



## Memorandum

To: Concerned Parties

Cc: Chapin Spencer (Director)

From: Steve Roy (Senior Water Resources Engineer), Megan Moir (Asst. Director)

Date: July 17, 2017

Re: Water Quality Review and Plan for Aquarehab Water Main Relining Process

While part of our vetting process on this technology was contacting a number of clients from Aquarehab's reference list and obtaining a construction permit from Vermont Water Supply, the intent of this memo is to focus on water quality questions that could be raised by customers regarding this process. This memo includes a discussion of both temporary water lines as well as the finished relined water main product. While there is some information available on Aquarehab's website ([www.aquarehab.com](http://www.aquarehab.com)), this memo provides additional information with regard to water quality questions during and after completion of water main relining.

There are several standards that we use when evaluating safety of drinking water materials.

1. National Sanitation Foundation (NSF): The NSF ([www.nsf.org](http://www.nsf.org)) is an accredited third-party certification that provides all stakeholders – industry, regulators, users and the general public – assurance that a certified product, material, component or service complies with the technical requirements of the referenced standard. The NSF certification process is specific to the product, process or service being certified and the type of certification, but generally follows seven steps:

1. Application and information submission
2. Product evaluation
3. Product testing in lab
4. Manufacturing facility inspection, production confirmation and product sampling
5. Test results review and acceptance
6. Contract signed and products listed
7. Annual plant inspection and retesting

2. American National Standards Institute (ANSI): The ANSI ([www.ansi.org](http://www.ansi.org)) is a separate, private non-profit organization that oversees the development of voluntary consensus standards for products, services, processes, systems, and personnel in the United States.

3. American Water Works Association (AWWA): Established in 1881, the AWWA ([www.awwa.org](http://www.awwa.org)) is the largest nonprofit, scientific and educational association dedicated

to managing and treating water. AWWA publishes over 170 ANSI/AWWA standards that provide valuable information on design, installation, disinfection, treatment, and manufacturing of products including pipe, chemicals, storage tanks, valves, meters and other appurtenances; industry-recognized consensus prerequisites; and practices for water utility management and operations.

4. Food and Drug Administration (FDA): The FDA ([www.fda.gov](http://www.fda.gov)) is responsible for protecting the public health by assuring the safety, efficacy and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation. Products that are "FDA compliant" means they are made with materials that have been determined to be safe for use by the public. In the case of rubber hoses below, compliance means they meet the requirements of the Code of Federal Regulations standard 21 CFR 177.2600.

#### Aquarehab's Temporary Water Lines

Depending on user needs, above-grade temporary water lines laid by Aquarehab consists of 4" rigid PVC pipe, 2" potable water rubber hose and ¾" reinforced potable water PVC tubing. The 2" and 4" lines are disinfected and tested in accordance with the latest edition of AWWA standard C651. This standard requires chlorination of water lines at either 50 mg/l for 3 hours, 25 mg/l for 12 hours or 10 mg/l for 24 hours. Aquarehab conservatively disinfects at 50 mg/l for around 24 hours. These lines are then flushed to remove the super-chlorinated water and then sampled in multiple locations for Total Coliform and *E. Coli* bacteria. The above pipes, hoses, gaskets and other materials in contact with water are either NSF or FDA approved for potable water use.

#### Relined Water Mains

The reconditioned water main meets NSF 61 and ANSI requirements and will be disinfected/tested in the same manner as the temporary water lines. A relined pipe has a projected life of over 50 years.

