



**Primary Standards:** NSF/ANSI 61-2012, section 5:

#### **Preparation of Test Samples**

The samples were prepared by applying a thin layer of sample (measure in the lab at 1ml) on the 2 1/8" x 4 3/8" glass.

#### **Conditioning and Exposure**

In vessel, the samples were exposed to 1 liter of pH5, pH10 for metal evaluation and pH8 none chlorine for organic evaluation and was sent to Pace Analytical for gross alpha and gross beta analysis (radionuclides). The materials were conditioned as described in section 5.5.4. The exposure water was made as described in Table B15. Conditioning and exposure for barrier materials was performed. Following sanitation, the conditioning and exposure was begun.

#### **Exposure and Normalization**

Following conditioning, the sample was exposed to extraction water according to the applicable scheme detailed in section 5.5.5 and Table 5.2.

The liner was normalized for use in section 5 of the standard. The normalization equation was of:

Normalized contaminant concentration = Lab contaminant concentration x (SAF/VF) x (VL/SAL) x 24/hours of exposure x 0.55102

Where

(SAF/VF) x (VL/SAL) = 1  
Final exposure = 24 hours

As the barrier material complies at the 9.8 square inches per liter, no normalization was used.

#### **Extraction Water**

The extraction water was prepared as described in NSF/ANSI 61-2012, Table B15

#### **Collection/Preservation of Extraction Water**

Immediately following the exposure period, extraction waters collected for analysis were poured into previously prepared sample containers for storage until analysis, as specified in annex B, Section B.6 and Table B8.

Extracts for metal analysis were acidified with nitric acid as specified in EPA 200.8 protocols.

Samples for volatile organic contaminants were preserved with sodium thiosulfate and HCl then refrigerated, as outlined in EPA 524.2 protocol.

Samples for semi-volatile organic contaminants were preserved with sulfuric acid then refrigerated, as described in EPA 525.2 and SW-846 8270 protocol.



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## **Evaluation of Contaminant Concentrations**

Metal and organics concentrations were determined as a single point analysis and normalized as specified. The most conservative normalization factors were used as outlined in the standard. The resulting level for each extraction water was compared to the SPAC as this is a barrier material. To comply with the standard the sample must pass all metal conditions in both extraction waters

### **Analytical methodology**

Metal determinations:	EPA 200.8, Metal determinations by ICP/MS
Volatile organic contaminants:	EPA 524.2, Volatile organic determinations by Purge and Trap, GCMS.
Semi-volatile contaminants:	EPA 8270, EPA525.2 Semi-volatile organic determinations by liquid/liquid extraction followed by GC/MS determinations.

### **Analytical Instrumentation**

Metal determinations:	Thermo Electron X7 ICP/MS with CCT
Volatile organic determinations:	Thermo Electron DSQ GC/MS with Tekmar Velocity Purge and Trap system.
Semi-volatile organic determinations:	Thermo Electron DSQ GC/MS with AS2000 auto sampler.



