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# 2023 Wetland Assessment
# Pointed Mountain Gas Plant

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## 1.0 INTRODUCTION

Millennium EMS Solutions Ltd. (MEMS) was retained by Paramount Resourced Ltd. (Paramount) to complete a 2023 wetland assessment program at the wetland 250 m south of the former Pointed Mountain Gas Plant in the Northwest Territories (NWT) (herein referred to as the "Site") located approximately 25 km northwest of the Liard River and Fort Liard (Figure 1, Appendix A). The wetland assessment program was undertaken with wetland data collected to aid in potentially developing an appropriate Risk Management Plan (RMP) and future Ecological Risk Assessment (ERA) for the Site and associated wetland.

### 1.1 Site Background and Setting

The Site includes a plant site, six associated well sites, a surge pond, and an airstrip. An overview of the Site is shown on Figure 2 in Appendix A and Site information is summarized in Table 1 below.

**Table 1 Site Information**

| | | Reference |
|---|---|---|
| Site type | Former gas plant | MEMS, 2023 |
| Size | Approximately 17.1 hectares (ha) | Worley Parsons, 2014 |
| Longitude and Latitude | Latitude 60.397586 Longitude -123.819042 | - |
| Distance / direction from nearest settlement | 25 km northwest of Fort Liard, NWT | - |
| Current Ownership | Paramount Resources Limited (since 2017) | MEMS, 2023a |
| Former Ownership | Pan American Petroleum Corporation (Amoco, 1966 to 1998)<br>BP Canada Energy Company (1998 to 2010)<br>Apache Canada Ltd. (2010 to 2017) | MEMS, 2023a |
| Adjacent land use | Forested land of traditional territory of the Acho Dene Koe First Nation (ADK) | MEMS, 2023 |

| **Table 1 Site Information** | | |
|---|---|---|
| | | **Reference** |
| Land Use Permit and Water License # | The assets were operated under the Mackenzie Valley Land and Water Board Land Use Permit MV2007X0007 and MV2014X0011 (WorleyParsons, 2014), until acquisition by Paramount Resources Limited in 2017 and subsequent Land Use Permit and Water License updating to MV2021X0003 and MV2021L1-0002, respectively.<br>Paramount initially filed for MV2021X0003 and MV2021L1-0002 but later withdrew these applications. This was done to strategize and create new applications with extended durations. | Worley Parsons, 2014<br>MEMS, 2023a |
| Site status | Decommissioned in 2002.<br>Infrastructure remaining at the Site at the start of the current remediation program included wildlife and waterfowl deterrents (metal fence around the surge pond and wires strung across the pond), metal debris, on the southwest portion of the Site and a tower, shack, and wooden structure. | |

The wetland located down-gradient approximately 250 m south of the Site is bordered to the north by a slope populated with trembling aspen and wild rose leading away from the Site (Figure 2 in Appendix A). Fisherman's Lake is located on the south border of the wetland and meanders to the southeast and southwest. Mixed wood forest borders the east and west sides of the wetland, and a third-party pipeline traverses the western portion of the wetland.

The Site is in the southwest region of the Taiga Plains ecozone (Government of Northwest Territories, 2022) within the Liard Plains Upland Mid-Boreal (MB) Ecoregion as identified by the Ecosystems Classification Group (Ecosystem Classification Group [ECG], 2007). This ecozone experiences the warmest climate of any area in the Northwest Territories due to Chinook-like winds from adjacent mountain ranges. The dominant landform in the ecoregion is undulating to rolling till with Luvisols and Brunisols being the most common soils along with till materials. Gleysols and Organic soils occur beneath wetlands in this area (ECG, 2007).

Vegetation consists of highly productive deciduous and mixedwood stands consisting of trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*) and white spruce (*Picea glauca*) with lush understories of low-bush cranberry (*Viburnum trilobum*), prickly rose (Rosa *acicularis*), dwarf raspberry (*Rubus pubescens*) and meadow-horsetail (*Equisetum pratense*) among other forbs and shrubs (ECG, 2007). Wetlands are limited in this area due to the undulating to rolling terrain but are typically rich, horizontal fens with sparse trees, willows, and sedges (ECG, 2007).

## 1.2 Environmental Status

Multiple environmental assessments have been completed at the Site and data from 2007 to 2022 was available to MEMS for review (Alpine Environmental, 2007; Worley Parsons, 2014, 2015a, 2015b, and 2019; Stantec, 2019; MEMS, 2023a). The surge pond at the Site was identified as a primary area of potential environmental concern (APEC), and the focus of 2023 Site activities as the pond was used for produced and process water storage. Previous analytical results for soil, groundwater, and surface water in this area were above the applied screening values.

Based on the relative magnitude of concentrations above the screening values, chloride was identified as the primary chemical of potential concern (COPC) in the surge pond water. Secondary COPC above historically applied screening values in the water in the surge pond have included iron, manganese, sodium, total dissolved solids (TDS), fluoride, and boron. The water in the surge pond was previously found to be stratified, with the highest concentrations of all parameters reported in water near the bottom of the pond.

Soil and sediment quality below the surge pond was assessed in 2003 (a summary of this analytical data is presented in Alpine Environmental, 2007). Information on soil quality in the area surrounding the surge pond was available in assessments conducted from 2007 to 2014 (WorleyParsons, 2015a). The primary COPC in soil and sediment in the surge pond were salinity parameters including electrical conductivity (EC), sodium adsorption ratio (SAR), and associated chloride concentrations. Secondary COPC include benzene, toluene, ethylbenzene, xylenes (BTEX); and Fraction (F)1, F2 and F3 petroleum hydrocarbons (PHC). Locally, pH and nickel concentrations in soil were previously reported above the applied screening values. The highest chloride (and associated EC and SAR values) and PHC concentrations were reported in sediment at the base of the surge pond during the 2003 assessment. Concentrations decreased rapidly with depth below the surge pond (Alpine Environmental, 2007).

The presence of the water-filled surge pond with continued and seasonally variable hydraulic head was considered a driver for groundwater migration and continued chloride mass distribution to areas downgradient of the surge pond.

MEMS completed a Site visit and monitoring program in 2022 that included groundwater monitoring, vegetation health assessments, and surface water sampling from the wetland, surge pond, ponded water along the northern Site boundary, and creek offsite to the west (MEMS, 2023). Chloride concentrations reported in the wetland in 2022 were higher than previously reported, however there appears to be substantial fluctuation in concentrations from year to year, likely due to variability in water levels, precipitation, and surface water run-off.

Remediation of the on-Site surge pond area and groundwater monitoring were completed at the Site in the summer of 2023; reports pertaining to each scope of work have been submitted separately from the 2023 wetland assessment results presented herein (MEMS, 2023b and 2023c, respectively). A total of approximately 5,700 $m^3$ of water from the surge pond was treated and either discharged to the ground surface at the Site (approximately 3,180 $m^3$) or transported to a licensed disposal facility (approximately 2,520 $m^3$). Once the surge pond had been emptied, approximately 6,500 $m^3$ of soil and sediment material with the highest concentrations of chloride and other COPC was then excavated. The monitoring of the wetlands in upcoming years will provide data on the effectiveness of the source removal.

## 2.0 PROJECT OBJECTIVES AND SCOPE OF WORK

A weight-of-evidence approach was proposed to support any focussed ecological risk assessment (ERA) that may be done in relation to the wetland at the Site. This approach was designed to establish multiple lines of evidence to support the maintenance of a diverse ecological community as the overarching protection goal, including establishing the invertebrate community's temporal diversity and abundance within the wetland. The components that would feed into any future ERA could change as any potential data gaps identified in the conceptual model are closed. The collection of temporal biological and chemistry data was recommended to support a future ERA aimed at refining any additional remediation or risk mitigation. Achieving an overarching protection goal for the Pointed Mountain Site wetland would be multi-tiered, with a goal of optimizing remedial efforts at the Site such that the ecological community is established and maintained with diversity and supported by:

- understanding how the salinity mass enters the wetland, and apportioning mass introduction *via* groundwater and overland flow;
- establishing the salinity trends in the wetland relative to the net volume;
- establishing ecological function metrics (*i.e.,* invertebrate and plant community composition) during the current chloride exposure, that can be used to quantify ecological function and maintenance of function over time; and
- validating and refining model assumptions, as necessary.

This report provides information regarding the wetland salinity assessment and ecological function metrics. Reporting on the other 2023 objectives for the Site will be provided separately.

### 2.1 Scope of Work

The scope of work for the 2023 wetland assessment program included the following:

1. Measuring field parameters and collecting surface water samples at field fit locations, paired with vegetation, invertebrate and sediment assessment locations, and analysing for routine water quality parameters to add to the current dataset and aid in ascertaining any temporal trends in water chemistry at the wetland.
2. Submitting surface water samples for toxicity identification evaluation.
3. Collecting fifteen modified samples from field fit locations and analysing for invertebrates to understand baseline invertebrate species richness and community composition, and aid in discerning any future temporal trends in macroinvertebrate species richness and community composition in the sediment at the wetland.
4. Collecting sediment samples from each invertebrate sample location and submitting samples for analysis of detailed salinity to understand the chemistry of sediment available to the invertebrate population.
5. Assessing vegetation species richness, vigor, and health metrics within vegetation plots representative of the wetland vegetation community. Plot locations were chosen based on chloride concentrations in surface water and vegetation was assessed in locations with the areas with the highest chloride concentrations (assessment locations) and lowest chloride concentrations (background locations).
6. Reference groundwater results of samples collected during the 2023 groundwater assessment program, where appropriate, to understand groundwater chemistry in the vicinity of the wetland area.

## 3.0 ASSESSMENT METHODOLOGY

### 3.1 Surface Water Sample Collection

MEMS visited the wetland to collect surface water samples and record conditions from July 28 to 30, 2023. Water was collected in the appropriate bottles provided by the laboratory. Nitrile gloves were worn during sampling and were replaced between sampling locations. Bottles were labelled prior to sampling with the location ID, sampling date and time, and parameters to be analysed. Field parameters including electrical conductivity (EC), dissolved oxygen (DO), oxidation reduction potential (ORP), pH, and temperature were measured and recorded on the field sheet. Sample locations were logged using a Trimble GeoXT handheld GPS system.

Surface water samples were packed in coolers with ice, but kept from freezing, and delivered to the receiving laboratory. The chain of custody (CoC) was filled out in the field and provided to the laboratory with the samples.

### 3.2 Sediment Sample Collection

Sediment was sampled with a petit-ponar sampling device where sediment was emptied into a stainless-steel tray and transferred into laboratory supplied sampling jars with limited head space. Prior to handling the sampling equipment and sample containers, a new pair of nitrile gloves was donned at each sample location. Cleaning and decontamination between sample locations was accomplished through physical removal of sediment from the sampling equipment followed with a water rinse.

### 3.3 Soil Sample Collection

Fifteen soil samples were collected from topsoil (0.2 to 1 m in depth) using a hand auger. Surface litters of non-decomposed plant materials was removed before sampling so as to ensure that only soil sample was collected. Following sample collection, the soil was uniformly homogenized in uncontaminated containers and properly stored in labeled sample containers. All soil samples were immediately transported to the laboratory.

### 3.4 Macroinvertebrate Sample Collection

Fifteen sediment substrate samples for macroinvertebrate assessment were collected on July 28 to 30, 2023, from field fit locations within the wetland. Sample locations were selected based on evidence of oxygenation (*i.e.*, ripples or elevation drop), unembedded substrates and emergent vegetation, where present. Macroinvertebrate sampling coincided the vegetation, surface water, and sediment assessment locations to better understand overall ecological function and the chemistry of water and sediment available to the invertebrate population.

Samples were collected using a modified Hess Sampler, or metal cylinder, with an attached 400 µm containment sieve. The sampler was vertically placed onto each location and driven into the sediment approximately 3 cm to 5 cm below the sediment surface. The substrate and vegetation were agitated and physically lifted into the cylinder. Any water was then drained through the 400 µm sieve, before transferring the entire contents into uniquely labelled containers and preserved in 10% buffered formalin. Samples were shipped to Cordillera Consulting (Cordillera) to be sorted, identified, and enumerated. Invertebrate sample sorting methodologies were provided by Cordillera and are presented in Appendix C.

### 3.5 Wetland Vegetation Assessment

The vegetation assessment methodology is presented in Appendix D.

### 3.6 Toxicity Assessment

A surface water sample (SW23-05TOX) in four 10-liter plastic containers was collected on July 30, 2023 and delivered to the Nautilus Environmental laboratory in Burnaby, BC on July 31, 2023 to measure following sub-lethal toxicity tests:

- Ceriodaphania dubia (*C. dubia*) survival and reproduction.
- 7-d fathead minnow (*P. promelas*) survival and growth.
- 7-d Lemna minor (*L. minor*) growth inhibition.
- 72-h Pseudokirchneriella subcapitata (*P. subcapitata*) growth inhibition.

The details method for the toxicity testing is provided in Appendix E.

## 4.0 SCREENING GUIDELINES

Concentrations COPC in surface water samples were screened against the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic life (CCME, 2023) and Guidelines for Canadian Drinking Water Quality (Health Canada, 2023). Tier 1 criteria from the NWT 2003 *Environmental Guideline for Contaminated Site Remediation* were applied as soil criteria for screening purposes. In the absence of criteria for a natural or wildlands setting, criteria for an agricultural land use setting with fine grained soils were applied.

No screening criteria for salinity are available in CCME for sediment. Therefore, the relative distribution of chloride across the sediment samples was analysed.

The applied guidelines for surface water and soil are presented in Appendix B, tables B2 and B4.

## 5.0 RESULTS

### 5.1 Surface Water Assessment Results

The analytical results of surface water samples are presented in Table B2 (Appendix B). Samples were collected from various field-fit locations within the wetland, paired with suitable invertebrate habitat, where water was present at the time of collection in July 2023 (Figure 3, Appendix A). The samples were analyzed for general, inorganic parameters and metals iron and manganese.

All the surface water samples collected from the assessment transects at the Site (including SW23-05, SW23-06, SW23-08, SW23-10, SW23-11, SW23-12, SW23-15, SW23-17, SW23-18) exceeded the CWQG-CCME chloride guideline value of 120 mg/L and the background concentration ranges at the Site (Table 2, Appendix B and Figure 4, Appendix A). The maximum reported chloride concentration was 350 mg/L. Several surface water samples from the Site also exhibited elevated sulphate levels

compared to background ranges and the applied Canadian Drinking Water (2022) standards for the aesthetic objective (Table 2, Appendix B and Figure 4, Appendix B).

Concentrations of total dissolved solids, iron, and manganese exceeded the applied guidelines, consistent with the elevated levels of these compounds in control transects (Table 2, Appendix B).

### 5.2 Sediment Assessment Results

Sediment was sampled at fifteen locations on the Site (Figure 3, Appendix A) and they were analyzed for general and inorganic parameters. The sediment laboratory data is included in Table 3, Appendix B and original laboratory data in Appendix F.

The relative higher concentrations of chloride, soluble chloride, sodium, and Sodium Adsorption Ratio (SAR) were detected in sediment samples collected from assessment transects compared to the control transects. The maximum reported chloride concentration in assessment transects was 2920 mg/kg in SS23-08.

### 5.3 Soil Assessment Results

Soil samples were analyzed for general and inorganic parameters. Soil laboratory data table is included in Table 4, Appendix B, and the original laboratory data is in Appendix F. The electric conductivity in HA23-08, HA23-47, HA23-48, and HA23-53 were above the applied soil quality guideline of 2 dS/m. The pH level of soil samples HA23-01 and HA23-02 exceeded the recommended guideline of 6-8. Chloride concentration decreased with depth (from 0.2 to 1 m bgs) at different samples (Table 4, Appendix B).

### 5.4 Benthic Invertebrate Assessment Results

Benthic invertebrates were collected from fifteen established locations within the Site, with nine from assessment transects and six from the control transects (Figures 3, Appendix A). The invertebrate survey result and original report from Cordillera consulting are presented in Table 5 (Appendix B) and Appendix C, respectively.

In terms of richness, samples from INV-1 had the lowest richness of benthic invertebrates with 6 species per sample. Invertebrate richness in INV-6 (13 species), INV-11 (14 species), and INV-4 (16 species) were also below the average richness observed in control transects with an average of 22 different species per sample. Invertebrate richness was highest in the INV-8 samples (32 different species per sample) and second highest (29 different species per sample) at INV-19 in a control transect. The invertebrate's richness in various samples, including assessment and control transects, is depicted in Chart 1.

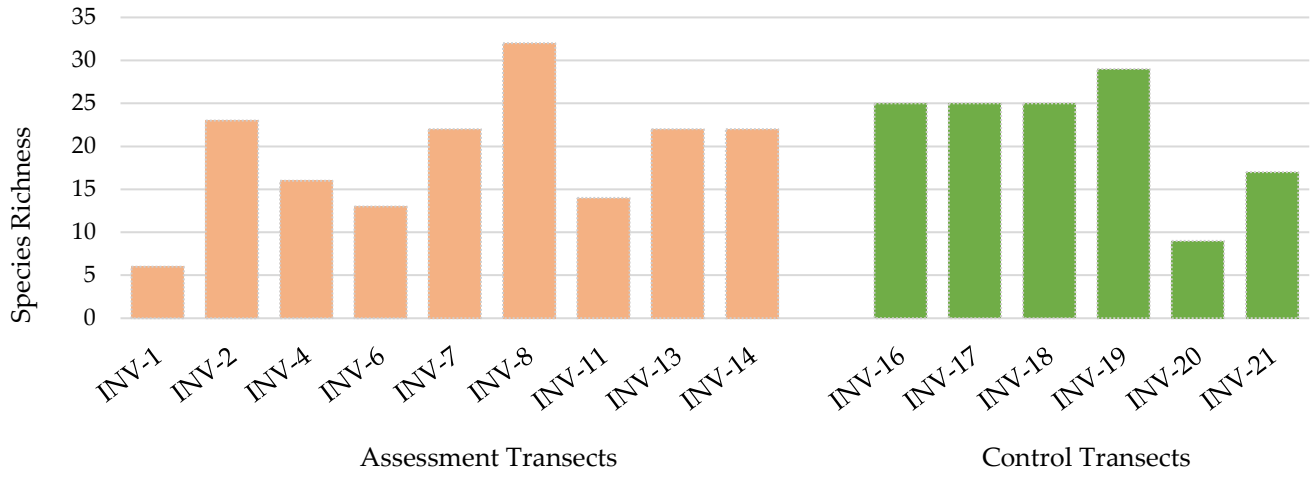


**Chart 1. The richness of invertebrates at the Site.**

The benthic invertebrates observed at the Site exhibited a wide range of different total abundance in both control and assessment samples. The average total abundance was reported to be higher in control compared to assessment transects. INV-20, located in the control transect, exhibited the lowest total abundance with 14 benthos per sample. INV-1 with 20 benthos per sample and INV-4 with 29 benthos per sample presented the lowest invertebrate abundance in the assessment transects. The control transects recorded the highest density and abundance of invertebrates, with INV-16 (286 benthos per sample) and INV-19 (201 benthos per sample) exhibiting the highest counts. In the assessment transects, INV-8 and INV-14 showed high total abundance, with 151 and 141 benthos, respectively (Table 5 of Appendix B and Chart 2).

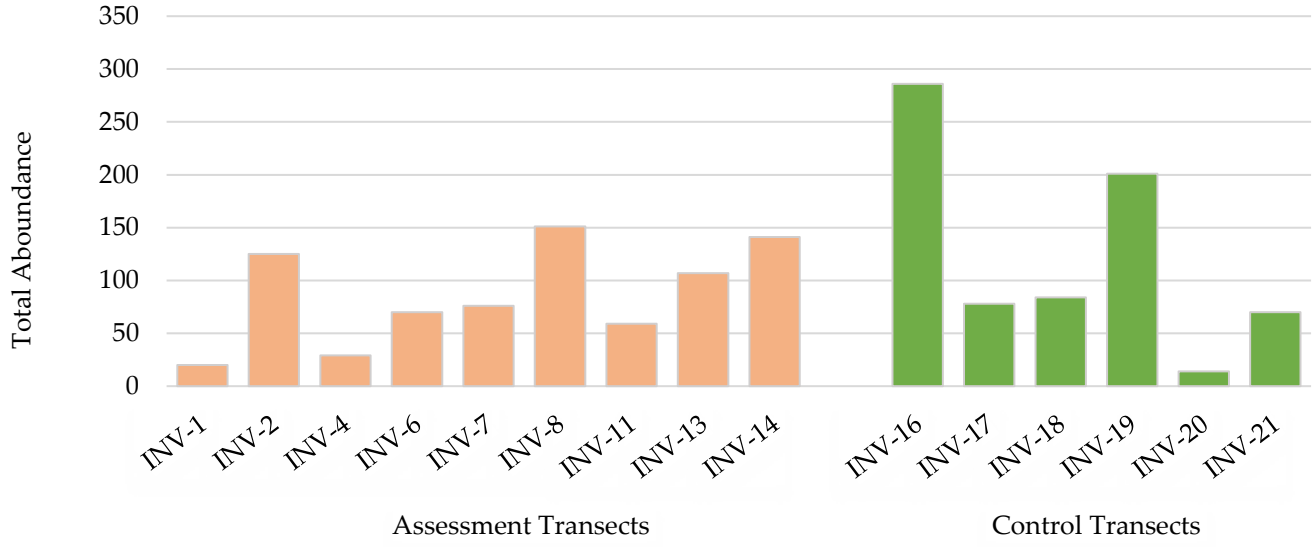


**Chart 2. The total abundance of invertebrates at the Site.**

Wetlands provide habitat for a diverse array of aquatic invertebrates adapted to these environments providing a variety of ecological services. Aquatic macroinvertebrates, specifically the abundance of select orders that are sensitive to pollution and represent the primary food source for higher trophic levels, are frequently used as an index of aquatic health or ecological function in rivers and creeks. The larvae of EPT, comprised of Mayfly (Order Ephemeroptera), Stonefly (Order Plecoptera), and Caddisfly (Order Trichoptera), are present year-round and are sensitive to pollution; their presence is often used as an index of biotic integrity. The comparison of EPT abundance within the site reveals no distinct ecological patterns between samples collected from the control and assessment areas. INV-2 and INV-11 within the assessment transects, as well as INV-17 in the control transect, each showed one EPT abundance, whereas the rest of the samples exhibited no EPT presence (Table 5, Appendix B).

The Family *Chironomidae* are also an important component fraction and link between producers and secondary consumers in wetlands. Due to their adapted stress response, chironomids are associated with lower diversity systems (Wrubleski and Ross, 2011). *Chironomidae* larvae are opportunistic omnivores ingesting a wide variety of food items, including algae, fungi, detritus and associated microorganisms, macrophytes, and wood debris; and are referred to as collector-gatherers as they are not restricted to a single feeding mode (Henriques-Oliveira *et al*., 2003). The presence and abundance of the predator feeding guild is an indication of system function as foundational food sources, like chironomids, are present. Across all the samples, INV-18 and INV-21 exhibited the highest chironomidae %, while INV-1, INV-11, and INV-20 were reported to have no presence of chironomidae.

The composition of invertebrates within various samples is illustrated in Chart 3, categorized by family groups.

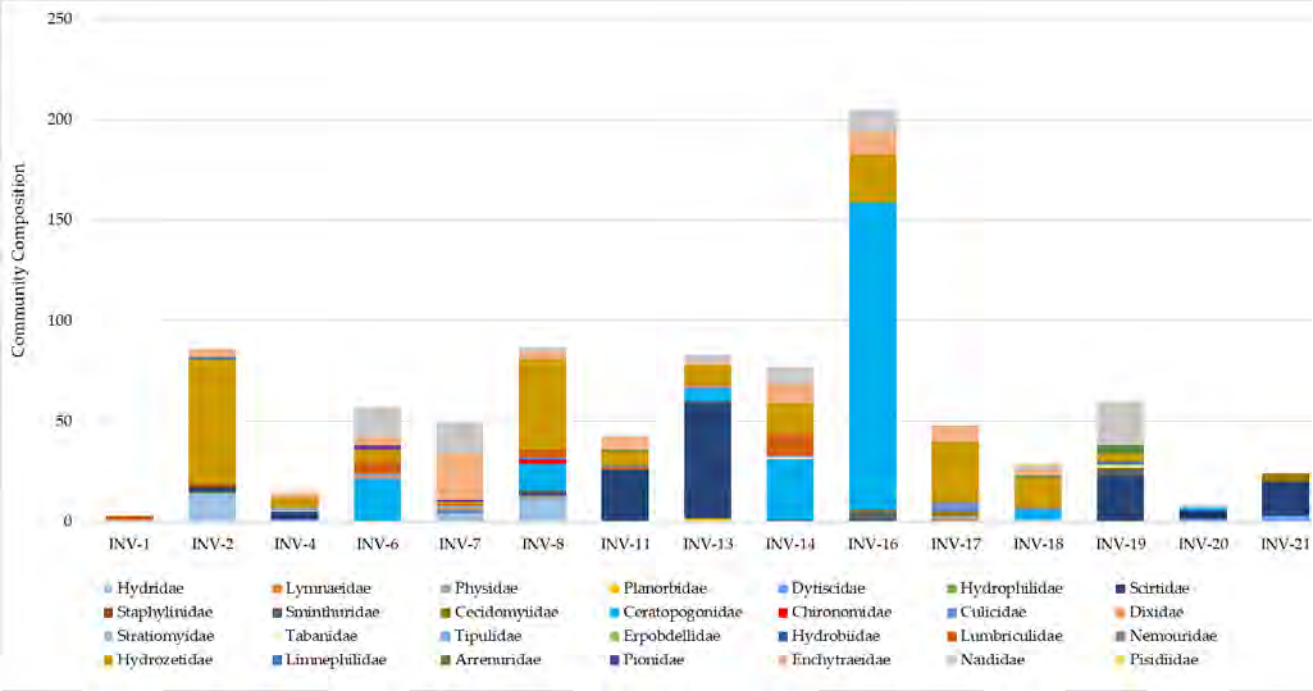


**Chart 3. The community composition of invertebrates at the Site.**

The observations made in the vicinity of each invertebrate sample are summarized in Table 2, together with information on reported chloride concentrations in sediment and soil. Despite the high concentration of chloride in sediment samples collected from assessment transects, the richness and abundance of invertebrates have not been influenced and differ little from those observed in control transects. Abundance varies throughout the habitat, possibly due to natural functionality (such as oxygen levels) or foraging preferences.

**Table 2 Summary of Invertebrate Sample Observations and Reported Chloride Concentrations in Surface Water and Sediment**

| | Invertebrate Species Richness | Invertebrate Total Abundance | Reported Surface Water Chloride Concentration (mg/L) | Reported Sediment Chloride Concentration (mg/L) |
|---|---|---|---|---|
| **Assessment Transect** | | | | |
| INV23-1 | 6 | 20 | 167 | 651 |
| INV23-2 | 23 | 125 | 248 | 1400 |
| INV23-4 | 16 | 29 | 224 | 1370 |
| INV23-6 | 13 | 70 | 350 | 1470 |
| INV23-7 | 22 | 76 | 315 | 1390 |
| INV23-8 | 32 | 151 | 314 | 2920 |
| INV23-11 | 14 | 59 | 289 | 1660 |
| INV23-13 | 22 | 107 | 279 | 1710 |
| INV23-14 | 22 | 141 | 288 | 1930 |
| ***Average*** | ***18.9*** | ***86.4*** | **302** | **1620** |
| **Control Transect** | | | | |
| INV23-16 | 25 | 286 | 18.2 | 305 |
| INV23-17 | 25 | 78 | 13.2 | 779 |
| INV23-18 | 25 | 84 | 18.1 | 166 |
| INV23-19 | 29 | 201 | 5.5 | 294 |
| INV23-20 | 9 | 14 | 5.4 | 329 |
| INV23-21 | 17 | 70 | 5.7 | 371 |
| ***Average*** | ***21.7*** | ***122*** | ***9.58*** | ***374*** |

## 5.5 Vegetation Assessment Results

The full Wetland Vegetation Assessment Report is included as Appendix D; a summary of the results is presented below.

The 2023 vegetation monitoring indicated that species richness in the assessment vegetation communities was similar to the control communities, as well as the vegetation strata layers, which does not indicate that there are losses of species or community structure related to higher

concentrations of salinity. The overall abundance of graminoid and forb species was higher in the assessment plots compared to the control transects. The assessment plots were located closer to where overland flow channels from the upland areas were observed, therefore more water tolerant graminoid species such as sedges and rushes would be anticipated. Abundance of shrubs was greater in the control plots and would be anticipated as they were located further from the overland flow inputs where water concentrations would disperse more evenly and would not be as susceptible to water stress. The differences in abundance between the assessment and control transects therefore may be attributed to natural functionality rather than variable chloride concentrations.

Individual plants that were discoloured were observed in both the assessment and control plots, with a higher abundance of discolored vegetation observed in the control transects compared to the assessment transects. The Fort Liard region had inordinately high temperatures in the summer of 2023, with numerous heat warnings issued by Environment Canada; local contractors also indicated that there was a spruce budworm infestation occurring in the region. Therefore, heat stress, drier conditions and insect pests may be attributed to some of the discoloration of the trees and shrubs that were observed.

Bare mineral soil resulting from poor growth was not observed in the vegetation communities, and litter production was higher in the assessment transects compared to the control transects indicating that there was no loss of plant productivity due to higher salt concentrations.

### 5.6 Toxicity Assessment Results

Exposure to different concentrations of SW23-05TOX (1.56 to 100% v/v) did not result in adverse effects on the survival of *C. dubia*. However, the analyzed sample did inhibit the reproduction of *C. dubia* by 25% (inhibitory concentration 25 or IC25 value) at a concentration of 27.1%.

No adverse effects were observed on the survival and biomass of *P. promelas*, nor on the cell yield of *P. subcapitata*, as indicated by IC25 and LC50 values exceeding the highest concentration tested. A significant stimulation was reported in *P. subcapitata* cell yield across all test concentrations, with percent stimulation ranging from 46.1 to 226.6%

No adverse effects were reported in the dry weight of *L. minor*, as indicated by IC25 values exceeding 97%. However, a reduction in frond count was reported, with IC25 values of 14.5%.