The pipe liner, called Nordipipe and made by Norditube Technologies ([www.norditube.com](http://www.norditube.com)) is made up of a glass fiber reinforced felt that is wetted with a heat-cured epoxy. The liner interior is coated with an NSF approved polyethylene membrane that is the only material in contact with drinking water. Polyethylene, specifically in the form of high density polyethylene (HDPE), is one of a number materials used to make water mains. NSF/ANSI Standard 61 includes criteria for testing and evaluating products to ensure they do not leach contaminants into the water that would be a health concern. These contaminants include those regulated by the United States Environmental Protection Agency (USEPA), as well as any other non-regulated compounds that may be of concern. The NSF Certification process has several steps to approve the material, including the following:

- Application: NSF/ANSI Standard 61 requires a disclosure by the manufacturer of all water contact materials in the product and a disclosure by the manufacturer's material suppliers of all chemical ingredients in the materials. This includes the lining material as well as the epoxy that is used to adhere the liner to the existing pipe.
- Formulation, toxicology and product use information: Client and suppliers complete and submit NSF's Product Information Form. This provides formulation (liner and epoxy), toxicology and product use information.

- NSF formulation review: NSF toxicologists perform a formulation review for each water contact material to determine any possible ingredients, contaminants, or reaction by-products that may potentially leach from the material into drinking water. This formulation review then determines the battery of chemical analyses that will be performed on a particular material.
- Plant audit and sample collection: NSF then conducts an inspection of the production facility annually to verify the product formulation and production process and to ensure adequate quality control procedures are in place to prevent the use of unauthorized materials. Product samples are collected during the inspection and sent to NSF laboratories to be tested to the appropriate exposure protocol of NSF/ANSI Standard 61.
- Laboratory testing: Devices or materials are evaluated according to the exposure and analysis methods in Annex B of NSF/ANSI Standard 61. Most products undergo a 3-week to 3-month exposure process where the products are exposed to various formulated waters designed to extract specific types of contaminants. Contaminant concentrations are determined from chemical analyses of the exposure water samples. (See below under additional testing for our attempt to safeguard against any unanticipated long term breakdown of the liner).
- Toxicology evaluation - These contaminant concentrations are then evaluated by a toxicologist to the pass/fail criteria in Annex D and E of NSF/ANSI Standard 61. Products that meet the requirements of the standard are then certified and appear in the NSF Listings. If products fail to meet the requirements of the standard, the manufacturer may identify the source of the failure and resubmit a reformulated product for certification.
- Attached at the end of this memo is Aquarehab's NSF/ANSI 61 certification.

#### Additional Testing

After questions were raised last year by Vermont Water Supply and a member of our own City Council (a registered nurse) regarding the potential for leaching of compounds from the completed product into our drinking water, we performed Volatile Organic Compound (VOC) testing using Method 524.2 to verify conformance with NSF/ANSI Standard 61 prior to transfer of water from the temporary above-grade to the newly rehabilitated underground main. At the end of this memo are the compounds tested as part of Method 524.2 with drinking water limits plus results from last year's relining project. The only compounds detected were disinfection byproducts from chlorination of the water that are well below MCLs (maximum contaminant levels). *Please note that disinfection is required for all surface water systems to prevent waterborne illnesses.*

We intend to do additional VOC testing this year as well.



The Public Health and Safety Organization

## NSF Product and Service Listings

These NSF Official Listings are current as of **Monday, March 20, 2017** at 12:15 a.m. Eastern Time. Please [contact NSF International](#) to confirm the status of any Listing, report errors, or make suggestions.

Alert: NSF is concerned about fraudulent downloading and manipulation of website text. Always confirm this information by clicking on the below link for the most accurate information:

<http://info.nsf.org/Certified/PwsComponents/Listings.asp?Company=0D680&Standard=061&>

### NSF/ANSI 61 Drinking Water System Components - Health Effects

**NOTE: Unless otherwise indicated for Materials, Certification is only for the Water Contact Material shown in the Listing. Click here for a list of [Abbreviations used in these Listings](#). Click here for the definitions of [Water Contact Temperatures denoted in these Listings](#).**

#### NordiTube Technologies SE

Bruckbachweg 23  
4203 Altenberg bei Linz  
Austria  
49 5284 94298 10

**Facility :** Liège, Belgium

#### Protective (Barrier) Materials

Trade Designation	Water Contact Size Restriction	Water Contact Temp	Water Contact Material
<b>Coatings - Pipe - Immediate Return to Service</b> [1] [2]			
Nordiflow[5] [6]	>= 6"	CLD 23	MLTPL
Nordipipe[3] [4]	>= 6"	CLD 23	MLTPL
Nordipipe[5] [6]	>= 6"	CLD 23	MLTPL

