RESEARCH & EDUCATION FUND

# TO DECOCT OR NOT TO DECOCT: THAT IS THE QUESTION


American Homebrewers Association®

# TO DECOCT OR NOT TO DECOCT: THAT IS THE QUESTION!

***Sponsored by the AHA Research and Education Fund in conjunction with Brew and Wine Hobby, E. Hartford, CT***
***By Timothy Phelps, Joseph Fuller & The Krausen Commandos***
***Photos by Will Siss and Timothy Phelps***

## THE PROJECT


Across the brewing community, we are sure the question has been asked hundreds of times on forums, boards, and brewing publications; “Have you ever done a decoction?” “Do I need to do a decoction to brew a traditional lager?” “Do you get anything viable for the added time a decoction requires?” and so on. We would think the most common answer would be that there is no reason to do a decoction because of the quality of modified malts that are available to brewers today.

During a regular club meeting of the Krausen Commandos early in January 2013, one of our members was looking to brew a Munich Dunkel and she came to the club looking for guidance. She asked if it was a requirement to do a decoction or if a single infusion mash would suffice for this type of beer. She also asked what the process was to perform a decoction, if anyone in the club had done one, and what the results were. Most people hadn’t ever done one and didn’t even really know what it meant, but a few people said it wasn’t required with the malts available to us today. Additionally, several members said it takes too much time for not much difference in outcome. The real fact of the matter was that we were just repeating information that had been read that none of us had practically performed. No one in our club had ever done a side-by-side comparison before to actually provide concrete proof nor was able to provide substantial reasoning for doing or not doing a decoction.

Not long passed before our club learned that the AHA started the Research & Education Fund, so we jumped at the opportunity to apply for a grant to (hopefully) answer this question.

The only way we felt we could evaluate this properly was to brew a single infusion mash, a single-, double- and triple-decoction, all in the same day, on the same equipment, with the same lots of grain, hops, water, yeast and then ferment in the same place, under the same conditions, etc., in order to eliminate any variants in separate brew day circumstances.

## WHAT IS A DECOCTION ANYWAY?

*This is an excerpt from John Palmer's How to Brew.*

1 Decoction mashing was developed to get the best extraction from the old-time Northern European barley strains that depended on over wintering to germinate and were more difficult to malt and modify. Decoction mashing provided for better breakdown and solubilization of the starches and better extraction from those less-modified malts. Beer connoisseurs claim better malt flavor and aroma from decoction mashing of those malts. These days, less-modified malts are hard to find, but decoction mashing is still useful for extracting that extra bit of malt character for bock and Oktoberfest-style lagers. In addition, the decoction mashing provides for increased hot break and clarity in the wort. The pH from decoction mashes has been shown to be 0.1 to 1.15 pH units lower than the same wort from an infusion mash.

Decoction mashing is a good way to conduct multi-step mashes without adding additional water or applying heat to the mash tun. It involves removing a portion of the mash to another pot., heating it to the conversion rest on the stove, then boiling it, and returning it to the mash to raise the rest of the mash to the next temperature rest. The portion removed should be pretty stiff-no free water should be showing above the top of the grain. The decoction should be held to conversion rest temperatures (150°F to 155°F, 65°C to 68°C) for 10 to 15 minutes before being boiled. Stir constantly!

Read "How to Brew" by John Palmer for the full details of the process.

## THE PLANNING

A very good friend of mine once said, "Make a plan and then plan on improvising." This quote has come into play many times in my brewing career, and would definitely come in to play on our brew day. – Joe

As an editor for a college yearbook years ago, the following was said to me and it has rang true in almost everything I do and certainly applied in the planning of this…"Failing to plan, is planning to fail." - Tim

At this point we had to figure out how were we going to brew four of the same beer, on the same day, on the same equipment, and to remove as many different variables as possible, with a lot of planning.

In early May 2013, we started to discuss the venture and how to do a side-by-side comparison, allowing us to educate fellow members on the actual differences using the decoction versus single infusion mashes.

Our plan was to brew a lager, which would have been traditionally brewed with a decoction. We would use the Munich Dunkel recipe that was in question earlier.

## THE EQUIPMENT

2 Blichmann TopTiers
15.5 gal Stainless eHLT (to heat all water)
15.5 gal Stainless Propane Fired Kettle
20 gal Coleman cooler mash tun
24 Quart Turkey Pot and Fryer (for decoctions)
Calibrated Electronic Thermocouple Readers
MaltMill Barley Crusher
Blichmann In-Line Thermometer
Chillzilla
Refractometer
Hydrometer
3 Propane Tanks
4-6.5 Gallon Carboys
Aeration Stone

**THE RECIPE**
Batch Size: 6 gallons
Boil time: 90 minutes

6 lbs Pilsner Malt
3.5 lbs Munich Malt 10L
1.25 lbs Crystal 60L
.75 lb Torrefied Wheat
.25 lb Crystal 40L
.25 lb Chocolate Malt
1.50 oz Tettnang Hops 3.08 aa (60 mins)
1 oz Tettnang Hops (30 mins)
2 Smack Packs Wyeast Munich Lager #2308
Big Y Spring Water (See attached water report)
(We opted to pitch two smack packs per batch versus making starters to keep the differences in starters out of the equation)

## THE BREW DAY

On Saturday November 16, 2013, 5-6 club members convened at 8:00am and were all eager to dive into the brew day!

To begin, we weighed out the grain for all four and then ran the grain for each batch through the same grain mill to achieve the same crush for each beer. We did two passes through the mill for each, the first at .08 in. and the second at .039 using the MaltMill Barley Crusher®.

After much discussion leading up to the brew, we decided that we would begin with brewing the single infusion mash. We thought this would be the best way to start since all club members are familiar with single infusion mashing. The morning of brewing, we also had further discussion that took place regarding the actual mash times. Again, as to allow for maximum time consistency for each batch, we agreed that the mash rest time for each would be 60 minutes of the entire wort and grist together (including the decoction times. **The decoction times and mash schedules were changed at the beginning of the brew day based on discussion and what seemed to be the best way to abate variability. In the end, we mashed each one for 60 minutes. *Bring on the questions and comments, we do have reasoning.***

The brew day went fairly smoothly, however, we encountered a few unforeseen issues. It was nothing that the experience of our club members couldn't overcome though, just using some problem solving.

One challenge that came along the way that we had to adapt our plans was the decoction schedule. The recipes and mash schedule called for distinct amounts of grist that were to be removed from the mash for the decoction. These amounts were calculated to raise the mash to the next temperature step. What we came to find out during the first decoction is that Beersmith® assumed that mash temperature was able to be maintained through an external heating source so that heat was not lost along the way. We used a cooler for our mash tun, and therefore were unable to do so. We were able to accurately monitor the mash temperature through the use of calibrated electronic thermocouple readers that were able to measure temperature down to the tenth of a degree. With this accuracy we could observe the trend of the mash cool down along the way and were able to revise the grist volume removed to hit our target rest temperatures.

At the pinnacle of the brew day we had three batches being brewed at the same time. We had strike water heating for the single decoction, the double decoction was going through its final mash rest, and the triple decoction was finishing the

boil and re-circulating. Even with equipment challenges, as well having three batches going on the same “system at the same time, we were able to hit our Original Gravities for each beer except for the double decoction coming out a few points higher than the rest. The well-coordinated timing in our planning made it possible for us to pull this off.

After 12.5 hours, we had completed all four beers and cleaned up, it was a long day!

## THE FERMENTATION

To achieve consistency in fermentation, we chose to ferment all the beers in 6.5 gallon carboys. The four beers were kept at 62°F for the first 12 hours in order for fermentation to begin. They all started at varying times over the night, but by morning all had a 2 to 3 inch thick krausen on the top. At this time, the carboys were all moved to a lager fridge, large enough to accommodate all four of them, in which they were fermented at 51°F.

The beers fermented for 2 weeks, during which time they were closely monitored to determined when they were ready for the diacetyl rest. At that point, the temperature was raised to 65°F to do the diacetyl rest for 4 days, after which the temperature was then dropped back down to 51°F. Following this, we pulled samples from each to measure gravities and to check for diacetyl. We were happy to find that there was no diacetyl present!

## KEGGING AND LAGERING

Since we determined we were at our target gravities with the exception of the double decoction, which finished higher because of the higher OG, we kegged them for lagering. The lager fridge was set to 36°F and the four beers were lagered for 4 weeks. After 4 weeks, the kegs were then moved to a kegerator set to 42°F to finish their last 2 weeks of lagering and to also to force carbonate them at the same time and at the same pressure.

The initial samples of the beers at kegging were great. We were pleased with our results, but we won’t give you a hint of our initial findings until our final conclusion.

## THE NUMBERS

Along the way, we meticulously kept track of all gravities, temperatures, etc. The following is a list of OGs and FGs. The target OG was 1.051 while the target FG was 1.013
Single Infusion: 1.051 OG / 1.011 FG
Single Decoction: 1.051 OG / 1.013 FG
Double Decoction: 1.053 OG / 1.016 FG
Triple Decoction: 1.051 OG / 1.012 FG
BJCP Guidelines range: OG: 1.048 – 1.056 / FG: 1.010 – 1.016

## THE TIMELINE

Day 01: Brewed. Started fermenting at 62°F for 12 hours.
Day 02: Carboys moved to lager fridge, set to 51°F.
Day 15: Diacetyl rest at 65°F for four days.
Day 19: End diacetyl rest. Temperature lowered to 51°F.
Day 24: Dunkels kegged for lagering. Temperature lowered to 36°F for 4 weeks.
Day 52: Kegs moved to kegerator for continued lagering/carbonating for 2 weeks
Day 70: Judging/Public Presentation

## THE CONSTANTS

All four batches brewed same day
Equipment (ex. Mash tun, kettle, etc)
Recipe
Ingredients (same lots of everything)
Grain crush
Yeast Pitch Rate (same date of manufacture)
Fermentation Environment
Glass Fermenters
Aeration Time
Lagering time
Carbonation Pressure/at the same time/same fridge

## THE CLUB BLIND TASTE TEST

At week 5 of the lagering process, the club had their monthly meeting. It was decided that a blind taste test would be done so all members present could try the beers and to try to taste the differences between them, if there were any. We had 19 club members present and 3 guests. We sampled the four beers side by side, along with a commercially brewed dunkel (Hofbräu Dunkel). At the time of the club tasting, the beers weren't quite carbonated enough, so they all tasted very similar to each other, with subtle nuances, just enough to be detectable. In relation to the single infusion and single decoction colors were identical. The double decoction had a slight increase in color (had to work to see the difference), and the triple was a little bit darker (noticeable in comparison to the other three). While these shades of differences were discernable, they were slight and were not able to be captured in a photograph. The consensus was to

carbonate them more before our public sampling and official judging but, overall there were mixed opinions on whether the decoction added any value to the flavor of the beers. As a note, this is merely based on personal tastes, not on the BJCP style guide. Those of us that sampled the batches during the lagering process, we noted that there were significant flavor difference between the decoctions with the triple decoction having more complex flavor than the others, unfortunately we did not get the same carryover of flavor during the final sampling

## THE JUDGING

After more than six months of planning, organizing, brewing, (impatiently) waiting, club sampling, details, etc., we arrived at our grand finale: to put this mystery to rest. – To Decoct, or not to decoct! On January 25, 2014, several club members as well as 6 judges descended upon Brew and Wine Hobby, E. Hartford, CT with our bar setup, kegs in tow, thirst, and eager to get opinions on the beers.