The results of toxicity testing are provided in Table 6 of Appendix B, and the original toxicity testing report from Nautilus Environmental is included in Appendix E.

# 6.0 CONCLUSIONS

The following findings were made based on the 2023 assessment program.

## 6.1 Surface Water

All surface water samples reported chloride concentrations exceeding the applicable guideline value for chloride, indicating salinity persists within the wetland. The chloride concentration reported in the wetland in 2023 (maximum 350 mg/L) is similar to the previously reported maximum concentration of chloride at this site (maximum 349 mg/L) (MEMS, 2022).

Several surface water samples exhibited elevated sulphate levels above the applicable guidelines; however, the concentrations were comparable with the range of concentrations measured in background sample locations. This further supports the presence of salinity in the region. In the prior assessment, three out of five surface water samples collected from the wetland assessment area exceeded the comparative guideline of 500 mg/L.

The exceedances in total dissolved solids, iron, and manganese concentrations reflect naturally occurring levels in this area, as similar exceedances were observed in reference locations.

## 6.2 Sediment

The sediment samples collected from assessment transects consistently exhibited higher concentrations of chloride compared to those from control transects.

## 6.3 Soil

The elevated electric conductivity levels in multiple samples (HA23-08, HA23-47, HA23-48, and HA23-53) provide further evidence of salinity presence at the Site.

Samples HA23-01 and HA23-02 exceeded the applied guideline for pH levels.

## 6.4 Benthic Invertebrate Survey

The 2023 Invertebrate monitoring indicated that the average species richness in the assessment transects was similar to the control transects.

The variable total abundance of benthic invertebrates observed in both control and assessment samples may be attributed to natural factors such as oxygen levels and foraging preferences.

### 6.5 Vegetation Assessment

- The 2023 vegetation monitoring showed similar species richness and strata layers between assessment and control communities.
- There is a variable abundance and strata layers between assessment and control transects, likely influenced by natural factors rather than chloride concentrations.
- The wetland did not show any clear effects from elevated salinity parameter concentrations, and the health and vigor ratings for both the assessment and control transects were similar and were rated as healthy to excellent condition.

### 6.6 Toxicity Assessment

- While the survival of *C. dubia* remained unaffected, their reproductive capabilities were compromised by the presence of SW23-05TOX.
- No adverse effects were observed on the dry weight of *L. minor*; however, a reduction in frond count was reported, indicating potential stress or impairment to the plant's growth.

### 6.7 Impact of Groundwater on Wetland Chloride Levels:

In the current report, we also assessed the influence of the groundwater plume on concentrations in the wetland. MEMS personnel conducted groundwater monitoring at the Plant Site on June 30, 2023. Reporting on the 2023 groundwater monitoring event will be provided separately (unpublished MEMS report, 2024). The summary of the groundwater results is present below:

- In 2023, groundwater monitoring utilized 29 shallow wells and one deep well, with samples taken from 27 of them.
- Depths to groundwater ranged from 0.15 to 3.0 meters below ground surface, with calculated elevations ranging from approximately 335.8 to 365.5 meters above relative datum. Groundwater flow was interpreted as moving towards the south.
- Hydraulic conductivity tests on four monitoring wells to improve spatial coverage of data downgradient of the Site. Results ranged from $1.0 \times 10^{-8}$ to $5.3 \times 10^{-6}$ m/s, with the highest conductivity observed in a well screened within a clay and silt layer.
- Analysis of groundwater samples from 27 locations revealed elevated chloride and sulphate concentrations.
- In the 2023 Site Visit and Monitoring Program, chloride, sulphate, total dissolved solids (TDS), and manganese concentrations in groundwater from numerous wells exceeded guideline levels. These exceedances were consistent with observed levels in 2023 wetland surface water. While sodium concentrations in groundwater surpassed guidelines, surface water consistently remained below the threshold. This discrepancy may be due to differences in geochemical

behaviors between sodium and chloride ions, potentially resulting in less impact on surface water from sodium.

Based on the information available, it is plausible that the groundwater plume is affecting concentrations in the wetland (see Figure 3, Appendix A).

Elevated chloride and sulphate concentrations in surface water samples, as well as elevated electrical conductivity levels in sediment and soil samples, indicate the presence of salinity at the Site. Despite salinity presence, vegetation and invertebrates' communities show minimal impact, as evidenced by similar species richness between assessment and control communities. This is a familiar response with ecosystems in long term impacted areas. The toxicity assessment information also suggests that the SW23-05TOX has sublethal effects on aquatic organisms and plants at the Site. While the survival of aquatic organisms is not impacted, their ability to reproduce may be compromised. The reproductive health indicates potential long-term ecological implications, as compromised reproductive capabilities can affect population dynamics and ecosystem health. Although there are no immediate adverse effects on the overall mass of plants, the reduction in frond count suggests that the plants may be experiencing stress or impairment in their growth and reproductive processes. Wetland monitoring at multi- year intervals (*i.e.*, 5 years) and investigation into the potential long-term effects on aquatic organisms and plants would ensure the overall health and sustainability of the ecosystem.

## 7.0 LIMITATION OF LIABILITY AND CLOSURE

Performance of a standardized environmental site assessment protocol is intended to reduce, but cannot eliminate, uncertainty regarding environmental conditions in connection with the property, given reasonable constraints of time and cost. No environmental site assessment can wholly eliminate uncertainty regarding the potential for environmental liability.

The 2023 Wetland Assessment program was conducted in accordance with the project objectives prepared for this project. The observations, findings, and conclusions contained in this report apply only to the testing performed during the project and on information gained from the activities described in this report. Such information may change over time.

MEMS' work is predicated on the fact that all data contained in third party reports and information provided by others is accurate and reflective of site conditions. As per the scope of this assignment, MEMS has not sought to independently verify the data provided by others unless otherwise noted. MEMS does not accept responsibility for any deficiency, misstatements or inaccuracies contained in this report as a result of omissions or misinterpretations by others.

While preparing this report, MEMS may use or incorporate MEMS' proprietary algorithms, methods, compilations, processes, designs, formulas, and/or techniques, and may also employ advanced technologies for simulation, information modeling, generative design, and the development of project documentation (the "**Technical Tools**"). The Technical Tools may be further used to create data sets and result in simulations or models (collectively, the "**Datasets**") that may be included in this report. Both the Technical Tools and the Datasets are a by-product of MEMS's internal processes and shall solely belong to MEMS. No unauthorized use of the Technical Tools or Datasets is permitted.

This report has been prepared for the sole and exclusive use of Paramount Resources Ltd., who may rely on this report for specific application to this project site. Any other use, or any use of this report by any other party, is prohibited without the express written consent of Paramount Resources Ltd. and MEMS. **MEMS accepts no responsibility for foreseeable or unforeseeable damages, or direct or indirect damages, if any, suffered by any third party as a result of decisions made or actions taken based on the unauthorized use of this report. If third parties choose to use this report in an unauthorized manner, such third parties are also choosing to indemnify MEMS and all of its officers, employees, agents, successors and assigns from any and all claims, damages, or liability of any kind (including but not limited to delay of project commencement or completion, reduction of property value, and/or fear of, or actual, exposure to or release of toxic or hazardous substances) in regards to such use.**

Third parties that wish to use this report will be required to return an executed copy of MEMS' Third-Party Reliance Agreement located in Appendix G.

We thank you for the opportunity to be of assistance to Paramount Resources Ltd. Should you have any questions, please contact the undersigned at 403.270.4724.

Yours truly,

**Millennium EMS Solutions Ltd.**

Prepared by:

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Environmental Scientist

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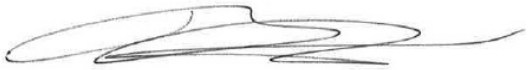

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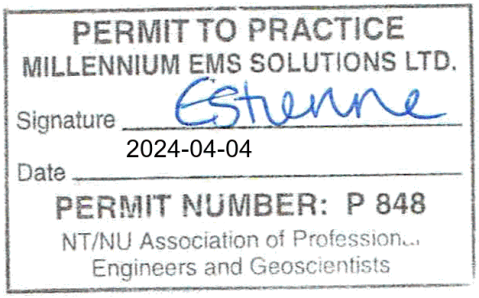
And: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Senior Advisor, Technical & Client Services

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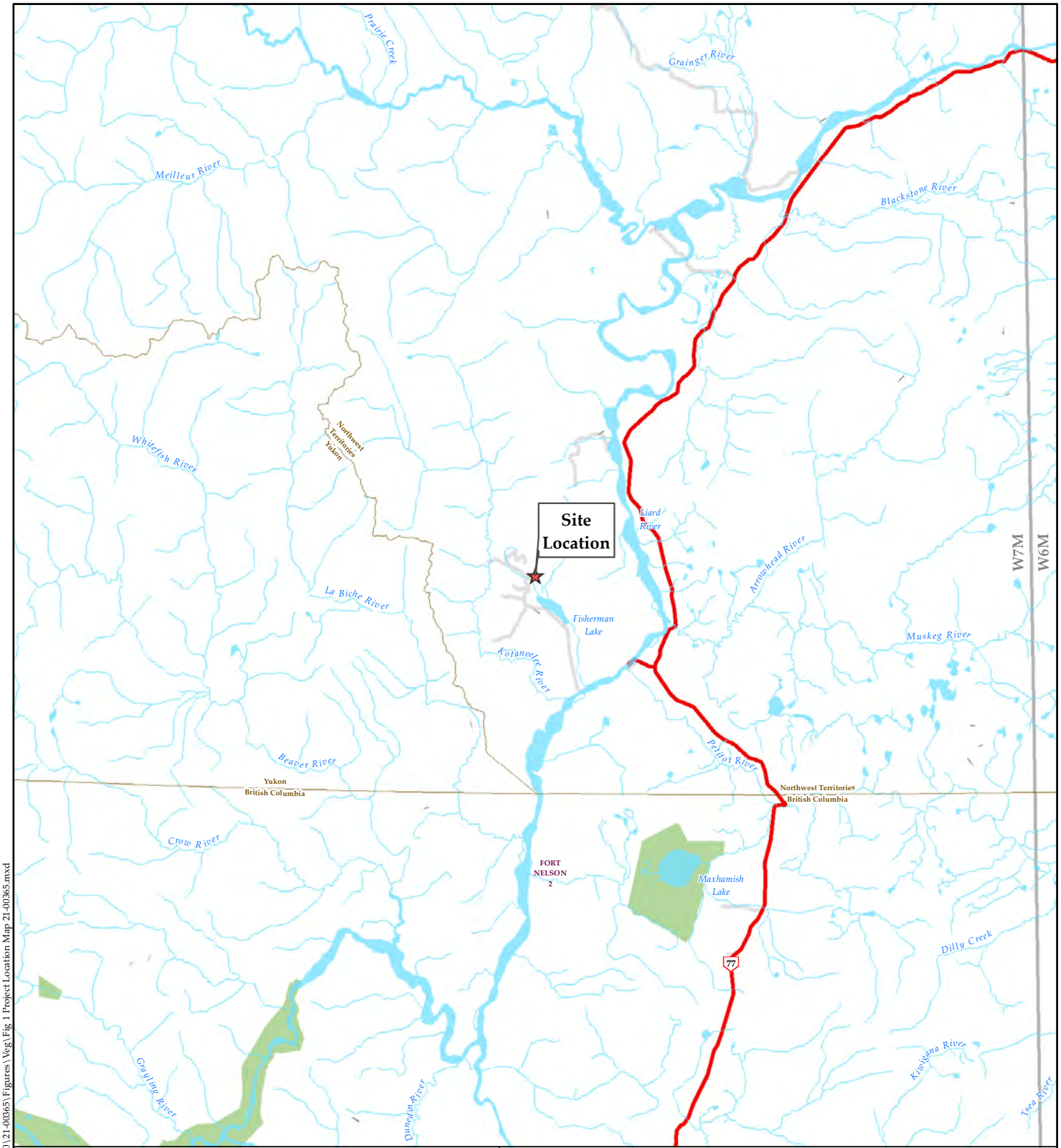
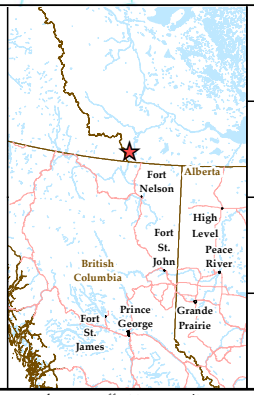
# APPENDIX A: FIGURES




**LEGEND**

- Site Location
- Primary Highway
- Secondary Highway
- Provincial Boundary
- Park/Protected Area
- First Nations Reserve/Metis Settlement
- Populated Place




Paramount resources

# PARAMOUNT RESOURCES LTD
# POINTED MOUNTAIN
# 2023 WETLAND ASSESSMENT

## SITE LOCATION MAP

DataBC, 2019; MEMS, 2024; OGC, 2020

Coordinate System: NAD 1983 UTM Zone 10N

0 25 50
Kilometres

MILLENNIUM EMS Solutions Ltd.

PROJECT: 21-00365
DRAWN BY: RHART
CHECKED BY: CH
DATE: JANUARY 9, 2024

FIGURE
1

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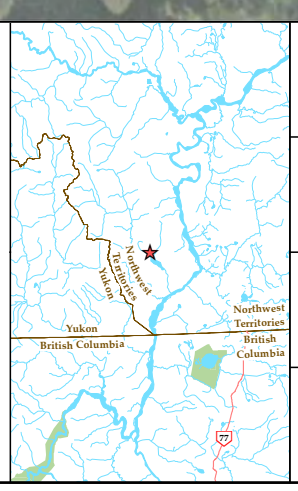
454400 454500 454600 454700 454800 454900 455000

6696200 6696100 6696000 6695900 6695800 6695700 6695600 6695500 6695400 6695300

## LEGEND

- Surface Water Sampling Location
- Wetland Invertibrate / Sediment / Surface Water Sample Locations
- Toxicity
- Hand Auger Location (2023)
- Monitoring Well Location
- Assessment Transect
- Control Transect
- Former Site Features
- Approximate Lease Boundary




Paramount resources

# PARAMOUNT RESOURCES LTD
# POINTED MOUNTAIN
# 2023 WETLAND ASSESSMENT

## SITE DIAGRAM

DataBC, 2019; MEMS, 2024; OGC, 2020; GDM, 2021
ESRI, 2024 (Image date: 2021)

Coordinate System: NAD 1983 UTM Zone 10N

0 100 200
Metres

MILLENNIUM EMS Solutions Ltd.

PROJECT: 21-00365
DRAWN BY: RHART
CHECKED BY: CH
DATE: MARCH 1, 2024

FIGURE
2

Document Path: K:\Active Projects 2021\AP 21-00351 to 21-00400\21-00365\Figures\Veg\Wetland Assessment\Fig 2 Site Diagram 21-00365.mxd

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454500

6695500

INV23-16
SS23-16
SW23-20

INV23-17
SS23-17
SW23-21

INV23-18
SS23-18
SW23-22

HA23-02

SW22-3-1

SW22-3-2

INV23-11
SS23-11
SW23-15

INV23-13
SS23-13
SW23-17

INV23-14
SS23-14
SW23-18

HA23-03

INV23-07
SS23-07
SW23-11

INV23-06
SS23-06
SW23-10

SW23-05TOX

INV23-08
SS23-08
SW23-12

SW22-2-1

INV23-02
SS23-02
SW23-06

INV23-01
SS23-01
SW23-05

INV23-04
SS23-04
SW23-08

SW22-1-1

SW22-2-2

INV23-19
SS23-19
SW23-23

INV23-20
SS23-20
SW23-24

INV23-21
SS23-21
SW23-25

6695400

## LEGEND

- 2022 Plant Site Surface Water Sample Locations
- 2023 Invertebrate / Sediment / Surface Water Sample Location
- Toxicity
- Hand Auger Location (2023); Hand Auger Location
- Assessment Transect
- Control Transect


Paramount resources

# PARAMOUNT RESOURCES LTD
# POINTED MOUNTAIN
# 2023 WETLAND ASSESSMENT

## SITE DIAGRAM - WETLAND AREA

MILLENNIUM EMS Solutions Ltd.

DataBC, 2019; MEMS, 2024; OGC, 2020; GDM, 2021
ESRI, 2024 (Image date: 2021)

Coordinate System: NAD 1983 UTM Zone 10N

0 10 20
Metres

| | |
|---|---|
| PROJECT: | 21-00365 |
| DRAWN BY: | RHART |
| CHECKED BY: | SG |
| DATE: | MARCH 1, 2024 |

FIGURE 3

Document Path: K:\Active Projects 2021\AP 21-00351 to 21-00400\21-00365\Figures\Veg\Wetland Assessment\Fig 3 Site Diagram - Wetland Area 21-00365.mxd

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454500

6695500

6695400

SW23-20
SW23-21
SW23-22
HA23-02
SW22-3-1
SW22-3-2
SW23-15
SW23-17
SW23-18
HA23-03
SW23-16
SW23-11
SW23-19
SW23-10
SW23-13
SW23-12
SW23-14
SW23-06
SW22-2-1
SW23-08
SW23-05
SW23-07
SW23-09
SW22-1-1
SW22-2-2
SW23-23
SW23-24
SW23-25

**SW23-15**
Chloride: 289 mg/L
Sulphate: 834 mg/L

**SW23-10**
Chloride: 350 mg/L
Sulphate: 695 mg/L

**SW23-17**
Chloride: 279 mg/L
Sulphate: 661 mg/L

**SW23-18**
Chloride: 288 mg/L
Sulphate: 621 mg/L

**SW23-12**
Chloride: 314 mg/L
Sulphate: 679 mg/L

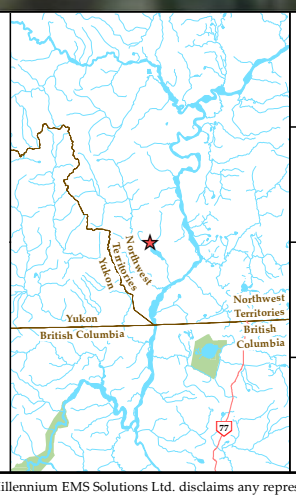
**SW23-06**
Chloride: 248 mg/L
Sulphate: 533 mg/L

**SW23-05**
Chloride: 167 mg/L

**SW23-08**
Chloride: 224 mg/L

## LEGEND

- Surface Water Sampling Location
- Surface Water Chloride and Sulphate Results are Within Applicable Guidelines
- Surface Water Chloride and/or Sulphate Results Exceed Applicable Guidelines
- Hand Auger Location (2023); Hand Auger
- Assessment
- Control




# PARAMOUNT RESOURCES LTD
# POINTED MOUNTAIN
# 2023 WETLAND ASSESSMENT

## SURFACE WATER SALINITY RESULTS - WETLAND AREA

DataBC, 2019; MEMS, 2024; OGC, 2020; GDM, 2021
ESRI, 2024 (Image date: 2021)

Coordinate System: NAD 1983 UTM Zone 10N

0 10 20
Metres

MILLENNIUM EMS Solutions Ltd.

PROJECT: 21-00365
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DATE: MARCH 1, 2024

FIGURE
4

Document Path: K:\Active Projects 2021\AP 21-00351 to 21-00400\21-00365\Figures\Veg\Wetland Assessment\Fig 4 Surface Water Salinity Results - Wetland Area 21-00365.mxd

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# APPENDIX B: DATA SUMMARY TABLES

**Table B1. Surface Water Field Measured Parameters**

| Study Area | Well ID | Sampling Date | Field | | | | |
|---|---|---|---|---|---|---|---|
| | | | pH | Electrical Conductivity | Temperature | Dissolved Oxygen | Oxidation Reduction Potential |
| | | | - | uS/cm | °C | mg/L | mV |
| Assessment Transects | SW23-05 | 28/Jul/23 | 7.29 | 1679 | 12.1 | 2.97 | -45.9 |
| | SW23-06 | 28/Jul/23 | 6.88 | 2250 | 11.4 | 1.91 | -98.1 |
| | SW23-07 | 28/Jul/23 | 6.96 | 1528 | 14 | 2.34 | -143.2 |
| | SW23-08 | 28/Jul/23 | 6.97 | 1863 | 15.1 | 0.74 | -165.4 |
| | SW23-09 | 28/Jul/23 | 7.02 | 1547 | 15.1 | 1.41 | -160.7 |
| | SW23-10 | 28/Jul/23 | 6.79 | 2444 | 10.8 | 4.77 | -71.3 |
| | SW23-11 | 28/Jul/23 | 6.84 | 2268 | 9.9 | 6.68 | -35.6 |
| | SW23-12 | 28/Jul/23 | 7.02 | 2333 | 12.4 | 2.59 | 16.7 |
| | SW23-13 | 28/Jul/23 | 6.84 | 1528 | 15.4 | 1.19 | -190.7 |
| | SW23-14 | 28/Jul/23 | 6.86 | 1765 | 14.5 | 0.97 | -197 |
| | SW23-15 | 29/Jul/23 | 6.97 | 2597 | 12.5 | 4.39 | 26.8 |
| | SW23-16 | 29/Jul/23 | 6.73 | 2252 | 14.3 | 2.52 | -44.7 |
| | SW23-17 | 29/Jul/23 | 6.85 | 2460 | 17.6 | 0.57 | -135.7 |
| | SW23-18 | 29/Jul/23 | 6.82 | 2292 | 16 | 0.89 | -182.8 |
| | SW23-19 | 29/Jul/23 | 6.87 | 2136 | 16.2 | 0.1 | -178.9 |
| Control Transects | SW23-20 | 29/Jul/23 | 6.96 | 1396 | 17.2 | 0.09 | -151.2 |
| | SW23-21 | 29/Jul/23 | 7.04 | 1288 | 14.3 | 1.19 | -145 |
| | SW23-22 | 29/Jul/23 | 6.65 | 1200 | 15.3 | 0.8 | -267 |
| | SW23-23 | 30/Jul/23 | 7.4 | 895 | 17.3 | 1.52 | -150.4 |
| | SW23-24 | 30/Jul/23 | 7.29 | 931 | 17.1 | 0.09 | -232.6 |
| | SW23-25 | 30/Jul/23 | 7.28 | 967 | 16.9 | 0.76 | -209.4 |

**Table B2. Surface Water Routine Chemistry Results**

| Study Area | Well ID | Sampling Date | Inorganics | | | | | | | | | | | | | General Chemistry | | | | | Metals | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Alkalinity (T) as CaCO3 | Bicarbonate | Calcium | Carbonate | Chloride | Hydroxide | Magnesium | Nitrate (as N) | Nitrate + Nitrite-N | Nitrite (as N) | Potassium | Sodium | Sulphate | Hardness | Electrical Conductivity | Ionic Balance | pH | Total Dissolved Solids | Iron | Manganese |
| | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | µS/cm | % | pH | mg/L | mg/L | mg/L |
| CWQG Aquatic Life [1] | | | | | | | 120 | | | 2.9 | | 0.06 | | | | | | | 6.5-9 | | 0.3 | |
| Health Canada, Canadian Drinking Water Quality (2022) AO [2] | | | | | | | 250 | | | | | | | 200 | 500 | | | | | 500 | 0.3 | 0.02 |
| Health Canada, Canadian Drinking Water Quality (2022) MAC [3] | | | | | | | | | | 10 | | 1 | | | | | | | | | | 0.12 |
| Health Canada, Canadian Drinking Water Quality (2022) OG [4] | | | | | | | | | | | | | | | | | | | 7-10.5 | | | |
| Assessment Transects | SW23-05 | 28-Jul-23 | 293 | 357 | 193 | <6 | 167 | <5 | 88.2 | 0.08 | 0.08 | <0.005 | 3.9 | 65.4 | 487 | 846 | 1720 | 96 | 7.64 | 1180 | 0.04 | <0.005 |
| | SW23-06 | 28-Jul-23 | 290 | 353 | 208 | <6 | 248 | <5 | 115 | 0.02 | 0.02 | <0.005 | 3.2 | 91.8 | 533 | 993 | 2020 | 101 | 7.23 | 1370 | 0.28 | 0.25 |
| | SW23-08 | 28-Jul-23 | 286 | 349 | 189 | <6 | 224 | <5 | 103 | <0.01 | <0.01 | <0.005 | 2.9 | 83.7 | 499 | 896 | 1890 | 97 | 7.37 | 1270 | 0.21 | 0.366 |
| | SW23-10 | 28-Jul-23 | 188 | 229 | 248 | <6 | 350 | <5 | 143 | 0.06 | 0.06 | <0.02 | 5 | 124 | 695 | 1210 | 2470 | 106 | 7.3 | 1680 | 0.3 | 0.02 |
| | SW23-11 | 28-Jul-23 | 199 | 243 | 213 | <6 | 315 | <5 | 123 | <0.01 | <0.01 | <0.005 | 6.2 | 114 | 605 | 1040 | 2190 | 102 | 7.25 | 1500 | 0.18 | 0.074 |
| | SW23-12 | 28-Jul-23 | 223 | 272 | 225 | <6 | 314 | <5 | 128 | <0.01 | <0.01 | <0.005 | 4.5 | 111 | 679 | 1090 | 2270 | 98 | 7.34 | 1600 | 0.11 | 0.11 |
| | SW23-15 | 29-Jul-23 | 245 | 299 | 291 | <6 | 289 | <5 | 139 | <0.05 | <0.07 | <0.02 | 3 | 145 | 834 | 1300 | 2530 | 107 | 7.34 | 1850 | 0.5 | <0.02 |
| | SW23-17 | 29-Jul-23 | 317 | 386 | 235 | <6 | 279 | <5 | 118 | 0.01 | 0.01 | <0.005 | 2.1 | 118 | 661 | 1070 | 2280 | 96 | 7.33 | 1600 | 0.75 | 0.632 |
| | SW23-18 | 29-Jul-23 | 252 | 308 | 220 | <6 | 288 | <5 | 115 | <0.01 | <0.01 | <0.005 | 1.6 | 119 | 621 | 1020 | 2230 | 98 | 7.41 | 1520 | 0.28 | 0.142 |
| Control Transects | SW23-20 | 29-Jul-23 | 591 | 721 | 166 | <6 | 18.2 | <5 | 93.2 | <0.01 | <0.01 | <0.005 | 5.7 | 41.9 | 224 | 799 | 1330 | 106 | 7.48 | 904 | 1.6 | 1.14 |
| | SW23-21 | 29-Jul-23 | 513 | 626 | 152 | <6 | 13.2 | <5 | 73.1 | <0.01 | <0.01 | <0.005 | 3.3 | 32.4 | 235 | 680 | 1220 | 98 | 7.49 | 817 | 1.13 | 0.869 |
| | SW23-22 | 29-Jul-23 | 510 | 622 | 135 | <6 | 18.1 | <5 | 62.8 | <0.01 | <0.01 | 0.007 | 4.6 | 27.4 | 101 | 595 | 1040 | 103 | 7.38 | 655 | 0.05 | 0.302 |
| | SW23-23 | 30-Jul-23 | 290 | 353 | 137 | <6 | 5.5 | <5 | 45.2 | <0.01 | <0.01 | <0.005 | 2.9 | 10.2 | 259 | 528 | 929 | 98 | 7.6 | 634 | 0.04 | 0.038 |
| | SW23-24 | 30-Jul-23 | 287 | 350 | 138 | <6 | 5.4 | <5 | 45.7 | <0.01 | <0.01 | <0.005 | 2.9 | 10.3 | 266 | 532 | 935 | 98 | 7.62 | 641 | 0.06 | 0.008 |
| | SW23-25 | 30-Jul-23 | 300 | 366 | 140 | <6 | 5.7 | <5 | 46.4 | <0.01 | <0.01 | <0.005 | 3.2 | 10.6 | 251 | 540 | 940 | 100 | 7.53 | 637 | 0.03 | 0.059 |
| Blank | Field Blank | 29-Jul-23 | <5 | <5 | <0.2 | <6 | <0.4 | <5 | <0.2 | <0.01 | <0.01 | <0.005 | <0.4 | <0.4 | <0.9 | <1.3 | 1 | - | 6.63 | <6 | <0.01 | <0.005 |
| | Trip Blank | 30-Jul-23 | <5 | <5 | <0.2 | <6 | <0.4 | <5 | <0.2 | <0.01 | <0.01 | <0.005 | <0.4 | <0.4 | <0.9 | <1.3 | 1 | - | 6.11 | <6 | <0.01 | <0.005 |

Notes:

Shaded values exceed applicable guidelines

[1] CWQG - CCME Water Quality Guidelines for the Protection of Aquatic Life, Freshwater Long Term