- [1] Only products bearing the NSF Mark are Certified.
- [2] Evaluated for Immediate Return to Service.
- [3] Certified for use with Nordipox D resin only.
- [4] Final Cure Time and Temperature: Resin is mixed and applied to felt side of liner and then cured by hot water cure for a minimum of 5 hours at 82°C. After the hot water resin cure, lined pipes are subject to an ambient cure of 7 days.
- or
- Final Cure Time and Temperature: Resin is mixed and applied to felt side of liner, then cured by steam cure for a minimum of 5 hours at 85° C. After the steam cure, lined pipes are subject to an ambient cure of 7 days.
- Special Comments: Mix ratio of resin (Part A: Part B) is 100:80 by weight.
- [5] Certified for use with r.tec 521-25 OF resin only.
- [6] Final Cure Time and Temperature: Resin is mixed and applied to felt side of liner; liner is inverted into pipe. Lined pipe is cured by a hot water cure for a minimum of 5 hours at 80°C. After the hot water cure, lined pipes are subject to an ambient cure of 7 days.
- or
- Final Cure Time and Temperature: Resin is mixed and applied to felt side of liner; liner is inverted into pipe. Lined pipe is cured by steam cure for a minimum of 3 hours at 90°C. After the steam cure, lined pipes are subject to an ambient cure of 7 days.
- Mix ratio of resin (Part A: Part B) is 100:40 by weight.

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Number of matching Manufacturers is 1

Number of matching Products is 3

Processing time was 0 seconds

EPA METHOD 524.2  
MEASUREMENT OF PURGEABLE ORGANIC COMPOUNDS IN WATER BY  
CAPILLARY COLUMN GAS CHROMATOGRAPHY/MASS SPECTROMETRY

<u>ANALYTE</u>	Chemical Abstract Service <u>Registry Number</u>	<u>Primary/Secon. MCL/Notes</u>
Acetone*	67-64-1	700 ppb (same units below)
Acrylonitrile*	107-13-1	5
Allyl chloride*	107-05-1	
Benzene	71-43-2	5
Bromobenzene	108-86-1	
Bromochloromethane	74-97-5	80 total trihalomethanes <sup>1</sup>
Bromodichloromethane	75-27-4	
Bromoform	75-25-2	
Bromomethane	74-83-9	10
2-Butanone*	78-93-3	
n-Butylbenzene	104-51-8	
sec-Butylbenzene	135-98-8	
tert-Butylbenzene	98-06-6	
Carbon disulfide*	75-15-0	
Carbon tetrachloride	56-23-5	5
Chloroacetonitrile*	107-14-2	
Chlorobenzene	108-90-7	100
1-Chlorobutane*	109-69-3	
Chloroethane	75-00-3	
Chloroform	67-66-3	
Chloromethane	74-87-3	
2-Chlorotoluene	95-49-8	100
4-Chlorotoluene	106-43-4	100
Dibromochloromethane	124-48-1	
1,2-Dibromo-3-chloropropane	96-12-8	0.2
1,2-Dibromoethane	106-93-4	
Dibromomethane	74-95-3	
1,2-Dichlorobenzene	95-50-1	600
1,3-Dichlorobenzene	541-73-1	
1,4-Dichlorobenzene	106-46-7	75
trans-1,4-Dichloro-2-butene*	110-57-6	
Dichlorodifluoromethane	75-71-8	1000
1,1-Dichloroethane	75-34-3	5
1,2-Dichloroethane	107-06-2	5
1,1-Dichloroethene	75-35-4	7
cis-1,2-Dichloroethene	156-59-2	70
trans-1,2-Dichloroethene	156-60-5	100
1,2-Dichloropropane	78-87-5	5
1,3-Dichloropropane	142-28-9	
2,2-Dichloropropane	590-20-7	
1,1-Dichloropropene	563-58-6	
1,1-Dichloropropanone*	513-88-2	
cis-1,3-Dichloropropene	10061-01-5	0.5
trans-1,3-Dichloropropene	10061-02-6	