We were able to gather together 4 BJCP judges, a professional brewer, as well a judge in training to evaluate the four beers for us. Like any typical judging situation, we provided them with a commercial calibration beer, Hofbräu Dunkel, the same one our club used for comparison. The judges were provided with minimal detail about the beers they were tasting, similar to a competition. They were judged blind and in random order. The judges used official BJCP tasting sheets and followed the guidelines for a 4B Munich Dunkel.

The 6 judges were amazingly thorough in evaluating the beers and we now have 24 score sheets outlining where we can ultimately make improvements on the beers. The feedback wasn't necessarily what we needed to make the final decision whether doing a decoction was worth it or not, it was which was closer to style in their consensus based upon opinions and score. With all that being said the single decoction was judged at the closest to the style guidelines for a Munich Dunkel.

The judges were very excited to have this opportunity to evaluate the four beers brewed with all the same variables. Only under these circumstances could we properly evaluate the differences between a single infusion mash, and the 3 decoctions without brewing them side by side and having as many constants as possible. We pulled it off!

## THE SCORES

Single Decoction 33.3
Single Infusion 32.5
Double Decoction 30.5
Triple Decoction 30.3
*(The scores are an average of all 6 judges together.)*

## THE JUDGES

Greg Radawich, BCJP E1283
Ryan Dacey, BJCP E1158
Ryan Galligan, BJCP E1153
Rich Loomis, BJCP E1170
Andrew Renehan, Professional Brewer at Olde Burnside Brewing Co., E. Hartford, CT
Heath Gelinas, working toward BJCP

## THE JUDGES OVERALL IMPRESSIONS (from the score sheets)

**Single Infusion**

Complex, needs body. Esters and Toasty malts. Too much bitterness.
Needs more complexity. Medium body. Easy drinking
Nice complexities, not as complex as nose tells it. Lingering bitterness. Easy drinking.
Astringent. Needs refinement.
Esters out of style. Phenols are unpleasant. Hazy.
Malt complexity. A bit bitter. Burn scorched notes?

Summary:
Some judges noted a good malt complexity, while others noted that it needed more. Some astringency issues were also mentioned by a few judges. More than one noted its “easy drinking” but perhaps is a bit too bitter.

**Single Decoction**:

Balanced. Richness, but could stand more. Brown sugar. Alcohol warmth.
Dark fruit esters too much. Flavor great. Complex malts. More balanced.
Oxidized and muted.
Balanced. Lower bitterness, complex.
Rich, complex, mouth feel. Balanced. Nice! Alcohol warmth. Well done.

Summary: Most judges remarked that this beer was well balanced, with several noting alcoholic warmth to it. “Complex” was another descriptor used frequently in their summaries.

**Double decoction**
Yeast masks the malt. Esters high. Body, drinkable. Add Munich.
Toasty. Mod. body. Easy drinking, lacking richness of style.
Well crafted. Thin. Esters high.
Good. Fermentation related issues? Gentle. Restrained.
Within style. Not flu of malt flavor. Dry, subtle.
Lacking depth. Toasty. Needs more richness. Decent though. Watch temps.
Esters.

Summary: Most judges noted this entry to be a bit estery, and perhaps thin and needing more body. Several noted the beer to be restrained in flavor as well.

**Triple decoction**
Not as balanced as could be. Esters, phenols. Drinkable. Needs body.
Low aroma. Low flavor caramels. Bitterness too high?
Bitterness and esters too high. body thin. Alcohol warmth.
Aroma nice but flavor lacking. Astringent.
Within style, well balanced. Scorched? Clean.

Summary: Judges noted a touch of astringency and bitterness levels a bit too high, and needing a bit more body. One judge noted a bit of a scorched grain note.

(*Writer's comment:* There was zero chance that a scorching event could have occurred. Knowing the criticality of preventing scorching the decoction area was monitored closely to make sure that the wort never sat without being stirred. Even with using propane for the decoction boil, the flame was ramped up slowly to minimize the chance of a quick scorching on the bottom and stirring of the mash occurred constantly).

## THE PUBLIC SAMPLING

While the judges were evaluating the beers, club members poured samples of the four beers for customers who came to Brew and Wine Hobby. We poured them in random order to see if people could tell the difference between them and see which one they felt was better. We had 30 or more patrons try all four beers and the consensus was that the double decoction was the favorite, taste-wise.

## THE SUMMARY

In the end, we have varying data here of which beer scored the best, and what tasted the best to others. We had no clear winner that was ahead of all the other samples. Of course, as always, it's a matter of opinion and tastes. Based on the 1 point score difference between the two highest scoring beers, the Single Infusion and Single Decoction, we feel that it's not really worth the extra effort to do a decoction. There were clear and noticeable differences between all of the beers, and not so much so that one was leaps and bounds above the rest.

That being said, in further study and refinement of our recipe and process, we could in fact prove otherwise. As previously mentioned, we decided to conduct our mashes with the decoctions at the same duration of time in order minimize the variability of mash rest time and in doing so may have ultimately altered the final outcome. A change in mash times may prove to bring about different results. Also, if we had sought out less-refined malt for the decoctions, the results may have been different as well. We also could alter variables again and again, such as mash temperatures, mash duration, etc.) in order to find the sweet spot for how a decoction may be beneficial.

We do feel that we learned from the process and that any brewer could benefit from trying a decoction at least once. This experience was a great team builder for all involved in the process. Who's to say you may come out with different results!

Through discussions with Brew and Wine Hobby and the club, we've decided to do a follow-up to this experiment to see if the results change. We would like to give it a try again, but the second time we won't control variables as much and do the decoctions as traditionally intended versus controlling time to minimize a variable. Stay tuned!

We would like to once again thank the American Homebrewers Association, Brew and Wine Hobby and our 6 Judges for helping to make this happen.

## QUOTES FROM THE JUDGES

**"**The Krausen Commandos set out to try something I was familiar with but had never tried in the three plus years I have been brewing. Decoction mashing was a technique I had read about several times but I never took the time to try myself. I was excited when asked to be part of this tasting and evaluation panel so I could experience for myself the effects of the different mashing procedures. Their experiment proved to not be a waste of time and exceeded my expectations. In blindly tasting and evaluating the samples there was a clear difference in each sample from taste, complexity and color that dictates decoction mash does change the overall characteristics of the beer. Although the changes might have been subtle between single, double and triple decoction, it was apparent that they were significantly different from just the single infusion mashed sample. I believe the Krausen Commandos achieved the results they set

out to accomplish and in doing so have opened my eyes to decoction mashing, something I now can't wait to try in the near future." - Heath Gelinas

"The Krausen commandos planned and executed the experiment quite well, from planning prior to the brew day until well after when judging took place. It was great to be able to judge this because, in my experience as a BJCP judge, it is beneficial to test the palate and become knowledgeable about various brewing techniques. It was fun to try to figure out which sample was which each time we were brought a new beer." -
Ryan Galligan

## ABOUT THE KRAUSEN COMMANDOS OF NORTHWEST CT

The Krausen Commandos started in 2010 with a few talented brewers who thought it would be great to start a club, not imagining after nearly 4 years, we would have 38 members, spread out all over CT. The Commandos pride themselves in being a learning organization and have some amazing, award-wining, talent in the group. Collectively among its members, they have won over 50 medals and ribbons; have been featured on the AHA website, the Brooklyn Brewery's blog, published in Draft Magazine as well as the Waterbury-Republican American newspaper. www.krausencommandos.com

**Footnotes:**
1 From John Palmer's How to Brew

National Testing Laboratories, Ltd.
Quality Water Analysis

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This report package contains 25 pages.

This package contains reports from the following laboratories:

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If you have any questions, please contact Susan Henderson at 1-800-458-3330.

Laboratory ID: CT:PH-0745, NY:11467, PA: 68-00362, NH:2046

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556 South Mansfield, Ypsilanti, MI, 48197-5166
(440) 449-2525, Fax: (440) 449-8585

## ANALYTICAL REPORTS

**SAMPLE CODE: 319577**

**3/28/2013**

**Customer:** Monadnock Mountain Spring
Ethan Gregory
P.O. Box 518
Wilton, NH 03086

**Source:** Source #1 & Source #2
**Source Type:** Spring Water
**Brand Name:** Monadnock Spring Water
**Production Code:** January 4, 2013 11:13
**Container Size:** 2.5 Gallon
**PA PWS ID#:** 9996436
**PA Location:** 100

**Date/Time Received:** 2/8/2013 09:00
**Collected by:** E. Gregory

The results herein conform to TNI and ISO/IEC 17025 standards, where applicable, unless otherwise narrated in the body of the report. The uncertainty of the test results are available upon request. All Dates and Times are reported as U.S. Eastern Time.

**Legend:**

Any 'Level Detected' marked with an asterisk (*) indicates that the value has exceeded the EPA Maximum Contaminant Level (MCL) or one of the Standards of Quality.

**"ND"** This contaminant was not detected at or above our lower reporting limit (LRL)

**"NA"** Not Analyzed

**"Standard"** This column indicates either the Maximum Contaminant Level (MCL) for EPA Primary Standards or the guideline values for EPA Secondary Standards.

**"LRL"** This column indicates the Lower Reporting Limit, which is the lowest level that the laboratory can detect a contaminant.