[2] AO - aesthetic objective

[3] MAC- maximum acceptable concentration

[4] OG - operational guidance value

**Table B3. Sediment Detailed Salinity Results**

| Study Area | Sample ID | Sample Depth (m) | Sampling Date | Sample Type | Inorganics | | | | | | | General Chemistry | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calcium | Chloride | Magnesium | Potassium | Sodium | Sulphate | Chloride, Soluble | EC | pH | SAR | Percent Saturation |
| | | | | | mg/kg | | | | | | mg/L | dS/m | pH | --- | % |
| Assessment Transects | SS23-01 | 0-10 | 29-Jul-23 | | 1,170 | 651 | 419 | 320 | 371 | 2,390 | 49 | 0.9 | 7.1 | 0.6 | 1,340 |
| | SS23-02 | 0-10 | 29-Jul-23 | | 1,840 | 1,400 | 820 | 953 | 550 | 3,260 | 151 | 2.04 | 7.2 | 0.9 | 930 |
| | SS23-04 | 0-10 | 29-Jul-23 | | 2,490 | 1,370 | 1,150 | 809 | 705 | 6,670 | 80 | 1.46 | 6.7 | 0.7 | 1,710 |
| | SS23-06 | 0-10 | 29-Jul-23 | | 1,760 | 1,470 | 922 | 209 | 669 | 5,500 | 113 | 1.35 | 6.7 | 0.9 | 1,300 |
| | SS23-07 | 0-10 | 29-Jul-23 | | 2,260 | 1,390 | 1,210 | 232 | 669 | 8,720 | 118 | 1.77 | 6.4 | 0.8 | 1,180 |
| | SS23-08 | 0-10 | 29-Jul-23 | | 2,830 | 2,920 | 1,510 | 770 | 1,180 | 9,770 | 118 | 1.33 | 6.9 | 0.9 | 2,470 |
| | SS23-11 | 0-10 | 29-Jul-23 | | 1,970 | 1,660 | 920 | 355 | 840 | 6,310 | 111 | 1.38 | 6.5 | 1 | 1,490 |
| | SS23-13 | 0-10 | 29-Jul-23 | | 2,430 | 1,710 | 1,140 | 130 | 807 | 9,490 | 113 | 1.48 | 6.4 | 0.9 | 1,510 |
| | SS23-14 | 0-10 | 29-Jul-23 | | 1,990 | 1,930 | 1,030 | 194 | 868 | 7,080 | 141 | 1.5 | 6.7 | 1.1 | 1,370 |
| Control Transects | SS23-16 | 0-10 | 29-Jul-23 | | 2,430 | 305 | 1,190 | 338 | 341 | 7,620 | 26 | 1.65 | 6.7 | 0.4 | 1,200 |
| | SS23-17 | 0-10 | 29-Jul-23 | | 4,370 | 779 | 1,790 | 790 | 420 | 15,400 | 56 | 2.18 | 6.3 | 0.4 | 1,400 |
| | SS23-18 | 0-10 | 29-Jul-23 | | 2,330 | 166 | 939 | 193 | 262 | 7,820 | 12 | 1.28 | 6.6 | 0.3 | 1,440 |
| | SS23-19 | 0-10 | 30-Jul-23 | | 2,060 | 294 | 728 | 200 | 220 | 5,280 | 8 | 0.49 | 7.1 | 0.2 | 3,510 |
| | SS23-20 | 0-10 | 30-Jul-23 | | 1,510 | 329 | 510 | 260 | 160 | 2,990 | 6 | 0.25 | 7.1 | 0.1 | 5,440 |
| | SS23-21 | 0-10 | 30-Jul-23 | | 2,010 | 371 | 674 | 702 | 160 | 2,800 | 12 | 0.54 | 7.3 | 0.1 | 3,120 |

Notes:
Shaded values exceed applicable guidelines

**Table B4. Soil Detailed Salinity Results**

| Sample ID | Sample Depth (m) | Sampling Date | Inorganics | | | | | | | General Chemistry | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Calcium | Chloride | Magnesium | Potassium | Sodium | Sulphate | Chloride, Soluble | EC | pH | SAR | Percent Saturation |
| | | | mg/kg | | | | | | mg/L | dS/m | pH | --- | % |
| NWT Contaminated Site Guideline, Tier 1, Agricultural | | | | | | | | | | 2 | 6-8 | | |
| HA23-01 | 0.2 | 07-Jul-23 | 284 | 52 | 133 | 5 | 121 | 1090 | 27 | 1.45 | 8.6 | 1.1 | 193 |
| | 0.7 | 07-Jul-23 | 89.5 | 21 | 48.7 | 2 | 50 | 415 | 32 | 1.46 | 7.8 | 1.3 | 63 |
| | 1 | 07-Jul-23 | 143 | 17 | 82.7 | 5 | 74 | 717 | 18 | 1.64 | 8 | 1.3 | 90 |
| HA23-02 | 0.2 | 07-Jul-23 | 287 | 236 | 100 | 5 | 163 | 943 | 135 | 1.66 | 8.5 | 1.6 | 174 |
| | 0.7 | 07-Jul-23 | 154 | 52 | 49.4 | 2 | 93 | 629 | 70 | 1.87 | 7.9 | 1.9 | 75 |
| | 1 | 07-Jul-23 | 162 | 28 | 51.6 | 3 | 103 | 703 | 26 | 1.52 | 7.9 | 1.7 | 108 |
| HA23-03 | 0.2 | 07-Jul-23 | 623 | 301 | 196 | 30 | 198 | 1730 | 43 | 0.81 | 6.6 | 0.7 | 695 |
| | 0.7 | 07-Jul-23 | 68.8 | 57 | 23.3 | 3 | 25 | 182 | 76 | 0.86 | 6.7 | 0.8 | 75 |
| | 1 | 07-Jul-23 | 106 | 97 | 35.3 | 5 | 38 | 249 | 94 | 0.92 | 7.2 | 0.8 | 104 |
| HA23-07 | 0.2 | 08-Jul-23 | 159 | 84 | 72.3 | 8 | 73 | 596 | 50 | 1.01 | 7.1 | 0.9 | 169 |
| | 0.7 | 08-Jul-23 | 127 | 40 | 49 | 4 | 60 | 442 | 34 | 1.04 | 7.7 | 1.1 | 119 |
| | 1 | 08-Jul-23 | 103 | 34 | 43.5 | 3 | 53 | 391 | 26 | 0.85 | 7.8 | 1 | 133 |
| HA23-08 | 0.2 | 08-Jul-23 | 158 | 373 | 113 | 4 | 89 | 384 | 298 | 1.76 | 7.3 | 1.2 | 125 |
| | 0.7 | 08-Jul-23 | 187 | 243 | 143 | <11 | 114 | 761 | 230 | 2.15 | 8 | 1.5 | 106 |
| | 1 | 08-Jul-23 | 175 | 260 | 141 | 6 | 107 | 735 | 162 | 1.56 | 7.8 | 1.2 | 160 |
| HA23-09 | 0.2 | 08-Jul-23 | 829 | 553 | 342 | 26 | 379 | 3090 | 131 | 1.88 | 6.8 | 1.4 | 421 |
| | 0.7 | 08-Jul-23 | 131 | 29 | 47.7 | 4 | 73 | 540 | 37 | 1.58 | 7.8 | 1.6 | 77 |
| | 1 | 08-Jul-23 | 122 | 21 | 44.4 | 4 | 71 | 524 | 30 | 1.64 | 7.7 | 1.7 | 70 |
| HA23-10 | 0.2 | 08-Jul-23 | 150 | 73 | 70.8 | 4 | 39 | 529 | 49 | 1 | 6.7 | 0.5 | 148 |
| | 0.7 | 08-Jul-23 | 121 | 16 | 48.6 | 3 | 43 | 421 | 15 | 0.99 | 7.7 | 0.8 | 110 |
| | 1 | 08-Jul-23 | 159 | 15 | 65.7 | 3 | 52 | 614 | 13 | 1.22 | 8 | 0.8 | 111 |
| HA23-47 | 0.5 | 27-Aug-23 | 1790 | 42 | 160 | <39 | <39 | 4280 | 11 | 2.03 | 6.6 | <0.1 | 390 |
| | 1 | 27-Aug-23 | 1680 | 77 | 138 | 30 | 30 | 4310 | 18 | 1.82 | 7.2 | <0.1 | 428 |
| HA23-48 | 0.7 | 29-Aug-23 | 28.9 | 13 | 18.7 | 3 | 19 | 97.1 | 16 | 0.45 | 6.3 | 0.8 | 80 |
| | 1.5 | 29-Aug-23 | 181 | 15 | 180 | <8 | 103 | 1170 | 18 | 2.47 | 7.9 | 1.4 | 84 |
| HA23-49 | 0.7 | 29-Aug-23 | 110 | 16 | 53 | 5 | 35 | 328 | 18 | 1.12 | 7.4 | 0.7 | 89 |
| | 1.5 | 29-Aug-23 | 175 | 23 | 93.3 | 6 | 58 | 718 | 17 | 1.21 | 7.8 | 0.7 | 137 |
| HA23-50 | 0.7 | 29-Aug-23 | 171 | 96 | 89.4 | 4 | 93 | 702 | 93 | 1.66 | 7.7 | 1.4 | 103 |
| | 1.5 | 29-Aug-23 | 133 | 51 | 80.9 | 8 | 114 | 672 | 39 | 1.28 | 7.7 | 1.7 | 130 |
| HA23-51 | 0.7 | 29-Aug-23 | 119 | 21 | 65.7 | 3 | 47 | 468 | 15 | 0.88 | 7.6 | 0.7 | 142 |
| | 1.5 | 29-Aug-23 | 210 | 13 | 135 | 8 | 129 | 1190 | 12 | 1.97 | 7.9 | 1.6 | 114 |
| HA23-52 | 0.7 | 29-Aug-23 | 135 | 20 | 77.5 | 5 | 45 | 441 | 12 | 0.82 | 7.9 | 0.6 | 172 |
| | 1.5 | 29-Aug-23 | 170 | 26 | 89.4 | 5 | 39 | 713 | 28 | 1.6 | 7.9 | 0.6 | 93 |
| HA23-53 | 0.7 | 29-Aug-23 | 244 | 283 | 76.7 | 3 | 89 | 581 | 256 | 1.91 | 7.8 | 1.2 | 110 |
| | 1.5 | 29-Aug-23 | 493 | 257 | 164 | 8 | 97 | 1490 | 342 | 3.98 | 7.6 | 1.1 | 75 |
| HA23-54 | 0.7 | 29-Aug-23 | 114 | 27 | 23.3 | 4 | 5 | 106 | 18 | 0.51 | 7.7 | <0.1 | 149 |
| | 1 | 29-Aug-23 | 89.9 | 91 | 20 | 2 | 13 | 72.9 | 128 | 0.89 | 7.6 | 0.4 | 72 |

Notes:
Shaded values exceed applicable guidelines

**Table B5. Density of Invertebrates**

| Sampling Year | Order | Family | Name | Sample Location Name in Assessment Transects | | | | | | | | | Sample Location Name in Control Transects | | | | | | Total Recorded |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | INV-1 | INV-2 | INV-4 | INV-6 | INV-7 | INV-8 | INV-11 | INV-13 | INV-14 | INV-16 | INV-17 | INV-18 | INV-19 | INV-20 | INV-21 | |
| 2023 | Anthoathecatae | Hydridae | Hydra | 0 | 14 | 0 | 0 | 4 | 11 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 30 |
| 2023 | Basommatophora | Lymnaeidae | Fossaria | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 2023 | Basommatophora | Lymnaeidae | Lymnaeidae | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2023 | Basommatophora | Physidae | Physidae | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 4 |
| 2023 | Basommatophora | Planorbidae | Gyraulus | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 2023 | Basommatophora | Planorbidae | Planorbidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 4 | 0 | 0 | 1 | 7 |
| 2023 | Cladocera | | Cladocera | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 13 |
| 2023 | Coleoptera | Dytiscidae | Agabus/Ilybius/Platambus/Ilybiosoma | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 |
| 2023 | Coleoptera | Dytiscidae | Dytiscidae | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 2023 | Coleoptera | Dytiscidae | Hydroporinae | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 |
| 2023 | Coleoptera | Hydrophilidae | Enochrus | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2023 | Coleoptera | Hydrophilidae | Hydrophilidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| 2023 | Coleoptera | Hydrophilidae | Paracymus | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 2023 | Coleoptera | Scirtidae | Scirtidae | 0 | 2 | 4 | 0 | 0 | 1 | 26 | 57 | 0 | 1 | 0 | 0 | 23 | 5 | 17 | 136 |
| 2023 | Coleoptera | Staphylinidae | Staphylinidae | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2023 | Coleoptera | | Coleoptera | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| 2023 | Collembola | Sminthuridae | Sminthuridae | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 4 | 0 | 0 | 3 | 0 | 0 | 11 |
| 2023 | Collembola | | Collembola | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 9 |
| 2023 | Diptera | Cecidomyiidae | Cecidomyiidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 4 | 8 |
| 2023 | Diptera | Ceratopogonidae | Atrichopogon | 0 | 0 | 0 | 21 | 0 | 13 | 0 | 6 | 30 | 153 | 0 | 5 | 0 | 1 | 0 | 229 |
| 2023 | Diptera | Ceratopogonidae | Ceratopogonidae | 3 | 11 | 1 | 3 | 4 | 12 | 0 | 2 | 5 | 22 | 2 | 3 | 3 | 0 | 0 | 71 |
| 2023 | Diptera | Ceratopogonidae | Culicoides | 0 | 3 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 11 | 2 | 0 | 0 | 0 | 0 | 20 |
| 2023 | Diptera | Ceratopogonidae | Dasyhelea | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 14 | 0 | 0 | 3 | 65 | 0 | 0 | 86 |
| 2023 | Diptera | Ceratopogonidae | Mallochohelea | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 4 |
| 2023 | Diptera | Chironomidae | Ablabesmyia | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 2023 | Diptera | Chironomidae | Allocladius | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2023 | Diptera | Chironomidae | Chironomidae | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 2023 | Diptera | Chironomidae | Chironomini | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 3 |
| 2023 | Diptera | Chironomidae | Chironomus | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 24 |
| 2023 | Diptera | Chironomidae | Corynoneura | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 20 | 0 | 0 | 28 |
| 2023 | Diptera | Chironomidae | Hydrosmittia | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2023 | Diptera | Chironomidae | Limnophyes | 0 | 2 | 1 | 0 | 6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 11 |
| 2023 | Diptera | Chironomidae | Metriocnemus | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 2 | 0 | 0 | 9 |
| 2023 | Diptera | Chironomidae | Monopelopia | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 7 | 1 | 0 | 19 | 9 | 0 | 0 | 37 |
| 2023 | Diptera | Chironomidae | Natarsia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 2023 | Diptera | Chironomidae | Orthocladiinae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 4 |
| 2023 | Diptera | Chironomidae | Orthocladius complex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 3 |
| 2023 | Diptera | Chironomidae | Parachironomus | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| 2023 | Diptera | Chironomidae | Paramerina | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| 2023 | Diptera | Chironomidae | Paraphaenocladius | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 2023 | Diptera | Chironomidae | Paratanytarsus | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 |
| 2023 | Diptera | Chironomidae | Polypedilum | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 2023 | Diptera | Chironomidae | Stempellinella | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| 2023 | Diptera | Chironomidae | Tanypodinae | 0 | 3 | 5 | 0 | 0 | 5 | 0 | 2 | 18 | 1 | 0 | 5 | 0 | 0 | 0 | 39 |
| 2023 | Diptera | Chironomidae | Tanytarsini | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 2023 | Diptera | Chironomidae | Thienemannia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2023 | Diptera | Culicidae | Aedes | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 10 |
| 2023 | Diptera | Culicidae | Culicidae | 0 | 2 | 1 | 0 | 2 | 2 | 0 | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 13 |
| 2023 | Diptera | Dixidae | Dixa | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 2023 | Diptera | Dixidae | Dixella | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |

**Table B5. Density of Invertebrates**

| Sampling Year | Order | Family | Name | Sample Location Name in Assessment Transects | | | | | | | | | Sample Location Name in Control Transects | | | | | | Total Recorded |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | INV-1 | INV-2 | INV-4 | INV-6 | INV-7 | INV-8 | INV-11 | INV-13 | INV-14 | INV-16 | INV-17 | INV-18 | INV-19 | INV-20 | INV-21 | |
| 2023 | Diptera | Stratiomyidae | Stratiomyidae | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2023 | Diptera | Tabanidae | Chrysops | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| 2023 | Diptera | Tabanidae | Tabanidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 3 |
| 2023 | Diptera | Tipulidae | Angarotipula | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 2023 | Diptera | Tipulidae | Tipula | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 2023 | Diptera | Tipulidae | Tipulidae | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 3 | 2 | 0 | 2 | 0 | 0 | 9 |
| 2023 | Diptera | | Diptera | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 5 | 0 | 0 | 8 |
| 2023 | Hirudinida | Erpobdellidae | Erpobdella | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 2023 | Hirudinida | Erpobdellidae | Erpobdellidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 |
| 2023 | Hypsogastropoda | Hydrobiidae | Hydrobiidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 2023 | Lumbriculida | Lumbriculidae | Lumbriculidae | 2 | 1 | 0 | 6 | 1 | 4 | 1 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| 2023 | Lumbriculida | Lumbriculidae | Lumbriculus | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 2 | 0 | 19 | 1 | 7 | 49 |
| 2023 | Oribatida | | Oribatida | 0 | 2 | 0 | 2 | 2 | 7 | 10 | 4 | 0 | 9 | 4 | 2 | 0 | 0 | 0 | 42 |
| 2023 | Plecoptera | Nemouridae | Zapada | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| 2023 | Sarcoptiformes | Hydrozetidae | Hydrozetidae | 0 | 62 | 5 | 6 | 1 | 45 | 7 | 10 | 15 | 24 | 30 | 15 | 4 | 0 | 0 | 224 |
| 2023 | Trichoptera | Limnephilidae | Limnephilidae | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2023 | Trombidiformes | Arrenuridae | Arrenurus | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 6 |
| 2023 | Trombidiformes | Pionidae | Pionidae | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 2023 | Trombidiformes | | Trombidiformes | 0 | 3 | 0 | 6 | 1 | 10 | 0 | 0 | 7 | 0 | 1 | 0 | 1 | 0 | 1 | 30 |
| 2023 | Tubificida | Enchytraeidae | Enchytraeus | 0 | 4 | 3 | 4 | 23 | 4 | 6 | 1 | 10 | 11 | 8 | 3 | 0 | 0 | 0 | 77 |
| 2023 | Tubificida | Naididae | Pristina | 0 | 0 | 0 | 15 | 15 | 2 | 1 | 4 | 8 | 11 | 0 | 2 | 22 | 1 | 0 | 81 |
| 2023 | Tubificida | Naididae | Tubificinae with hair chaetae | 12 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 19 |
| 2023 | Veneroida | Pisidiidae | Pisidiidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 2023 | | | Copepoda | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 14 |
| 2023 | | | Gastropoda | 0 | 0 | 0 | 0 | 0 | 11 | 1 | 0 | 4 | 0 | 4 | 0 | 2 | 0 | 1 | 23 |
| 2023 | | | Nemata | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 6 |
| 2023 | | | Ostracoda | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 11 |
| 2023 | | | Turbellaria | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 3 |
| 2023 | **Species Richness** | | | **6** | **23** | **16** | **13** | **22** | **32** | **14** | **22** | **22** | **25** | **25** | **25** | **29** | **9** | **17** | **78** |
| | **Total Abundance** | | | **20** | **125** | **29** | **70** | **76** | **151** | **59** | **107** | **141** | **286** | **78** | **84** | **201** | **14** | **70** | **1511** |
| | **EPT Abundance** | | | **0** | **1** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** |
| | **Density (x/m2)** | | | **3144.65** | **19654.09** | **4559.75** | **11006.29** | **11949.69** | **23742.14** | **9276.73** | **16823.90** | **22169.81** | **44968.55** | **12264.15** | **13207.55** | **31603.77** | **2201.26** | **11006.29** | **237578.62** |
| | **Chironomidae %** | | | **0** | **4** | **24.14** | **2.86** | **13.16** | **9.27** | **0** | **6.54** | **18.44** | **1.75** | **1.28** | **44.05** | **17.41** | **0** | **45.71** | **11.98** |

**Table B6. Surfacewater Toxicity Results**

| Sample ID | Sample Depth (m) | Sampling Date | *Ceriodaphnia dubia* | | | *Pimephales promelas* | | | | *Lemna minor* | | | | *Pseudokirchneriella subcapitata* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Survival LC50 | Reporduction IC25 | Reproduction IC50 | Survival LC25 | Survival LC50 | Biomass IC25 | Biomass IC50 | Frond count IC25 | Frond count IC50 | Dry weight IC25 | Dry weight IC50 | Growth IC25 | Growth IC50 |
| | | | % v/v (95% CL) | | | | | | | | | | | | |
| SW23-05TOX | | 30-Jul-23 | > 100 | 27.1 (9.8 - N/A) | >100 | >100 | >100 | >100 | >100 | 14.5 (N/A - 70.6) | 92.8 (30.9 - N/A) | >97.0 | >97.0 | >95.2 | >95.2 |

Notes:
LC = Lethal Concentration
IC = Inhibition Concentration
CL = Confidence Limits
N/A = Not Available

# APPENDIX C: INVERTEBRATE SAMPLE SORTING METHODOLOGIES

# Methods and QC Report 2023

Project ID: 21-00365-07

Client: Millennium EMS Solutions Ltd

**Prepared by:**
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Summerland, BC
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## Sample Reception

On August 2, 2023, Cordillera Consulting received 15 benthic samples from Millennium EMS Ltd. When samples arrived to Cordillera Consulting, exterior packaging was initially inspected for damage or wet spots that would have indicated damage to the interior containers.

Samples were logged into a proprietary software database (INSTAR1) where the clients assigned sample name was recorded along with a Cordillera Consulting (CC) number for cross-reference. Each sample was checked to ensure that all sites and replicates recorded on field sheets or packing lists were delivered intact and with adequate preservative. Any missing, mislabelled or extra samples were reported to the client immediately to confirm the total numbers and correct names on the sample jars. The client representative was notified of the arrival of the shipment and provided a sample inventory once intake was completed.
See table below for sample inventory:

**Table 1: Summary of sample information including Cordillera Consulting (CC) number**

| Sample | CC# | Date | Size | # of Jars |
|---|---|---|---|---|
| INV23-01 | CC240154 | 07/28/2023 | 243 µM | 1 |
| INV23-02 | CC240155 | 07/28/2023 | 243 µM | 1 |
| INV23-04 | CC240156 | 07/28/2023 | 243 µM | 1 |
| INV23-06 | CC240157 | 07/28/2023 | 243 µM | 1 |
| INV23-07 | CC240158 | 07/28/2023 | 243 µM | 1 |
| INV23-08 | CC240159 | 07/28/2023 | 243 µM | 1 |
| INV23-11 | CC240160 | 07/29/2023 | 243 µM | 1 |
| INV23-13 | CC240161 | 07/29/2023 | 243 µM | 1 |
| INV23-14 | CC240162 | 07/29/2023 | 243 µM | 1 |
| INV23-16 | CC240163 | 07/29/2023 | 243 µM | 1 |
| INV23-17 | CC240164 | 07/29/2023 | 243 µM | 1 |
| INV23-18 | CC240165 | 07/29/2023 | 243 µM | 1 |
| INV23-19 | CC240166 | 07/30/2023 | 243 µM | 1 |
| INV23-20 | CC240167 | 07/30/2023 | 243 µM | 1 |
| INV23-21 | CC240168 | 07/30/2023 | 243 µM | 1 |

## Sample Sorting

- Using a gridded Petri dish, fine forceps and a low power stereo-microscope (Olympus, Nikon, Leica) the sorting technicians removed the invertebrates and sorted them into family/orders.
- The sorting technician kept a running tally of total numbers excluding organisms from Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera and terrestrial drop-ins such as aphids. These organisms were marked for their presence (given a value of 1) only and left in the sample. They were not included towards the 300-organism subsample count.

- Where specimens are broken or damaged, only heads were counted.
- Subsampling was conducted with the use of a Marchant Box.
- When using the Marchant box, cells were extracted at the same time in the order indicated by a random number table. If the 300$^{th}$ organism was found part way into sorting a cell then the balance of that cell was sorted. If the organism count had not reached 300 by the 50$^{th}$ cell then the entire sample was sorted.
- The total number of cells sorted and the number of organisms removed were recorded manually on a bench sheet and then recorded into INSTAR1
- Organisms were stored in vials containing 80% ethanol and an interior label indicating the site names, date of sampling, site code numbers and portion subsampled. This information was also recorded on the laboratory bench sheet and on INSTAR1.
- The sorted portion of the debris was preserved and labeled separately from the unsorted portion and was tested for sorting efficiency (Sorting Quality Control – Sorting Efficiency). The unsorted portion was also labeled and preserved in separate jars.

Percent sub-sampled and total countable invertebrates pulled from the samples were summarized in the table below.

**Table 2: Percent sub-sample and invertebrate count for each sample**

| Sample | Date | CC# | 243 micron fraction | |
|---|---|---|---|---|
| | | | % Sampled | # Invertebrates |
| INV23-01 | 28-Jul-23 | CC240154 | 100% | 19 |
| INV23-02 | 28-Jul-23 | CC240155 | 100% | 123 |
| INV23-04 | 28-Jul-23 | CC240156 | 100% | 26 |
| INV23-06 | 28-Jul-23 | CC240157 | 100% | 70 |
| INV23-07 | 28-Jul-23 | CC240158 | 100% | 73 |
| INV23-08 | 28-Jul-23 | CC240159 | 100% | 148 |
| INV23-11 | 29-Jul-23 | CC240160 | 100% | 54 |
| INV23-13 | 29-Jul-23 | CC240161 | 100% | 106 |
| INV23-14 | 29-Jul-23 | CC240162 | 100% | 138 |
| INV23-16 | 29-Jul-23 | CC240163 | 100% | 280 |
| INV23-17 | 29-Jul-23 | CC240164 | 100% | 71 |
| INV23-18 | 29-Jul-23 | CC240165 | 100% | 80 |
| INV23-19 | 30-Jul-23 | CC240166 | 100% | 198 |
| INV23-20 | 30-Jul-23 | CC240167 | 100% | 11 |
| INV23-21 | 30-Jul-23 | CC240168 | 100% | 63 |

## Sorting Quality Control - Sorting Efficiency

As a part of Cordillera's laboratory policy, all projects undergo sorting efficiency checks.

- As sorting progresses, 10% of samples were randomly chosen by senior members of the sorting team for resorting.
- All sorters working on a project had at least 1 sample resorted by another sorter.
- An efficiency of 90 % was expected (95% for CABIN samples).
- If 90/95% efficiency was not met, samples from that sorter were resorted.
- To calculated sorting efficiency the following formula was used:

$$\frac{\#Orgamisms\ Missed}{Total\ Organisms\ Found} * 100 = \%OM$$

**Table 3 Summary of sorting efficiency**

| | | Total from Sample | Percent Efficiency |
|---|---|---|---|
| Site - QC, Sample - QC 1, CC# - CC240162, Percent sampled = 100%, Sieve size = 243 | | | |
| Diptera | 7 | | |
| Chironomidae | 1 | | |
| Trombidiformes | 2 | | |
| **Total:** | **10** | 138 | 92.75% |

| | | Total from Sample | Percent Efficiency |
|---|---|---|---|
| Site - QC, Sample - QC 2, CC# - CC240167, Percent sampled = 100%, Sieve size = 243 | | | |
| No Invertebrates Found | 1 | | |
| **Total:** | **1** | 11 | 100% |

## Taxonomic Effort

The next procedure was the identification to genus-species level where possible of all the organisms in the sample.

- Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol) in a random sample from each group, otherwise ID was made to Family.
- Non-insect organisms (except those not included in CABIN count) were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.
- The Standard Taxonomic Effort lists compiled by the CABIN manual[1], SAFIT[2] , and PNAMP[3] were used as a guide line for what level of identification to achieve where the condition and maturity of the organism enabled.

- Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.
- Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.
- Oligochaetes was identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.
- Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.
- Mollusca was identified to family and genus/species where possible
- Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.
- Bryozoans and Nemata remained at the phylum level
- Hydrachnidae and Cnidaria were identified at the family/genus level where possible.
- When requested, reference collections were made containing at least one individual from each taxa listed. Organisms represented will have been identified to the lowest practical level.
- Reference collection specimens were stored in 55 mm glass vials with screw-cap lids with polyseal inserts (museum quality). They were labeled with taxa name, site code, date identified and taxonomist name. The same information was applied to labels on the slide mounts.

Taxonomy Notes: Baetis tricaudatus group has now been renamed to Baetis rhodani group. There has been no change in the determination of the taxa. See Webb 2017 in the taxonomy keys.

## Taxonomists

The taxonomists for this project were certified by the Society of Freshwater Science (SFS) Taxonomic Certification Program at level 2 which is the required certification for CABIN projects:

**Scott Finlayson**: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae (East/West); Group 4 Oligochaeta
**Adam Bliss**: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae
**Rita Avery:** Group 1 General Arthropods (East/West); Group 2 EPT (East/West)
**Garret Naish:** Group 2 EPT (East/West)

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[3] Pacific Northwest Aquatic Monitoring Partnership (Accessed 2015). www.pnamp.org

# Taxonomic Keys

Below is a reference list of taxonomic keys utilized by taxonomists at Cordillera Consulting. Cordillera taxonomists routinely seek out new literature to ensure the most accurate identification keys are being utilized. This is not reflective of the exhaustive list of resources that we use for identification. A more complete list of taxonomic resources can be found at Southwest Association of Freshwater Invertebrate Taxonomists. (2015).
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# APPENDIX D: WETLAND VEGETATION ASSESSMENT

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# Pointed Mountain Gas Plant
# 2023 Wetland Vegetation Assessment

Prepared for:
**Paramount Resources Ltd.**

Prepared by:
**Millennium EMS Solutions Ltd.**
#148, 2257 Premier Way
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April 2024
Project# 21-00365-07

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## 1.0 INTRODUCTION

Paramount Resources Ltd. (Paramount) retained Millennium EMS Solutions Ltd. (MEMS) to conduct a vegetation assessment of the wetland approximately 250 m south of the former Pointed Mountain Gas Field in the Northwest Territories (NWT) (herein referred to as the "Site") located approximately 25 km northwest of the Liard River and Fort Liard. The Site includes a plant site, six associated wellsites, and an airstrip. An overview of the Site is shown on Figure 1.

Investigations conducted prior to 2023 identified the seepage of water with elevated chloride levels from surge pond located at the Site. In the summer of 2023, water from the surge pond was pumped out and remediated. Treated water from the remediation process was discharged to ground on-site and reject brine was transported to a disposal facility. Following treatment and disposal of the surge pond water, surrounding soil and sediment with elevated concentrations of chloride (and other COPC) was excavated, and the surge pond area was backfilled with clean material. The goal of the surge pond remediation program was to remove chloride "source" materials and reduce chloride concentrations predicted to affect the downgradient wetland in the future.

The purpose of this report is to:

- provide a description of the vegetation species and communities within the wetland;
- characterize the vegetation health and vigour of vegetation species and communities within the wetland; and
- identify any chloride impacts from the surge pond release into the wetland.

## 2.0 SITE DESCRIPTION

### 2.1 Ecological Setting

The Site is in the southwest region of the Taiga Plains ecozone (Government of Northwest Territories 2022) within the Liard Plains Upland Mid-Boreal (MB) Ecoregion as identified by the Ecosystems Classification Group (ECG 2007). The ecozone experiences the warmest climate of any area in the Northwest Territories due to Chinook-like winds and influences from adjacent mountain ranges. The dominant landform in the ecoregion is undulating to rolling till with Luvisols and Brunisols being the most common soils with till materials. Gleysols and Organic soils occur under wetlands (ECG 2007).