<u>ANALYTE</u>	Chemical Abstract Service <u>Registry Number</u>	<u>Primary/Secon. MCL/Notes</u>
Diethyl ether*	60-29-7	
Ethylbenzene	100-41-4	700
Ethyl methacrylate*	97-63-2	
Hexachlorobutadiene	87-68-3	1
Hexachloroethane*	67-72-1	
2-Hexanone*	591-78-6	
Isopropylbenzene	98-82-8	
4-Isopropyltoluene	99-87-6	
Methacrylonitrile*	126-98-7	
Methylacrylate*	96-33-3	
Methylene chloride	75-09-2	5
Methyl iodide*	74-88-4	
Methylmethacrylate*	80-62-6	
4-Methyl-2-pentanone*	108-10-1	
Methyl-t-butyl ether* (MTBE)	1634-04-4	40
Naphthalene	91-20-3	20
Nitrobenzene*	98-95-3	
2-Nitropropane*	79-46-9	
Pentachloroethane*	76-01-7	
Propionitrile*	107-12-0	
n-Propylbenzene	103-65-1	
Styrene	100-42-5	100
1,1,1,2-Tetrachloroethane	630-20-6	5
1,1,2,2-Tetrachloroethane	79-34-5	70
Tetrachloroethene	127-18-4	5
Tetrahydrofuran*	109-99-9	
Toluene	108-88-3	1000
1,2,3-Trichlorobenzene	87-61-6	
1,2,4-Trichlorobenzene	120-82-1	70
1,1,1-Trichloroethane	71-55-6	200
1,1,2-Trichloroethane	79-00-5	5
Trichloroethene	79-01-6	5
Trichlorofluoromethane	75-69-4	2100
1,2,3-Trichloropropane	96-18-4	5
1,2,4-Trimethylbenzene	95-63-6	5
1,3,5-Trimethylbenzene	108-67-8	4
Vinyl chloride	75-01-4	2
o-Xylene	95-47-6	10,000 total Xylenes <sup>2</sup>
m-Xylene	108-38-3	
p-Xylene	106-42-3	

#### NOTES

1. Total trihalomethanes, a disinfection byproduct, consists of the sum of bromoform, chloroform, chlorodibromomethane and bromodichloromethane.
2. Total Xylenes consists of the sum of o-, m- and p- Xylene.

## Laboratory Report

DATE REPORTED: 09/22/2016

CLIENT: Burlington DPW- Water Div.  
PROJECT: WSID 5053 VOC SPWORK ORDER: 1609-21330  
DATE RECEIVED 09/20/2016

001 Site: Industrial Parkway

Date Sampled: 9/20/16 Time: 12:50

Facility ID: TP001 Smp Pt: EP001 Categ: GE Smp Type: SP Compl Ind: N Repl Ind: N

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
VOC Potable Water							
Dichlorodifluoromethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Chloromethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Vinyl chloride	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Bromomethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Chloroethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Trichlorofluoromethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,1-Dichloroethene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Methylene chloride	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Methyl-t-butyl ether (MTBE)	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
trans-1,2-Dichloroethene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,1-Dichloroethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
2,2-Dichloropropane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
cis-1,2-Dichloroethene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Bromochloromethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Chloroform	43.8	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,1,1-Trichloroethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Carbon tetrachloride	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,1-Dichloropropene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Benzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,2-Dichloroethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Trichloroethene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,2-Dichloropropane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Dibromomethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Bromodichloromethane	4.0	ug/L	EPA 524.2	9/21/16	W SJM	A	
cis-1,3-Dichloropropene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Toluene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
trans-1,3-Dichloropropene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,1,2-Trichloroethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Tetrachloroethene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,3-Dichloropropane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Dibromochloromethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Chlorobenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Ethylbenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,1,1,2-Tetrachloroethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Xylenes, Total	< 1.0	ug/L	EPA 524.2	9/21/16	W SJM	A	
Styrene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Bromoform	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Isopropylbenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,1,2,2-Tetrachloroethane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
Bromobenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
n-Propylbenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,2,3-Trichloropropane	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
2-Chlorotoluene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	
1,3,5-Trimethylbenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A	