**Report Notes:**

pH analysis by EPA Method 150.1 has a 15 minute hold time from sampling to analysis. Analysis of pH past the 15 minute hold time should be considered an estimate.

| Fed Id # | Contaminant | Method | Standard | Units | LRL | Level Detected | Date/Time Sampled | Date Prepped | Date/Time Analyzed |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **Inorganic Analytes - Metals** | | | | | |
| 1002 | Aluminum | 200.7 | 0.2 | mg/L | 0.05 | ND | 2/27/2013 13:46 | | 3/12/2013 |
| 1074 | Antimony | 200.8 | 0.006 | mg/L | 0.003 | ND | 2/27/2013 13:46 | | 3/6/2013 |
| 1005 | Arsenic | 200.8 | 0.010 | mg/L | 0.002 | ND | 2/27/2013 13:46 | | 3/6/2013 |
| 1010 | Barium | 200.7 | 2 | mg/L | 0.10 | ND | 2/27/2013 13:46 | | 3/12/2013 |
| 1075 | Beryllium | 200.7 | 0.004 | mg/L | 0.001 | ND | 2/27/2013 13:46 | | 3/12/2013 |
| 1079 | Boron | 200.7 | -- | mg/L | 0.10 | ND | 2/27/2013 13:46 | | 3/12/2013 |
| 1015 | Cadmium | 200.7 | 0.005 | mg/L | 0.001 | ND | 2/27/2013 13:46 | | 3/12/2013 |
| 1016 | Calcium | 200.7 | -- | mg/L | 2.0 | 6.3 | 2/27/2013 13:46 | | 3/12/2013 |
| 1020 | Chromium | 200.7 | 0.100 | mg/L | 0.007 | ND | 2/27/2013 13:46 | | 3/12/2013 |
| 1022 | Copper | 200.7 | 1.0 | mg/L | 0.002 | ND | 2/27/2013 13:46 | | 3/12/2013 |
| 1028 | Iron | 200.7 | 0.3 | mg/L | 0.020 | ND | 2/27/2013 13:46 | | 3/12/2013 |
| 1030 | Lead | 200.8 | 0.015 | mg/L | 0.001 | ND | 2/27/2013 13:46 | | 3/6/2013 |
| 1031 | Magnesium | 200.7 | -- | mg/L | 0.10 | 1.20 | 2/27/2013 13:46 | | 3/12/2013 |
| 1032 | Manganese | 200.7 | 0.05 | mg/L | 0.004 | 0.007 | 2/27/2013 13:46 | | 3/12/2013 |
| 1035 | Mercury | 200.8 | 0.002 | mg/L | 0.0002 | ND | 2/27/2013 13:46 | | 3/6/2013 |
| 1036 | Nickel | 200.7 | -- | mg/L | 0.005 | ND | 2/27/2013 13:46 | | 3/12/2013 |
| 1042 | Potassium | 200.7 | -- | mg/L | 1.0 | 1.4 | 2/27/2013 13:46 | | 3/12/2013 |
| 1045 | Selenium | 200.8 | 0.05 | mg/L | 0.002 | ND | 2/27/2013 13:46 | | 3/6/2013 |

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## ANALYTICAL REPORTS

### SAMPLE CODE: 319577

### 3/28/2013

| Fed Id # | Contaminant | Method | Standard | Units | LRL | Level Detected | Date/Time Sampled | | Date Prepped | Date/Time Analyzed | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1050 | Silver | 200.7 | 0.10 | mg/L | 0.002 | ND | 2/27/2013 | 13:46 | | 3/12/2013 | |
| 1052 | Sodium | 200.7 | -- | mg/L | 1 | 16 | 2/27/2013 | 13:46 | | 3/12/2013 | |
| 1085 | Thallium | 200.8 | 0.002 | mg/L | 0.001 | ND | 2/27/2013 | 13:46 | | 3/6/2013 | |
| 4009 | Uranium | 200.8 | 0.030 | mg/L | 0.001 | ND | 2/27/2013 | 13:46 | | 3/6/2013 | |
| 1095 | Zinc | 200.7 | 5.000 | mg/L | 0.004 | ND | 2/27/2013 | 13:46 | | 3/12/2013 | |
| | | | | | **Physical Factors** | | | | | | |
| 1927 | Alkalinity (Total as CaCO3) | 2320B | -- | mg/L | 20 | ND | 2/27/2013 | 13:46 | | 3/7/2013 | |
| 1905 | Apparent Color | 2120B | 15 | CU | 3 | ND | 2/27/2013 | 13:46 | | 2/27/2013 | 15:30 |
| 1928 | Bicarbonate (as CaCO3) | 2320B | -- | mg/L | 20 | ND | 2/27/2013 | 13:46 | | 3/7/2013 | |
| 1929 | Carbonate (as CaCO3) | 2320B | -- | mg/L | 20 | ND | 2/27/2013 | 13:46 | | 3/7/2013 | |
| 1910 | Corrosivity | 2330B | -- | SI | | -4.6 | 2/27/2013 | 13:46 | | 3/12/2013 | |
| 2905 | Foaming Agents | 5540C | 0.5 | mg/L | 0.1 | ND | 2/27/2013 | 13:46 | | 2/28/2013 | 14:00 |
| | MBAS, calculated as Linear Alkylate Sulfonate (LAS), mol wt of 342.4 g/mole | | | | | | | | | | |
| 1915 | Hardness (as CaCO3) | 2340C | -- | mg/L | 10 | 16 | 2/27/2013 | 13:46 | | 3/9/2013 | |
| 1021 | Hydroxide (as CaCO3) | 2320B | -- | mg/L | 20 | ND | 2/27/2013 | 13:46 | | 3/7/2013 | |
| 1920 | Odor Threshold | 2150B | 3 | ton | 1 | ND | 2/27/2013 | 13:46 | | 2/27/2013 | 15:00 |
| 1925 | pH | 150.1 | 6.5-8.5 | pH Units | | 5.9* | 2/27/2013 | 13:46 | | 2/27/2013 | 13:52 |
| 4254 | pH Temperature | 150.1 | -- | Deg, C | | 21 | 2/27/2013 | 13:46 | | 2/27/2013 | 13:52 |
| 1064 | Specific Cond. @ 25 deg. C | 2510B | -- | umhos/cm | 1 | 160 | 2/27/2013 | 13:46 | | 3/1/2013 | |
| 1930 | Total Dissolved Solids | 2540C | 500 | mg/L | 5 | 93 | 2/27/2013 | 13:46 | | 3/1/2013 | |
| 0100 | Turbidity | 2130B | 1 | NTU | 0.1 | 0.1 | 2/27/2013 | 13:46 | | 2/27/2013 | 14:20 |
| | | | | | **Inorganic Analytes - Other** | | | | | | |
| 1011 | Bromate | 300.1 | 0.010 | mg/L | 0.005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 | |
| 1004 | Bromide | 300.1 | -- | mg/L | 0.005 | 0.015 | 2/27/2013 | 13:46 | | 3/4/2013 | |
| 1006 | Chloramine as Cl2 | 4500Cl-G | 4.0 | mg/L | 0.05 | ND | 2/27/2013 | 13:46 | | 2/27/2013 | 13:57 |
| 1017 | Chloride | 300.0 | 250 | mg/L | 1.0 | 30.0 | 2/27/2013 | 13:46 | | 2/27/2013 | 16:06 |
| 1012 | Chlorine as Cl2 | 4500Cl-G | 4.0 | mg/L | 0.05 | ND | 2/27/2013 | 13:46 | | 2/27/2013 | 13:57 |
| 1008 | Chlorine Dioxide as Cl02 | 4500Cl02D | 0.8 | mg/L | 0.1 | ND | 2/27/2013 | 13:46 | | 2/27/2013 | 13:57 |
| 1009 | Chlorite | 300.1 | 1.0 | mg/L | 0.005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 | |
| 1025 | Fluoride | 300.0 | 4.0 | mg/L | 0.10 | ND | 2/27/2013 | 13:46 | | 2/27/2013 | 16:06 |
| 1040 | Nitrate as N | 300.0 | 10 | mg/L | 0.05 | 0.45 | 2/27/2013 | 13:46 | | 2/27/2013 | 16:06 |
| 1041 | Nitrite as N | 300.0 | 1 | mg/L | 0.05 | ND | 2/27/2013 | 13:46 | | 2/27/2013 | 16:06 |
| 1044 | Ortho Phosphate | 300.0 | -- | mg/L | 2.0 | ND | 2/27/2013 | 13:46 | | 2/27/2013 | 16:06 |
| 1055 | Sulfate | 300.0 | 250 | mg/L | 5.0 | 6.8 | 2/27/2013 | 13:46 | | 2/27/2013 | 16:06 |
| | | | | | **Organic Analytes - Trihalomethanes** | | | | | | |
| 2943 | Bromodichloromethane | 524.2 THMs | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 | |
| 2942 | Bromoform | 524.2 THMs | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 | |
| 2941 | Chloroform | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 | |

# National Testing Laboratories, Ltd

556 South Mansfield, Ypsilanti, MI, 48197-5166
(440) 449-2525, Fax: (440) 449-8585


## ANALYTICAL REPORTS

### SAMPLE CODE: 319577

### 3/28/2013

| Fed Id # | Contaminant | Method | Standard | Units | LRL | Level Detected | Date/Time Sampled | | Date Prepped | Date/Time Analyzed |
|---|---|---|---|---|---|---|---|---|---|---|
| | | THMs | | | | | | | | |
| 2944 | Dibromochloromethane | 524.2 THMs | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2950 | Total THMs | 524.2 THMs | 0.080 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| | | | | **Organic Analytes - Haloacetic Acids** | | | | | | |
| 2454 | Dibromoacetic Acid | 552.2 HAAs | -- | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | 3/6/2013 | 3/7/2013 |
| 2451 | Dichloroacetic Acid | 552.2 HAAs | -- | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | 3/6/2013 | 3/7/2013 |
| 2453 | Monobromoacetic Acid | 552.2 HAAs | -- | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | 3/6/2013 | 3/7/2013 |
| 2450 | Monochloroacetic Acid | 552.2 HAAs | -- | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | 3/6/2013 | 3/7/2013 |
| 2452 | Trichloroacetic Acid | 552.2 HAAs | -- | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | 3/6/2013 | 3/7/2013 |
| 2456 | Total HAAs | 552.2 HAAs | 60 | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | 3/6/2013 | 3/7/2013 |
| | | | | **Organic Analytes - Volatiles** | | | | | | |
| 2986 | 1,1,1,2-Tetrachloroethane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2981 | 1,1,1-Trichloroethane | 524.2 | 0.2 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2988 | 1,1,2,2-Tetrachloroethane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2985 | 1,1,2-Trichloroethane | 524.2 | 0.005 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2978 | 1,1-Dichloroethane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2977 | 1,1-Dichloroethene | 524.2 | 0.007 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2410 | 1,1-Dichloropropene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2420 | 1,2,3-Trichlorobenzene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2414 | 1,2,3-Trichloropropane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2378 | 1,2,4-Trichlorobenzene | 524.2 | 0.07 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2418 | 1,2,4-Trimethylbenzene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2968 | 1,2-Dichlorobenzene | 524.2 | 0.6 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2980 | 1,2-Dichloroethane | 524.2 | 0.005 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2983 | 1,2-Dichloropropane | 524.2 | 0.005 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2424 | 1,3,5-Trimethylbenzene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2967 | 1,3-Dichlorobenzene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2412 | 1,3-Dichloropropane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2969 | 1,4-Dichlorobenzene | 524.2 | 0.075 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2416 | 2,2-Dichloropropane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2965 | 2-Chlorotoluene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2966 | 4-Chlorotoluene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2030 | 4-Isopropyltoluene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2990 | Benzene | 524.2 | 0.005 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2993 | Bromobenzene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2430 | Bromochloromethane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2214 | Bromomethane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2982 | Carbon Tetrachloride | 524.2 | 0.005 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |

**National Testing Laboratories, Ltd**
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## ANALYTICAL REPORTS

### SAMPLE CODE: 319577

### 3/28/2013

| Fed Id # | Contaminant | Method | Standard | Units | LRL | Level Detected | Date/Time Sampled | | Date Prepped | Date/Time Analyzed |
|---|---|---|---|---|---|---|---|---|---|---|
| 2989 | Chlorobenzene | 524.2 | 0.1 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2216 | Chloroethane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2210 | Chloromethane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2380 | cis-1,2-Dichloroethene | 524.2 | 0.07 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2228 | cis-1,3-Dichloropropene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2408 | Dibromomethane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2212 | Dichlorodifluoromethane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2964 | Dichloromethane | 524.2 | 0.005 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2992 | Ethylbenzene | 524.2 | 0.7 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2246 | Hexachlorobutadiene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2994 | Isopropylbenzene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2251 | Methyl Tert Butyl Ether | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2247 | Methyl-Ethyl Ketone | 524.2 | -- | mg/L | 0.005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2248 | Naphthalene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2422 | n-Butylbenzene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2997 | o-Xylene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2963 | p and m-Xylenes | 524.2 | -- | mg/L | 0.0010 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2998 | Propylbenzene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2428 | sec-Butylbenzene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2996 | Styrene | 524.2 | 0.1 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2426 | tert-Butylbenzene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2987 | Tetrachloroethene | 524.2 | 0.005 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2991 | Toluene | 524.2 | 1 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2979 | trans-1,2-Dichloroethene | 524.2 | 0.1 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2224 | trans-1,3-Dichloropropene | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2984 | Trichloroethene | 524.2 | 0.005 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2218 | Trichlorofluoromethane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2904 | Trichlorotrifluoroethane | 524.2 | -- | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2976 | Vinyl Chloride | 524.2 | 0.002 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| 2955 | Xylenes (Total) | 524.2 | 10 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | | 3/4/2013 |
| | **Organic Analytes - Others** | | | | | | | | | |
| 2931 | 1,2-Dibromo-3-chloropropane | 504.1 | 0.0002 | mg/L | 0.00001 | ND | 2/27/2013 | 13:46 | 3/13/2013 | 3/13/2013 |
| 2946 | 1,2-Dibromoethane | 504.1 | 0.00005 | mg/L | 0.00001 | ND | 2/27/2013 | 13:46 | 3/13/2013 | 3/13/2013 |
| 2066 | 3-Hydroxycarbofuran | 531.2 | -- | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | | 3/15/2013 |
| 2051 | Alachlor | 508.1 | 0.002 | mg/L | 0.0002 | ND | 2/27/2013 | 13:46 | 3/13/2013 | 3/24/2013 |
| 2047 | Aldicarb | 531.2 | 7 | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | | 3/15/2013 |
| 2044 | Aldicarb sulfone | 531.2 | 7 | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | | 3/15/2013 |
| 2043 | Aldicarb sulfoxide | 531.2 | 7 | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | | 3/15/2013 |
| 2356 | Aldrin | 505 | -- | mg/L | 0.00007 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |

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## ANALYTICAL REPORTS

### SAMPLE CODE: 319577

### 3/28/2013

| Fed Id # | Contaminant | Method | Standard | Units | LRL | Level Detected | Date/Time Sampled | | Date Prepped | Date/Time Analyzed |
|---|---|---|---|---|---|---|---|---|---|---|
| 2050 | Atrazine | 508.1 | 0.003 | mg/L | 0.0001 | ND | 2/27/2013 | 13:46 | 3/13/2013 | 3/24/2013 |
| 2306 | Benzo(A)pyrene | 525.2 | 0.2 | ug/L | 0.2 | ND | 2/27/2013 | 13:46 | 3/8/2013 | 3/12/2013 |
| 2076 | Butachlor | 525.2 | -- | ug/L | 0.2 | ND | 2/27/2013 | 13:46 | 3/8/2013 | 3/12/2013 |
| 2021 | Carbaryl | 531.2 | -- | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | | 3/15/2013 |
| 2046 | Carbofuran | 531.2 | 40 | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | | 3/15/2013 |
| 2959 | Chlordane | 505 | 0.002 | mg/L | 0.0001 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2035 | Di(2-ethylhexyl) adipate | 525.2 | 400 | ug/L | 0.2 | ND | 2/27/2013 | 13:46 | 3/8/2013 | 3/12/2013 |
| 2039 | Di(2-ethylhexyl) phthalate | 525.2 | 6 | ug/L | 0.6 | ND | 2/27/2013 | 13:46 | 3/8/2013 | 3/12/2013 |
| 2933 | Dichloran | 505 | -- | mg/L | 0.001 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2070 | Dieldrin | 505 | -- | mg/L | 0.00002 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2032 | Diquat | 549.2 | 20 | ug/L | 1 | ND | 2/27/2013 | 13:46 | 3/4/2013 | 3/13/2013 |
| 2033 | Endothall | 548.1 | 100 | ug/L | 9 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/8/2013 |
| 2005 | Endrin | 525.2 | 2 | ug/L | 0.2 | ND | 2/27/2013 | 13:46 | 3/8/2013 | 3/12/2013 |
| 2034 | Glyphosate | 547 | 700 | ug/L | 6 | ND | 2/27/2013 | 13:46 | | 3/1/2013 |
| 2065 | Heptachlor | 505 | 0.0004 | mg/L | 0.00001 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2067 | Heptachlor Epoxide | 505 | 0.0002 | mg/L | 0.00001 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2274 | Hexachlorobenzene | 505 | 0.001 | mg/L | 0.0001 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2042 | Hexachlorocyclopentadiene | 505 | 0.05 | mg/L | 0.0001 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2010 | Lindane | 505 | 0.0002 | mg/L | 0.00002 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2022 | Methomyl | 531.2 | -- | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | | 3/15/2013 |
| 2015 | Methoxychlor | 505 | 0.04 | mg/L | 0.0001 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2045 | Metolachlor | 525.2 | -- | ug/L | 0.2 | ND | 2/27/2013 | 13:46 | 3/8/2013 | 3/12/2013 |
| 2595 | Metribuzin | 525.2 | -- | ug/L | 0.2 | ND | 2/27/2013 | 13:46 | 3/8/2013 | 3/12/2013 |
| 2626 | Molinate | 525.2 | -- | ug/L | 0.2 | ND | 2/27/2013 | 13:46 | 3/8/2013 | 3/12/2013 |
| 2036 | Oxamyl | 531.2 | 200 | ug/L | 1.0 | ND | 2/27/2013 | 13:46 | | 3/15/2013 |
| 2934 | Pentachloronitrobenzene | 505 | -- | mg/L | 0.0001 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2077 | Propachlor | 508.1 | -- | mg/L | 0.0002 | ND | 2/27/2013 | 13:46 | 3/13/2013 | 3/24/2013 |
| 2037 | Simazine | 508.1 | 0.004 | mg/L | 0.0001 | ND | 2/27/2013 | 13:46 | 3/13/2013 | 3/24/2013 |
| 2627 | Thiobencarb | 525.2 | -- | ug/L | 0.2 | ND | 2/27/2013 | 13:46 | 3/8/2013 | 3/12/2013 |
| 2383 | Total PCBs | 505 | 0.0005 | mg/L | 0.0005 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2020 | Toxaphene | 505 | 0.003 | mg/L | 0.001 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |
| 2055 | Trifluralin | 505 | -- | mg/L | 0.001 | ND | 2/27/2013 | 13:46 | 3/5/2013 | 3/6/2013 |

**National Testing Laboratories, Ltd**
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## ANALYTICAL REPORTS

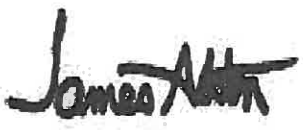
**SAMPLE CODE: 319577**

**3/28/2013**

| Fed Id # | Contaminant | Method | Standard | Units | LRL | Level Detected | Date/Time Sampled | Date Prepped | Date/Time Analyzed |
|---|---|---|---|---|---|---|---|---|---|

These test results may be used for compliance purpose as required.

(1) DUE TO THE LIMITATION OF EPA METHOD 524.2, m AND p ISOMERS OF XYLENE ARE REPORTED AS AGGREGATE.



| Analyst | Tests |
|---|---|
| JA | 200.7,2330B |
| RW | 200.8 |
| PC | 2320B,2120B,5540C,2340C,2150B,150.1,2510B,2540C,2130B |
| SB | 300.1,300.0,524.2 THMs,531.2,549.2,547 |
| MG | 4500Cl-G,4500Cl02D |
| ADW | 552.2 HAAs |
| JPT | 504.1,508.1,505 |
| JF | 525.2,548.1 |

James Abston, Production Manager

Laboratory ID: CT:PH-0745, NY:11467, PA: 68-00362, NH:2046

**National Testing Laboratories, Ltd**
556 South Mansfield, Ypsilanti, MI, 48197-5166
(440) 449-2525, Fax: (440) 449-8585

## ANALYTICAL REPORTS

**SAMPLE CODE: 319576**

**3/5/2013**

**Customer:** Monadnock Mountain Spring
Ethan Gregory
P.O. Box 518
Wilton, NH 03086

**Source:** Source #1 & Source #2
**Source Type:** Spring Water
**Brand Name:** Monadnock Spring Water
**Production Code:** January 4, 2013 11:13
**Container Size:** 2.5 Gallon
**PA PWS ID#:** 9996436
**PA Location:** 100

**Date/Time Received:** 2/8/2013 09:00
**Collected by:** E. Gregory

The results herein conform to TNI and ISO/IEC 17025 standards, where applicable, unless otherwise narrated in the body of the report. The uncertainty of the test results are available upon request. All Dates and Times are reported as U.S. Eastern Time.