Vegetation consists of highly productive deciduous and mixedwood stands consisting of trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*) and white spruce (*Picea glauca*) with lush understories of low-bush cranberry (*Viburnum trilobum*), prickly rose (Rosa *acicularis*), dwarf raspberry (*Rubus pubescens*) and meadow-horsetail (*Equisetum pratense*) among other forbs and shrubs

(ECG 2007). Wetlands are limited due to the undulating to rolling terrain but are typically rich, horizontal fens with sparse trees, willows, and sedges (ECG 2007).

### 2.2 Site Description

The wetland is bordered to the north by a slope consisting of trembling aspen and wild rose leading from the Site. Fisherman's Lake is located on the south border of the wetland and meanders to the southeast and southwest. Mixed wood forest borders the east and west sides of the wetland. A pipeline traverses the western portion of the wetland.

## 3.0 METHODS

### 3.1 Field Survey

Field assessments were conducted between July 28 and 30, 2023 to characterize the vegetation species and communities within the wetland and assess their health and vigor. Assessment of upland vegetation was not within the scope of the project and is not discussed in this report.

Plot locations were chosen in the field based on the most representative representation of the vegetation communities that were observed. Three assessment transects (23T1,23T2, 23T3) were established where elevated salinity concentrations had been identified during groundwater sampling in 2022 and three control transects (23CT1, 23CT2, 23CT3) outside of the areas of elevated salinity concentrations were also established in the wetland in the most representative communities of the vegetation around the control transects and their similarity to the assessment transects. The location of the transects and their UTM coordinates is provided below in Table 1 and in Figure 1.

**Table 1 Location of Assessment and Control Transects**

| Transect | | UTM | Easting | Northing |
|---|---|---|---|---|
| Assessment Transects | 23T1 | 10U | 454536 | 6695453 |
| | 23T2 | 10U | 454533 | 6695464 |
| | 23T3 | 10U | 454525 | 6695476 |
| Control Transects | 23CT1 | 10U | 454467 | 6695527 |
| | 23CT2 | 10U | 454481 | 6695517 |
| | 23CT3 | 10U | 454518 | 6695379 |

The location of the transects was refined to capture any changes in the vegetation community as well as areas where vegetation may have been stressed. Transect lengths varied from 15-25 m depending

on the heterogeneity of the vegetation and accessibility related to water depth and substrate stability. There were no upgradient vegetation communities that were exactly similar to the assessment transect locations, therefore the location with the most individual vegetation species that were observed in the other assessment and control transects was selected.

Five-one square meter monitoring plots were established along each transect. Each plot was located within any changes in vegetation along the transect, or spaced as evenly as possible where vegetation was heterogenous. A summary of all plant community data that was collected is presented in Tables 2 and 3.

General site characteristics (slope, hill slope position, aspect, and moisture regime) and percent cover of all vegetation strata (tree overstory layer, tree understory layer, tall shrub (2.5-5.0 m tall), short shrubs (0.4 to 2.5 m tall), forbs, grass, and grass-like species (graminoid), moss, lichen, and epiphytes) and surface substrate data was recorded within the plot. Percent cover was assigned within cover classes (Table 2), with the mid-point of each cover class taken for data analysis. The vigor of each plant species and the community as a whole was also recorded. The methodology for assigning health and vigor values is presented in Section 1.2.2. A summary of the data collected at each plot along the transects is provided below in Table 3.

All field data was reviewed in the field for accuracy and completeness.

**Table 2 Vegetation Cover Classes**

| Cover Class | Range of Percent Cover (%) |
|---|---|
| + | <1 |
| A | 1-5 |
| B | 5-10 |
| C | 10-25 |
| D | 25-33 |
| E | 33-50 |
| F | 50-75 |
| G | >75 |

| **Table 3 General Information Collected for Field Surveys** | |
|---|---|
| Plot Information | Project ID<br>Date<br>Plot Label<br>Elevation<br>Surveyor(s)<br>Preliminary Mapped As<br>UTM Zone, Easting, Northing |
| Site Characteristics | Slope<br>Aspect (degrees)<br>Structural stage<br>Surface expression<br>Surface shape<br>Slope position<br>Moisture regime<br>Nutrient regime |
| Surface Substrate | Decaying wood, bedrock, cobbles/stones, mineral soil, organic matter, water |
| Vegetation | Latin name<br>Strata[1]<br>% Cover<br>Vigour |

[1] Plant species were assigned to a stratum from 1-9 based on the vertical vegetative stratum in which they occurred as follows: Overstory tree canopy; 2. Understory tree canopy; 3. Tall shrub (2.5 – 5 m); 4. Short shrub (<2.5 m); 5. Forb; 6. Graminoid; 7. Ground bryophytes; 8. Ground lichens; and 9. Epiphytic lichens and bryophytes.

The top 30 cm of the soil substrate was also assessed. They were described based the texture of the soil, signs of mottling or gleying, the level at which water was encountered within the top 30 cm of the soil, and the moisture or saturation of the soil, The degree of decomposition of the soils was described using the Von Post Decomposition Scale (Table 4). Typically, peatlands will have a Von Post rating of 5 or less, while mineral wetlands will have a rating of 6 or higher (ESRD 2015).

**Table 4 Von Post Decomposition Scale[1]**

| Degree of Decomposition | Nature of Squeezed Liquid | Properties of Organic Matter Extruded | Nature of Plant Matter | Description |
|---|---|---|---|---|
| 1 | Clear, colourless | None | Plant structure unaltered | Undecomposed |
| 2 | Almost clear, yellow brown | None | Plant structure distinct, almost unaltered | Almost undecomposed |
| 3 | Slightly turbid, brown | None | Plant structure distinct, most remains easily identifiable | Very weakly decomposed |
| 4 | Strongly turbid, brown | None | Plant structure distinct, most remains easily identifiable | Weakly decomposed |
| 5 | Strongly turbid, contains little organic material in suspension | Very little | Plant structure clear but indistinct and difficult to identify | Moderately decomposed |
| 6 | Muddy, much organic material in suspension | One third | Plant structure indistinct, with most undefinable | Well decomposed |
| 7 | Strongly muddy | Strongly muddy | Plant structure indistinct | Strongly decomposed |
| 8 | Thick mud, little free water | Thick mud, little free water | Plant structure very indistinct with only resistant material such as roots identifiable | Very strongly decomposed |
| 9 | No free water | No free water | Plant structure almost unrecognizable | Almost completely decomposed |
| 10 | No free water | No free water | Plant structure not recognizable, amorphous | Completely decomposed |

[1] Adapted from Alberta Wetland Classification System (ESRD 2015).

Species nomenclature and authorities used in this document follow *The Flora of Alberta* (Moss 1983) and the Alberta Conservation Information Management System (ACIMS) list of All Vascular Elements Recorded for Alberta in the ACIMS Database (ACIMS 2022a), ACIMS List of all Moss and Liverwort Elements Recorded for Alberta in the ACIMS Database (ACIMS 2022b) and ACIMS List of All Lichen Elements Recorded for Alberta in the ACIMS Database (ACIMS 2022c).

### 3.2 Vegetation Ecological Function Criteria

The following indicators based on the data collected were used to define the ecological function of the release area:

- community indices;
- vegetation health parameters;
- vegetation vigour indices; and
- representative vegetation species.

#### 3.2.1 Community Indices

Species richness, abundance, community composition and diversity are indices that are used to describe plant communities. Species richness is defined as the total number of species found in a given area (*e.g.*, , a count of the species in each 1-m² plot). Species abundance reflects the total percent foliar cover of each species identified within a given area. In a disturbance event, such as the release of contaminants of potential concern (COPC), a decline in plant species richness, abundance and diversity can indicate deterioration in ecological function and integrity.

Comparisons of the data collected during the assessment were made between the impacted and non-impacted transects within each vegetation community to identify any differences in species richness and abundance between transects.

All vegetation species recorded within the transects were assigned a wetland indicator category. Species indicator statuses were derived from the US Army Corp of Engineers National Wetland Plant List (US Army 2020). Species lists for the Alaska Region were used as the most representative wetland region for the Site. These indicator statuses are used to designate a plant species' affinity/specificity to wetland *vs.* upland habitats. Table 5 provides a list of wetland indicator categories used in this report and their descriptions.

**Table 5 Wetland Indicator Status Codes**

| Indicator Code[1] | Indicator Status Name | Designation | Description |
|---|---|---|---|
| OBL | Obligate Wetland | Hydrophyte | Almost always occur in wetlands |
| FACW | Facultative Wetland | Hydrophyte | Usually occur in wetlands, but may occur in non-wetlands |
| FAC | Facultative | Hydrophyte | Occur in wetlands and non-wetlands |
| FACU | Facultative Upland | Non-hydrophyte | Usually occur in non-wetlands, but may occur in wetlands |
| UPL | Obligate Upland | Non-hydrophyte | Almost never occur in wetlands |

[1]Based on the USDA National Plant Database (United States Department of Agriculture 2014) and National Wetland Plant List (US Army 2016).

Vegetation communities comprising of mostly species with wetland affinities (hydrophytes as opposed to non-hydrophytes species) coupled with the absence of upland species can be classified as functional wetlands. Functions within a wetland would include wetland habitat, wetland species diversity, and indications of community stability. The health of individual species, percent cover, proportion relative to other species, and wetland indicator status can be used to monitor change in wetland health and functionality over time.

### 3.2.2 Vegetation Health and Vigour Parameters

Assigning vegetation vigour indices scores is a standard technique to estimate plant health. Vegetation vigour was assessed at the transect level, by vegetation strata, and at the species level to provide an estimate of plant health and change over time. Vigour is assigned as a categorical value and follows the Ecological Land Survey Site Description Manual (Alberta Environment and Parks (AEP), 1994). Vigour classes are as follows:

4 (excellent; green, healthy foliage);
3 (good; mostly green, but with some faded or yellowish-brownish inclusions);
2 (fair; faded or yellowish-brownish plots of foliage prominent);
1 (poor; faded, yellowish-brownish plots dominate foliage); and
0 (dead).

## 4.0 NON-NATIVE AND INVASIVE SPECIES

Introduced (also known as alien) species pose a threat to the natural dynamics and functioning of ecosystems as they can have a competitive advantage over native species and can remain within a plant community for lengthy periods of time (McClay *et al.* 2004, Adams *et al.* 2016).

The introduction of these species has the potential to negatively affect the biodiversity of an ecosystem as these plants are more effective at competing for resources such as light, water, nutrients, and space. When invasive species begins to dominate an area, the habitat becomes altered and organisms that previously relied on the native vegetation can be impacted. When non-native species dominates an area, it is difficult to remove this vegetation and return the ecosystem back to its natural state (McClay *et al.* 2004, Adams *et al.* 2016).

Non native species observations were recorded during the vegetation surveys at each plot, with occurrences of invasive species between plots noted and recorded. The Northwest Territories Species Infobase (NWT 2023) was used to determine the status of each species observed. Identified weeds and invasive species were assigned a density class as per the Weed Density Chart in Adams *et al*, 2016.

## 5.0 RESULTS

Results of the field discussion are presented in Sections 5.1 and 5.2. Photographs of the assessment and control transects are presented in Appendix A.

### 5.1 General Field Observations

The Study Area bears more resemblance to a mosaic of wetland communities within the riparian edge of a lake than an isolated wetland. The upland area adjacent to the wetland is a deciduous mixed wood forest consisting of trembling aspen and white spruce. There is some discoloration in the leaves of the trees and shrubs in a narrow band leading down from the general direction of the discharge pond.

The wetland consists of sedges and shrubs along the edge of the toe of the upland forest, with shrub concentrations being lowest along assessment transect 23T1 and increasing in the next two assessment transects west of it. The entire area is interspersed with pockets of open water and patches of common cattail (*Typha latifolia*) with the greatest concentrations occurring west of assessment transect 23T2 and around control transect 23CT3. Sporadic pockets of black spruce (*Picea mariana*) are also interspersed throughout and closer to the open water areas.

The upland area in the vicinity of transect 23CT3 is more coniferous consisting of black spruce and tamarack (*Larix laricana*) with a higher cover of moss. The emergent zone around the transect is

narrower than the rest of the wetland with a narrow ring of bluejoint (*Calamagrostis canadensis*), alder (*Alnus* spp.), mosses, and cattails (approx. 4 m wide).

Overland flow from the surrounding forest appears to discharge in a southwesterly direction towards the assessment locations with drainage channels observed at the edge.

Soils across all the assessment and control transects were saturated and composed of well to strongly decomposed organic soils with a Von Post index of seven. Water depths in the assessment transects was 25-30 cm deep and 5-10 cm deep along the control transects.

## 5.2 Community Health Indices

### 5.2.1 Species Richness

A summary of the observed species, the strata layer, and their wetland indicator status is provided in Appendix B.

A total of 38 species (34 vascular and 4 non-vascular species) were observed during the assessment in the assessment and control transects. There were 26 species (23 vascular and 3 non-vascular species) observed in the assessment transects and 27 species (26 vascular and 1 non-vascular) in the control transects. The highest richness was observed in assessment transects 23T1 and 23T2 while the lowest species richness was observed in control transect 23CT3. Table 6 provides a summary of the species richness across each transect.

**Table 6 Species Richness Along Each Transect**

| Transect | Species Richness |
|---|---|
| 23T1 | 18 |
| 23T2 | 17 |
| 23T3 | 12 |
| 23CT1 | 11 |
| 23CT2 | 15 |
| 23CT3 | 9 |

Species richness across each assessment transect was highest in the low shrub strata layer (Table 7) and in the low shrub and forb layer in the control transects. Non-vascular species were observed in all the assessment transects and only in one of the controls transects (23CT3). The average richness of

low shrubs and non-vascular species was higher in the assessment transects while average forb and graminoid richness was similar in both the assessment and control transects.

**Table 7 Comparison of Species Richness Across Strata Layers Along the Assessment and Control Transects**

| Strata Layer | Assessment Transects | | | Average Richness Assessment Transects | Control Transects | | | Average Richness Control Transects |
|---|---|---|---|---|---|---|---|---|
| | Transect 23T1 | Transect 23T2 | Transect 23T3 | | Transect 23CT1 | Transect 23CT2 | Transect 23CT3 | |
| Low shrub | 10 | 8 | 6 | **8** | 3 | 5 | 7 | **5** |
| Forbs | 3 | 5 | 3 | **3.7** | 5 | 7 | 0 | **4** |
| Grasses and grass-like species | 3 | 3 | 2 | **2.7** | 3 | 3 | 1 | **2.3** |
| Non-vascular species (mosses, lichens, and liverworts) | 2 | 1 | 1 | **1.3** | 0 | 0 | 1 | **0.3** |
| Total | 18 | 17 | 12 | **15.7** | 11 | 15 | 9 | **11.7** |

### 5.2.2 Abundance

The percentage cover or abundance of each strata layer for the assessment and control transects is presented in Table 8. The abundance in all the assessment transects and two of the control transects was highest in the graminoid strata layer. The lone exception was control transect 23CT3 where abundance was greatest in the non-vascular strata layer. The low shrub layer contained the second highest abundance across all the transects and was highest in the control plots.

The average abundance was higher in the assessment plot graminoid, and forb layers compared to the control transects while the average abundance in the control transects was higher in the low shrub and non-vascular strata layers.

**Table 8 Abundance by Strata Layer Across Assessment and Control Transects**

| Strata Layer | Assessment Transects | | | Average Abundance Assessment Transects | Control Transects | | | Average Abundance Control Transects |
|---|---|---|---|---|---|---|---|---|
| | 23T1 | 23T2 | 23T3 | | 23CT1 | 23CT2 | 23CT3 | |
| Tall shrub | 2 | 0 | 0 | **0.7** | 0 | 0 | 0 | **0** |
| Low Shrubs | 15 | 20 | 20 | **18.3** | 25 | 15 | 30 | **23.3** |
| Forbs | 8 | 20 | 20 | **16.0** | 10 | 15 | 0 | **8.3** |
| Grass and Grass-Like Species | 72 | 59 | 60 | **63.7** | 65 | 70 | 20 | **51.7** |
| Non-vascular species (mosses, lichens, and liverworts) | 5 | 1 | 0 | **2** | 0 | 0 | 50 | **16.7** |

### 5.2.3 Vegetation Health Parameters

The substrate parameters in the assessment and control transects are provided below in Table 9. Litter is an indicator of the previous years plant productivity and was higher in the assessment transects (20.7%) compared to the control assessment transects (10%). Green vegetation comprised 82.7% of the vegetation substrate in the control transects and 60.7% in the assessment transects, with the higher litter cover accounting for the lower percent cover of green vegetation in the assessment transects. Discolored vegetation was slightly higher in the control transects.

The vigor rating at assessment transect 23T1 was rated as 3 (good, mostly green, some yellowish or brownish inclusions) to 4 (excellent, green, healthy foliage). Senescence due to heat stress was observed on some of the trees and Labrador tea (*Rhododendron groenlandicum*) in the vicinity of the transect. The remaining assessment and control plots had a vigor rating of 4 except for control transect 23CT3, which had a vigor rating of 3-4 due to water stress on the alder observed in the area.

**Table 9 Comparison of Substrate Parameters and Vigor in Assessment and Control Transects**

| Transect | Decaying Wood | Litter | Water | Discolored Vegetation | Green Vegetation | Vigor |
|---|---|---|---|---|---|---|
| 23T1 | 5 | 20 | 5 | 5 | 65 | 3-4 |
| 23T2 | 1 | 19 | 10 | 1 | 69 | 4 |
| 23T3 | 2 | 23 | 25 | 2 | 48 | 4 |
| **Average Assessment Plots** | **2.7** | **20.7** | **13.3** | **2.7** | **60.7** | **3.7** |
| 23CT1 | 0 | 5 | 5 | 2 | 88 | 4 |
| 23CT2 | 0 | 25 | 0 | 0 | 75 | 4 |
| 23CT3 | 0 | 0 | 5 | 10 | 85 | 3-4 |
| **Average Control Plots** | **0** | **10** | **3.3** | **4** | **82.7** | **3.7** |

### 5.2.4 Indicator Species

A summary of the wetland indicator species across the assessment and control transects is provided in Table 10. The number of obligate wetland and facultative wetland species in the assessment and control transects are similar. Hydrophytic species (obligate, facultative wetland and facultative species) comprised 50% of the total number of species in the assessment plots, and 63% of the species in the control plots. Approximately 42.3% of the species in the assessment plots did not have an assigned wetland indicator status, while 29.6% of the control species did not have an assigned wetland indicator status. Many of the non-rated species are willows, alders and sedges which would be expected in a wetland community.

**Table 10 Comparison of Number of Wetland Indicator Species and Abundance Across Impacted and Non-Impacted Transects**

| Wetland Indicator Code | Wetland Indicator Status | Assessment Transects | Control Transects) |
|---|---|---|---|
| OBL | Obligate Wetland | 4 | 5 |
| FACW | Facultative Wetland | 4 | 4 |
| FAC | Facultative | 5 | 8 |
| FACU | Facultative Upland | 2 | 2 |
| NR | Not Rated | 11 | 8 |
| Total | | 26 | 27 |

The composition of wetland indicator status species for each transect is provided below in Table 11. The percentage of hydrophytic species in each assessment transect ranged from 55.6% in 23T1 to 64.7% in 23T2. In the control transects, the percentage of hydrophytic species ranged from 63.6% in 23CT1 to 70% in 23CT3.

The average wetland indicator species in the assessment transect compared to the control transects was higher in the obligate, facultative upland and non- rated species while the average facultative wetland and facultative species were similar between the assessment and control transects. The average number of hydrophytic species was higher in the control transects compared to the assessment transects.

**Table 11 Comparison of Wetland Indicator Species Across Assessment and Control Transects**

| Wetland Indicator Code | Wetland Indicator Status | 23T1 | 23T2 | 23T3 | Average Wetland Indicator Code in Assessment Transects | 23CT1 | 23CT2 | 23CT3 | Average Wetland Indicator Code in Control Transects |
|---|---|---|---|---|---|---|---|---|---|
| OBL | Obligate Wetland | 2 | 3 | 3 | **2.7** | 2 | 4 | 0 | **2** |
| FACW | Facultative Wetland | 4 | 3 | 1 | **2.7** | 1 | 3 | 4 | **2.7** |
| FAC | Facultative | 4 | 5 | 1 | **3.3** | 4 | 3 | 3 | **3.3** |
| FACU | Facultative Upland | 3 | 1 | 1 | **1.7** | 1 | 1 | 0 | **0.7** |
| NR | Not rated | 5 | 5 | 6 | **5.3** | 3 | 4 | 3 | **3.3** |
| **Total** | | **18** | **17** | **12** | **15.7** | **11** | **15** | **10** | **12.0** |
| **Percent Composition of Hydrophytic Species (OBL, FACW, FAC)** | | **55.6** | **64.7** | **63.6** | **55.4** | **63.6** | **66.7** | **70** | **66.7** |

### 5.2.5 Vegetation Communities

The dominant vegetation community along the assessment transect consists of water sedge (*Carex aquatilis*), Cusick's sedge (*Carex cusickii*), gray willow (*Salix glauca*), diamond-leaved willow (*Salix planifolia*), marsh hedge nettle (*Stachys palustris*), water hemlock (*Cicuta maculata*) and white birch (*Betula papyrifera*).

The dominant vegetation along the control transects consists of water sedge, bluejoint (*Calamagrostis canadensis*), white birch, green alder (*Alnus crispa*), arrow-leaved coltsfoot (*Petasitis sagittatus*) and bulb bearing water hemlock (*Cicuta bulbifera*).

### 5.2.6 Alien Species

There were no alien species listed under the Northwest Territories Species List for the Taiga Plains region observed during the assessment.

## 6.0 DISCUSSION

### 6.1 Community Indices

A decline or shift in plant species richness, abundance and diversity over time would occur if the high concentrations of salinity has had a negative effect on the vegetation communities. The 2023 monitoring indicated that species richness in the assessment vegetation communities was similar to the control communities as well as the vegetation strata layers which does not indicate that there are losses of species or community structure related to higher concentrations of salinity.

The overall abundance of graminoid and forb species was higher in the assessment plots compared to the control transects. The assessment plots were located closer to where overland flow channels from the upland areas were observed, therefore more water tolerant graminoid species such as sedges and rushes would be anticipated. Abundance of shrubs was greater in the control plots and would be anticipated as they were located further from the overland flow inputs where water concentrations would disperse more evenly and would not be as susceptible to water stress. The differences in abundance between the assessment and control transects therefore may be attributed to natural functionality and not higher salt concentrations.

### 6.2 Vegetation Health Parameters

Release of contaminants of potential concern (COPC) may cause physical signs of vegetation stress such as stunted or slow growth, reduced vigor and necrosis or discoloration of leafy material. The overall wetland did not show any clear effects from higher salinity concentrations, and the health and vigor ratings for both the assessment and control transects were similar and rated as healthy to excellent condition.

There were individual plants in both the assessment and control plots that were discolored, with a higher abundance of discolored vegetation observed in the control transects compared to the assessment transects. The Fort Liard region has had a hot summer with numerous heat warnings issued by Environment Canada, and local contractors also indicated that there was a spruce budworm

infestation occurring in the region. Therefore, heat stress, drier conditions and insect pests may be attributed to some of the discoloration of the trees and shrubs that was observed.

Bare mineral soil resulting from poor growth was not observed in the vegetation communities, and litter production was higher in the assessment transects compared to the control transects indicating that there was no loss of plant productivity due to higher salt concentrations.

### 6.3 Representative Vegetation Species, Community Similarity and Function

A loss of ecosystem function, loss of obligate, facultative wetland and facultative vegetation species, and loss of vegetation community integrity and function may be anticipated due to increased salinity concentrations. This was not observed during the 2023 vegetation assessment. The number of obligate and facultative wetland species, the most representative species of a wetland community, is similar between the assessment and control transects. The composition of hydrophytic species is higher in the control transects compared to the assessment transects which can be attributed to a higher number of non-rated species in the assessment transects. Many of the non-rated species would be anticipated in a wetland community.

Overall, the vegetation communities observed are comprised of vegetation species and the anticipated vegetation structural layers (low shrubs, graminoids, forbs) that would be anticipated in a wetland community.

No alien species were identified during the assessment.

## 7.0 CONCLUSIONS

Observations from the 2023 vegetation assessment indicate that there are no clear impacts from increased salinity concentrations in the wetland. Indicators of wetland health and function within the assessment plots are comparable to non-impacted control assessment communities.

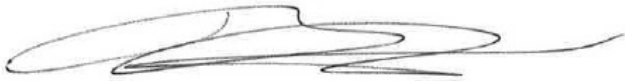
## 8.0 CLOSURE

A copy of MEMS Limitations of Liability Statement is provided in Appendix C. We thank you for the opportunity to be of assistance to Paramount Resources Ltd. Should you have any questions, please contact either of the undersigned at 780.496.9048.

Regards,

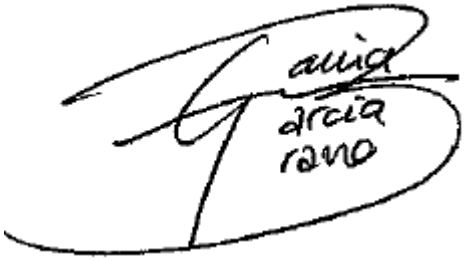
**Millennium EMS Solutions Ltd.**

Prepared by:



Darcy Meyers, P.Ag., P. Biol.
Senior Ecologist

Reviewed by:



Tania Garcia Bravo, P.Ag, CERP
Regulatory Project Manager

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# FIGURES

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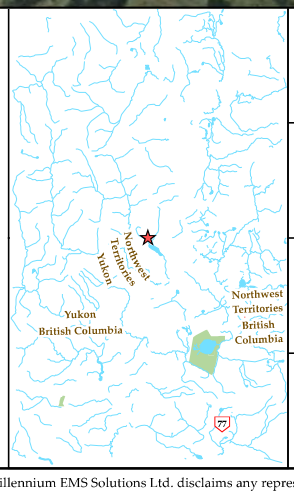
6696300 6696200 6696100 6696000 6695900 6695800 6695700 6695600 6695500 6695400 6695300 6695200 6695100

23CT1 23CT2 23CT3 23T3 23T2 23T1

## LEGEND

- GPS Plot Locations
- Approximate Lease Boundary




**PARAMOUNT RESOURCES LTD**
**POINTED MOUNTAIN**
**WETLAND VEGETATION ASSESSMENT**

## 2023 WETLAND VEGETATION ASSESSMENT AND CONTROL TRANSECTS

DataBC, 2019; MEMS, 2023; OGC, 2020; GDM, 2021
ESRI, 2023. (Image date: 2021)

Coordinate System: NAD 1983 UTM Zone 10N

MILLENNIUM EMS Solutions Ltd.

| | |
|---|---|
| PROJECT: | 21-00365 |
| DRAWN BY: | NBUSAAN |
| CHECKED BY: | DM |
| DATE: | SEPTEMBER 18, 2023 |

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Disclaimer: This figure was derived from multiple data sources and while we make every effort to assure its accuracy, Millennium EMS Solutions Ltd. disclaims any representation or warranty and assumes no liability either for any errors, omission or inaccuracies that may occur.

# APPENDIX A: SITE PHOTOGRAPHS

**Photo 1:** Looking north from transect 23T1 showing upland vegetation along edge of the wetland (July 28, 2023).

**Photo 2:** Looking north showing upland vegetation north of 23TC3 (August 30, 2023).

**Photo 3:** Looking east from transect 23T1 showing wetland (July 28, 2023).

**Photo 4:** Looking south showing wetland from transect 23T1 (July 28, 2023).

**Photo 5:** Looking southwest from transect 23T2 showing (July 28, 2023).

**Photo 6:** Looking east from transect 23T3 showing wetland (July 29, 2023).

**Photo 7:** Looking southwest from edge of transect 23T3 showing portion of wetland dominated by cattail in the wetland (July 29, 2023).

**Photo 8:** Looking south showing vegetation in wetland along pipeline (July 29, 2023).

**Photo 9:** Looking north from end of transect 23CT1 showing vegetation in control portion of the wetland (July 29, 2023).

**Photo 10:** Looking east from end of transect 23CT1 showing vegetation in the control portion of the wetland (July 29, 2023).

**Photo 11:** Looking north from end of transect 23CT2 showing vegetation in the control portion of the wetland (July 29, 2023).