**Laboratory Report**

DATE REPORTED: 09/22/2016

CLIENT: Burlington DPW- Water Div.  
PROJECT: WSID 5053 VOC SPWORK ORDER: 1609-21330  
DATE RECEIVED 09/20/2016

001	Site: Industrial Parkway						Date Sampled: 9/20/16	Time: 12:50
Facility ID:	Smp Pt:	EP001	Categ: GE	Smp Type: SP	Compl Ind: N	Repl Ind: N		
Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.	
4-Chlorotoluene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
t-Butylbenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
1,2,4-Trimethylbenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
s-Butylbenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
4-Isopropyltoluene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
1,3-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
1,4-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
n-Butylbenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
1,2-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
1,2,4-Trichlorobenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
Hexachlorobutadiene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
Naphthalene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
1,2,3-Trichlorobenzene	< 0.5	ug/L	EPA 524.2	9/21/16	W SJM	A		
Surr. 1 (4-Bromofluorobenzene)	87	%	EPA 524.2	9/21/16	W SJM	A		
Surr. 2 (1,2-Dichlorobenzene d4)	82	%	EPA 524.2	9/21/16	W SJM	A		

002	Site: Trip Blank Not Needed						Date Sampled: 9/20/16	Time: 12:50
Facility ID:	Smp Pt:	UNKNO	Categ: UN	Smp Type: SP	Compl Ind: N	Repl Ind: U		IN
Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.	
No analysis								

Endyne will submit this data electronically to the State of VT Water Supply Division in accordance with their policy and standards.

**Laboratory Report**

DATE REPORTED: 09/26/2016

CLIENT: Burlington DPW- Water Div.  
PROJECT: WSID 5053 VOC SPWORK ORDER: 1609-21208  
DATE RECEIVED 09/19/2016

001 Site: Pitkin Street

Date Sampled: 9/19/16 Time: 10:45

Facility ID: TP001 Smp Pt: EP001 Categ: GE Smp Type: SP Compl Ind: N Repl Ind: N

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
VOC Potable Water							
Dichlorodifluoromethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Chloromethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Vinyl chloride	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Bromomethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Chloroethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Trichlorofluoromethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,1-Dichloroethene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Methylene chloride	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Methyl-t-butyl ether (MTBE)	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
trans-1,2-Dichloroethene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,1-Dichloroethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
2,2-Dichloropropane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
cis-1,2-Dichloroethene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Bromochloromethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Chloroform	25.8	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,1,1-Trichloroethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Carbon tetrachloride	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,1-Dichloropropene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Benzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,2-Dichloroethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Trichloroethene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,2-Dichloropropane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Dibromomethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Bromodichloromethane	3.3	ug/L	EPA 524.2	9/23/16	W EEP	A	
cis-1,3-Dichloropropene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Toluene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
trans-1,3-Dichloropropene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,1,2-Trichloroethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Tetrachloroethene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,3-Dichloropropane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Dibromochloromethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Chlorobenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Ethylbenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,1,1,2-Tetrachloroethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Xylenes, Total	< 1.0	ug/L	EPA 524.2	9/23/16	W EEP	A	
Styrene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Bromoform	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Isopropylbenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,1,2,2-Tetrachloroethane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Bromobenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
n-Propylbenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,2,3-Trichloropropane	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
2-Chlorotoluene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,3,5-Trimethylbenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	

**Laboratory Report**

DATE REPORTED: 09/26/2016

CLIENT: Burlington DPW- Water Div.  
PROJECT: WSID 5053 VOC SPWORK ORDER: 1609-21208  
DATE RECEIVED 09/19/2016