**Legend:**

Any 'Level Detected' marked with an asterisk (*) indicates that the value has exceeded the EPA Maximum Contaminant Level (MCL) or one of the Standards of Quality.

**"ND"** This contaminant was not detected at or above our lower reporting limit (LRL)

**"NA"** Not Analyzed

**"Standard"** This column indicates either the Maximum Contaminant Level (MCL) for EPA Primary Standards or the guideline values for EPA Secondary Standards.

**"LRL"** This column indicates the Lower Reporting Limit, which is the lowest level that the laboratory can detect a contaminant.

**Report Notes:**

| Fed Id # | Contaminant | Method | Standard | Units | LRL | Level Detected | Date/Time Sampled | Date Prepped | Date/Time Analyzed |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **Microbiologicals** | | | | | |
| 3114 | E. Coli | 9223B | 1 | MPN/100 mL | 1 | ND | 2/27/2013 13:46 | | 2/27/2013 16:30 |
| 3001 | Standard Plate Count | 9215B | 500 | CFU/ml | 1 | <1 | 2/27/2013 13:46 | | 2/27/2013 16:15 |
| | | | | Pour Plate Method, 35°C/48hr, Plate Count Agar | | | | | |
| 3000 | Total Coliform | 9223B | 1 | MPN/100 mL | 1 | ND | 2/27/2013 13:46 | | 2/27/2013 16:30 |

These test results may be used for compliance purpose as required.

| Analyst | Tests |
|---|---|
| BS | 9223B,9215B |

James Abston, Production Manager

Pace Analytical™
www.pacelabs.com

**Pace Analytical Services, Inc.**
1700 Elm Street
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444

**Report Prepared for:**

Susan Henderson
National Testing Laboratories
6571 Wilson Mills Road
Cleveland OH 44143

# REPORT OF LABORATORY ANALYSIS FOR 2,3,7,8-TCDD

**Report Summary:**

Enclosed are analytical results of one drinking water sample analyzed for 2,3,7,8-TCDD content. This sample was analyzed according to Method 1613B by High Resolution Gas Chromatography/High Resolution Mass Spectrometry.

The results reported for this sample and the associated quality control samples were all within the criteria described in Method 1613B. If you have any questions or concerns regarding these results, please contact Emily Hazelroth, your Pace Project Manager.

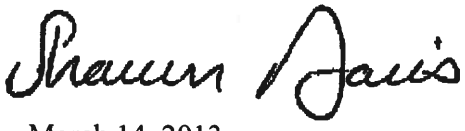
**Pace Project Number:**
10221421

**Report Prepared Date:**
March 14, 2013

**Finished Product**

Sample ID: 319577
Source Name: Source 1 & # 2
Source Location:
PWS ID: N/A
Date & Time Opened: 02/27/2013 @ 13:46
Opened By: JR/AF
Laboratory Sample ID: 10221421001
Date Sampled: 02/27/2013 @ 13:46
Date Received: 03/01/2013 @ 09:45

**This report has been reviewed by:**



March 14, 2013
Shawn Davis, Project Manager
(612) 607-6378
(612) 607-6444 (fax)
shawn.davis@pacelabs.com

ACCREDITED IN ACCORDANCE WITH nelac

**Report of Laboratory Analysis**

Pace Analytical™

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

# Minnesota Laboratory Certifications

| Authority | Certificate # | Authority | Certificate # |
|---|---|---|---|
| Alabama | 40770 | Montana | 92 |
| Alaska | MN00064 | Nebraska | |
| Arizona | AZ0014 | Nevada | MN_00064_200 |
| Arkansas | 88-0680 | New Jersey (NE | MN002 |
| California | 01155CA | New Mexico | MN00064 |
| Colorado | MN00064 | New York (NEL | 11647 |
| Connecticut | PH-0256 | North Carolina | 27700 |
| EPA Region 5 | WD-15J | North Dakota | R-036 |
| EPA Region 8 | 8TMS-Q | Ohio | 4150 |
| Florida (NELAP | E87605 | Ohio VAP | CL101 9507 |
| Georgia (DNR) | 959 | Oklahoma | D9922 |
| Guam | 959 | Oregon (ELAP) | MN200001-005 |
| Hawaii | SLD | Oregon (OREL | MN300001-001 |
| Idaho | MN00064 | Pennsylvania | 68-00563 |
| Illinois | 200012 | Saipan | MP0003 |
| Indiana | C-MN-01 | South Carolina | 74003001 |
| Indiana | C-MN-01 | Tennesee | 2818 |
| Iowa | 368 | Tennessee | 02818 |
| Kansas | E-10167 | Texas | T104704192-08 |
| Kentucky | 90062 | Utah (NELAP) | PAM |
| Louisiana | 03086 | Virginia | 00251 |
| Maine | 2007029 | Washington | C755 |
| Maryland | 322 | West Virginia | 9952C |
| Michigan | 9909 | Wisconsin | 999407970 |
| Minnesota | 027-053-137 | Wyoming | 8TMS-Q |
| Mississippi | MN00064 | | |

## REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

# Reporting Flags

A = Reporting Limit based on signal to noise

B = Less than 10x higher than method blank level

C = Result obtained from confirmation analysis

D = Result obtained from analysis of diluted sample

E = Exceeds calibration range

I = Interference present

J = Estimated value

Nn = Value obtained from additional analysis

P = PCDE Interference

R = Recovery outside target range

S = Peak saturated

U = Analyte not detected

V = Result verified by confirmation analysis

X = %D Exceeds limits

Y = Calculated using average of daily RFs

* = See Discussion

**REPORT OF LABORATORY ANALYSIS**

Report No.....10221421_1613DW

Page 4 of 7

# National Testing Laboratories, Ltd.

Quality Water Analysis

## CHAIN OF CUSTODY

Page 1 of 1

**Initiated by:** ☐ Client ☑ National Testing Laboratories, Ltd. ☐ Other

10221421

CLIENT/COMPANY NAME:

CLIENT COMMENTS:

TYPES OF SAMPLES:

DRINKING WATER = D SOIL SAMPLE = S
GROUND WATER = G SLUDGE/WASTE = W
POOL WATER = P OTHER TYPE =O

| SAMPLE # | COLLECTION DATE | COLLECTION TIME | SAMPLE SITE DESCRIPTION | SAMPLE TYPE | # OF CONTAINERS | TEST(S) REQUESTED PER SAMPLE (X): dioxin | LAB # |
|---|---|---|---|---|---|---|---|
| 319577 | 2/27/13 | 13:46 | 2032595 | D | 2 | X | 001 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

RECEIVER SIGNATURE CONFIRMS THAT THE BOTTLES RECEIVED ARE CONSISTENT WITH THE REQUIRED TESTING PROTOCOL.

| | | | | | |
|---|---|---|---|---|---|
| SAMPLED BY: (Signature) (1) | DATE | TIME | RELINQUISHED BY: (Signature) (4) | DATE | TIME |
| SHIPPED BY: (Signature) (2) | DATE 2/28/13 | TIME 1600 | RECEIVED BY: (Signature) (5) | DATE | TIME |
| RECEIVED BY: (Signature) (3) | DATE | TIME | RELINQUISHED BY: (Signature) (6) | DATE | TIME |
| | | | RECEIVED BY: (Signature) (7) | DATE 3/1/13 | TIME 0945 |

LABORATORY COMMENTS:

T= 1.7°

COC-001 2/22/11

**See instructions on reverse side →**

**National Testing Laboratories, Ltd.**

*Quality Water Analysis*

1-800-458-3330

# Beverage - Finished Product

Order Number: 2032595
Order Date: 01/11/2013 319577
Sample Number:
Product: 50 DDBP
**Paid:** No **Method:** **P.O.:**
**TSR:** SBW

Wilton NH 03086

**For Laboratory Use ONLY**

**Lab Accounting Information:**

**Payment $:**_____

**Check #:**_____

**Lab Comments/Special Instructions:**

2013 Spring Product Annual

Dioxin

**State Forms:**
CT|NY|PA

**Lab Sample Information:**

**Date Received:** 2 / 8 / 13

**Time Received:** 09 : 00

**Received By:** BF

**Date Opened:** FEB 27 2013

**Time Opened:** 13:46

**Opened By:** RM/BF

☒ Sample receipt criteria checked & acceptable.

☐ Deviations from acceptable sample receipt criteria noted on PSA form.

If finished product is submitted in laboratory containers, complete the following information.

**Date Opened:**___/___/___ **Time Opened:**____:____

Please Use Military Time, e.g. 3:00pm = 15:00

Check Time Zone: ☐ EST ☐ CST ☐ MST ☐ PST

**Client Name:**_____

**Phone Number:**_____

**Fax Number:**_____

**PWS ID# (if applicable):**_____

**Source Type:** ☒ Spring ☐ Well ☐ Municipal
☐ Other:_____

**Source Name:** Source 1 & Source #2
(Source Information is REQUIRED for All Finished Products)

**City & State:**_____
(If Different than Above)

**Product Collected By:** Ethan Gregory
(Signature)

**Product Collected By:** Ethan Gregory
(Please Print)

**Brand Name/Product Type:** Monadnock Spring Water
e.g. XYZ Spring Water or XYZ Distilled Water

**Container Size:** 2.5 Gallon (X2)

**Production Code/Lot Number:** January 4, 2013 11:13

**Form Completed By:** Ethan Gregory

**Additional Comments:**

**IF PENNSYLVANIA REPORTING IS REQUIRED AND YOUR PRODUCT IS GREATER THAN 1.77 LITERS, PLEASE PROVIDE THE FOLLOWING:**

**Penn. PWS ID#:** 9996436

**Location:**_____

**INCOMPLETE INFORMATION MAY DELAY ANALYSIS AND/OR INVALIDATE RESULTS**

| Pace Analytical | Document Name: Sample Condition Upon Receipt Form | Document Revised: 28Jan2013 Page 1 of 1 |
|---|---|---|
| | Document No.: F-MN-L-213-rev.06 | Issuing Authority: Pace Minnesota Quality Office |