**Photo 12:** Looking east showing vegetation along transect 23CT3 (July 30, 2023).

**Photo 13:** Looking west showing vegetation along transect 23CT3 (July 30, 2023).

# APPENDIX B: SPECIES LIST

**Table B1 Vegetation Species Observed Along the Assessment Transects**

| Scientific Name | Common Name |
|---|---|
| **Shrubs** | |
| *Alnus crispa* | Green alder |
| *Betula papyrifera* | Paper birch |
| *Cornus sericea* | Red osier dogwood |
| *Picea mariana* | Black spruce |
| *Rhododendron groenlandicum* | Labrador tea |
| *Salix discolor* | Pussy willow |
| *Salix exigua* | Narrowleaf willow |
| *Salix glauca* | Gray willow |
| *Salix myrtillifolia* | Blueberry willow |
| *Salix pedicellaris* | Bog willow |
| *Salix planifolia* | Diamond-leaf willow |
| *Vaccinium vitis-idaea* | Bog cranberry |
| **Forbs** | |
| *Chamaenerion angustifolium* | Fireweed |
| *Cicuta bulbifera* | Bulb-bearing water hemlock |
| *Cicuta maculata* | Water hemlock |
| *Ranunculus cymbalaria* | Seaside buttercup |
| *Stachys palustris* | Marsh hedge nettle |
| *Typha latifolia* | Common cattail |
| *Viola nephrophylla* | Northern bog violet |
| **Graminoid** | |
| *Calamagrostis canadensis* | Bluejoint |
| *Carex aquatilis* | Water sedge |
| *Carex cusickii* | Cusick's sedge |
| *Carex sartwellii* | Sartwell's sedge |
| **Mosses** | |
| *Pleurozium schreberi* | Schreber's moss |
| *Ptilium crista-castrensis* | Knight's plume |
| *Sphagnum angustifolium* | Sphagnum moss |

**Table B2 Vegetation Species Observed Along the Control Transects**

| Scientific Name | Common Name |
|---|---|
| **Shrubs** | |
| *Alnus crispa* | Green alder |
| *Betula papyrifera* | White birch |
| *Betula pumilla* | Bog birch |
| *Cornus sericea* | Red osier dogwood |
| *Picea mariana* | Black spruce |
| *Rhododendron groenlandicum* | Labrador tea |
| *Rubus pubescens* | Dwarf raspberry |
| *Salix bebbiana* | Bebb's willow |
| *Salix glauca* | Gray willow |
| *Salix planifolia* | Diamond-leaf willow |
| *Vaccinium vitis-idaea* | Bog cranberry |
| **Forbs** | |
| *Cicuta bulbifera* | Bulb-bearing water hemlock |
| *Cicuta maculata* | Water hemlock |
| *Geocaulon lividum* | False toadflax |
| *Mentha arvensis* | Marsh mint |
| *Petasites sagittatus* | Arrow-leaved coltsfoot |
| *Ranunculus cymbalaria* | Seaside buttercup |
| *Rumex crispa* | Curly dock |
| *Sium suave* | Water parsnip |
| *Stellaria longifolia* | Long-leaved chickweed |
| *Tephroseris palustris* | Marsh ragwort |
| *Viola nephrophylla* | Northern bog violet |
| **Graminoid** | |
| *Calamagrostis canadensis* | Bluejoint |
| *Carex aquatilis* | Water sedge |
| *Carex atherodes* | Awned sedge |
| *Carex cusickii* | Cusick's sedge |
| **Moss** | |
| *Sphagnum angustifolium* | Sphagnum moss |

# APPENDIX C: LIMITATIONS OF LIABILITY AND MILLENNIUM EMS SOLUTIONS LTD. THIRD PARTY RELIANCE AGREEMENT

## 1.0 LIMITATIONS OF LIABILITY

This report pertains solely to the assessment of the Paramount Resources Ltd. (Paramount) Pointed Mountain Gas Plant Wetland Assessment located approximately 25 kilometers northwest of Fort Liard, Northwest Territories. This assessment was conducted in accordance with the scope of work using industry accepted biological survey practices and hydrogeological practices to satisfy the requirements of the applicable regulations, approvals and/or directives. Millennium has exercised reasonable skill, care, and due diligence in assessing the information acquired during the preparation of this report, however information and data used in this assessment and obtained from third parties has not been independently verified unless otherwise noted.

While preparing this report, Millennium may use or incorporate Millennium's proprietary algorithms, methods, compilations, processes, designs, formulas, and/or techniques, and may also employ advanced technologies for simulation, information modeling, generative design, and the development of project documentation (the "**Technical Tools**"). The Technical Tools may be further used to create data sets and result in simulations or models (collectively, the "**Datasets**") that may be included in this report. Both the Technical Tools and the Datasets are by-products of Millennium's internal processes and shall belong solely to Millennium. No unauthorized use of the Technical Tools or Datasets is permitted.

This report has been prepared for the sole and exclusive use of Paramount who may rely on this report for specific application to this project site. Any other use, or any use of this report by any other party, including any individuals or organisations who may obtain access to this report through applications under the *Freedom of Information and Protection of Privacy Act*, is prohibited without the express written consent of Paramount and Millennium. **Millennium accepts no responsibility for foreseeable or unforeseeable damages, or direct or indirect damages, if any, suffered by any third party as a result of decisions made or actions taken based on the unauthorized use of this report. If third parties choose to use this report in an unauthorized manner, such third parties are also choosing to indemnify Millennium and its officers, employees, agents, successors and assigns from any and all claims, damages, or liability of any kind (including but not limited to delay of project commencement or completion, reduction of property value, and/or fear of, or actual, exposure to or release of toxic or hazardous substances) in regard to such use.**

Third parties that wish to use this report, including any individuals or organizations who may obtain access to this report through applications under the *Freedom of Information and Protection of Privacy Act*, will be required to return an executed copy of Millennium's Third-Party Reliance Agreement.

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tel: 1.888.722.2563

**toll free: 888.722.2563**
**www.mems.ca**

[Name of recipient]

[Date]
**DELIVERED VIA E-MAIL**

Dear [name],

**RE: RELIANCE LETTER PERTAINING TO COAL VALLEY MINE 2022 WETLAND MONITORING REPORT CONSTRUCTED MINERAL WETLANDS**

Paramount Resources Ltd. ("**Client**") retained Millennium EMS Solutions Ltd. ("**Millennium**") to prepare "Pointed Mountain Gas Plant 2023 Wetland Vegetation Assessment" ("**Report**") for the property located approximately 25 km northwest of Fort Liard, Northwest Territories.

We understand that you wish to rely on the information presented in the Report. Millennium has agreed to allow you to rely on the contents of the Report based on the terms and conditions below:

1) The limitations and assumptions stated in the Report in association with any closure statement continue to apply to your use of the Report.
2) You may have an interest in the Report that conflicts with the interest of Client. Millennium takes no responsibility for claims, liabilities, damages or expenses that arise because of such conflict.
3) Millennium expressly disclaims any and all warranties in connection with the Report. This disclaimer of warranties includes, without limitation, any warranty that the Report and any associated site investigation work has uncovered all potential environmental liabilities associated with the property that is the subject of the Report. Millennium disclaims any warranty of the completeness or accuracy of information supplied to Millennium that was relied upon in the preparation of the Report. You will waive any claim against Millennium, its officers, employees, agents, assignees and successors as a result of use of the Report.
4) You agree to defend, indemnify, protect and hold harmless Millennium and its officers, employees, agents, assignees and successors from any and all claims, liabilities, damages or expenses, including but not limited to delay of project commencement or completion, reduction of property value, fear of or actual exposure to or release of toxic or hazardous substances, or conflicts of interest, whether foreseeable or unforeseeable, which may arise directly or indirectly, to any party, as a result of your use of the Report.
5) Millennium's and its officers, employees, agents, assignees, and successors liability arising out of or relating to the use of the Report is limited to one thousand Canadian dollars (CAD$1,000.00). We will not be liable for consequential, incidental or indirect damages as a result of your use of the Report.
6) Use of the Report, including all information and recommendations prepared or issued by Millennium within the Report or pertaining to the Report, is for your exclusive use. No other use is authorized, including distribution to any other party without our prior written consent, which may be arbitrarily withheld. You will release us from liability and agrees to defend, indemnify, protect and hold harmless Millennium and its officers, employees, agents, assignees and successors from any and all claims, liabilities, damages or expenses arising, in whole or in part, from such unauthorized distribution.

Please sign in the space provided below to indicate your acceptance to the above conditions.

Regards,

MILLENNIUM EMS SOLUTIONS LTD.

By: _____
MEMS Representative
Title
Date

Agreed to this ____ day of •, _____.
[THIRD PARTY]

By: _____
Name:
Title
Date

# APPENDIX E: TOXICITY TESTING ASSESSMENT

NAUTILUS ENVIRONMENTAL

**TESTING LOCATION (Please Circle)**

**Burnaby** (●)
8664 Commerce Court
Burnaby, British Columbia, Canada
V5A 4N7
Phone 604.420.8773

**Calgary** ( )
10823 27 Street SE
Calgary, Alberta, Canada
T2Z 3V9
Phone 403.253.7121

**Point Edward** ( )
704 Mara Street, Suite 122
Point Edward, Ontario, Canada
N7V 1X4
Phone 519.339.8787

# Chain of Custody

Date 31/07/23 Page 1 of 1

| **Report to:** | | **Invoice To:** | |
|---|---|---|---|
| **Company** | Millennium EMS Solutions Ltd. (MEMS) | **Company** | Paramount Resources Ltd. c/o MEMS |
| **Address** | #148 – 2257 Premier Way | **Address** | 888 3 St SW #4700 |
| **City/Prov/PC** | Sherwood Park, AB T8H 2M8 | **City/Prov/PC** | Calgary, AB T2P 5C5 |
| **Contact** | Jeff Belecky | **Contact** | Jeff Belecky |
| **Phone** | 780.554.3280 | **Phone** | 780.554.3280 |
| **Email** | jbelecky@mems.ca | **Email** | jbelecky@mems.ca |
| | | **PO No.** | 23SR0061 |

**Sample Collection By:** Drew MacPhail (MEMS) **Sample Type:** **Grab** (●) **OR** **Composite** ( )

| | SAMPLE ID | DATE (DD/MM/YY) | TIME | MATRIX | # OF CONTAINERS AND VOLUME (e.g. 1 x 20 L) | COMMENTS | ANALYSES REQUIRED: 7-day C. dubia (water flea) survival and reproduction | 7-day P. promelas (fathead minnow) survival and growth | 7-day L. minor (common duckweed) growth inhibition | 72-hour P. subcapitata (algae) growth inhibition | | | | | | | | Receipt Temperature (°C) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SW23-05TOX | 30/07/23 | 11:00 | Water | 4 x 10 L Bladders | Containers are not labeled with sample ID | ✔ | ✔ | ✔ | ✔ | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | |

**SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)**

Note short hold time (72 hr) on select tests

**SAMPLE RECEIPT DETAILS (LABORATORY)**

| | | | |
|---|---|---|---|
| **1. Total No. of Containers** | 4 | **4. Ice Present in Cooler?** | **Y / N** |
| **2. Courier** | Ambitious | **5. Seal Present?** | **Y / N** |
| **3. Good Condition?** | **Y / N** | **6. Initials Present on Seal?** | **Y / N** |

**SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)**

**RELINQUISHED BY (CLIENT)**

DREW MACPHAIL (Printed Name) DM (Signature)

MEMS (Company) 31/07/23 @ 17:00 (expected) (Date DD/MM/YY and Time)

**RECEIVED BY (LABORATORY)**

(Printed Name) (Signature)

(Company) (Date DD/MM/YY and Time)

Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling, or transport of the sample, application or interpretation of the test data or results in part or in whole.

**Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.**

# Toxicity testing on sample SW23-05TOX

Collected on July 30, 2023

Final Report

November 2, 2023

Submitted to: **Millenium EMS Solutions Ltd. (MEMS)**
Sherwood Park, AB

8664 Commerce Court, Burnaby, BC V5A 4N7

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## SIGNATURE PAGE

Report By:
Rachel Sakurdeep, B.Sc.
Senior Biologist

Reviewed By:
Mimi Tran, Dipl. T.
Senior Biologist

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

## SUMMARY

### Sample Information and Test Type

| | |
|---|---|
| Sample ID | SW23-05TOX |
| Sample collection date | July 30, 2023 |
| Sample receipt date | July 31, 2023 |
| Sample receipt temperature | 0.3 – 4.3°C |
| Test types | *Ceriodaphnia dubia* survival and reproduction |
| | 7-d fathead minnow (*Pimephales promelas*) survival and growth |
| | 7-d *Lemna minor* growth inhibition |
| | 72-h *Pseudokirchneriella subcapitata* growth inhibition |

## Summary of Results

| Endpoint | SW23-05TOX<br>% v/v (95% CL) |
|---|---|
| *Ceriodaphnia dubia* | |
| Survival LC50 | >100 |
| Reproduction IC25 | 27.1 (9.8 – N/A) |
| Reproduction IC50 | >100 |
| *Pimephales promelas* | |
| Survival LC25 | >100 |
| Survival LC50 | >100 |
| Biomass IC25 | >100 |
| Biomass IC50 | >100 |
| *Lemna minor* | |
| Frond count IC25 | 14.5 (N/A – 70.6) |
| Frond count IC50 | 92.8 (30.9 – N/A) |
| Dry weight IC25 | >97.0 |
| Dry weight IC50 | >97.0 |
| *Pseudokirchneriella subcapitata* | |
| Growth IC25 | >95.2 |
| Growth IC50 | >95.2 |

LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, N/A = Not Available

## 1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted sub-lethal toxicity tests for Millenium EMS Solutions Ltd. (MEMS) on a sample identified as SW23-05TOX. The sample was collected on July 30, 2023, and delivered to the Nautilus Environmental laboratory in Burnaby, BC on July 31, 2023. The sample was transported in four 10-L plastic containers. The sample was received at temperatures ranging between 0.3 – 4.3°C and was stored in the dark at 4 ± 2°C prior to testing. The following sub-lethal toxicity tests were performed:

- *Ceriodaphnia dubia* survival and reproduction
- 7-d fathead minnow (*Pimephales promelas*) survival and growth
- 7-d *Lemna minor* growth inhibition
- 72-h *Pseudokirchneriella subcapitata* growth inhibition

Testing for *C. dubia* was initiated on August 1, 2023 and *O. mykiss, L. minor* and *P. subcapitata* were initiated on August 2, 2023. This report describes the results of these toxicity tests. Copies of raw laboratory datasheets and statistical analyses for each test species are provided in Appendices A to D. The chain-of-custody form is provided in Appendix E.

## 2.0 METHODS

Methods for the toxicity tests are summarized in Tables 1 to 4. Testing was conducted according to procedures described by Environment Canada (2007a, 2007b, 2007c and 2011). Statistical analyses for the tests were performed using CETIS (Tidepool Scientific Software, 2021).

**Table 1. Summary of test conditions: *Ceriodaphnia dubia* survival and reproduction test.**

| | |
|---|---|
| Test species | *Ceriodaphnia dubia* |
| Organism source | In-house culture |
| Organism age | <24 hour old neonates, produced within a 12 hour window |
| Test type | Static-renewal |
| Test duration | 7 ± 1 day |
| Test vessel | 20-mL glass test tube |
| Test volume | 15 mL |
| Test solution depth | 10 cm |
| Test concentrations | Seven concentrations, plus laboratory control |
| Test replicates | 10 per treatment |
| Number of organisms | 1 per replicate |
| Control/dilution water | 20% Perrier water and 80% deionized water + 5 µg/L Se and 2 µg/L vitamin B12 |
| Test solution renewal | Daily (100% renewal) |
| Test temperature | 25 ± 1°C |
| Feeding | Daily with *Pseudokirchneriella subcapitata* and TCC[1] (3:1 ratio) |
| Light intensity | 100 to 600 lux at water surface |
| Photoperiod | 16 hours light / 8 hours dark |
| Aeration | None |
| Test measurements | Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival and reproduction recorded daily |
| Test protocol | Environment Canada (2007a), EPS 1/RM/21 |
| Statistical software | CETIS Version 2.1.4 |
| Test endpoints | Survival and reproduction |
| Test acceptability criteria for controls | ≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods; no ephippia present |
| Reference toxicant | Sodium chloride (NaCl) |

[1] TCC = Trout chow and Cerophyll

**Table 2. Summary of test conditions: fathead minnow *(Pimephales promelas)* survival and growth test.**

| | |
|---|---|
| Test species | *Pimephales promelas* |
| Organism source | Aquatic BioSystems, Fort Collins, CO |
| Organism age | <24 hours post-hatch |
| Test type | Static-renewal |
| Test duration | 7 days |
| Test vessel | 375-mL glass container |
| Test volume | 250 mL |
| Test solution depth | 6.5 cm |
| Test concentrations | Seven concentrations, plus laboratory control |
| Test replicates | 3 per treatment |
| Number of organisms | 10 per replicate |
| Control/dilution water | Moderately-hard reconstituted water |
| Test solution renewal | Daily (80% renewal) |
| Test temperature | 25 ± 1°C |
| Feeding | Twice a day with approximately 1500-2250 newly hatched brine shrimp nauplii (*Artemia sp.*) in each test container |
| Light intensity | 100 to 500 lux |
| Photoperiod | 16 hours light / 8 hours dark |
| Aeration | None, unless dissolved oxygen falls to <40% saturation |
| Test measurements | Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival checked daily |
| Test protocol | Environment Canada (2011), EPS 1/RM/22 |
| Statistical software | CETIS Version 2.1.4 |
| Test endpoints | Survival and biomass |
| Test acceptability criteria for controls | ≥80% survival; ≥250 µg mean dry weight |
| Reference toxicant | Sodium chloride (NaCl) |

**Table 3. Summary of test conditions: *Lemna minor* growth inhibition test.**

| | |
|---|---|
| Test species | *Lemna minor*, strain CPCC# 490 |
| Organism source | In-house axenic culture, obtained from Canadian Phycological Culture Centre, and originally isolated from Wainfleet, Stinking Barn, Niagara Peninsula, Ontario, Canada |
| Organism age | 7- to 10-day old culture |
| Test type | Static |
| Test duration | 7 days |
| Test vessel | 250-mL glass container |
| Test volume | 100 mL |
| Test solution depth | 4 cm |
| Test concentrations | Seven concentrations, plus laboratory control |
| Test replicates | 4 per treatment |
| Number of organisms | Two 3-frond plants per replicate |
| Control/dilution water | Modified APHA media (deionized water plus 1% of each APHA stock solution A, B and C) |
| Test solution renewal | None |
| Test temperature | 25 ± 2°C |
| Feeding | None |
| Light intensity | 4000 to 5600 lux |
| Photoperiod | 24 hours light |
| Aeration | None |
| Test measurements | Test area temperature measured daily; temperature, pH and conductivity measured in all concentrations at test initiation; dissolved oxygen of highest concentration measured at test initiation; temperature and pH measured at test termination |
| Test protocol | Environment Canada (2007b), EPS 1/RM/37 |
| Statistical software | CETIS Version 2.1.4 |
| Test endpoints | Number of fronds and dry weight |
| Test acceptability criterion for controls | ≥ 8-fold increase in number of fronds |
| Reference toxicant | Potassium chloride (KCl) |

**Table 4. Summary of test conditions: *Pseudokirchneriella subcapitata* growth inhibition test.**

| | |
|---|---|
| Test species | *Pseudokirchneriella subcapitata*, strain CPCC# 37 |
| Organism source | In-house axenic culture, obtained from Canadian Phycological Culture Center, and originally isolated from Nivelta River, Norway. |
| Organism age | 3-to 7-day old culture in logarithmic growth phase |
| Test type | Static |
| Test duration | 72 hours |
| Test vessel | Microplate |
| Test volume | 220 µL |
| Test concentrations | Seven concentrations, plus laboratory control |
| Test replicates | 4 per treatment; 8 for laboratory control |
| Number of organisms | 10,000 cells/mL |
| Control/dilution water | Deionized water supplemented with nutrients |
| Test solution renewal | None |
| Test temperature | 24 ± 2°C |
| Feeding | None |
| Light intensity | 3600 to 4400 lux |
| Photoperiod | 24 hours light |
| Aeration | None |
| Test measurements | Test area temperature measured daily; temperature and pH measured at test initiation; pH of two control wells measured at test termination |
| Test protocol | Environment Canada (2007c), EPS 1/RM/25 |
| Statistical software | CETIS Version 2.1.4 |
| Test endpoint | Algal cell growth inhibition |
| Test acceptability criteria for controls | >16-fold increase in number of algal cells; CV ≤ 20%; no trend when analyzed using Mann-Kendall test |
| Reference toxicant | Zinc (added as $ZnSO_4$) |

## 3.0 RESULTS

Results of the toxicity tests are summarized in Tables 5 to 8. There was no adverse effect observed on survival of *C. dubia* (Table 5). However, there was an inhibitory effect observed on reproduction, which resulted in an IC25 value of 27.1%. There was no adverse effect observed on the dry weight of *L. minor*, but a reduction in frond count was observed, resulting in IC25 values of 97 and 14.5%, respectively (Table 7). There were no adverse effects observed on survival and biomass of *P. promelas* (Table 6) and cell yield of *P. subcapitata* (Table 8), resulting in IC25 and LC50 values greater than the highest concentration tested. Significant stimulation was observed in *P. subcapitata* cell yield in all test concentrations, with percent stimulation ranging from 46.1% to 226.6%.

**Table 5. Results: *Ceriodaphnia dubia* survival and reproduction test.**

| Concentration (% v/v) | Survival (%) | Reproduction (Mean ± SD) |
|---|---|---|
| Laboratory Control | 100 | 20.9 ± 2.2 |
| 1.56 | 90 | 18.8 ± 5.3 |
| 3.12 | 100 | 20.6 ± 5.2 |
| 6.25 | 90 | 20.0 ± 2.9 |
| 12.5 | 80 | 15.7 ± 8.4 |
| 25 | 100 | 15.8 ± 5.3 |
| 50 | 90 | 14.8 ± 6.2 |
| 100 | 100 | 15.4 ± 6.7 |
| **Test endpoint (% v/v)** | | |
| LC50 | >100 | -- |
| IC25 (95% CL) | -- | 27.1 (9.8 – N/A) |
| IC50 | -- | >100 |

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, N/A = Not Available

**Table 6. Results: fathead minnow (*Pimephales promelas*) survival and growth test.**

| Concentration (%v/v) | Survival (%) Mean ± SD | Biomass (mg) Mean ± SD |
|---|---|---|
| Laboratory Control | 96.7 ± 5.8 | 0.59 ± 0.03 |
| 1.56 | 96.7 ± 5.8 | 0.57 ± 0.04 |
| 3.12 | 93.3 ± 5.8 | 0.68 ± 0.05 |
| 6.25 | 86.7 ± 5.8 | 0.61 ± 0.02 |
| 12.5 | 86.7 ± 11.6 | 0.56 ± 0.03 |
| 25 | 93.3 ± 5.8 | 0.58 ± 0.01 |
| 50 | 100 ± 0.0 | 0.58 ± 0.01 |
| 100 | 100 ± 0.0 | 0.68 ± 0.04 |
| **Test endpoint (% v/v)** | | |
| LC25 | >100 | -- |
| LC50 | >100 | -- |
| IC25 | -- | >100 |
| IC50 | -- | >100 |

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration

**Table 7. Results: *Lemna minor* growth inhibition test.**

| Concentration (% v/v) | Frond Count (Mean ± SD) | Dry Weight (mg) (Mean ± SD) |
|---|---|---|
| Laboratory Control | 102.5 ± 25.8 | 7.8 ± 2.0 |
| 1.5 | 90.8 ± 14.9 | 6.9 ± 0.9 |
| 3.0 | 78.2 ± 4.9 | 6.2 ± 0.7 |
| 6.1 | 74.8 ± 11.0 | 6.2 ± 0.9 |
| 12.1 | 83.2 ± 4.5 | 8.3 ± 0.5 |
| 24.2 | 71.5 ± 10.3 | 7.4 ± 1.6 |
| 48.5 | 62.2 ± 4.6 | 8.4 ± 1.1 |
| 97.0 | 50.5 ± 1.7 | 6.7 ± 0.6 |
| **Test endpoint (% v/v)** | | |
| IC25 (95% CL) | 14.5 (N/A – 70.6) | >97.0 |
| IC50 (95% CL) | 92.8 (30.9 – N/A) | >97.0 |

SD = Standard Deviation, IC = Inhibition Concentration, CL = Confidence Limits, N/A = Not Available

**Table 8. Results: *Pseudokirchneriella subcapitata* growth inhibition test.**

| Concentration (% v/v) | Cell Yield (x $10^4$ cells/mL) (Mean ± SD) | Stimulation (%) |
|---|---|---|
| Laboratory Control | 38.5 ± 2.7 | -- |
| 1.5 | 56.2 ± 5.4* | 46.1 |
| 3.0 | 101.8 ± 4.1* | 164.3 |
| 6.0 | 102.8 ± 5.6* | 166.9 |
| 11.9 | 112.5 ± 6.9* | 192.2 |
| 23.8 | 125.8 ± 4.8* | 226.6 |
| 47.6 | 123.5 ± 4.0* | 220.8 |
| 95.2 | 123.5 ± 3.1* | 220.8 |
| **Test endpoint (% v/v)** | | |
| IC25 | >95.2 | -- |
| IC50 | >95.2 | -- |

SD = Standard Deviation, IC = Inhibition Concentration
* = Indicates the cell yield was significantly greater than the lab control

## 4.0 QA/QC

The health history of the test organisms used in the exposures was acceptable and met the requirements of the Environment Canada protocols. The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocols throughout the tests. Uncertainty associated with the test is best described by the standard deviation around the mean and/or the confidence intervals around the point estimates.

Results of the reference toxicant tests conducted during the testing program are summarized in Table 9. Results for these tests fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with these tests, with the exception of the *C. dubia* reference toxicant. The *C. dubia* reproduction point estimate fell marginally outside the baseline historical range of mean ± two standard deviations. This was not an indication that the organism's sensitivity was inappropriate, but rather a variation in reference toxicant results falling outside narrow warning limits as a consequence of the Coefficient of Variation (% CV) being low (9%). Exceedance of the two standard deviation range is expected to occur in 5% of cases by chance alone. The reference toxicant tests were performed under the same conditions as those used for the sample.

**Table 9. Reference toxicant test results.**

| Test Species | Endpoint | Historical Mean (2 SD Range) | CV (%) | Test Date |
|---|---|---|---|---|
| *C. dubia* | Survival (LC50): 2.0 g/L NaCl | 2.0 (1.9 – 2.2) g/L NaCl | 4 | August 7, 2023 |
| | Reproduction (IC50): 1.5 g/L NaCl | 1.8 (1.5 – 2.2) g/L NaCl | 9 | |
| *P. promelas* | Survival (LC50): 3.9 g/L NaCl | 4.9 (3.6 – 6.5) g/L NaCl | 15 | August 2, 2023 |
| | Biomass (IC50): 3.8 g/L NaCl | 4.1 (3.2 – 5.2) g/L NaCl | 12 | |
| *L. minor* | No. of Fronds (IC50): 2.9 g/L KCl | 3.1 (2.7 – 3.6) g/L KCl | 7 | July 20, 2023 |
| *P. subcapitata* | Growth (IC50): 29.4 µg/L Zn | 30.3 (23.7 – 38.7) µg/L Zn | 12 | July 27, 2023 |

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration

## 5.0 REFERENCES


Environment Canada. 2007a. Biological test method: test of reproduction and survival using the cladoceran *Ceriodaphnia dubia*. Environmental Protection Series, Report EPS 1/RM/21, Second Edition, February 2007. Environment Canada, Method Development and Application Section, Environmental Science and Technology Centre, Science and Technology Branch, Ottawa, ON. 74 pp.

Environment Canada. 2007b. Biological test method: tests for measuring the inhibition of growth using the freshwater macrophyte, *Lemna minor*. Environmental Protection Series, Report EPS 1/RM/37, Second Edition, January 2007. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 112 pp.

Environment Canada. 2007c. Biological test method: growth inhibition test using the freshwater alga. Environmental Protection Series, Report EPS 1/RM/25, Second Edition, March 2007. Environment Canada, Method Development and Application Section, Environmental Science and Technology Centre, Science and Technology Branch, Ottawa, ON. 53 pp.

Environment Canada. 2011. Biological test method: test of larval growth and survival using fathead minnows. Environmental Protection Series, Report EPS 1/RM/22, February 2011. Environment Canada, Environmental Protection, Conservation and Protection, Ottawa, ON. 73 pp.

Tidepool Scientific Software. 2021. CETIS comprehensive environmental toxicity information system, version 2.1.4 Tidepool Scientific Software, McKinleyville, CA. 303 pp.