001 Site: Pitkin Street Date Sampled: 9/19/16 Time: 10:45

Facility ID: TP001 Smp Pt: EP001 Categ: GE Smp Type: SP Compl Ind: N Repl Ind: N

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
4-Chlorotoluene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
t-Butylbenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,2,4-Trimethylbenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
s-Butylbenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
4-Isopropyltoluene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,3-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,4-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
n-Butylbenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,2-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,2,4-Trichlorobenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Hexachlorobutadiene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Naphthalene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
1,2,3-Trichlorobenzene	< 0.5	ug/L	EPA 524.2	9/23/16	W EEP	A	
Surr. 1 (4-Bromofluorobenzene)	90	%	EPA 524.2	9/23/16	W EEP	A	
Surr. 2 (1,2-Dichlorobenzene d4)	81	%	EPA 524.2	9/23/16	W EEP	A	

002 Site: Trip Blank Not Needed Date Sampled: 9/19/16 Time: 10:45

Facility ID: UNKNO Smp Pt: UNKNO Categ: UN Smp Type: SP Compl Ind: N Repl Ind: U

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
No analysis							

Endyne will submit this data electronically to the State of VT Water Supply Division in accordance with their policy and standards.

## Laboratory Report

DATE REPORTED: 10/06/2016

CLIENT: Burlington DPW- Water Div.  
PROJECT: WSID 5053 VOC SPWORK ORDER: 1609-21848  
DATE RECEIVED 09/26/2016

001 Site: King St Date Sampled: 9/26/16 Time: 10:35

Facility ID: TP001 Smp Pt: EP001 Categ: GE Smp Type: SP Compl Ind: N Repl Ind: N

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
VOC Potable Water							
Dichlorodifluoromethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Chloromethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Vinyl chloride	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Bromomethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Chloroethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Trichlorofluoromethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,1-Dichloroethene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Methylene chloride	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Methyl-t-butyl ether (MTBE)	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
trans-1,2-Dichloroethene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,1-Dichloroethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
2,2-Dichloropropane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
cis-1,2-Dichloroethene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Bromochloromethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Chloroform	22.4	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,1,1-Trichloroethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Carbon tetrachloride	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,1-Dichloropropene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Benzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,2-Dichloroethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Trichloroethene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,2-Dichloropropane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Dibromomethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Bromodichloromethane	3.4	ug/L	EPA 524.2	10/5/16	W SJM	A	
cis-1,3-Dichloropropene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Toluene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
trans-1,3-Dichloropropene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,1,2-Trichloroethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Tetrachloroethene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,3-Dichloropropane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Dibromochloromethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Chlorobenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Ethylbenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,1,1,2-Tetrachloroethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Xylenes, Total	< 1.0	ug/L	EPA 524.2	10/5/16	W SJM	A	
Styrene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Bromoform	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Isopropylbenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,1,2,2-Tetrachloroethane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
Bromobenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
n-Propylbenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,2,3-Trichloropropane	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
2-Chlorotoluene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	
1,3,5-Trimethylbenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A	

**Laboratory Report**

DATE REPORTED: 10/06/2016

CLIENT: Burlington DPW- Water Div.  
PROJECT: WSID 5053 VOC SPWORK ORDER: 1609-21848  
DATE RECEIVED 09/26/2016

001	Site: King St						Date Sampled: 9/26/16	Time: 10:35
Facility ID:	Smp Pt:	EP001	Categ: GE	Smp Type: SP	Compl Ind: N	Repl Ind: N		
Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.	
4-Chlorotoluene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
t-Butylbenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
1,2,4-Trimethylbenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
s-Butylbenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
4-Isopropyltoluene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
1,3-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
1,4-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
n-Butylbenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
1,2-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
1,2,4-Trichlorobenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
Hexachlorobutadiene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
Naphthalene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
1,2,3-Trichlorobenzene	< 0.5	ug/L	EPA 524.2	10/5/16	W SJM	A		
Surr. 1 (4-Bromofluorobenzene)	93	%	EPA 524.2	10/5/16	W SJM	A		
Surr. 2 (1,2-Dichlorobenzene d4)	78	%	EPA 524.2	10/5/16	W SJM	A		