**Metal Evaluations at Room Temperature Conditions (23°C):**

Metal	SPAC (ug/L)	pH5 Analytical Data @ 23°C (ug/L)	pH5 Static Normalized @ 23°C (ug/L)	pH10 Analytical Data @ 23°C (ug/L)	pH10 Static Normalized @ 23°C (ug/L)	Test Methods
Aluminum	2000	10.677	5.883	17.460	9.621	EPA 200.8
Antimony	0.60	ND (< 0.0344)	ND (< 0.0190)	ND (< 0.0344)	ND (< 0.0190)	EPA 200.8
Arsenic	1	ND (< 0.0950)	ND (< 0.0523)	ND (< 0.0950)	ND (< 0.0523)	EPA 200.8
Barium	200	0.626	0.345	1.102	0.607	EPA 200.8
Beryllium	0.40	ND (< 0.0925)	ND (< 0.0510)	ND (< 0.0925)	ND (< 0.0510)	EPA 200.8
Bismuth	10	ND (< 0.0859)	ND (< 0.0473)	ND (< 0.0859)	ND (< 0.0473)	EPA 200.8
Cadmium	0.50	ND (< 0.1083)	ND (< 0.0597)	ND (< 0.1083)	ND (< 0.0597)	EPA 200.8
Chromium	10	ND (< 0.1738)	ND (< 0.0958)	0.249	0.137	EPA 200.8
Copper	130	0.564	0.311	ND (< 0.4425)	ND (< 0.2438)	EPA 200.8
Mercury	0	ND (< 0.0191)	ND (< 0.0105)	0.143	0.079	EPA 200.8
Nickel	10	0.568	0.313	ND (< 0.1060)	ND (< 0.0584)	EPA 200.8
Selenium	5	ND (< 0.2911)	ND (< 0.1604)	ND (< 0.2911)	ND (< 0.1604)	EPA 200.8
Thallium	0.20	ND (< 0.0461)	ND (< 0.0254)	ND (< 0.0461)	ND (< 0.0254)	EPA 200.8
Tin	20	ND (< 0.0957)	ND (< 0.0527)	ND (< 0.0957)	ND (< 0.0527)	EPA 200.8
Zinc	300	ND (< 2.2865)	ND (< 1.2599)	ND (< 2.2865)	ND (< 1.2599)	EPA 200.8
Lead	0.50	ND (< 0.1236)	ND (< 0.0681)	ND (< 0.1236)	ND (< 0.0681)	EPA 200.8

Normalized concentration = Lab contaminant concentration x N1 x 24/hours of exposure X 0.551.

$N1 = \text{SAF/SAL} \times \text{VI/Vfstatic} = 1$



VOCs were measured by GC/MS. No target analytes were observed in the resulting volatile GC/MS. No non-target analytes were observed in the resulting volatile GC/MS chromatogram.

Semi-volatile organic compounds were monitored by GC/MS. Caprolactam and di-n-butyl-phthalate were the only target analytes were observed in the resulting semi-volatile GC/MS at normalized concentration well below the SPAC level set in the standard. No non-target analytes were observed in the resulting semi-volatile GC/MS chromatogram.

Radionuclides were measured by Pace Analytical.

Evaluation of the data from Pace is based on April 3, 2013 report and June 23, 2009 memo from TOXservices.

Gross alpha particle activity was detected at  $-1.25 \pm 0.535$  pCi/L in the sample forwarded. This level is well below the SPAC level in Annex D1 of the NSF/ANSI 61 Standard.

Gross beta activity was detected at  $0.727 \pm 0.680$  pCi/liter or 1.4 pCi/liter. The SPAC for Gross beta is 0.4 mrems/year. The TOXservices memo indicates that for static conditions 8pCi/liter is based on the concentration of Strontium 90 that yields a dose of 4 millirems per year to the body or any critical organ. The SPAC is 10% of the TAC or 0.4 mrem/year, which would be equivalent to 0.8 pCi/liter. The maximum observed level was above this activity for the exposure rate of 9.8 in<sup>2</sup>/liter. Gaylord, R.F. . in 2005 Radioactivity of Potassium Solutions: A Comparison of Calculated Activity to Measured Activity from Gross Beta Counting and Gamma Spectroscopy. Lawrence Livermore national Library. Report #UCRL-TR-214061 (<http://www.llnl.gov/tid/lof/documents/pdf/322937.pdf>) indicates that K-40 is a significant background source of beta radiation. 1 mg/L yields 0.84 pCi. K was assayed at 0.093 mg/L which would adjust down the gross Alpha to 1.3 pCi/liter. This level still exceeds the SPAC. Normalizing the result to a lower wetted area to volume ratio would make the results acceptable. With the exposure rate of 5.4 in<sup>2</sup>/liter, the maximum observed level is below 0.8 pCi/liter. ( $1.4/9.8*5.4= 0.77$  pCi/L)

Using Table 5.6 in NSF/ANSI 61 – 2012, this change in exposure rate would correspond to changing a standardized tank described in the table from about 300 gallons to one that is about 1000 gallons.