# APPENDIX A – *Ceriodaphnia dubia* Toxicity Test Data

# *Ceriodaphnia dubia* Summary Sheet

Client: Millenium EMS Solutions Ltd. Start Date/Time: Aug 1, 2023 @ 1400 h
Work Order No.: 231313 Set up by: KYL

**Sample Information:**

Sample ID: SW23-05TOX
Sample Date: July 30, 2023
Date Received: July 31, 2023
Sample Volume: 4 x 10 L

**Test Validity Criteria:**

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

**WQ Ranges:**

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

**Test Organism Information:**

Broodstock No.: BB072023 ; BB072723
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 20
Mortality (%) in previous 7 d: 0
Individual female # used ≥8 young on test day: # 2-7 : 1, 2, 4, 5, 19

**NaCl Reference Toxicant Results:**

Reference Toxicant ID: Cd337
Stock Solution ID: 23NaCl
Date Initiated: Aug 7, 2023

7-d LC50 (95% CL): 2.0 (1.7-2.3) g/L NaCl
7-d IC50 (95% CL): ~~1.4 (1.3-1.6)~~ J72 ~~1.5~~ 1.5 (1.3-1.7) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.9-2.2) g/L NaCl CV (%): 4
7-d IC50 Reference Toxicant Mean and Historical Range: 1.8 (1.5-2.2) g/L NaCl CV (%): 9

Test Results:

| | Survival | Reproduction |
|---|---|---|
| LC50 % (v/v) (95% CL) | >100 | |
| IC25 % (v/v) (95% CL) | | 27.1 (9.8 - N/A) |
| IC50 % (v/v) (95% CL) | | >100 |

Reviewed by: EMM Date reviewed: Sept 22/23

# Chronic Freshwater Toxicity Test
## Initial and Final Water Quality Measurements

**Client:** Millenium EMS Solutions Ltd.
**Sample ID:** SW23-05TOX
**Work Order #:** 231313
**Start Date & Time:** Aug. 1/23 @ 1400 h
**Stop Date & Time:** Aug. 8/23 @ 1430 h
**CER #:** 4
**Test Species:** *Ceriodaphnia dubia*

%(v/v)

| Concentration (control) | Days | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 26.0 | 25.5 | 25.0 | 26.0 | 25.0 | 26.0 | 25.5 | 26.0 | 25.5 | 26.0 | 25.5 | 26.0 | 25.5 | 26.0 |
| DO (mg/L) | 7.8 | 6.8 | 7.9 | 6.1 | 7.9 | 5.8 | 8.0 | 5.2 | 8.0 | 4.0 | 7.9 | 6.1 | 7.9 | 6.1 |
| pH | 8.3 | 7.8 | 8.0 | 7.6 | 8.2 | 7.3 | 8.2 | 7.2 | 8.2 | 7.3 | 8.3 | 7.5 | 8.0 | 7.7 |
| Cond. (µS/cm) | 207 | 213 | | 208 | | 207 | | 210 | | 210 | | 211 | | 218 |
| Initials | JZL | JZL | | AHS | | AHS | | JZL | | RZS | | RZS | | KYL |

| Concentration 1.56 | Days | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 24.5 | 25.5 | 25.5 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 |
| DO (mg/L) | 7.5 | 6.9 | 7.2 | 6.2 | 7.8 | 6.0 | 7.7 | 5.5 | 7.3 | 4.9 | 7.1 | 5.9 | 7.6 | 6.1 |
| pH | 8.0 | 7.8 | 7.9 | 7.7 | 7.9 | 7.4 | 7.9 | 7.4 | 8.1 | 7.4 | 7.9 | 7.5 | 8.2 | 7.7 |
| Cond. (µS/cm) | 254 | 256 | | 250 | | 252 | | 248 | | 248 | | 247 | | 250 |
| Initials | JZL | AHS | | AHS | | AHS | | JZL | | RZS | | RZS | | KYL |

| Concentration 12.5 | Days | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 24.5 | 26.0 | 25.5 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 |
| DO (mg/L) | 7.6 | 6.9 | 7.3 | 6.3 | 7.9 | 5.5 | 7.7 | 5.2 | 7.4 | 4.8 | 7.1 | 5.8 | 7.7 | 6.0 |
| pH | 8.0 | 7.8 | 8.0 | 7.8 | 8.0 | 7.4 | 8.0 | 7.4 | 8.1 | 7.4 | 7.9 | 7.5 | 8.0 | 7.7 |
| Cond. (µS/cm) | 526 | 538 | | 502 | | 528 | | 516 | | 519 | | 505 | | 502 |
| Initials | JZL | AHS | | AHS | | AHS | | JZL | | RZS | | RZS | | KYL |

| Concentration 100 | Days | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 26.0 | 26.0 | 25.5 | 26.0 | 24.5 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 |
| DO (mg/L) | 6.5 | 4.6 | 7.4 | 5.0 | 7.9 | 5.5 | 7.5 | 4.7 | 7.3 | 4.2 | 7.0 | 4.5 | 4.7 | 4.6 |
| pH | 7.3 | 7.4 | 7.8 | 7.8 | 7.6 | 7.6 | 7.5 | 7.7 | 7.6 | 7.6 | 7.7 | 7.7 | 7.5 | 7.8 |
| Cond. (µS/cm) | 2410 | 2400 | | 2280 | | 2350 | | 2380 | | 2420 | | 2270 | | 2180 |
| Initials | JZL | AHS | | AHS | | AHS | | JZL | | RZS | | RZS | | KYL |

Thermometer: CER #4 DO meter/probe: 1 / 1 pH meter/probe: 1 / 1 Conductivity meter/probe: 1 / 1

| | Control | 100% | | |
|---|---|---|---|---|
| Hardness* | 100 | 1040 | | |
| Alkalinity* | 92 | 190 | | |

* mg/L as CaCO3

**Analysts:** JZL, AHS, RZS, KYL, GJU, PYK
**Reviewed by:** EMM
**Date reviewed:** Sept 28/23

**Sample Description:** Dark brown, turbid, organic smell w/ native organisms and particulates.

**Comments:** Broodboard Used: BB072023 # 2-7 ; BB072723 # 1, 2, 4, 5, 19

# Chronic Freshwater Toxicity Test
## *C. dubia* Reproduction Data

**Client:** Millenium EMS Solutions Ltd.
**Sample ID:** SW23-05TOX
**Work Order:** 231313

**Start Date & Time:** Aug 1/23 @ 1400h
**Stop Date & Time:** Aug 8/23 @ 1430h
**Set up by:** BML

%(v/v)

| Days | Concentration: Control | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | / | / | 3 | / | / | / | / | / | / | / | GDM |
| 5 | 2 | 4 | / | 2 | 5 | 3 | 2 | 5 | 2 | 3 | RZS |
| 6 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 9 | 6 | 6 | PKM |
| 7 | 11 | 9 | 10 | 11 | 9 | 10 | 12 | 11 | 10 | 9 | BML |
| 8 | | | | | | | | | | | |
| Total | 19 | 23 | 21 | 21 | 22 | 21 | 21 | 25 | 18 | 18 | AHS |

| Days | Concentration: 1.56 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 5 | 4 | 6 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | GDM |
| 5 | 10 | 5 | X | 11 | 9 | 7 | 9 | 8 | 8 | 8 | RZS |
| 6 | 10 | 11 | \| | 8 | 8 | 7 | 10 | 4 | 6 | 9 | PKM |
| 7 | 7 | 9 | \| | 5 | 2 | 8 | 9 | / | 6 | 5 | BML |
| 8 | | | ↓ | | | | | | | | |
| Total | 25 | 20 | 6× | 23 | 20 | 18 | 23 | 16 | 17 | 20 | AHS |

| Days | Concentration: 3.12 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 4 | 5 | 4 | 4 | 5 | 3 | 3 | 5 | 3 | 5 | GDM |
| 5 | 10 | 9 | 3 | 9 | 9 | 6 | 10 | 9 | / | 9 | RZS |
| 6 | 11 | 2 | 7 | 8 | 11 | 11 | 9 | 11 | 9 | 11 | PKM |
| 7 | 8 | 9 | 5 | 7 | 8 | 9 | 6 | 8 | 6 | 9 | BML |
| 8 | | | | | | | | | | | |
| Total | 25 | 16 | 9 | 21 | 25 | 20 | 22 | 25 | 18 | 25 | AHS |

| Days | Concentration: 6.25 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 4 | 4 | 4 | 3 | / | 2 | 3 | 2 | 3 | / | GDM |
| 5 | 6 | 7 | / | / | 7 | 3 | 8 | 7 | 7 | / | RZS |
| 6 | 11 | 9 | 8 | 10 | 7 | 10 | 9 | 12 | 10 | 8 | PKM |
| 7 | 6 | 4 | 9 | 8 | 4× | 6 | 4 | 11 | 8 | 9 | BML |
| 8 | | | | | ↓ | | | | | | |
| Total | 21 | 20 | 21 | 21 | 18× | 15 | 20 | 21 | 26 | 17 | AHS |

| Days | Concentration: 12.5 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 4 | 4 | 4 | 3 | 6 | 3 | 2 | × | 3× | 4 | GDM |
| 5 | 9 | 11 | 4 | 10 | 10 | / | / | \| | \| | 7 | RZS |
| 6 | 6 | 5 | 4 | 12 | 3 | 14 | 9 | \| | \| | 9 | PKM |
| 7 | 5 | 6 | 9 | 10 | 4 | #7 | 4 | ↓ | ↓ | 6 | BML |
| 8 | | | | | | | | | | | |
| Total | 19 | 20 | 12 | 25 | 19 | 24 | 15 | 0× | 3× | 20 | AHS |

| Days | Concentration: 25 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 3 | 4 | 5 | 4 | 3 | 6 | 2 | 4 | / | 4 | GDM |
| 5 | 2 | / | 5 | / | / | 4 | / | 3 | / | 5 | RZS |
| 6 | 7 | 11 | 9 | 4 | 6 | 4 | 8 | 4 | / | 11 | PKM |
| 7 | 6 | 10 | 10 | 8 | 9 | 4 | 7 | 6 | 6 | 4 | BML |
| 8 | | | | | | | | | | | |
| Total | 12 | 25 | 19 | 16 | 18 | 14 | 17 | 11 | 6 | 20 | AHS |

| Days | Concentration: 50 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 3 | 5 | 2 | / | / | / | 4 | 3 | 4 | 4 | GDM |
| 5 | / | 2 | 5 | / | / | X | / | / | / | 2 | RZS |
| 6 | 9 | 10 | / | 7 | 11 | \| | 12 | 8 | 8 | 10 | RZS |
| 7 | 6 | 7 | 9 | 8 | 4 | \| | 8 | 4 | 6 | 6 | BML |
| 8 | | | | | | ↓ | | | | | |
| Total | 17 | 17 | 16 | 10 | 15 | 0× | 24 | 15 | 18 | 16 | AHS |

| Days | Concentration: 100 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 4 | 5 | 6 | 4 | / | 4 | 4 | 4 | 4 | / | GDM |
| 5 | 4 | 7 | 9 | 3 | / | / | 3 | 5 | 3 | / | RZS |
| 6 | 11 | 9 | 6 | #10 | 2 | 11 | 9 | 10 | 8 | / | RZS |
| 7 | 8 | 7 | 8 | 4 | 6 | 4 | 7 | 6 | 4 | / | BML |
| 8 | | | | | | | | | | | |
| Total | 19 | 21 | 21 | 17 | 8 | 19 | 16 | 19 | 14 | 0 | AHS |

| Days | Concentration: | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| Total | | | | | | | | | | | |

Notes: X = mortality.

**Comments:** 1. Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

2. Ephippia present in Controls (Y), (N)?

**Reviewed by:** EMM

**Date reviewed:** Sept 22/23

# CETIS Summary Report



**Ceriodaphnia 7-d Survival and Reproduction Test** — **Nautilus Environmental**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Batch ID:** | 05-0954-2319 | **Test Type:** | Reproduction-Survival (7d) | **Analyst:** | Stephanie Hans | | |
| **Start Date:** | 01 Aug-23 14:00 | **Protocol:** | ~~EPA/821/R-02-013 (2002)~~ SMH EPS1/RM/21 | **Diluent:** | 20% Perrier Water | | |
| **Ending Date:** | 08 Aug-23 14:30 | **Species:** | Ceriodaphnia dubia | **Brine:** | | | |
| **Test Length:** | 7d 0h | **Taxon:** | Branchiopoda | **Source:** | In-House Culture | **Age:** | <24 h |

| | | | | | |
|---|---|---|---|---|---|
| **Sample ID:** | 05-5034-7669 | **Code:** | 20CDA395 | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 51h (0.3 °C) | **Client:** | Millennium EMS Solutions | | |

## Point Estimate Summary

| Analysis ID | Endpoint | Point Estimate Method | ✓ | Level | % | 95% LCL | 95% UCL | TU | S |
|---|---|---|---|---|---|---|---|---|---|
| 10-9405-5295 | 7d Survival Rate | Linear Interpolation (ICPIN) | | EC15 | >100 | --- | --- | <1 | 1 |
| | | | | EC20 | >100 | --- | --- | <1 | |
| | | | | EC25 | >100 | --- | --- | <1 | |
| | | | ✓ | EC40 | >100 | --- | --- | <1 | |
| | | | ✓ | EC50 | >100 | --- | --- | <1 | |
| 04-2315-9167 | Reproduction | Linear Interpolation (ICPIN) | ✓ | IC15 | 8.908 | 1.435 | 27.5 | 11.2 | 1 |
| | | | ✓ | IC20 | 10.63 | 7.877 | --- | 9.4 | |
| | | | ✓ | IC25 | 27.1 | 9.812 | --- | 3.7 | |
| | | | ✓ | IC40 | >100 | --- | --- | <1 | |
| | | | ✓ | IC50 | >100 | --- | --- | <1 | |

## Test Acceptability

| Analysis ID | Endpoint | Attribute | Test Stat | TAC Limits Lower | TAC Limits Upper | Overlap | Decision |
|---|---|---|---|---|---|---|---|
| 10-9405-5295 | 7d Survival Rate | Control Resp | 1 | 0.8 | << | Yes | Passes Criteria |
| 04-2315-9167 | Reproduction | Control Resp | 20.9 | 15 | << | Yes | Passes Criteria |

## 7d Survival Rate Summary

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | 0.00% |
| 1.56 | | 10 | 0.9000 | 0.6738 | 1.1260 | 0.0000 | 1.0000 | 0.1000 | 0.3162 | 35.14% | 10.00% |
| 3.12 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | 0.00% |
| 6.25 | | 10 | 0.9000 | 0.6738 | 1.1260 | 0.0000 | 1.0000 | 0.1000 | 0.3162 | 35.14% | 10.00% |
| 12.5 | | 10 | 0.8000 | 0.4984 | 1.1020 | 0.0000 | 1.0000 | 0.1333 | 0.4216 | 52.70% | 20.00% |
| 25 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | 0.00% |
| 50 | | 10 | 0.9000 | 0.6738 | 1.1260 | 0.0000 | 1.0000 | 0.1000 | 0.3162 | 35.14% | 10.00% |
| 100 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | 0.00% |

## Reproduction Summary

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 10 | 20.9 | 19.34 | 22.46 | 18 | 25 | 0.6904 | 2.183 | 10.45% | 0.00% |
| 1.56 | | 10 | 18.8 | 15 | 22.6 | 6 | 25 | 1.679 | 5.308 | 28.24% | 10.05% |
| 3.12 | | 10 | 20.6 | 16.89 | 24.31 | 9 | 25 | 1.641 | 5.19 | 25.19% | 1.44% |
| 6.25 | | 10 | 20 | 17.89 | 22.11 | 15 | 26 | 0.9309 | 2.944 | 14.72% | 4.31% |
| 12.5 | | 10 | 15.7 | 9.686 | 21.71 | 0 | 25 | 2.659 | 8.407 | 53.55% | 24.88% |
| 25 | | 10 | 15.8 | 11.99 | 19.61 | 6 | 25 | 1.685 | 5.329 | 33.73% | 24.40% |
| 50 | | 10 | 14.8 | 10.34 | 19.26 | 0 | 24 | 1.971 | 6.233 | 42.11% | 29.19% |
| 100 | | 10 | 15.4 | 10.64 | 20.16 | 0 | 21 | 2.104 | 6.653 | 43.20% | 26.32% |

**Ceriodaphnia 7-d Survival and Reproduction Test** — **Nautilus Environmental**

## 7d Survival Rate Detail

MD5: 07B20B6829247647642F83A83C7D9AFD

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 1.56 | | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 3.12 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 6.25 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 12.5 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 1.0000 |
| 25 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 50 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 100 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

## Reproduction Detail

MD5: E66F5D895F28AE7ACDA3A6F201A068F8

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 19 | 23 | 21 | 21 | 22 | 21 | 21 | 25 | 18 | 18 |
| 1.56 | | 25 | 20 | 6 | 23 | 20 | 18 | 23 | 16 | 17 | 20 |
| 3.12 | | 25 | 16 | 9 | 21 | 25 | 20 | 22 | 25 | 18 | 25 |
| 6.25 | | 21 | 20 | 21 | 21 | 18 | 15 | 20 | 21 | 26 | 17 |
| 12.5 | | 19 | 20 | 12 | 25 | 19 | 24 | 15 | 0 | 3 | 20 |
| 25 | | 12 | 25 | 19 | 16 | 18 | 14 | 17 | 11 | 6 | 20 |
| 50 | | 17 | 17 | 16 | 10 | 15 | 0 | 24 | 15 | 18 | 16 |
| 100 | | 19 | 21 | 21 | 17 | 8 | 19 | 16 | 19 | 14 | 0 |

## 7d Survival Rate Binomials

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 1.56 | | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 3.12 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 6.25 | | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 12.5 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 0/1 | 1/1 |
| 25 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 50 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 100 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |

# CETIS Analytical Report



**Ceriodaphnia 7-d Survival and Reproduction Test** — Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 10-9405-5295 | **Endpoint:** | 7d Survival Rate | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 20 Sep-23 15:10 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 20 Sep-23 15:07 | **MD5 Hash:** | 07B20B6829247647642F83A83C7D9AFD | **Editor ID:** | 002-888-235-1 |
| **Batch ID:** | 05-0954-2319 | **Test Type:** | Reproduction-Survival (7d) | **Analyst:** | Stephanie Hans |
| **Start Date:** | 01 Aug-23 14:00 | **Protocol:** | ~~EPA/821/R-02-013 (2002)~~ SMH EPS1/RM/21 | **Diluent:** | 20% Perrier Water |
| **Ending Date:** | 08 Aug-23 14:30 | **Species:** | Ceriodaphnia dubia | **Brine:** | |
| **Test Length:** | 7d 0h | **Taxon:** | Branchiopoda | **Source:** | In-House Culture Age: <24 h |
| **Sample ID:** | 05-5034-7669 | **Code:** | 20CDA395 | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 51h (0.3 °C) | **Client:** | Millennium EMS Solutions | | |

**Linear Interpolation Options**

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 1632267 | 200 | Yes | Two-Point Interpolation |

**Test Acceptability Criteria**

| | | TAC Limits | | | |
|---|---|---|---|---|---|
| **Attribute** | **Test Stat** | **Lower** | **Upper** | **Overlap** | **Decision** |
| Control Resp | 1 | 0.8 | << | Yes | Passes Criteria |

**Point Estimates**

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| EC15 | >100 | --- | --- | <1 | --- | --- |
| EC20 | >100 | --- | --- | <1 | --- | --- |
| EC25 | >100 | --- | --- | <1 | --- | --- |
| EC40 | >100 | --- | --- | <1 | --- | --- |
| EC50 | >100 | --- | --- | <1 | --- | --- |

**7d Survival Rate Summary**

| | | | Calculated Variate(A/B) | | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Conc-%** | **Code** | **Count** | **Mean** | **Median** | **Min** | **Max** | **CV%** | **%Effect** | **ΣA/ΣB** | **Mean** | **%Effect** |
| 0 | N | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | 0.00% | 10/10 | 1.0000 | 0.00% |
| 1.56 | | 10 | 0.9000 | 1.0000 | 0.0000 | 1.0000 | 35.14% | 10.00% | 9/10 | 0.9500 | 5.00% |
| 3.12 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | 0.00% | 10/10 | 0.9500 | 5.00% |
| 6.25 | | 10 | 0.9000 | 1.0000 | 0.0000 | 1.0000 | 35.14% | 10.00% | 9/10 | 0.9200 | 8.00% |
| 12.5 | | 10 | 0.8000 | 1.0000 | 0.0000 | 1.0000 | 52.70% | 20.00% | 8/10 | 0.9200 | 8.00% |
| 25 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | 0.00% | 10/10 | 0.9200 | 8.00% |
| 50 | | 10 | 0.9000 | 1.0000 | 0.0000 | 1.0000 | 35.14% | 10.00% | 9/10 | 0.9200 | 8.00% |
| 100 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | 0.00% | 10/10 | 0.9200 | 8.00% |

**7d Survival Rate Detail**

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 1.56 | | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 3.12 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 6.25 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 12.5 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 1.0000 |
| 25 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 50 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 100 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

## Ceriodaphnia 7-d Survival and Reproduction Test

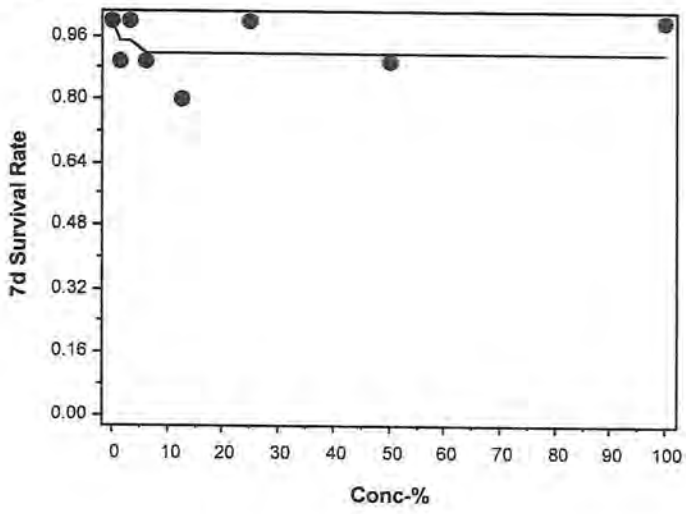
Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 10-9405-5295 | **Endpoint:** | 7d Survival Rate | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 20 Sep-23 15:10 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 20 Sep-23 15:07 | **MD5 Hash:** | 07B20B6829247647642F83A83C7D9AFD | **Editor ID:** | 002-888-235-1 |

### 7d Survival Rate Binomials

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 1.56 | | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 3.12 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 6.25 | | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 12.5 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 0/1 | 1/1 |
| 25 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 50 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 100 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |

### Graphics



## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 04-2315-9167 | **Endpoint:** | Reproduction | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 20 Sep-23 15:11 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 20 Sep-23 15:07 | **MD5 Hash:** | E66F5D895F28AE7ACDA3A6F201A068F8 | **Editor ID:** | 002-888-235-1 |
| **Batch ID:** | 05-0954-2319 | **Test Type:** | Reproduction-Survival (7d) SMH | **Analyst:** | Stephanie Hans |
| **Start Date:** | 01 Aug-23 14:00 | **Protocol:** | ~~EPA/821/R-02-013 (2002)~~ EPS1/RM/21 | **Diluent:** | 20% Perrier Water |
| **Ending Date:** | 08 Aug-23 14:30 | **Species:** | Ceriodaphnia dubia | **Brine:** | |
| **Test Length:** | 7d 0h | **Taxon:** | Branchiopoda | **Source:** | In-House Culture **Age:** <24 h |
| **Sample ID:** | 05-5034-7669 | **Code:** | 20CDA395 | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 51h (0.3 °C) | **Client:** | Millennium EMS Solutions | | |

### Linear Interpolation Options

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 890486 | 200 | Yes | Two-Point Interpolation |

### Test Acceptability Criteria

| | | TAC Limits | | | |
|---|---|---|---|---|---|
| **Attribute** | **Test Stat** | **Lower** | **Upper** | **Overlap** | **Decision** |
| Control Resp | 20.9 | 15 | << | Yes | Passes Criteria |

### Point Estimates

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | 8.908 | 1.435 | 27.5 | 11.2 | 3.6 | 69.7 |
| IC20 | 10.63 | 7.877 | --- | 9.4 | --- | 12.7 |
| IC25 | 27.1 | 9.812 | --- | 3.7 | --- | 10.2 |
| IC40 | >100 | --- | --- | <1 | --- | --- |
| IC50 | >100 | --- | --- | <1 | --- | --- |

### Reproduction Summary

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Conc-%** | **Code** | **Count** | **Mean** | **Median** | **Min** | **Max** | **CV%** | **%Effect** | **Mean** | **%Effect** |
| 0 | N | 10 | 20.9 | 21 | 18 | 25 | 10.45% | 0.00% | 20.9 | 0.00% |
| 1.56 | | 10 | 18.8 | 20 | 6 | 25 | 28.24% | 10.05% | 19.8 | 5.26% |
| 3.12 | | 10 | 20.6 | 21.5 | 9 | 25 | 25.19% | 1.44% | 19.8 | 5.26% |
| 6.25 | | 10 | 20 | 20.67 | 15 | 26 | 14.72% | 4.31% | 19.8 | 5.26% |
| 12.5 | | 10 | 15.7 | 19 | 0 | 25 | 53.55% | 24.88% | 15.75 | 24.64% |
| 25 | | 10 | 15.8 | 16.5 | 6 | 25 | 33.73% | 24.40% | 15.75 | 24.64% |
| 50 | | 10 | 14.8 | 16 | 0 | 24 | 42.11% | 29.19% | 15.1 | 27.75% |
| 100 | | 10 | 15.4 | 18.5 | 0 | 21 | 43.20% | 26.32% | 15.1 | 27.75% |

### Reproduction Detail

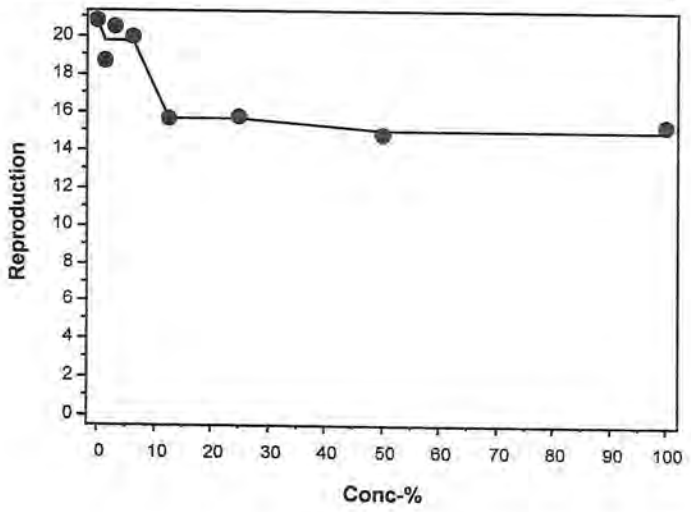
| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 19 | 23 | 21 | 21 | 22 | 21 | 21 | 25 | 18 | 18 |
| 1.56 | | 25 | 20 | 6 | 23 | 20 | 18 | 23 | 16 | 17 | 20 |
| 3.12 | | 25 | 16 | 9 | 21 | 25 | 20 | 22 | 25 | 18 | 25 |
| 6.25 | | 21 | 20 | 21 | 21 | 18 | 15 | 20 | 21 | 26 | 17 |
| 12.5 | | 19 | 20 | 12 | 25 | 19 | 24 | 15 | 0 | 3 | 20 |
| 25 | | 12 | 25 | 19 | 16 | 18 | 14 | 17 | 11 | 6 | 20 |
| 50 | | 17 | 17 | 16 | 10 | 15 | 0 | 24 | 15 | 18 | 16 |
| 100 | | 19 | 21 | 21 | 17 | 8 | 19 | 16 | 19 | 14 | 0 |

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 04-2315-9167 | **Endpoint:** | Reproduction | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 20 Sep-23 15:11 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 20 Sep-23 15:07 | **MD5 Hash:** | E66F5D895F28AE7ACDA3A6F201A068F8 | **Editor ID:** | 002-888-235-1 |

**Graphics**



# APPENDIX B – *Pimephales promelas* Toxicity Test Data

# Fathead Minnow Test Summary Sheet

(7-d *Pimephales promelas* Survival and Growth Test)

Client: Millenium EMS Solutions Ltd. (MEMS)
Work Order No.: 231314

Start Date/Time: August 2, 2023 / 18:00
Test Species: P. promelas

**Test Validity Criteria:**
The test is invalid if :

1) for the control solutions, the combined and cumulative incidence of any mortalities, or fish showing loss of equilibrium or other signs of atypical swimming behavior, is >20%

2) the average dry weight of the surviving control fish does not attain 250 ug when the fish are dried and weighed.

**WQ Ranges:**
T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4; pH = 6.5 to 8.5

**Sample Information:**

Sample ID: SW23-OSTOX
Sample Date: July 30 2023
Date Received: July 31, 2023
Sample Volume: 4x10L

**Dilution Water** (initial water quality):

Type: Moderately Hard Water
Temperature (°C): 25.5
pH: 7.9
Dissolved Oxygen (mg/L): 7.8
Hardness (mg/L $CaCO_3$): 96
Alkalinity (mg/L $CaCO_3$): 76

**Test Organism Information:**

Batch No.: 080123
Source: Aquatic Biosystems, CO
Age: <24h
Receipt temperature: 23.5
Acclimation rate: <3.0°C/day

Mortality prior to test initiation: 3.9%
Swim bladder inflated at test initiation? (Y/N): Y
Breeding stock mortality during the week prior to test initiation (%): <1%
Breeding stock mortality on weekly basis: <1%
Incidence of disease: None

**NaCl Reference Toxicant Results:**

Reference Toxicant ID: PP218
NaCl Lot #: 22A1562L4
Date Initiated: August 2, 2023
7-d EC50 (95% CL): 3.9 (3.4 – 4.5) g/L NaCl
7-d IC50 (95% CL): 3.8 (3.4 – 4.2) g/L NaCl

**Survival:**
Reference Toxicant Mean and Historical Range: 4.9 (3.6 – 6.5) NaCl (g/L) 15 CV (%)

**Biomass:**
Reference Toxicant Mean and Historical Range: 4.1 (3.2 – 5.2) NaCl (g/L) 12.2 CV (%)

**Test Results:**

| | Survival | Biomass |
|---|---|---|
| LC25 % (v/v) (95% CL) | >100 | |
| LC50 % (v/v) (95% CL) | >100 | |
| IC25 % (v/v) (95% CL) | | >100 |
| IC50 % (v/v) (95% CL) | | >100 |

Reviewed by: ML
Date reviewed: 08/27/23

# 7-d Chronic Freshwater Toxicity Test
## Initial and Final Water Quality Measurements

Client:
Sample ID: Millenium SW23-OSTOX
Work Order #: 231314

Start Date & Time: Aug 2, 2023 / ~~11:00~~ 11:00
Stop Date & Time: Aug 9, 2023 / ~~13:00~~ 13:00
CER #: 11
Test Species: *Pimephales promelas*

| % (v/v) Concentration (control) | Days | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 25.5 | 25.0 | 26.0 | 25.0 | 25.5 | 25.0 | 25.0 | 25.0 | 25.0 | 24.5 | 24.0 | 24.5 | 24.0 | 24.0 |
| DO (mg/L) | 7.8 | 7.3 | 8.0 | 5.7 | 8.1 | 4.9 | 8.0 | 3.9 | 8.1 | 5.0 | 8.1 | 5.2 | 8.1 | 5.1 |
| pH | 7.9 | 7.7 | 8.2 | 7.5 | 8.0 | 7.4 | 8.0 | 7.5 | 8.0 | 7.5 | ~~8.0~~ 8.0 | 7.3 | 8.0 | 7.4 |
| Cond. (µS/cm) | 358 | 355 | | 355 | | 357 | | 356 | | 355 | | 355 | | 385 |
| Initials | PYH | LSR/PYH | | PYH | | IMC | | T.C./IMC | | PYH | | LSR/PYH | | PYH |

| Concentration 1.56 | Days | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 25.5 | 25.0 | 25.5 | 25.0 | 25.5 | 25.0 | 25.0 | 25.0 | 25.0 | 24.5 | 24.5 | 24.5 | 24.0 | 24.0 |
| DO (mg/L) | 8.0 | 7.4 | 8.0 | 5.4 | 7.9 | 5.0 | 7.8 | 3.5 | 7.9 | 5.0 | 8.1 | 5.4 | 8.2 | 5.2 |
| pH | ~~8.01~~ 8.0 | 7.9 | 8.0 | 7.4 | 8.0 | 7.5 | 7.9 | 7.5 | 8.0 | 7.7 | 8.0 | 7.4 | 7.9 | 7.4 |
| Cond. (µS/cm) | 394 | 393 | | 390 | | ~~2389~~ 389 | | 396 | | 392 | | 397 | | 416 |
| Initials | PYH | LSR/ | | PYH | | IMC | | T.C/IMC | | PYH | | LSR/PYH | | PYH |

| Concentration 12.5 | Days | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 25.5 | 25.0 | 25.5 | 25.0 | 25.5 | 25.0 | 25.0 | 25.0 | 25.0 | 24.5 | 24.5 | 24.5 | 24.0 | 24.0 |
| DO (mg/L) | 8.0 | 7.3 | 8.0 | 5.7 | 8.0 | 4.7 | 8.0 | 4.4 | 8.1 | 5.4 | 8.1 | 5.9 | 8.2 | 5.5 |
| pH | 8.0 | 7.9 | 8.0 | 7.5 | 8.0 | 7.3 | 7.8 | 7.3 | 8.0 | 7.5 | 7.9 | 7.5 | 7.9 | 7.4 |
| Cond. (µS/cm) | 637 | 639 | | 634 | | 626 | | 643 | | 646 | | 663 | | 679 |
| Initials | PYH | LSR/ | | PYH | | IMC | | TC/IMC | | PYH | | LSR/PYH | | PYH |

| Concentration 100 | Days | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 24.5 | 24.5 | 24.5 | 24.5 | 24.0 |
| DO (mg/L) | 6.8 | 6.5 | 7.6 | 5.0 | 8.0 | 3.6 | 7.9 | 3.4 | 8.1 | 4.8 | 8.2 | 5.2 | 8.2 | 3.8 |
| pH | 7.4 | 8.0 | 7.3 | 7.9 | 7.9 | 7.7 | 7.8 | 7.6 | 7.9 | ~~7.7~~ 7.7 | 7.5 | 7.8 | 7.1 | 7.6 |
| Cond. (µS/cm) | 2260 | 2290 | | 2330 | | 2330 | | 2310 | | 2370 | | 2400 | | 2400 |
| Initials | PYH | LSR/PYH | | PYH | | IMC | | TC/IMC | | PYH | | LSR/PYH | | PYH |