002	Site: Trip Blank Not Needed						Date Sampled: 9/12/16	Time: 10:35
Facility ID:	Smp Pt:	UNKNO	Categ: UN	Smp Type: UN	Compl Ind: Y	Repl Ind: U		IN
Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.	
No analysis								

**Report Summary of Qualifiers and Notes**

Samples were received at the laboratory with a temperature of 18.0 degrees Celsius. Samples must be received in a cooler with sufficient ice to attain a temperature of 6 degrees Celsius or below. Samples must not be frozen. Endyne will submit this data electronically to the State of VT Water Supply Division in accordance with their policy and standards.

## Laboratory Report

DATE REPORTED: 09/01/2016

CLIENT: Burlington DPW- Water Div.  
PROJECT: WSID 5053 VOC SPWORK ORDER: 1608-19451  
DATE RECEIVED 08/31/2016

001 Site: Isham Water Main Date Sampled: 8/31/16 Time: 10:45

Facility ID: TP001 Smp Pt: EP001 Categ: GE Smp Type: SP Compl Ind: N Repl Ind: N

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
VOC Potable Water							
Dichlorodifluoromethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Chloromethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Vinyl chloride	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Bromomethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Chloroethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Trichlorofluoromethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,1-Dichloroethene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Methylene chloride	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Methyl-t-butyl ether (MTBE)	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
trans-1,2-Dichloroethene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,1-Dichloroethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
2,2-Dichloropropane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
cis-1,2-Dichloroethene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Bromochloromethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Chloroform	34.1	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,1,1-Trichloroethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Carbon tetrachloride	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,1-Dichloropropene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Benzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,2-Dichloroethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Trichloroethene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,2-Dichloropropane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Dibromomethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Bromodichloromethane	4.0	ug/L	EPA 524.2	8/31/16	W SJM	A	
cis-1,3-Dichloropropene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Toluene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
trans-1,3-Dichloropropene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,1,2-Trichloroethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Tetrachloroethene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,3-Dichloropropane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Dibromochloromethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Chlorobenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Ethylbenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,1,1,2-Tetrachloroethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Xylenes, Total	< 1.0	ug/L	EPA 524.2	8/31/16	W SJM	A	
Styrene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Bromoform	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Isopropylbenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,1,2,2-Tetrachloroethane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
Bromobenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
n-Propylbenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,2,3-Trichloropropane	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
2-Chlorotoluene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	
1,3,5-Trimethylbenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A	

**Laboratory Report**

DATE REPORTED: 09/01/2016

CLIENT: Burlington DPW- Water Div.  
PROJECT: WSID 5053 VOC SPWORK ORDER: 1608-19451  
DATE RECEIVED 08/31/2016

001		Site: Isham Water Main				Date Sampled: 8/31/16		Time: 10:45	
Facility ID:	Smp Pt:	EP001	Categ: GE	Smp Type: SP	Compl Ind: N	Repl Ind: N			
Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.		
4-Chlorotoluene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
t-Butylbenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
1,2,4-Trimethylbenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
s-Butylbenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
4-Isopropyltoluene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
1,3-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
1,4-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
n-Butylbenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
1,2-Dichlorobenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
1,2,4-Trichlorobenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
Hexachlorobutadiene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
Naphthalene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
1,2,3-Trichlorobenzene	< 0.5	ug/L	EPA 524.2	8/31/16	W SJM	A			
Surr. 1 (4-Bromofluorobenzene)	96	%	EPA 524.2	8/31/16	W SJM	A			
Surr. 2 (1,2-Dichlorobenzene d4)	89	%	EPA 524.2	8/31/16	W SJM	A			

002		Site: Trip Blank Not Needed				Date Sampled: 8/31/16		Time: 10:45	
Facility ID:	Smp Pt:	UNKNO	Categ: UN	Smp Type: SP	Compl Ind: N	Repl Ind: U	IN		
Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.		
No analysis									

Endyne will submit this data electronically to the State of VT Water Supply Division in accordance with their policy and standards.