**Test Result of Organics:**

Target Analyte	Test Method	Result	Normalized
Volatile Organic Compounds:	EPA 524.2	(ug/L)	Result (ug/L)
Difluorodichloromethane		ND < 0.3	ND < 0.1653
Chloromethane		ND < 0.3	ND < 0.1653
Vinylchloride		ND < 0.3	ND < 0.1653
1,3-Butadiene		ND < 0.3	ND < 0.1653
Bromomethane		ND < 5.0	ND < 2.7551
Bromomethane		ND < 5.0	ND < 2.7551
Chloroethane		ND < 0.3	ND < 0.1653
Trichlorofluoromethane		ND < 0.3	ND < 0.1653
1,1-Dichloro-1-fluoroethane		ND < 0.3	ND < 0.1653
1,1-Dichloroethene		ND < 0.3	ND < 0.1653
Carbon disulfide		ND < 0.3	ND < 0.1653
Dichloromethane		ND < 0.3	ND < 0.1653
t-Butanol		ND < 0.3	ND < 0.1653
MtBE		ND < 0.3	ND < 0.1653
trans-1,2-Dichloroethene		ND < 0.5	ND < 0.2755
Acrylonitrile		ND < 0.3	ND < 0.1653
Vinylacetate		ND < 0.3	ND < 0.1653
Chloroprene		ND < 0.3	ND < 0.1653
1,1-Dichloroethane		ND < 0.3	ND < 0.1653
2,2-Dichloropropane		ND < 0.3	ND < 0.1653
cis-1,2-Dichloroethene		ND < 0.3	ND < 0.1653
2-Butanone		ND < 0.3	ND < 0.1653
Bromochloromethane		ND < 0.3	ND < 0.1653
Tetrahydrofuran		ND < 0.3	ND < 0.1653
Chloroform		ND < 0.3	ND < 0.1653
1,1,1-Trichloroethane		ND < 0.3	ND < 0.1653
Carbon tetrachloride		ND < 0.3	ND < 0.1653
1,1-Dichloropropene		ND < 0.3	ND < 0.1653
Isopropylacetate		ND < 0.3	ND < 0.1653
Benzene		ND < 0.3	ND < 0.1653
1,2-Dichloroethane		ND < 0.3	ND < 0.1653
Trichloroethene		ND < 0.3	ND < 0.1653
Methylmethacrylate		ND < 0.3	ND < 0.1653
1,2-Dichloropropane		ND < 0.3	ND < 0.1653
Dibromomethane		ND < 0.3	ND < 0.1653
Bromodichloromethane		ND < 0.3	ND < 0.1653
cis-1,3-Dichloropropene		ND < 0.3	ND < 0.1653
Toluene		ND < 0.3	ND < 0.1653
Ethylmethacrylate		ND < 0.3	ND < 0.1653

**Test Result of Organics:**

Target Analyte	Test Method	Result	Normalized
<b>Volatile Organic Compounds:</b>	<b>EPA 524.2</b>	<b>(ug/L)</b>	<b>Result (ug/L)</b>
trans-1,3-Dichloropropene		ND < 0.3	ND < 0.1653
1,1,2-Trichloroethane		ND < 0.3	ND < 0.1653
Tetrachloroethene		ND < 0.3	ND < 0.1653
Butylacetate		ND < 0.3	ND < 0.1653
1,3-Dichloropropane		ND < 0.3	ND < 0.1653
Dibromochloromethane		ND < 0.3	ND < 0.1653
1,2-Dibromoethane		ND < 0.3	ND < 0.1653
Chlorobenzene		ND < 0.3	ND < 0.1653
Ethylbenzene		ND < 0.3	ND < 0.1653
1,1,1,2-Tetrachloroethane		ND < 0.3	ND < 0.1653
m and p - Xylenes		ND < 0.3	ND < 0.1653
o-Xylene		ND < 0.3	ND < 0.1653
Styrene		ND < 0.3	ND < 0.1653
Tribromomethane		ND < 0.3	ND < 0.1653
Isopropylbenzene		ND < 0.3	ND < 0.1653
Cyclohexanone		ND < 0.3	ND < 0.1653
1,1,2,2-Tetrachloroethane		ND < 0.3	ND < 0.1653
Propylbenzene		ND < 0.3	ND < 0.1653
Bromobenzene		ND < 0.3	ND < 0.1653
1,2,3-Trichloropropane		ND < 0.3	ND < 0.1653
1,3,5-Trimethylbenzene		ND < 0.3	ND < 0.1653
2-Chlorotoluene		ND < 0.3	ND < 0.1653
4-Chlorotoluene		ND < 0.3	ND < 0.1653
t-Butylbenzene		ND < 0.3	ND < 0.1653
1,2,4-Trimethylbenzene		ND < 0.3	ND < 0.1653
sec-Butylbenzene		ND < 0.3	ND < 0.1653
p-Isopropyltoluene		ND < 0.3	ND < 0.1653
1,3-Dichlorobenzene		ND < 0.3	ND < 0.1653
1,4-Dichlorobenzene		ND < 0.3	ND < 0.1653
n-Butylbenzene		ND < 0.3	ND < 0.1653
1,2-Dichlorobenzene		ND < 0.3	ND < 0.1653
1,2-Dibromo-3-chloropropane		ND < 0.3	ND < 0.1653
1,2,4-Trichlorobenzene		ND < 0.3	ND < 0.1653
Hexachlorobutadiene		ND < 0.3	ND < 0.1653
Naphthalene		ND < 0.3	ND < 0.1653
1,2,3-Trichlorobenzene		ND < 0.3	ND < 0.1653