Thermometer: CER#11 DO meter/probe: 4 / 4 pH meter/probe: 4 / 4 Conductivity meter/probe: 4 / 4

| | Control | SW23-OSTOX | (100% v/v) | |
|---|---|---|---|---|
| Hardness* | 96 | 1040 | | |
| Alkalinity* | 76 | 190 | | |

* mg/L as CaCO3

Analysts: PYH, LSR, IMC, TC
Reviewed by: KYL
Date reviewed: MG Oct 26/23

Sample Description: Dark brown, turbid, organic odour, liquid w/ native organisms & particulates

Comments: ① 8.1 (pH)

# 7-d Fathead Minnow Toxicity Test
## Daily Survival

**Client:** Millerdale
**Sample ID:** SW23-0510x
**Work Order #:** ~~23~~ 231314

**Start Date & Time:** Aug 2, 2023 / 11:00h
**Stop Date & Time:** Aug 9, 2023 / 13:00
**Test Species:** *Pimephales promelas*

| Concentration % (v/v) | Rep | Day of Test - Percent Survival | | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Control | A | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| | B | ↓ | ↓ | 100 | 100 | 100 | 100 | ↓ | |
| | C | ↓ | ↓ | 90 | 90 | 90 | 90 | 90 | |
| 1.56 | A | ↓ | ↓ | 100 | 100 | 100 | 100 | 100 | |
| | B | ↓ | ↓ | ↓ | 100 | 100 | 100 | ↓ | |
| | C | ↓ | ↓ | ↓ | 90 | 90 | 90 | 90 | |
| 3.12 | A | ↓ | ↓ | 90 | 90 | 90 | ↓ | ↓ | |
| | B | ↓ | ↓ | 100 | 100 | 90 | ↓ | ↓ | |
| | C | ↓ | ↓ | 100 | 100 | 100 | 100 | 100 | |
| 6.25 | A | ↓ | ↓ | 90 | 90 | 90 | 90 | 90 | |
| | B | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 80 | |
| | C | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 90 | |
| 12.5 | A | ↓ | ↓ | 100 | 100 | 100 | 100 | 100 | |
| | B | ↓ | ↓ | 80 | 80 | 80 | 80 | 80 | |
| | C | ↓ | ↓ | 90 | 90 | 90 | 80 | 80 | |
| 25 | A | ↓ | ↓ | 100 | 100 | 100 | 100 | 100 | |
| | B | ↓ | ↓ | 100 | 90 | 90 | 90 | 90 | |
| | C | ↓ | ↓ | 90 | 90 | 90 | ~~100~~ 90 | 90 | |
| 50 | A | ↓ | ↓ | 100 | 100 | 100 | AE 100 | 100 | |
| | B | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| | C | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| 100 | A | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| | B | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| | C | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| Tech Initials | | PM | PM | TMC | T.C/KM | PM | PM | PM | |

**Legend:**
1- Fish dying
2- Fish showing loss of equilibrium
3- Fish showing atypical swimming

**Test solution depth:** ~6.5 cm
**Comments:** Remaining fish appear normal at termination

**Reviewed by:** MG
**Date reviewed:** Oct 26/23

# Fathead Minnow Toxicity Test Data Sheet

## Dry Weight Data

Client: Millennium

Sample ID: SW23-0590

Work Order No.: 231314

Start Date & Time: Aug 2, 2023 @ 1100h

Termination Date & Time: Aug 9, 2023 @ 1310h

Balance ID: Bal - 6

Oven ID: 2

C Blue

| Concentration %(v/v) | Rep | Pan No. | No. alive | Initials | Pan weight (mg) | Pan + organism (mg) | No. weighed | Initials |
|---|---|---|---|---|---|---|---|---|
| Control | A | 1 | 10 | AJD | 980.84 | 986.97 | 10 | AJD / AJD |
| | B | 2 | ↓ | \| | 993.09 | 999.01 | ↓ | \| |
| | C | 3 | 9 | \| | 1000.09 | 1005.69 | 9 | \| |
| 1.56 | A | 4 | 10 | \| | 993.59 | 998.96 | 10 | \| |
| | B | 5 | 10 | \| | 977.99 | 984.10 | ↓ | \| |
| | C | 6 | 9 | \| | 985.77 | 991.37 | 9 | \| |
| 3.12 | A | 7 | \| | \| | 989.06 | 995.79 | \| | \| |
| | B | 8 | ↓ | \| | 984.36 | 990.70 | ↓ | \| |
| | C | 9 | 10 | \| | 987.24 | 994.50 | 10 | \| |
| 6.25 | A | 10 | 9 | \| | 1026.82 | 1032.49 | 8① | \| |
| | B | 11 | 8 | \| | 999.87 | 1005.75 | 8 | \| |
| | C | 12 | 9 | \| | 1004.67 | 1010.87 | 9 | \| |
| 12.5 | A | 13 | 10 | \| | 1031.08 | 1036.81 | 10 | \| |
| | B | 14 | 8 | \| | 969.99 | 975.35 | 8 | \| |
| | C | 15 | 8 | \| | 985.81 | 991.65 | 8 | \| |
| ~~50~~ 25 | A | 16 | 10 | \| | 987.09 | 992.80 | 10 | \| |
| | B | 17 | 9 | \| | 974.67 | 980.41 | 9 | \| |
| | C | 18 | 9 | \| | 989.27 | 995.17 | ↓ | \| |
| 50 | A | 19 | 10 | \| | 995.29 | 1001.07 | 10 | \| |
| | B | 20 | \| | \| | 992.16 | 998.13 | \| | \| |
| | C | 21 | \| | \| | 1005.14 | 1010.85 | \| | \| |
| 100 | A | 22 | \| | \| | 1008.43 | 1015.73 | \| | \| |
| | B | ~~23~~ 8 | \| | \| | 1009.01 | 1015.81 | \| | \| |
| | C | 24 | ↓ | ↓ | 1008.39 | 1014.80 | ↓ | ↓ |

Date/time pan placed in oven: Aug 1/23 @ 0900h

Date/time pan + organisms placed in oven: Aug 9/23 @ 1330h

Date/time pan removed from oven: Aug 2/23 @ 0930h

Date/time pan + organisms removed from oven: Aug 10/23 @ 1330h

Comments: (1) lost in transfer

10% re-weigh: Pan #8: 998.92mg Pan #21: 1010.36mg

Reviewed by: MG

Date Reviewed: Oct 26/23

# CETIS Summary Report

Report Date: 27 Oct-23 14:25 (p 1 of 1)
Test Code/ID: 231314 / 15-7078-4980

**Fathead Minnow 7-d Larval Survival and Growth Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| Batch ID: | 08-5572-9747 | Test Type: | Growth-Survival (7d) | Analyst: | Pierre Koelich |
| Start Date: | 02 Aug-23 11:00 | Protocol: | EC/EPS 1/RM/22 | Diluent: | Mod-Hard Synthetic Water |
| Ending Date: | 09 Aug-23 13:00 | Species: | Pimephales promelas | Brine: | |
| Test Length: | 7d 2h | Taxon: | Actinopterygii | Source: | Aquatic Biosystems, CO Age: <24h |
| Sample ID: | 05-5034-7669 | Code: | 20CDA395 | Project: | |
| Sample Date: | 30 Jul-23 11:00 | Material: | Water Sample | Source: | Millennium EMS Solutions |
| Receipt Date: | 31 Jul-23 16:49 | CAS (PC): | | Station: | SW23-05TOX |
| Sample Age: | 72h (0.3 °C) | Client: | Millennium EMS Solutions | | |

**Point Estimate Summary**

| Analysis ID | Endpoint | Point Estimate Method | Level | % | 95% LCL | 95% UCL | TU | S |
|---|---|---|---|---|---|---|---|---|
| 01-7246-7026 | 7d Survival Rate | Linear Interpolation (ICPIN) | EC15 | >100 | --- | --- | <1 | 1 |
| | | | EC20 | >100 | --- | --- | <1 | |
| | | | EC25 | >100 | --- | --- | <1 | |
| | | | EC40 | >100 | --- | --- | <1 | |
| | | | EC50 | >100 | --- | --- | <1 | |

**7d Survival Rate Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | LC | 3 | 0.9667 | 0.8232 | 1.1100 | 0.9000 | 1.0000 | 0.0333 | 0.0577 | 5.97% | 0.00% |
| 1.56 | | 3 | 0.9667 | 0.8232 | 1.1100 | 0.9000 | 1.0000 | 0.0333 | 0.0577 | 5.97% | 0.00% |
| 3.12 | | 3 | 0.9333 | 0.7899 | 1.0770 | 0.9000 | 1.0000 | 0.0333 | 0.0577 | 6.19% | 3.45% |
| 6.25 | | 3 | 0.8667 | 0.7232 | 1.0100 | 0.8000 | 0.9000 | 0.0333 | 0.0577 | 6.66% | 10.34% |
| 12.5 | | 3 | 0.8667 | 0.5798 | 1.1540 | 0.8000 | 1.0000 | 0.0667 | 0.1155 | 13.32% | 10.34% |
| 25 | | 3 | 0.9333 | 0.7899 | 1.0770 | 0.9000 | 1.0000 | 0.0333 | 0.0577 | 6.19% | 3.45% |
| 50 | | 3 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | -3.45% |
| 100 | | 3 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | -3.45% |

**7d Survival Rate Detail**

MD5: 342CF60E98BB2F664600869E1BD26391

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 1.0000 | 1.0000 | 0.9000 |
| 1.56 | | 1.0000 | 1.0000 | 0.9000 |
| 3.12 | | 0.9000 | 0.9000 | 1.0000 |
| 6.25 | | 0.9000 | 0.8000 | 0.9000 |
| 12.5 | | 1.0000 | 0.8000 | 0.8000 |
| 25 | | 1.0000 | 0.9000 | 0.9000 |
| 50 | | 1.0000 | 1.0000 | 1.0000 |
| 100 | | 1.0000 | 1.0000 | 1.0000 |

**7d Survival Rate Binomials**

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 10/10 | 10/10 | 9/10 |
| 1.56 | | 10/10 | 10/10 | 9/10 |
| 3.12 | | 9/10 | 9/10 | 10/10 |
| 6.25 | | 9/10① | 8/10 | 9/10 |
| 12.5 | | 10/10 | 8/10 | 8/10 |
| 25 | | 10/10 | 9/10 | 9/10 |
| 50 | | 10/10 | 10/10 | 10/10 |
| 100 | | 10/10 | 10/10 | 10/10 |

① 1 lost in transfer ∴ 8

# CETIS Summary Report



**Fathead Minnow 7-d Larval Survival and Growth Test** — **Nautilus Environmental**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Batch ID:** | 08-5572-9747 | **Test Type:** | Growth-Survival (7d) | **Analyst:** | Pierre Koelich | | |
| **Start Date:** | 02 Aug-23 11:00 | **Protocol:** | EC/EPS 1/RM/22 | **Diluent:** | Mod-Hard Synthetic Water | | |
| **Ending Date:** | 09 Aug-23 13:00 | **Species:** | Pimephales promelas | **Brine:** | | | |
| **Test Length:** | 7d 2h | **Taxon:** | Actinopterygii | **Source:** | Aquatic Biosystems, CO | **Age:** | <24 h |
| **Sample ID:** | 05-5034-7669 | **Code:** | 20CDA395 | **Project:** | | | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions | | |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX | | |
| **Sample Age:** | 72h (0.3 °C) | **Client:** | Millennium EMS Solutions | | | | |

**Point Estimate Summary**

| Analysis ID | Endpoint | Point Estimate Method | ✓ | Level | % | 95% LCL | 95% UCL | TU | S |
|---|---|---|---|---|---|---|---|---|---|
| ✓ 06-1805-6512 | Mean Dry Biomass-mg | Linear Interpolation (ICPIN) | ✓ | IC15 | >100 | --- | --- | <1 | 1 |
| | | | ✓ | IC20 | >100 | --- | --- | <1 | |
| | | | ✓ | IC25 | >100 | --- | --- | <1 | |
| | | | ✓ | IC40 | >100 | --- | --- | <1 | |
| | | | ✓ | IC50 | >100 | --- | --- | <1 | |
| ✓ 20-7618-7278 | Mean Dry Weight-mg | Linear Interpolation (ICPIN) | ✓ | IC15 | >100 | --- | --- | <1 | 1 |
| | | | ✓ | IC20 | >100 | --- | --- | <1 | |
| | | | ✓ | IC25 | >100 | --- | --- | <1 | |
| | | | ✓ | IC40 | >100 | --- | --- | <1 | |
| | | | ✓ | IC50 | >100 | --- | --- | <1 | |

**Mean Dry Biomass-mg Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | LC | 3 | 0.5883 ✓ | 0.522 | 0.6546 | 0.56 | 0.613 | 0.01541 | 0.02669 | 4.54% | 0.00% |
| 1.56 | | 3 | 0.5693 | 0.4753 | 0.6634 | 0.537 | 0.611 | 0.02187 | 0.03787 | 6.65% | 3.23% |
| 3.12 | | 3 | 0.6777 | 0.563 | 0.7924 | 0.634 | 0.726 | 0.02666 | 0.04618 | 6.81% | -15.18% |
| 6.25 | | 3 | 0.6127 | 0.5582 | 0.6672 | 0.588 | 0.63 | 0.01267 | 0.02194 | 3.58% | -4.14% |
| 12.5 | | 3 | 0.5643 | 0.5019 | 0.6268 | 0.536 | 0.584 | 0.01452 | 0.02515 | 4.46% | 4.08% |
| 25 | | 3 | 0.5783 | 0.553 | 0.6037 | 0.571 | 0.59 | 0.005897 | 0.01021 | 1.77% | 1.70% |
| 50 | | 3 | 0.582 | 0.5486 | 0.6154 | 0.571 | 0.597 | 0.007769 | 0.01346 | 2.31% | 1.08% |
| 100 | | 3 | 0.6837 | 0.5728 | 0.7945 | 0.641 | 0.73 | 0.02576 | 0.04461 | 6.53% | -16.20% |

**Mean Dry Weight-mg Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | LC | 3 | 0.6091 ✓ | 0.5706 | 0.6475 | 0.592 | 0.6222 | 0.008942 | 0.01549 | 2.54% | 0.00% |
| 1.56 | | 3 | 0.5901 | 0.475 | 0.7051 | 0.537 | 0.6222 | 0.02673 | 0.0463 | 7.85% | 3.12% |
| 3.12 | | 3 | 0.7261 | 0.6723 | 0.7799 | 0.7044 | 0.7478 | 0.01251 | 0.02166 | 2.98% | -19.21% |
| 6.25 | | 3 | 0.7109 | 0.6534 | 0.7683 | 0.6889 | 0.735 | 0.01335 | 0.02313 | 3.25% | -16.72% |
| 12.5 | | 3 | 0.6577 | 0.4609 | 0.8545 | 0.573 | 0.73 | 0.04574 | 0.07922 | 12.05% | -7.98% |
| 25 | | 3 | 0.6214 | 0.5107 | 0.7322 | 0.571 | 0.6556 | 0.02574 | 0.04458 | 7.17% | -2.03% |
| 50 | | 3 | 0.582 | 0.5486 | 0.6154 | 0.571 | 0.597 | 0.007769 | 0.01346 | 2.31% | 4.44% |
| 100 | | 3 | 0.6837 | 0.5728 | 0.7945 | 0.641 | 0.73 | 0.02576 | 0.04461 | 6.53% | -12.25% |

## Mean Dry Biomass-mg Detail

MD5: 65721FF2F768C737EF04884BFF159C61

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 0.613 | 0.592 | 0.56 |
| 1.56 | | 0.537 | 0.611 | 0.56 |
| 3.12 | | 0.673 | 0.634 | 0.726 |
| 6.25 | | 0.63 | 0.588 | 0.62 |
| 12.5 | | 0.573 | 0.536 | 0.584 |
| 25 | | 0.571 | 0.574 | 0.59 |
| 50 | | 0.578 | 0.597 | 0.571 |
| 100 | | 0.73 | 0.68 | 0.641 |

## Mean Dry Weight-mg Detail

MD5: C3190A524DD8067C236846928976A585

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 0.613 | 0.592 | 0.6222 |
| 1.56 | | 0.537 | 0.611 | 0.6222 |
| 3.12 | | 0.7478 | 0.7044 | 0.726 |
| 6.25 | | 0.7088 | 0.735 | 0.6889 |
| 12.5 | | 0.573 | 0.67 | 0.73 |
| 25 | | 0.571 | 0.6378 | 0.6556 |
| 50 | | 0.578 | 0.597 | 0.571 |
| 100 | | 0.73 | 0.68 | 0.641 |

# CETIS Analytical Report



**Fathead Minnow 7-d Larval Survival and Growth Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 01-7246-7026 | **Endpoint:** | 7d Survival Rate | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 27 Oct-23 14:11 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 27 Oct-23 14:10 | **MD5 Hash:** | 342CF60E98BB2F664600869E1BD26391 | **Editor ID:** | 004-311-246-8 |
| **Batch ID:** | 08-5572-9747 | **Test Type:** | Growth-Survival (7d) | **Analyst:** | Pierre Koelich |
| **Start Date:** | 02 Aug-23 11:00 | **Protocol:** | EC/EPS 1/RM/22 | **Diluent:** | Mod-Hard Synthetic Water |
| **Ending Date:** | 09 Aug-23 13:00 | **Species:** | Pimephales promelas | **Brine:** | |
| **Test Length:** | 7d 2h | **Taxon:** | Actinopterygii | **Source:** | Aquatic Biosystems, CO **Age:** <24h |
| **Sample ID:** | 05-5034-7669 | **Code:** | 20CDA395 | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 72h (0.3 °C) | **Client:** | Millennium EMS Solutions | | |

**Linear Interpolation Options**

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 1427641 | 200 | Yes | Two-Point Interpolation |

**Point Estimates**

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| EC15 | >100 | --- | --- | <1 | --- | --- |
| EC20 | >100 | --- | --- | <1 | --- | --- |
| EC25 | >100 | --- | --- | <1 | --- | --- |
| EC40 | >100 | --- | --- | <1 | --- | --- |
| EC50 | >100 | --- | --- | <1 | --- | --- |

**7d Survival Rate Summary**

| | | | Calculated Variate(A/B) | | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | ΣA/ΣB | Mean | %Effect |
| 0 | LC | 3 | 0.9667 | 1.0000 | 0.9000 | 1.0000 | 5.97% | 0.00% | 29/30 | 0.9667 | 0.00% |
| 1.56 | | 3 | 0.9667 | 1.0000 | 0.9000 | 1.0000 | 5.97% | 0.00% | 29/30 | 0.9667 | 0.00% |
| 3.12 | | 3 | 0.9333 | 0.9000 | 0.9000 | 1.0000 | 6.19% | 3.45% | 28/30 | 0.9333 | 3.46% |
| 6.25 | | 3 | 0.8667 | 0.9000 | 0.8000 | 0.9000 | 6.66% | 10.34% | 26/30 | 0.9333 | 3.46% |
| 12.5 | | 3 | 0.8667 | 0.8000 | 0.8000 | 1.0000 | 13.32% | 10.34% | 26/30 | 0.9333 | 3.46% |
| 25 | | 3 | 0.9333 | 0.9000 | 0.9000 | 1.0000 | 6.19% | 3.45% | 28/30 | 0.9333 | 3.46% |
| 50 | | 3 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | -3.45% | 30/30 | 0.9333 | 3.46% |
| 100 | | 3 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | -3.45% | 30/30 | 0.9333 | 3.46% |

**7d Survival Rate Detail**

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 1.0000 | 1.0000 | 0.9000 |
| 1.56 | | 1.0000 | 1.0000 | 0.9000 |
| 3.12 | | 0.9000 | 0.9000 | 1.0000 |
| 6.25 | | 0.9000 | 0.8000 | 0.9000 |
| 12.5 | | 1.0000 | 0.8000 | 0.8000 |
| 25 | | 1.0000 | 0.9000 | 0.9000 |
| 50 | | 1.0000 | 1.0000 | 1.0000 |
| 100 | | 1.0000 | 1.0000 | 1.0000 |

**7d Survival Rate Binomials**

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 10/10 | 10/10 | 9/10 |
| 1.56 | | 10/10 | 10/10 | 9/10 |
| 3.12 | | 9/10 | 9/10 | 10/10 |
| 6.25 | | 9/10① | 8/10 | 9/10 |
| 12.5 | | 10/10 | 8/10 | 8/10 |
| 25 | | 10/10 | 9/10 | 9/10 |
| 50 | | 10/10 | 10/10 | 10/10 |
| 100 | | 10/10 | 10/10 | 10/10 |

① 1 lost in transfer ∴ 8

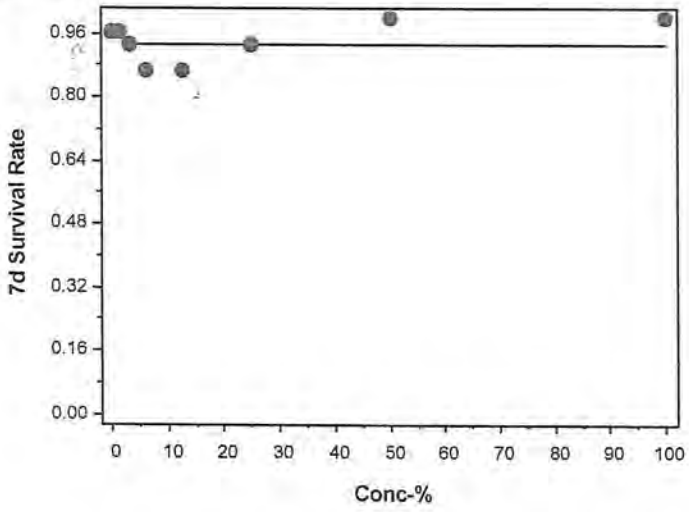
Oct 27/23

## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 01-7246-7026 | **Endpoint:** | 7d Survival Rate | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 27 Oct-23 14:11 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 27 Oct-23 14:10 | **MD5 Hash:** | 342CF60E98BB2F664600869E1BD26391 | **Editor ID:** | 004-311-246-8 |

**Graphics**



# CETIS Analytical Report



## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| Analysis ID: | 06-1805-6512 | Endpoint: | Mean Dry Biomass-mg | CETIS Version: | CETISv2.1.4 |
| Analyzed: | 17 Oct-23 14:08 | Analysis: | Linear Interpolation (ICPIN) | Status Level: | 1 |
| Edit Date: | 17 Oct-23 14:04 | MD5 Hash: | 65721FF2F768C737EF04884BFF159C61 | Editor ID: | 004-311-246-8 |
| Batch ID: | 08-5572-9747 | Test Type: | Growth-Survival (7d) | Analyst: | Pierre Koelich |
| Start Date: | 02 Aug-23 11:00 | Protocol: | EC/EPS 1/RM/22 | Diluent: | Mod-Hard Synthetic Water |
| Ending Date: | 09 Aug-23 13:00 | Species: | Pimephales promelas | Brine: | |
| Test Length: | 7d 2h | Taxon: | Actinopterygii | Source: | Aquatic Biosystems, CO Age: <24h |
| Sample ID: | 05-5034-7669 | Code: | 20CDA395 | Project: | |
| Sample Date: | 30 Jul-23 11:00 | Material: | Water Sample | Source: | Millennium EMS Solutions |
| Receipt Date: | 31 Jul-23 16:49 | CAS (PC): | | Station: | SW23-05TOX |
| Sample Age: | 72h (0.3 °C) | Client: | Millennium EMS Solutions | | |

### Linear Interpolation Options

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 1396914 | 200 | Yes | Two-Point Interpolation |

### Point Estimates

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | >100 | --- | --- | <1 | --- | --- |
| IC20 | >100 | --- | --- | <1 | --- | --- |
| IC25 | >100 | --- | --- | <1 | --- | --- |
| IC40 | >100 | --- | --- | <1 | --- | --- |
| IC50 | >100 | --- | --- | <1 | --- | --- |

### Mean Dry Biomass-mg Summary

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | Mean | %Effect |
| 0 | LC | 3 | 0.5883 | 0.592 | 0.56 | 0.613 | 4.54% | 0.00% | 0.612 | 0.00% |
| 1.56 | | 3 | 0.5693 | 0.56 | 0.537 | 0.611 | 6.65% | 3.23% | 0.612 | 0.00% |
| 3.12 | | 3 | 0.6777 | 0.673 | 0.634 | 0.726 | 6.81% | -15.18% | 0.612 | 0.00% |
| 6.25 | | 3 | 0.6127 | 0.62 | 0.588 | 0.63 | 3.58% | -4.14% | 0.612 | 0.00% |
| 12.5 | | 3 | 0.5643 | 0.573 | 0.536 | 0.584 | 4.46% | 4.08% | 0.6021 | 1.62% |
| 25 | | 3 | 0.5783 | 0.574 | 0.571 | 0.59 | 1.77% | 1.70% | 0.6021 | 1.62% |
| 50 | | 3 | 0.582 | 0.578 | 0.571 | 0.597 | 2.31% | 1.08% | 0.6021 | 1.62% |
| 100 | | 3 | 0.6837 | 0.68 | 0.641 | 0.73 | 6.53% | -16.20% | 0.6021 | 1.62% |

### Mean Dry Biomass-mg Detail

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 0.613 | 0.592 | 0.56 |
| 1.56 | | 0.537 | 0.611 | 0.56 |
| 3.12 | | 0.673 | 0.634 | 0.726 |
| 6.25 | | 0.63 | 0.588 | 0.62 |
| 12.5 | | 0.573 | 0.536 | 0.584 |
| 25 | | 0.571 | 0.574 | 0.59 |
| 50 | | 0.578 | 0.597 | 0.571 |
| 100 | | 0.73 | 0.68 | 0.641 |

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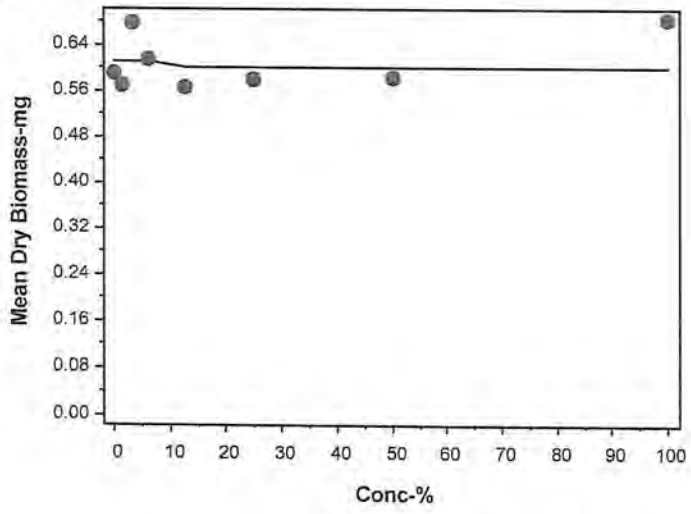
| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 06-1805-6512 | **Endpoint:** | Mean Dry Biomass-mg | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 17 Oct-23 14:08 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 17 Oct-23 14:04 | **MD5 Hash:** | 65721FF2F768C737EF04884BFF159C61 | **Editor ID:** | 004-311-246-8 |

**Graphics**



# CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| Analysis ID: | 20-7618-7278 | Endpoint: | Mean Dry Weight-mg | CETIS Version: | CETISv2.1.4 |
| Analyzed: | 17 Oct-23 14:08 | Analysis: | Linear Interpolation (ICPIN) | Status Level: | 1 |
| Edit Date: | 17 Oct-23 14:04 | MD5 Hash: | C3190A524DD8067C236846928976A585 | Editor ID: | 004-311-246-8 |
| Batch ID: | 08-5572-9747 | Test Type: | Growth-Survival (7d) | Analyst: | Pierre Koelich |
| Start Date: | 02 Aug-23 11:00 | Protocol: | EC/EPS 1/RM/22 | Diluent: | Mod-Hard Synthetic Water |
| Ending Date: | 09 Aug-23 13:00 | Species: | Pimephales promelas | Brine: | |
| Test Length: | 7d 2h | Taxon: | Actinopterygii | Source: | Aquatic Biosystems, CO Age: <24 h |
| Sample ID: | 05-5034-7669 | Code: | 20CDA395 | Project: | |
| Sample Date: | 30 Jul-23 11:00 | Material: | Water Sample | Source: | Millennium EMS Solutions |
| Receipt Date: | 31 Jul-23 16:49 | CAS (PC): | | Station: | SW23-05TOX |
| Sample Age: | 72h (0.3 °C) | Client: | Millennium EMS Solutions | | |

**Linear Interpolation Options**

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 1178966 | 200 | Yes | Two-Point Interpolation |

**Point Estimates**

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | >100 | --- | --- | <1 | --- | --- |
| IC20 | >100 | --- | --- | <1 | --- | --- |
| IC25 | >100 | --- | --- | <1 | --- | --- |
| IC40 | >100 | --- | --- | <1 | --- | --- |
| IC50 | >100 | --- | --- | <1 | --- | --- |

