0.00	4E-09
Butanone, 2-	0.00256	0.00	-	0.00	-
Chloroform	0.00686	0.00	1.33E-08	0.00	2.85E-08
Chrysene	0.0154	-	7.3E-11	-	2.48E-10
Di-n-butyl phthalate	1.89	0.00	-	0.00	-
Dinitrophenol, 2,4-	10.9	0.01	-	0.06	-
Fluoranthene	0.0276	0.00	-	0.00	-
HMX	0.38	0.00	-	0.00	-
Indeno(1,2,3-c,d)pyrene	0.0136	-	6.45E-09	-	2.19E-08
Pentaerythritol tetranitrate (PETN)	142	0.12	3.3E-07	1.16	1.17E-06
Perchlorate	6.48	0.01	-	0.12	-
Phenanthrene	0.0108	0.00	-	0.01	-
Pyrene	0.0234	0.00	-	0.00	-
RDX	8.83	0.00	5.63E-07	0.05	2E-06
Styrene	0.000453	0.00	-	0.00	-
Total		0.24	7.34E-06	2.66	2.94E-05

Notes:
[a] EPA 1989
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
– = Information not available or not applicable

Recommendation

Based upon field investigation results, soil sample analytical data, and the results of human health and ecological risk assessment, a determination of corrective action complete (CAC) without controls is recommended for SWMU 502 for the following explanations:

- COCs are not present in the soil at levels considered hazardous to human health for either an industrial or residential land-use scenario.
- COCs warrant no ecological concern because ecological risks are acceptable using NMED guidance.

This site has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

For More Information, Contact:

U.S. Department of Energy
Sandia Field Office
Environmental Restoration
Mr. David Rast
Telephone: (505) 845-6867

Sandia National Laboratories
Analytical Services, Long Term Stewardship
Mr. Timmie Jackson
Telephone: (505) 284-2547