No non-target analytes observed in the chromatogram



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## Test Result of Organics:

Target Analyte	EPA 8270/EPA 625	Result	Normalized
<b>Semi-Volatile Organics</b>	C.A.S. Number	(ug/L)	Result (ug/L)
1,2,4-Trichlorobenzene	120-82-1	ND < 0.50	ND < 0.2755
1,3-Dichlorobenzene	541-73-1	ND < 0.50	ND < 0.2755
1,4-Dichlorobenzene	106-46-7	ND < 0.50	ND < 0.2755
1,2-Dichlorobenzene	95-50-1	ND < 0.50	ND < 0.2755
2,3,4,6-Tetrachlorophenol	58-90-2	ND < 0.50	ND < 0.2755
2,4,5-Trichlorophenol	95-95-4	ND < 1.20	ND < 0.6612
2,4,6-Trichlorophenol	88-06-2	ND < 1.00	ND < 0.5510
2,4-Dichlorophenol	120-83-2	ND < 0.50	ND < 0.2755
2,4-Dimethylphenol	105-67-9	ND < 0.50	ND < 0.2755
2,4-Dinitrophenol	51-28-5	ND < 10.00	ND < 5.5102
2,4-Dinitrotoluene	121-14-2	ND < 0.50	ND < 0.2755
2,6-Dichlorophenol	87-65-0	ND < 0.50	ND < 0.2755
2,6-Dinitrotoluene	606-20-2	ND < 0.50	ND < 0.2755
2-Chlorophenol	95-57-8	ND < 0.50	ND < 0.2755
2-Chloronaphthalene	91-58-7	ND < 0.50	ND < 0.2755
2-Ethylhexylmethacrylate	688-84-6	ND < 0.50	ND < 0.2755
2-Methylphenol	95-48-7	ND < 0.50	ND < 0.2755
2-Nitrophenol	88-75-5	ND < 10.00	ND < 5.5102
2-Phenyl 2-Propanol	617-94-7	ND < 0.50	ND < 0.2755
3-and 4-Methylphenol	108-39-4, 106-44-5	ND < 1.00	ND < 0.5510
4,6-Dinitro-2-methylphenol	534-52-1	ND < 0.70	ND < 0.3857
4-Bromophenylphenylether	101-55-3	ND < 0.50	ND < 0.2755
4-Chloro-3-methylphenol	59-50-7	ND < 0.50	ND < 0.2755
4-Chlorophenyl phenyl ether	7005-72-3	ND < 0.50	ND < 0.2755
4-Nitrophenol	100-02-7	ND < 10.00	ND < 5.5102
a,a,a'-Tetramethyl-1,4-benzenedimethanol	2948-46-1	ND < 0.50	ND < 0.2755
a,a,a'-Tetramethyl-1,3-benzenedimethanol	1999-85-5	ND < 0.50	ND < 0.2755
Acenaphthene	83-32-9	ND < 0.50	ND < 0.2755
Acenaphthylene	208-96-8	ND < 0.50	ND < 0.2755
Acetophenone	98-86-2	ND < 0.50	ND < 0.2755
Anthracene	120-12-7	ND < 0.50	ND < 0.2755
Azobenzene	103-33-3	ND < 0.50	ND < 0.2755
Benzo(a)anthracene	56-55-3	ND < 0.50	ND < 0.2755
Benzo(a)pyrene	50-32-8	ND < 0.50	ND < 0.2755
Benzo(b)fluoranthene	205-59-2	ND < 0.50	ND < 0.2755
Benzo(ghi)perylene	191-24-2	ND < 0.50	ND < 0.2755