**Sample Condition Upon Receipt**

**Client Name:** NTL

**Project #:** WO#: 10221421

10221421

**Courier:** ☐ Fed Ex ☑ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other:

**Tracking Number:** 1ZA1U2701583655794

**Custody Seal on Cooler/Box Present?** ☐ Yes ☑ No **Seals Intact?** ☐ Yes ☑ No

**Optional:** Proj. Due Date: Proj. Name:

**Packing Material:** ☐ Bubble Wrap ☐ Bubble Bags ☐ None ☑ Other: foam **Temp Blank?** ☐ Yes ☑ No

**Thermom. Used:** ☑ 888A912167504 ☐ 80512447 ☐ 72337080 **Type of Ice:** ☑ Wet ☐ Blue ☐ None ☐ Samples on ice, cooling process has begun

**Cooler Temp Read (°C):** 1.0 **Cooler Temp Corrected (°C):** 1.7 **Biological Tissue Frozen?** ☐ Yes ☐ No

Temp should be above freezing to 6°C **Correction Factor:** +0.7 **Date and Initials of Person Examining Contents:** 3/3/13

| | | | | Comments: |
|---|---|---|---|---|
| Chain of Custody Present? | ☑ Yes | ☐ No | ☐ N/A | 1. |
| Chain of Custody Filled Out? | ☑ Yes | ☐ No | ☐ N/A | 2. |
| Chain of Custody Relinquished? | ☑ Yes | ☐ No | ☐ N/A | 3. |
| Sampler Name and/or Signature on COC? | ☐ Yes | ☑ No | ☐ N/A | 4. |
| Samples Arrived within Hold Time? | ☑ Yes | ☐ No | ☐ N/A | 5. |
| Short Hold Time Analysis (<72 hr)? | ☐ Yes | ☑ No | ☐ N/A | 6. |
| Rush Turn Around Time Requested? | ☐ Yes | ☑ No | ☐ N/A | 7. |
| Sufficient Volume? | ☑ Yes | ☐ No | ☐ N/A | 8. |
| Correct Containers Used? | ☑ Yes | ☐ No | ☐ N/A | 9. |
| -Pace Containers Used? | ☑ Yes | ☐ No | ☐ N/A | |
| Containers Intact? | ☑ Yes | ☐ No | ☐ N/A | 10. |
| Filtered Volume Received for Dissolved Tests? | ☐ Yes | ☐ No | ☑ N/A | 11. |
| Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: WT | ☑ Yes | ☐ No | ☐ N/A | 12. |
| All containers needing acid/base preservation have been checked? Noncompliances are noted in 13. | ☐ Yes | ☐ No | ☑ N/A | 13. ☐ $HNO_3$ ☐ $H_2SO_4$ ☐ NaOH ☐ HCl |
| All containers needing preservation are found to be in compliance with EPA recommendation? ($HNO_3$, $H_2SO_4$, HCl<2; NaOH>12) | ☐ Yes | ☐ No | ☑ N/A | Sample # |
| Exceptions: VOA, Coliform, TOC, Oil and Grease, WI-DRO (water) | ☐ Yes | ☑ No | | Initial when completed: Lot # of added preservative: |
| Headspace in VOA Vials ( >6mm)? | ☐ Yes | ☐ No | ☑ N/A | 14. |
| Trip Blank Present? | ☐ Yes | ☐ No | ☑ N/A | 15. |
| Trip Blank Custody Seals Present? | ☐ Yes | ☐ No | ☑ N/A | |
| Pace Trip Blank Lot # (if purchased): | | | | |

**CLIENT NOTIFICATION/RESOLUTION** **Field Data Required?** ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

**Project Manager Review:** GKM **Date:** 01 March 2013

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e out of hold, incorrect preservative, out of temp, incorrect containers)

Pace AnalyticalServices, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612-607-6444

# Drinking Water Analysis Results
## 2,3,7,8-TCDD -- USEPA Method 1613B

**Sample ID.....319577** Date Collected.....02/27/2013 Spike.....200 pg
Client.....National Testing Laborato Date Received.....03/01/2013 IS Spike.....2000 pg
Lab Sample ID.....10221421001 Date Extracted.....03/07/2013 CS Spike.....200 S

| | Sample 319577 | Method Blank | Lab Spike | Lab Spike Dup |
|---|---|---|---|---|
| [2,3,7,8-TCDD] | **ND** | ND | -- | -- |
| RL | 5.0 pg/L | 5.0 pg/L | -- | -- |
| 2,3,7,8-TCDD Recovery | -- | -- | 87% | 82% |
| pg Recovered | -- | -- | 175pg/L | 163pg/L |
| Spike Recovery Limit | -- | -- | 73-146% | 73-146% |
| RPD | | | | 7.0% |
| IS Recovery | **61%** | 63% | 76% | 64% |
| pg Recovered | 1224 pg/L | 1258 pg/L | 1518 pg/L | 1277 pg/L |
| IS Recovery Limits | 31-137% | 31-137% | 25-141% | 25-141% |
| CS Recovery | **69%** | 81% | 81% | 76% |
| pg Recovered | 139 pg/L | 161 pg/L | 163 pg/L | 152 pg/L |
| CS Recovery Limits | 42-164% | 42-164% | 37-158% | 37-158% |
| Filename | R130310A_15 | R130309A_11 | R130309A_21 | R130309A_22 |
| Analysis Date | 03/10/2013 | 03/09/2013 | 03/09/2013 | 03/09/2013 |
| Analysis Time | 21:10 | 09:33 | 15:14 | 15:49 |
| Analyst | BAL | BAL | BAL | BAL |
| Volume | 0.827L | 1.018L | 1.024L | 1.040L |
| Dilution | NA | NA | NA | NA |
| ICAL Date | 12/23/2012 | 12/23/2012 | 12/23/2012 | 12/23/2012 |
| CCAL Filename | R130310A_02 | R130309A_02 | R130309A_02 | R130309A_02 |

! = Outside the Control Limits
ND = Not Detected
RL = Reporting Limit
Limits = Control Limits from Method 1613 (10/94 Revision), Tables 6A and 7A
RPD = Relative Percent Difference of Lab Spike Recoveries
IS = Internal Standard [2,3,7,8-TCDD-$^{13}C_{12}$]
CS = Cleanup Standard [2,3,7,8-TCDD-$^{37}Cl_4$]

Analyst: Barn A Lark

Project No.....10221421

Pace Analytical®
www.pacelabs.com

**Pace Analytical Services, Inc.**
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

## ANALYTICAL RESULTS

Project: 2032595
Pace Project No.: 3088590

**Sample: 319577** **Lab ID: 3088690001** Collected: 02/27/13 13:46 Received: 03/01/13 09:00 Matrix: Drinking Water
PWS: Site ID: Sample Type:

Comments:
- FINISHED WATER, Source #1 & Source #2
- Monadnock Spring Water, Cont. size: 2.5 gallon, Prod. code: January 4, 2013 11:13
- sample opened on 2/27/13 @13:46 by JR/DF

| Parameters | Method | Act ± Unc (MDC) | Units | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|
| Gross Alpha | EPA 900.0 | **0.514 ± 0.795 (1.73)** | pCi/L | 03/14/13 08:13 | 12587-46-1 | |
| Gross Beta | EPA 900.0 | **1.45 ± 0.849 (1.68)** | pCi/L | 03/14/13 08:13 | 12587-47-2 | |
| Radium-226 | EPA 903.1 | **0.0617 ± 0.121 (0.167)** | pCi/L | 03/18/13 15:37 | 13982-63-3 | |
| Radium-228 | EPA 904.0 | **0.371 ± 0.407 (0.864)** | pCi/L | 03/19/13 15:03 | 15262-20-1 | |

NSF International
789 N. Dixboro Rd. Ann Arbor, MI 48105, USA
1-800.NSF.MARK | +1-734.769.8010 | www.nsf.org

# TEST REPORT

**Send To: C0023226**
Ms. Susan Henderson
National Testing Laboratories, Ltd.
6571 Wilson Mills Road
Cleveland, OH 44143

**Facility: C0023227**
National Testing Laboratories, Ltd.
556 South Mansfield Street
Ypsilanti MI 48197
United States

| | | | |
|---|---|---|---|
| **Result** | **COMPLETE** | Report Date | 12-MAR-2013 |
| Customer Name | National Testing Laboratories, Ltd. | | |
| Tested To | USFDA CFR Title 21 Part 165.110 | | |
| Description | Sample # 319577 Order # 2032595 | | |
| Test Type | Test Only | | |
| Job Number | J-00122663 | | |
| Project Number | 9150114 (CL14) | | |
| Project Manager | Myla Estacio | | |

**Thank you for having your product tested by NSF International.**

Please contact your Project Manager if you have any questions or concerns pertaining to this report.

**Report Authorization** _____ **Date** 12-MAR-2013

Kurt R. Kneen - Director, Chemistry Laboratory

**General Information**

Standard: USFDA CFR Title 21 Part 165.110
Date and Time Sampled: 2/27/2013 13:46
Product Description: Sample # 319577 Order # 2032595

Sample Id: **S-0000953775**
Description: Sample # 319577 Order # 2032595 2/27/2013 13:46
Sampled Date: 02/27/2013
Received Date: 03/04/2013

| Testing Parameter | Detection Limit | Result | FDA SOQ | Units | P / F |
|---|---|---|---|---|---|
| **Inorganic Chemicals** | | | | | |
| Phenolics | 0.001 | ND | 0.001 | mg/L | Pass |
| **Organic Chemicals** | | | | | |
| Herbicides (Ref: EPA 515.3) | | | | | |
| 2,4,5-TP | 0.2 | ND | 50 | ug/L | Pass |
| 2,4-D | 0.1 | ND | 70 | ug/L | Pass |
| Bentazon | 0.2 | ND | | ug/L | |
| Dalapon | 1 | ND | 200 | ug/L | Pass |
| DCPA Acid Metabolites | 0.2 | ND | | ug/L | |
| Dicamba | 0.1 | ND | | ug/L | |
| Dinoseb | 0.2 | ND | 7 | ug/L | Pass |
| Pentachlorophenol | 0.04 | ND | 1 | ug/L | Pass |
| Picloram | 0.1 | ND | 500 | ug/L | Pass |

## <<Additional Information>>

Sample Id: S-0000953775

| Test Parameter | Date Analyzed | Time Analyzed | Date Prepared/ Processed |
|---|---|---|---|
| **Inorganic Chemicals** | | | |
| * Phenolics, Total Recoverable (Based on EPA 420.2) | 6-MAR-2013 | | |
| **Organic Chemicals** | | | |
| Herbicides (Ref. EPA 515.3) | 9-MAR-2013 | | 7-MAR-2013 |

***Testing Laboratories:***

| | Flag | Id | Address |
|---|---|---|---|
| All work performed at: (Unless otherwise specified) | → | NSF_AA | NSF International<br>789 N. Dixboro Road<br>Ann Arbor MI 48105 |

***References to Testing Procedures:***

| NSF Reference | Parameter / Test Description |
|---|---|
| C3021 | * Phenolics, Total Recoverable (Based on EPA 420.2) |
| C4202 | Herbicides (Ref. EPA 515.3) |

***Certifications:***

| | | |
|---|---|---|
| Arizona ( # AZ0655 ) | California ( # 03214 CA ) | Connecticut ( # PH-0625 ) |
| Florida ( # E-87752 FL ) | Hawaii | Indiana |
| Maryland ( # 201 ) | Michigan ( # 0048 ) | North Carolina (# 26701) |
| New Jersey ( # MI770 ) | Nevada ( # MI000302010A ) | New York (# 11206 ) |
| Pennslyvania ( # 68-00312 ) | South Carolina ( # 81005 ) | Virginia ( # 00045 ) |
| Vermont ( # VT 11206 ) | | |

Test descriptions preceded by an asterisk "*" indicate that testing has been performed per NSF International requirements but is not within its scope of accreditation.