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## Test Result of Organics:

Target Analyte	EPA 8270/EPA 625	Result	Normalized
Semi-Volatile Organics	C.A.S.Number	(ug/L)	Result (ug/L)
Benzo(k)fluoranthene	207-08-9	ND < 0.50	ND < 0.2755
Benzyl alcohol	100-51-6	ND < 0.50	ND < 0.2755
Benzylbutylphthalate	85-68-8	ND < 5.00	ND < 2.7551
Bis(2-Ethylhexyl)adipate	103-23-1	ND < 0.70	ND < 0.3857
bis-2-Chloroethoxy methane	111-91-1	ND < 0.50	ND < 0.2755
bis-2-Chloroethyl ether	111-44-4	ND < 0.50	ND < 0.2755
bis-2-Chloroisopropyl ether	108-60-1	ND < 0.50	ND < 0.2755
bis-2-ethylhexyl phthalate	117-81-7	ND < 1.00	ND < 0.5510
Bisphenol A	80-05-7	ND < 0.50	ND < 0.2755
Caprolactam	105-60-2	3.58	1.973
Carbazole	86-74-8	ND < 0.50	ND < 0.2755
Chrysene	218-01-9	ND < 0.50	ND < 0.2755
Dibenz(ah)anthracene	53-70-3	ND < 0.50	ND < 0.2755
Diethylphthalate	84-66-2	ND < 0.50	ND < 0.2755
Dimethylphthalate	131-11-3	ND < 0.50	ND < 0.2755
Di-n-butylphthalate	84-74-2	1.92	1.058
Di-n-octylphthalate	117-84-0	ND < 0.50	ND < 0.2755
Dinoseb	88-85-7	ND < 1.00	ND < 0.5510
Fluoranthene	206-44-0	ND < 0.50	ND < 0.2755
Fluorene	86-73-7	ND < 0.50	ND < 0.2755
Hexachlorobenzene	118-74-1	ND < 0.50	ND < 0.2755
Hexachlorobutadiene	87-68-3	ND < 0.50	ND < 0.2755
Hexachlorocyclopentadiene	77-47-4	ND < 0.50	ND < 0.2755
Hexachloroethane	67-72-1	ND < 0.50	ND < 0.2755
Indeno(1,2,3-cd)pyrene	193-39-5	ND < 0.50	ND < 0.2755
Isophorone	78-58-1	ND < 0.50	ND < 0.2755
Methyl 4-methoxysalicylate	5446-02-6	ND < 0.50	ND < 0.2755
Naphthalene	91-20-3	ND < 0.50	ND < 0.2755
Nitrobenzene	98-95-3	ND < 0.50	ND < 0.2755
N-Nitrosodimethylamine	62-75-9	ND < 0.50	ND < 0.2755
N-Nitroso-di-n-propylamine	621-64-7	ND < 0.50	ND < 0.2755
N-Nitrosodiphenylamine	86-30-6	ND < 0.50	ND < 0.2755
Pentachlorophenol	87-86-5	ND < 1.20	ND < 0.6612
Phenanthrene	85-01-8	ND < 0.50	ND < 0.2755
Phenol	108-95-2	ND < 0.50	ND < 0.2755
Pyrene	129-000-0	ND < 0.50	ND < 0.2755

No non-target analytes observed in the chromatogram