The reported result for Odor, Phenolics, Potassium, Specific Conductance and Total Residual Chlorine cannot be used for compliance purposes within the State of Anzona.

Notes:

1) Bottled water sold in the United States shall not contain Fluoride in excess of the levels published by the USFDA in 21 CFR Part 165.110. These levels are based on the annual average of maximum daily air temperatures at the location where the bottled water is sold at retail. Please refer to the most current edition of the regulation to determine the Fluoride maximum level that pertains to your product.
2) A blank on the FDA SOQ column indicates that no maximum level has been established by the FDA for that contaminant.
3) An ND result means that the contaminant was not detected at or above the detection limit for the instrument.

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.emsl.com / cinnasblab@EMSL.com

| | |
|---|---|
| EMSL Order ID: | 041304761 |
| Customer ID: | NTLI78 |
| Customer PO: | 14630 |
| Project ID: | |

| | | | |
|---|---|---|---|
| **Attn:** | Susan Henderson | Phone: | (440) 449-2525 |
| | National Testing Laboratories, Inc. | Fax: | (Ema) il -only |
| | 6571 Wilson Mills Road | Collected: | 02/27/2013 |
| | Cleveland, OH 44143 | Received: | 03/01/2013 |
| | | Analyzed: | 03/07/2013 |
| **Proj:** | 2032595 | | |

## Test Report: Determination of Asbestos Structures >10µm in Drinking Water Performed by the 100.2 Method (EPA 600/R-94/134)

| Sample ID Client / EMSL | Sample Filtration Date/Time | Original Sample Vol. Filtered (ml) | Effective Filter Area ($mm^2$) | Area Analyzed ($mm^2$) | ASBESTOS | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Asbestos Types | Fibers Detected | Analytical Sensitivity | Concentration | Confidence Limits |
| | | | | | | | MFL (million fibers per liter) | | |
| 319577<br>041304761-0001 | 3/1/2013<br>11:45 AM | 100 | 1282 | 0.0660 | None Detected | ND | 0.19 | <0.19 | 0.00 - 0.72 |

Analyst(s)
Chris Little (1)

Stephen Siegel, CIH, Laboratory Manager
or Other Approved Signatory

Any questions please contact Steve Siegel.

Initial report from: 03/07/2013 20:39:00

**RADON DIAGNOSTIC LABORATORY**
3100 Hotel Rd., P.O. Box 1507
Auburn, Maine 04211

National Testing Laboratories, LTD
6571 Wilson Mills Road
Cleveland, OH 44143

## CUSTOMER INFORMATION

**BOTTLE NUMBER:** 41568W **DATE RECEIVED:** 03/01/13

**ORDER NUMBER:** #2032595

**NTL CUST SAMPLE ID:** 319577

**DATE/TIME COLLECTED:**

**DATE/TIME OPENED:** 02/27/13 @ 1346

**DATE ANALYZED:** 03/01/13

## RESULTS OF WATER RADON ANALYSIS

**154 pCi/L**

The test results from water samples are reported for the samples as received in our laboratory. RDL cannot be responsible for samples that were not collected under direct supervision.

RDL/A&L Laboratory Inc., P.O. Box 1507, Auburn, ME 04211-1507
207-784-5354 fax: 207-782-5561 email: allabs@adelphia.net

Jonathan T. Dyer

Jonathan Dyer, Lab Director

# Laboratory Report

Client: National Testing Laboratories

Attn: Susan Henderson
6571 Wilson Mills Road
Cleveland, OH 44143

Report: 292860
Priority: Standard Written
Status: Final
PWS ID: PA9996436

Copies to: None

**Sample Information**

| UL ID # | Client ID | Method | Collected Date / Time | Collected By: | Received Date / Time |
|---|---|---|---|---|---|
| 2786981 | 319577/2032595 | 335.4 | 02/27/13 13:46 | Client | 03/01/13 09:15 |
| 2786986 | 319577/2032595 | 331.0 | 02/27/13 13:46 | Client | 03/01/13 09:15 |

**Report Summary**

Source Type: Spring
Source Name: Source #1 & Source #2, Wilton, NH
Brand Name/Product Type: Monadnock Spring Water, 2.5 Gallon (x2)
Production Code/Lot #: January 4, 2013 11:13

Note: The Method 331.0 sample was filtered by laboratory personnel upon receipt.

Note: This data was submitted electronically to the Pennsylvania DEP for compliance.

---

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call Traci Chlebowski at (574) 233-4777.

*Note: This report may not be reproduced, except in full, without written approval from UL.*

Traci Chlebowski - Project Manager
Digitally signed by traci.j.chlebowski@ul.com
Date: 2013.03.11 08:58:53 -04'00'

Authorized Signature | Title | Date

Client Name: National Testing Laboratories
Report #: 292860



UL LLC
110 S. Hill St., South Bend, IN 46617-2702 USA
T: 800.332.4345 / F: 574.233.8207 / W: UL.com

Client Name: National Testing Laboratories

Report #: 292860

Sampling Point: 319577/2032595

PWS ID: PA9996436

| General Chemistry | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Analyte ID # | Analyte | Method | Reg Limit | MRL† | Result | Units | Preparation Date | Analyzed Date | UL ID # |
| 14797-73-0 | Perchlorate | 331.0 | --- | 0.05 | **0.10** | ug/L | --- | 03/06/13 01:01 | 2786986 |
| 57-12-5 | Cyanide, Total | 335.4 | 0.1 & | 0.02 | < 0.02 | mg/L | 03/04/13 14:40 | 03/04/13 16:57 | 2786981 |

† UL has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

| Reg Limit Type: | MCL | SMCL | AL | SOQ |
|---|---|---|---|---|
| Symbol: | * | ^ | ! | & |

## Lab Definitions

**Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) -** is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis.

**Internal Standards (IS) -** are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

**Laboratory Duplicate (LD) -** is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

**Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) -** is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control.

**Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) -** is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

**Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) -** is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

**Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) -** is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix.

**Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) -** is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results.

**Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) -** is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

**Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) -** is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

**Surrogate Standard (SS) / Surrogate Analyte (SUR) -** is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.

STATE OF CONNECTICUT
DEPARTMENT OF CONSUMER PROTECTION
Food & Standards Division
165 Capital Ave., Hartford, CT 06106Telephone (860) 713-7237 E-Mail: food.standards@po.state.ct.us
**Internet:** www.state.ct.us/dep

# WATER ANALYSIS REQUIREMENT FORM

#319577

WATER BOTTLERS: Please provide the appropriate analytical values from a State of Connecticut approved public health laboratory in the spaces provided on this form. Contact the Connecticut Dept. Health, bureau of Laboratories at (860) 509-7389 for a list of approved laboratories. Submit documentation for all the analytical results you provide, for water samples taken within the past 6 months, as attachments to this questionnaire. Detection limits must be provided for each parameter tested. ALL the required information must be submitted or the application will be denied.

SODA & JUICE DRINK BOTTLERS: Submit raw/source lab results for Total Coliform. (THIS QUESTIONNAIRE NOT REQUIRED)

NAME OF BOTTLED WATER FIRM: _____

STREET: _____
CITY, STATE & COUNTRY: _____
COMPLETED BY: _____ PHONE: (___) _____
FIRM'S AUTHORIZED SIGNATURE: _____ DATE: _____

1. Source Approval:
   Are copies of all current governmental certification for the sources being reviewed provided for Connecticut approval?
   ( ) Yes ( ) No

2. Treatment:
   If you treat the source(s) to meet potability standards for finished water, what treatment do you use?

   _____

NOTE: Include analytical results for treated water in the column "Finished Water Value"

## DCP USE:

( ) Approved ( ) Denied (see comments)

Comments:

_____

Reviewed by: _____ Date: _____

FOR DPH USE:

( )Approved ( ) Denied (see comments)

Comments:

_____

Reviewed by: _____ Date: _____

Pesticides and Herbicides,PCB, AND THEIR LIMITS

| CONTAMINANT (1) | MAXIMUM CONTAMINANT LEVEL (MG/L) | SOURCE WATER VALUE | FINISHED WATER VALUE |
|---|---|---|---|
| ALACHLOR | 0.002 | | <0.0002 |
| ALDICARB | ** | | <0.001 |
| ALDICARB SULFOXIDE | ** | | <0.001 |
| ALDICARB SULFONE | ** | | <0.001 |
| ALDRIN | ** | | <0.00007 |
| ATRAZINE | 0.003 | | <0.0001 |
| BENZO (A) PYRENE | 0.0002 | | <0.0002 |
| BUTACHLOR | ** | | <0.0002 |
| CARBARYL | ** | | <0.001 |
| CARBOFURAN | 0.04 | | <0.001 |
| CHLORDANE | 0.002 | | <0.0001 |
| DALAPON | 0.2 | | <0.001 |
| DI (2-ETHYLHEXYL) ADIPATE | 0.4 | | <0.0002 |
| DI (2-ETHYLHEXYL) PHTHALATES | 0.006 | | <0.0006 |
| DICAMBA | ** | | <0.0001 |
| DIELDRIN | ** | | <0.00002 |
| DINOSEB | 0.007 | | <0.0002 |
| DIQUAT | 0.02 | | <0.001 |
| DIBROMOCHLOROPROPANE (DBCP) | 0.0002 | | <0.00001 |
| 2.4-D | 0.07 | | <0.0001 |
| ETHYLENE DIBROMIDE (EDB) | 0.00005 | | <0.00001 |
| ENDRIN | 0.002 | | <0.0002 |
| ENDOTHALL | 0.1*** | | <0.009 |
| GLYPHOSATE | 0.7 | | <0.006 |
| HEPTACHLOR | 0.0004* | | <0.00001 |
| HEPTACHLOR EPOXIDE | 0.0002* | | <0.00005 |
| HEXACHLOROBENZENE | 0.001 | | <0.0001 |
| HEXACHLOROCYCLOPENTADIENE | 0.05 | | <0.0001 |
| 3-HYDROXYCARBOFURAN | ** | | <0.001 |
| LINDANE | 0.0002 | | <0.00002 |

| | | | |
|---|---|---|---|
| METHOXYCHLOR | 0.04 | | <0.0001 |
| METHOMYL | ** | | <0.001 |
| METOLACHLOR | ** | | <0.0002 |
| METRIBUZIN | ** | | <0.0002 |
| OXAMYL (VYDATE) | 0.2 | | <0.001 |
| PICLORAM | 0.5 | | <0.0001 |
| PROPACHLOR | ** | | <0.0002 |
| SIMAZINE | 0.004 | | <0.0001 |
| 2,3,7,8-TCDD (DIOXIN) | 0.00000003*** | | <5.0 pg/l |
| POLYCHLORINATED BIPHENYLS (PCB) | 0.0005 | | <0.0005 |
| PENTACHLOROPHENOL | 0.001 | | <0.00004 |
| TOXAPHENE | 0.003 | | <0.001 |
| 2,4,5-TP (SILVEX) | 0.05 | | <0.0002 |

FOOTNOTES:1THE METHOD DETECTION LIMITS FOR ALL PESTICIDES,HERBICIDES AND PCB SHALL CONFORM TO THOSE ACCEPTED AND APPROVED BY EPA. **MCL HAS NOT BEEN ESTABLISHED FOR THIS CHEMICAL. *IF MONITORING RESULTS IN DETECTION OF ONE OR MORE OF THESE CONTAMINANTS, THEN SUBSEQUENT MONITORING SHALL ANALYZE FOR ALL THESE CONTAMINANTS. *** DO NOT NEED TO TEST FOR THIS CHEMICAL AT THE PRESENT TIME.

ORGANIC CHEMICALS NA= NOT ANALYZED

| CONTAMINANT | QUANTIFICATION LIMIT (UG/L) | MCL (UG/L) | SOURCE WATER VALUE | FINISHED WATER VALUE |
|---|---|---|---|---|
| Benzene | 0.5 | 5 | | <0.5 |
| Bromobenzene | 0.5 | | | <0.5 |
| Bromomethane | 0.5 | | | <0.5 |
| n Butyl Benzene | 0.5 | | | <0.5 |
| Carbon Tetrachoride | 0.5 | 5 | | <0.5 |
| Chlorobenzene | 0.5 | 100 | | <0.5 |
| Chloroethane | 0.5 | | | <0.5 |
| Chloromethane | 0.5 | | | <0.5 |
| Ortho-Chlorotoluene | 0.5 | | | <0.5 |
| Para-Chlorotoluene | 0.5 | | | <0.5 |
| Dibromomethane | 0.5 | | | <0.5 |
| Meta-Dichlorobenzene | 0.5 | | | <0.5 |
| Ortho-Dichlorobenzene | 0.5 | 600 | | <0.5 |
| Para-Dichlorobenzene | 0.5 | 75 | | <0.5 |
| 1,1 Dichloroethane | 0.5 | | | <0.5 |

| | | | | |
|---|---|---|---|---|
| 1,2 Dichloroethane (EDC) | 0.5 | 5 | | <0.5 |
| 1,1 Dichloroethylene | 0.5 | 7 | | <0.5 |
| Cis 1,2 Dichloroethylene | 0.5 | 70 | | <0.5 |
| Trans 1,2 Dichloroethylene | 0.5 | 100 | | <0.5 |
| 1,2 Dichloropropane | 0.5 | 5 | | <0.5 |
| 1,3 Dichloropropane | 0.5 | | | <0.5 |
| 2,2 Dichloropropane | 0.5 | | | <0.5 |
| 1,1 Dichloropropene | 0.5 | | | <0.5 |
| 1,3 Dichloropropene | 0.5 | | | <0.5 |
| Ethylbenzene | 0.5 | 700 | | <0.5 |
| Methylene Chloride | 0.5 | 5 | | <0.5 |
| Methyl Tert Butyl Ether (MTBE) | 0.5 | | | <0.5 |
| Napthalene | 0.5 | | | <0.5 |
| n Propylbenzene | 0.5 | | | <0.5 |
| Styrene | 0.5 | 100 | | <0.5 |
| 1,1,1,2 Tetrachloroethane | 0.5 | | | <0.5 |
| 1,1,2,2 Tetrachloroethane | 0.5 | | | <0.5 |
| Tetrachloroethylene | 0.5 | 5 | | <0.5 |
| Toluene | 0.5 | 1000 | | <0.5 |
| 1,1,1 Trichloroethane | 0.5 | 200 | | <0.5 |
| 1,1,2 Trichloroethane | 0.5 | 5 | | <0.5 |
| 1,2,4 Trichlorobenzene | 0.5 | 70 | | <0.5 |
| Trichloroethylene | 0.5 | 5 | | <0.5 |
| 1,2,3 Trichloropropane | 0.5 | | | <0.5 |
| 1,2,4 Trimethyl Benzene | 0.5 | | | <0.5 |
| 1,3,5 Trimethyl Benzene | 0.5 | | | <0.5 |
| Vinyl Chloride | 0.5 | 2 | | <0.5 |
| Xylenes (Total) | | 10000 | | <0.5 |
| Meta Xylene | 0.5 | | | <0.5 |
| Ortho Xylene | 0.5 | | | <0.5 |
| Para Xylene | 0.5 | | | <0.5 |
| Total Trihalomethanes (TTHM) | | 100 | | <0.5 |
| 1. Bromodichloromethane | | | | <0.5 |
| | | | | |

| | | | | |
|---|---|---|---|---|
| 2. Bromoform | | | | <0.5 |
| 3. Chlorodibromomethane | 0.5 | | | <0.5 |
| 4. Chloroform | | | | <0.5 |

| Contaminant | Quanitification Limit (UG/L) | MCL (UG/L) | SourceWater Value | Finished Water Value |
|---|---|---|---|---|
| Bromate | | 10 | | <5.0 |
| Chlorite | | 1000 | | <5.0 |
| Haloacetic Acids (HAA5) | | 60 | | <5.0 |
| 1.Monochloroacetic Acid | | | | <1.0 |
| 2.Dichloroacetic Acid | | | | <1.0 |
| 3.Trichloroacetic Acid | | | | <1.0 |
| 4.Bromoacetic Acid | | | | <1.0 |
| 5.Dibromoacetic Acid | | | | <1.0 |

| Disinfection Residuals | Maximum Residual Disinfectant Level | | SourceWater Value | Finished Water Value |
|---|---|---|---|---|
| | (MRDL) MG/L | | | |
| Chlorine | 4.0 as CL2 | | | <0.05 |
| Chloramine | 4.0 as CL2 | | | <0.05 |
| Chlorine Dioxide | 0.8 | | | <0.1 |

***BACTERIOLOGICAL/ PHYSICAL***

| CONTAMINANT | MAXIMUM CONTAMINANT LEVEL (MCL) | SOURCE WATER VALUE | FINISHED WATER VALUE |
|---|---|---|---|
| Coliform | Absence | | 0 |
| Color (apparent) | 15 Units | | <3.0 |
| Turbidity | 5 Units | | 0.1 |
| Odor | Value of 2 | | <1 |
| pH (acceptable range) | 6.4 to 8.5 | | 5.9 |
| | | | |

INORGANIC CHEMICALS ( MCL mg/l)

| CONTAMINANT | MCL (MG/L) (1) | SOURCE WATER VALUE | FINISHED WATER VALUE |
|---|---|---|---|
| Antimony | .006 | | <0.003 |
| Arsenic | .05 | | <0.002 |
| Asbestos | 7.0 MFL (2) | | <0.19 |
| Barium | 2.0 | | <0.10 |
| Beryllium | .004 | | <0.001 |
| Cadmium | .005 | | <0.001 |
| Chromium | .1 | | <0.007 |
| Cyanide | .2 | | <0.02 |
| Flouride | 4.0 | | <0.10 |
| Lead | (4) | | <0.001 |
| MBAS | 0.5 | | <0.1 |
| | | | |

| | | | |
|---|---|---|---|
| Mercury | .002 | | <0.0002 |
| Nickel | .1 | | <0.005 |
| Nitrite Nitrogen | 1.0 (as N) | | <0.05 |
| Nitrate Nitrogen plus Nitrite | 10.0 (as N) | | 0.45 |
| Selenium | .05 | | <0.002 |
| Silver | .05 | | <0.002 |
| Sulfate | (3) | | 6.8 |
| Thallium | .002 | | <0.001 |
| Copper | (4) | | <0.002 |
| Sodium (notification level) | 28.0 | | 16 |
| Chloride | 250.0 | | 30.0 |
| Total Dissolved Solids | (3) | | 93 |

***RADIOLOGICAL***

| CONTAMINANT | MCL AS PCI/L | SOURCE WATER VALUE | FINISHED WATER VALUE |
|---|---|---|---|
| Radioactivity (natural) Gross Alpha | | | 0.514+-0.795 |
| Combined Radium 226 & 228 | | | 0.4327+-0.528 |
| Radioactivity (man-made) (6) | | | |
| Gross beta particle | | | 1.45+-0.849 |
| Uranium | | | <0.001 mg/L |
| Tritium | 20000 | | |
| Strontium - 90 | 8 | | |
| Dose equivalent of tritium plus srontium - 90 | 4 millirem | | |

Foot Notes:

(1) The method detection limits for inorganic chemicals shall conform to those accepted by the EPA.

(2) MFL = Million fibers/liter

(3) MCL has not been established for this chemical.

(4) See section 19-13-B102(1)(6) Contact Conn. Dept. Heath Services, Water Supplies 860-509-7333

5) If gross alpha is over 5pCi/l, test for radium 226. If radium 226 is over 3pCi/l, test for radium 228.

(6) Man-made radioactivity test only required for bottlers using surface water ( reservoirs).