**Mean Dry Weight-mg Summary**

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | Mean | %Effect |
| 0 | LC | 3 | 0.6091 | 0.613 | 0.592 | 0.6222 | 2.54% | 0.00% | 0.659 | 0.00% |
| 1.56 | | 3 | 0.5901 | 0.611 | 0.537 | 0.6222 | 7.85% | 3.12% | 0.659 | 0.00% |
| 3.12 | | 3 | 0.7261 | 0.726 | 0.7044 | 0.7478 | 2.98% | -19.21% | 0.659 | 0.00% |
| 6.25 | | 3 | 0.7109 | 0.7088 | 0.6889 | 0.735 | 3.25% | -16.72% | 0.659 | 0.00% |
| 12.5 | | 3 | 0.6577 | 0.67 | 0.573 | 0.73 | 12.05% | -7.98% | 0.6577 | 0.20% |
| 25 | | 3 | 0.6214 | 0.6378 | 0.571 | 0.6556 | 7.17% | -2.03% | 0.629 | 4.55% |
| 50 | | 3 | 0.582 | 0.578 | 0.571 | 0.597 | 2.31% | 4.44% | 0.629 | 4.55% |
| 100 | | 3 | 0.6837 | 0.68 | 0.641 | 0.73 | 6.53% | -12.25% | 0.629 | 4.55% |

**Mean Dry Weight-mg Detail**

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 0.613 | 0.592 | 0.6222 |
| 1.56 | | 0.537 | 0.611 | 0.6222 |
| 3.12 | | 0.7478 | 0.7044 | 0.726 |
| 6.25 | | 0.7088 | 0.735 | 0.6889 |
| 12.5 | | 0.573 | 0.67 | 0.73 |
| 25 | | 0.571 | 0.6378 | 0.6556 |
| 50 | | 0.578 | 0.597 | 0.571 |
| 100 | | 0.73 | 0.68 | 0.641 |

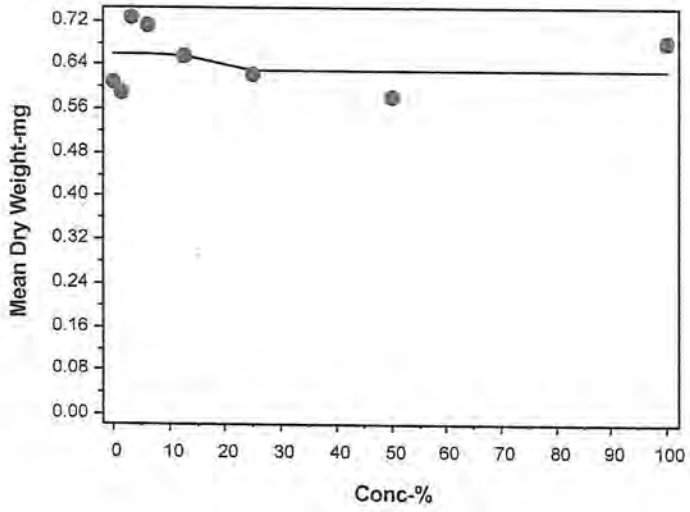
Oct 27/23

## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 20-7618-7278 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 17 Oct-23 14:08 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 17 Oct-23 14:04 | **MD5 Hash:** | C3190A524DD8067C236846928976A585 | **Editor ID:** | 004-311-246-8 |

**Graphics**






Analyst: PYN

QA: MG

10/27/23

# APPENDIX C – *Lemna minor* Toxicity Test Data

# *Lemna minor* Summary Sheet

Client: Millennium EMS Solutions Ltd (MEMS) Start Date/Time: Aug 2/23 @ 1330h
Work Order No.: 231315 Set up by: GSL

**Sample Information:**

Sample ID: SW23-05TDX
Sample Date: July. 30/23
Date Received: July. 31/23
Sample Volume: 4 x 10 L

**Test Organism Information:**

Culture Date: July. 26/23
Age of culture (Day 0): 7 days
≥8X growth in APHA?: y (74 fronds)

**KCl Reference Toxicant Results:**

Reference Toxicant ID: Lm246
Date Initiated: July. 20/23

7-d No. of Fronds IC50 (95% CL): 2.9 (1.6 - 3.5) g/L KCl

7-d No. Fronds IC50 Reference Toxicant Mean (2 SD Range): 3.1 (2.7 - 3.6) g/L KCl CV (%): 7

| | | Number of Fronds | Dry Weight |
|---|---|---|---|
| Test Results: | IC25 %(v/v) (95% CL) | 14.5 (N/A - 70.6) | 7.97 |
| | IC50 %(v/v) (95% CL) | 92.8 (30.9 - N/A) | 7.97 |

Reviewed by: ML Date reviewed: Oct 1/23

# Plant Growth Inhibition Toxicity Test
## Water Quality Measurements

**Client :** Millennium EMS Solutions Ltd. (MEMS) **Setup by:** GSM

**Sample ID:** SW23 - 05TOX **Test Date & Time:** Aug. 2/23 @ 1330h

**Work Order No.:** 231315 **CER #:** 9

**Culture Source:** CPCC #490 **Test Species:** *Lemna minor*

**Test Culture Age:** 7 days **> 8X Growth? (Y/N):** y (74 fronds)

**Light Intensity Range:** 4870 – 5500 lux **Date Measured:** Aug. 2/23

| Day | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Shelf Temp (°C) | 25.5 | 25.5 | 26.0 | 25.5 | 25.5 | 26.0 | 25.5 | 26.0 |
| Initials | GSM | GSM | GSM | GSM | KML | KML | RZJ | GSM |

| Sample Characteristics: | Initial Water Quality | | Adjusted Water Quality |
|---|---|---|---|
| Temperature (°C) | 26.0 | Aeration?: 20 min | 24.0 |
| DO (mg/L) | 2.3 | Nutrients added?[1]: | 6.9 |
| pH | 6.9 | y | 7.6 |
| Conductivity (µS) | 2330 | | 2950 |

[1] 10 mL of each APHA stock (A,B and C) added to 970 mL sample.

| Concentration % (v/v) | Temperature (°C) | | pH | | Conductivity (µS) |
|---|---|---|---|---|---|
| | Day 0 | Day 7 | Day 0 | Day 7 | 0 h |
| Control | 24.5 | 26.0 | 8.3 | 9.0 | 870 |
| 1.5 | 25.0 | 26.0 | 8.3 | GSM 10.8 | 924 |
| 3.0 | 25.5 | 26.0 | 8.3 | 11.1 | 957 |
| 6.1 | 25.5 | 26.0 | 8.3 | 11.3 | 1029 |
| 12.1 | 25.5 | 26.0 | 8.3 | 10.8 | 1173 |
| 24.2 | 25.0 | 26.0 | 8.2 | 10.8 | 1455 |
| 48.5 | 25.0 | 26.0 | 8.1 | 10.9 | 1974 |
| 97 | 24.0 | 26.0 | 7.6 | 10.6 | 2950 |
| Initials | GSM | GSM | GSM | GSM | GSM |

**Thermometer:** CPCC #9 **Light meter:** 1 **pH meter/probe:** 1 / 1 **DO meter/probe:** 1 / 1 **Conductivity meter/probe:** 1 / 1

**Sample Description:** ~~light~~ dark brown, turbid, organic smell, ~~y~~ native organisms and particulates GSM

**Comments:**

**Reviewed:** MK **Date Reviewed:** Sept 26/23

# *Lemna minor* Toxicity Test Data Sheet - 7-d Frond Counts

Client: Millennium EMS Solutions Ltd (MEMS)
Sample ID: SW23 - 05TOX
Work Order #: 231315

Start Date & Time: Aug. 2/23 @ 1330h
Termination Date: Aug. 9/23
Test set up by: GSM

| Concentration % (v/v) | Rep | No. of fronds | | Chlorosis | Necrosis | Yellow | Abnormal size | Gibbosity | Single fronds | Root destruction | Loss of buoyancy | Comments | Initials |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day 0 | Day 7 | | | | | | | | | | |
| control | A | 6 | 70 | | | | | | | | | pH: 9.5; conductivity = 894 | GSM |
| | B | ↓ | 119 | | | | | | | | | | ↓ |
| | C | | 121 | | | | | | | | | | |
| | D | | 124 | | | | | | | | | | |
| 1.5 | A | | 116 | | | | | | | | | pH: 10.5; conductivity = 923 ① | |
| | B | | 93 | | | | | | | | | | |
| | C | | 98 | | | | | | | | | | |
| | D | | 80 | × | | × | | | | | | | |
| 3.0 | A | | 77 | | | × | | | | | | | |
| | B | | 86 | × | | × | | | | | | | |
| | C | | 87 | × | | × | | | | | | | |
| | D | | 87 | × | | × | | | | | | | |
| 6.1 | A | | 79 | | | × | | | | | | | |
| | B | | 91 | | | × | | | | | | | |
| | C | | 66 | | | | | | | | | | |
| | D | | 87 | × | | × | | | | | | | |
| 12.1 | A | | 93 | | | | | | | | | | |
| | B | | 83 | | | × | | | | | | | |
| | C | | 92 | | | | | | | | | | |
| | D | | 89 | | | | | | | | | | |
| 24.2 | A | | 89 | | | | | | | | | | |
| | B | | 78 | | | | | | | | | | |
| | C | | 64 | | | | | | | | | | |
| | D | ↓ | 79 | | | | | | | | | | ↓ |

Comments: ① Algae present

Reviewed by: MJ

Date Reviewed: Sept 26/23

# *Lemna minor* Toxicity Test Data Sheet - 7-d Frond Counts

Client: Millennium EMS Solutions Ltd (MEMS)
Sample ID: 2023-OSTOX
Work Order #: 231315

Start Date & Time: Aug. 2/23 @ 1330h
Termination Date: Aug. 9/23
Test set up by: CSM

| Concentration % (v/v) | Rep | No. of fronds | | Chlorosis | Necrosis | Yellow | Abnormal size | Gibbosity | Single fronds | Root destruction | Loss of buoyancy | Comments | Initials |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day 0 | Day 7 | | | | | | | | | | |
| 48.5 ~~97~~ | A | 6 | 62 | | | | | | | | | ① | CSM |
| | B | ↓ | 73 | | | | | | | | | ↓ | ↓ |
| | C | | 70 | | | | | | | | | | |
| | D | | 68 | | | | | | | | | | |
| 97 | A | | 54 | | | | | | | | | | |
| | B | | 58 | | | | | | | | | | |
| | C | | 59 | | | | | | | | | | |
| | D | ↓ | 57 | | | | | | | | | ↓ | ↓ |
| | A | | | | | | | | | | | | |
| | B | | | | | | | | | | | | |
| | C | | | | | | | | | | | | |
| | D | | | | | | | | | | | | |
| | A | | | | | | | | | | | | |
| | B | | | | | | | | | | | | |
| | C | | | | | | | | | | | | |
| | D | | | | | | | | | | | | |
| | A | | | | | | | | | | | | |
| | B | | | | | | | | | | | | |
| | C | | | | | | | | | | | | |
| | D | | | | | | | | | | | | |
| | A | | | | | | | | | | | | |
| | B | | | | | | | | | | | | |
| | C | | | | | | | | | | | | |
| | D | | | | | | | | | | | | |

Comments: ① Algae present

Reviewed by: MG

Date Reviewed: Sept 26/23

# 7-d *Lemna minor* Weight Data Sheet

Client: Millennium EMS Solutions Ltd (MEMS) Start Date & Time: Aug. 2/23 @ 1330h

Sample ID: SW23 - 05TOX Termination Date: Aug. 9/23

WO #: 231315 Balance ID: Bal - 6

% (v/v) BA blue

| Concentration | Rep | Pan No. | Pan weight (mg) | Pan + plant (mg) | Initials |
|---|---|---|---|---|---|
| control | A | 1 | 1011.12 | 1015.99 | LSR / AJD |
| | B | 2 | 1023.13 | 1031.64 | |
| | C | 3 | 1025.36 | 1034.36 | |
| | D | 4 | 1008.68 | 1017.60 | |
| 1.5 | A | 5 | 1004.52 | 1012.55 | |
| | B | 6 | 1003.15 | 1009.97 | |
| | C | 7 | 997.56 | 1004.59 | |
| | D | 8 | 1019.04 | 1024.89 | |
| 3.0 | A | 9 | 1022.39 | 1027.61 | |
| | B | 10 | 1024.34 | 1030.76 | |
| | C | 11 | 1003.81 | 1010.36 | |
| | D | 12 | 995.67 | 1002.36 | |
| 6.1 | A | 13 | 988.33 | 994.13 | |
| | B | 14 | 991.82 | 998.77 | |
| | C | 15 | 983.09 | 988.17 | |
| | D | 16 | 998.33 | 1005.11 | |
| 12.1 | A | 17 | 986.52 | 995.25 | |
| | B | 18 | 987.83 | 995.59 | |
| | C | 19 | 992.77 | 1001.52 | |
| | D | 20 | 1007.14 | 1015.16 | |
| 24.2 | A | 21 | 1001.59 | 1010.52 | |
| | B | 22 | 1004.05 | 1011.22 | |
| | C | 23 | 992.64 | 997.81 | |
| | D | 24 | 1002.44 | 1010.60 | |
| 48.5 | A | 25 | 997.83 | 1004.73 | |
| | B | 26 | 996.91 | 1006.13 | |
| | C | 27 | 982.71 | 991.01 | |
| | D | 28 | 985.10 | 994.14 | ↓ |

Date/time pan placed in oven: July 31/23 @ 1030h

Date/time pan + organisms placed in oven: Aug. 9/23 @ 1130h

Date/time pan removed from oven: Aug. 1/23 @ 1030h

Date/time pan + organisms removed from oven: Aug. 10/23 @ 1130h

Comments: 10% reweigh pan #5: 1012.38 mg pan #17: 995.14

pan #30: 1022.80 mg

Reviewed by: MC Date Reviewed: Oct 1/23

# 7-d *Lemna minor* Weight Data Sheet

Client: Hüllenmium EHS Solutions Ltd (ALEXS) Start Date & Time: Aug. 2/23 @ 1330h

Sample ID: SW23-05TOX Termination Date: Aug. 9/23

WO #: 231315 Balance ID: Bal - 6

7.(%) BA blue

| Concentration | Rep | Pan No. | Pan weight (mg) | Pan + plant (mg) | Initials |
|---|---|---|---|---|---|
| 97 | A | 29 | 1023.79 | 1030.95 | LSR / AJD |
| | B | 30 | 1015.79 | 1022.92 | ↓ |
| | C | 31 | 1007.58 | 1014.12 | |
| | D | 32 | 1006.91 | 1012.86 | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |

Date/time pan placed in oven: July. 31/23 @ 1030h

Date/time pan + organisms placed in oven: Aug. 9/23 @ 1130h

Date/time pan removed from oven: Aug. 1/23 @ 1030h

Date/time pan + organisms removed from oven: Aug. 10/23 @ 1130h.

Comments:

Reviewed by: MCT Date Reviewed: Oct 1/23

# CETIS Summary Report



**EC Lemna Growth Inhibition Test** — **Nautilus Environmental**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Batch ID:** | 18-5520-3472 | **Test Type:** | Lemna Growth | **Analyst:** | Gabriella Utomo | | |
| **Start Date:** | 02 Aug-23 13:30 ✓ | **Protocol:** | EC/EPS 1/RM/37 ✓ | **Diluent:** | Modified APHA ✓ | | |
| **Ending Date:** | 09 Aug-23 ✓ | **Species:** | Lemna minor ✓ | **Brine:** | | | |
| **Test Length:** | 6d 10h | **Taxon:** | Tracheophyta | **Source:** | CPCC#490 ✓ | **Age:** | 7d ✓ |

| | | | | | |
|---|---|---|---|---|---|
| **Sample ID:** | 16-4549-4470 | **Code:** | SW23-05TOX | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 ✓ | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions ✓ |
| **Receipt Date:** | 31 Jul-23 16:49 ✓ | **CAS (PC):** | | **Station:** | SW23-05TOX ✓ |
| **Sample Age:** | 74h (0.3 °C) ✓ | **Client:** | Millennium | | |

**Point Estimate Summary**

| Analysis ID | Endpoint | Point Estimate Method | ✓ | Level | % | 95% LCL | 95% UCL | TU | S |
|---|---|---|---|---|---|---|---|---|---|
| ✓08-2397-8843 | Frond Count | Linear Interpolation (ICPIN) | | IC15 | 1.881 | --- | 38.4 | 53.2 | 1 |
| | | | | IC20 | 2.522 | --- | 51.38 | 39.7 | |
| | | | ✓ | IC25 | 14.52 | --- | 70.57 | 6.9 | |
| | | | | IC40 | 50.71 | 1.41 | 123 | 2 | |
| | | | ✓ | IC50 | 92.82 | 30.88 | --- | 1.1 | |
| ✓01-1949-4530 | Total Dry Weight-mg | Linear Interpolation (ICPIN) | | IC15 | >97 | --- | --- | <1 | 1 |
| | | | | IC20 | >97 | --- | --- | <1 | |
| | | | ✓ | IC25 | >97 | --- | --- | <1 | |
| | | | | IC40 | >97 | --- | --- | <1 | |
| | | | ✓ | IC50 | >97 | --- | --- | <1 | |

**Frond Count Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 4 | 102.5 | 61.53 | 143.5 | 64 | 118 | 12.87 | 25.75 | 25.12% | 0.00% |
| 1.5 | | 4 | 90.75 | 67.03 | 114.5 | 74 | 110 | 7.454 | 14.91 | 16.43% | 11.46% |
| 3 | | 4 | 78.25 | 70.52 | 85.98 | 71 | 81 | 2.428 | 4.856 | 6.21% | 23.66% |
| 6.1 | | 4 | 74.75 | 57.2 | 92.3 | 60 | 85 | 5.513 | 11.03 | 14.75% | 27.07% |
| 12.1 | | 4 | 83.25 | 76.09 | 90.41 | 77 | 87 | 2.25 | 4.5 | 5.41% | 18.78% |
| 24.2 | | 4 | 71.5 | 55.14 | 87.86 | 58 | 83 | 5.14 | 10.28 | 14.38% | 30.24% |
| 48.5 | | 4 | 62.25 | 54.86 | 69.64 | 56 | 67 | 2.323 | 4.646 | 7.46% | 39.27% |
| 97 | | 4 | 50.5 | 47.74 | 53.26 | 48 | 52 | 0.866 | 1.732 | 3.43% | 50.73% |

**Total Dry Weight-mg Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 4 | 7.83 | 4.673 | 10.99 | 4.87 | 9 | 0.992 | 1.984 | 25.34% | 0.00% |
| 1.5 | | 4 | 6.932 | 5.51 | 8.355 | 5.85 | 8.03 | 0.4471 | 0.8941 | 12.90% | 11.46% |
| 3 | | 4 | 6.22 | 5.145 | 7.295 | 5.22 | 6.69 | 0.3379 | 0.6757 | 10.86% | 20.56% |
| 6.1 | | 4 | 6.152 | 4.758 | 7.547 | 5.08 | 6.95 | 0.4382 | 0.8764 | 14.25% | 21.42% |
| 12.1 | | 4 | 8.315 | 7.516 | 9.114 | 7.76 | 8.75 | 0.2511 | 0.5022 | 6.04% | -6.19% |
| 24.2 | | 4 | 7.357 | 4.769 | 9.946 | 5.17 | 8.93 | 0.8133 | 1.627 | 22.11% | 6.03% |
| 48.5 | | 4 | 8.365 | 6.687 | 10.04 | 6.9 | 9.22 | 0.5274 | 1.055 | 12.61% | -6.83% |
| 97 | | 4 | 6.695 | 5.783 | 7.607 | 5.95 | 7.16 | 0.2864 | 0.5728 | 8.56% | 14.50% |

EC Lemna Growth Inhibition Test — Nautilus Environmental

**Frond Count Detail** — MD5: 2955C77A865BD22B9694060EF1AFD10B

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
|---|---|---|---|---|---|
| 0 | N | 64 | 113 | 115 | 118 |
| 1.5 | | 110 | 87 | 92 | 74 |
| 3 | | 71 | 80 | 81 | 81 |
| 6.1 | | 73 | 85 | 60 | 81 |
| 12.1 | | 87 | 77 | 86 | 83 |
| 24.2 | | 83 | 72 | 58 | 73 |
| 48.5 | | 56 | 67 | 64 | 62 |
| 97 | | 48 | 52 | 51 | 51 |

**Total Dry Weight-mg Detail** — MD5: 19FFE5F78638CF41E7AA862F8B731D70

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
|---|---|---|---|---|---|
| 0 | N | 4.87 | 8.53 | 9 | 8.92 |
| 1.5 | | 8.03 | 6.82 | 7.03 | 5.85 |
| 3 | | 5.22 | 6.42 | 6.55 | 6.69 |
| 6.1 | | 5.8 | 6.95 | 5.08 | 6.78 |
| 12.1 | | 8.73 | 7.76 | 8.75 | 8.02 |
| 24.2 | | 8.93 | 7.17 | 5.17 | 8.16 |
| 48.5 | | 6.9 | 9.22 | 8.3 | 9.04 |
| 97 | | 7.16 | 7.13 | 6.54 | 5.95 |

## EC Lemna Growth Inhibition Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| Analysis ID: | 08-2397-8843 | Endpoint: | Frond Count | CETIS Version: | CETISv2.1.4 |
| Analyzed: | 17 Aug-23 14:55 | Analysis: | Linear Interpolation (ICPIN) | Status Level: | 1 |
| Edit Date: | 17 Aug-23 14:53 | MD5 Hash: | 2955C77A865BD22B9694060EF1AFD10B | Editor ID: | |
| Batch ID: | 18-5520-3472 | Test Type: | Lemna Growth | Analyst: | Gabriella Utomo |
| Start Date: | 02 Aug-23 13:30 | Protocol: | EC/EPS 1/RM/37 | Diluent: | Modified APHA |
| Ending Date: | 09 Aug-23 | Species: | Lemna minor | Brine: | |
| Test Length: | 6d 10h | Taxon: | Tracheophyta | Source: | CPCC#490 Age: 7d |
| Sample ID: | 16-4549-4470 | Code: | SW23-05TOX | Project: | |
| Sample Date: | 30 Jul-23 11:00 | Material: | Water Sample | Source: | Millennium EMS Solutions |
| Receipt Date: | 31 Jul-23 16:49 | CAS (PC): | | Station: | SW23-05TOX |
| Sample Age: | 74h (0.3 °C) | Client: | Millennium | | |

### Linear Interpolation Options

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 1378069 | 200 | Yes | Two-Point Interpolation |

### Point Estimates

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | 1.881 | --- | 38.4 | 53.2 | 2.6 | --- |
| IC20 | 2.522 | --- | 51.38 | 39.7 | 1.9 | --- |
| IC25 | 14.52 | --- | 70.57 | 6.9 | 1.4 | --- |
| IC40 | 50.71 | 1.41 | 123 | 2 | 0.8 | 70.9 |
| IC50 | 92.82 | 30.88 | --- | 1.1 | --- | 3.2 |

### Frond Count Summary

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | Mean | %Effect |
| 0 | N | 4 | 102.5 | 114 | 64 | 118 | 25.12% | 0.00% | 102.5 | 0.00% |
| 1.5 | | 4 | 90.75 | 89.5 | 74 | 110 | 16.43% | 11.46% | 90.75 | 11.46% |
| 3 | | 4 | 78.25 | 80.67 | 71 | 81 | 6.21% | 23.66% | 78.75 | 23.17% |
| 6.1 | | 4 | 74.75 | 77 | 60 | 85 | 14.75% | 27.07% | 78.75 | 23.17% |
| 12.1 | | 4 | 83.25 | 84.5 | 77 | 87 | 5.41% | 18.78% | 78.75 | 23.17% |
| 24.2 | | 4 | 71.5 | 72.5 | 58 | 83 | 14.38% | 30.24% | 71.5 | 30.24% |
| 48.5 | | 4 | 62.25 | 63 | 56 | 67 | 7.46% | 39.27% | 62.25 | 39.27% |
| 97 | | 4 | 50.5 | 51 | 48 | 52 | 3.43% | 50.73% | 50.5 | 50.73% |

### Frond Count Detail

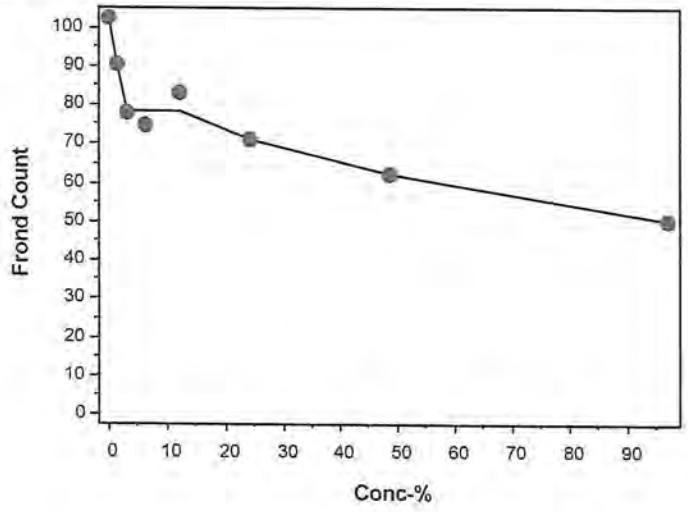
| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
|---|---|---|---|---|---|
| 0 | N | 64 | 113 | 115 | 118 |
| 1.5 | | 110 | 87 | 92 | 74 |
| 3 | | 71 | 80 | 81 | 81 |
| 6.1 | | 73 | 85 | 60 | 81 |
| 12.1 | | 87 | 77 | 86 | 83 |
| 24.2 | | 83 | 72 | 58 | 73 |
| 48.5 | | 56 | 67 | 64 | 62 |
| 97 | | 48 | 52 | 51 | 51 |

## EC Lemna Growth Inhibition Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 08-2397-8843 | **Endpoint:** | Frond Count | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 17 Aug-23 14:55 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 17 Aug-23 14:53 | **MD5 Hash:** | 2955C77A865BD22B9694060EF1AFD10B | **Editor ID:** | |

**Graphics**



## EC Lemna Growth Inhibition Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 01-1949-4530 | **Endpoint:** | Total Dry Weight-mg | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 17 Aug-23 14:56 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 17 Aug-23 14:53 | **MD5 Hash:** | 19FFE5F78638CF41E7AA862F8B731D70 | **Editor ID:** | |
| **Batch ID:** | 18-5520-3472 | **Test Type:** | Lemna Growth | **Analyst:** | Gabriella Utomo |
| **Start Date:** | 02 Aug-23 13:30 | **Protocol:** | EC/EPS 1/RM/37 | **Diluent:** | Modified APHA |
| **Ending Date:** | 09 Aug-23 | **Species:** | Lemna minor | **Brine:** | |
| **Test Length:** | 6d 10h | **Taxon:** | Tracheophyta | **Source:** | CPCC#490 **Age:** 7d |
| **Sample ID:** | 16-4549-4470 | **Code:** | SW23-05TOX | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 74h (0.3 °C) | **Client:** | Millennium | | |

### Linear Interpolation Options

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 147551 | 200 | Yes | Two-Point Interpolation |

### Point Estimates

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | >97 | --- | --- | <1 | --- | --- |
| IC20 | >97 | --- | --- | <1 | --- | --- |
| IC25 | >97 | --- | --- | <1 | --- | --- |
| IC40 | >97 | --- | --- | <1 | --- | --- |
| IC50 | >97 | --- | --- | <1 | --- | --- |

### Total Dry Weight-mg Summary

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | Mean | %Effect |
| 0 | N | 4 | 7.83 | 8.725 | 4.87 | 9 | 25.34% | 0.00% | 7.83 | 0.00% |
| 1.5 | | 4 | 6.932 | 6.925 | 5.85 | 8.03 | 12.90% | 11.46% | 7.224 | 7.74% |
| 3 | | 4 | 6.22 | 6.485 | 5.22 | 6.69 | 10.86% | 20.56% | 7.224 | 7.74% |
| 6.1 | | 4 | 6.152 | 6.29 | 5.08 | 6.95 | 14.25% | 21.42% | 7.224 | 7.74% |
| 12.1 | | 4 | 8.315 | 8.375 | 7.76 | 8.75 | 6.04% | -6.19% | 7.224 | 7.74% |
| 24.2 | | 4 | 7.357 | 7.665 | 5.17 | 8.93 | 22.11% | 6.03% | 7.224 | 7.74% |
| 48.5 | | 4 | 8.365 | 8.67 | 6.9 | 9.22 | 12.61% | -6.83% | 7.224 | 7.74% |
| 97 | | 4 | 6.695 | 6.835 | 5.95 | 7.16 | 8.56% | 14.50% | 6.695 | 14.50% |

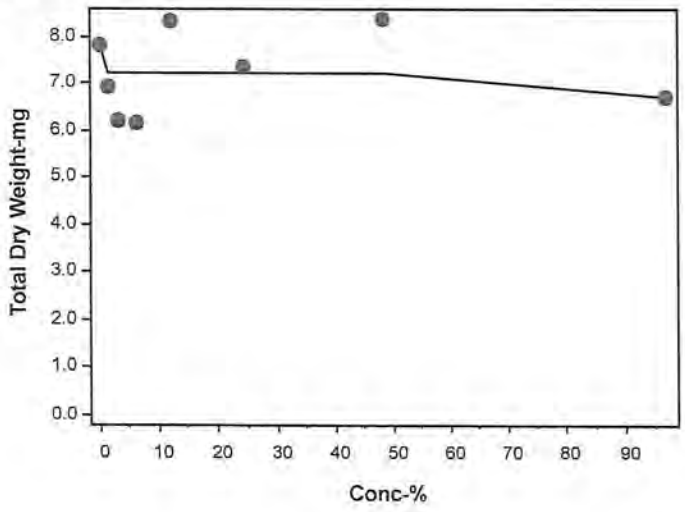
### Total Dry Weight-mg Detail

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
|---|---|---|---|---|---|
| 0 | N | 4.87 | 8.53 | 9 | 8.92 |
| 1.5 | | 8.03 | 6.82 | 7.03 | 5.85 |
| 3 | | 5.22 | 6.42 | 6.55 | 6.69 |
| 6.1 | | 5.8 | 6.95 | 5.08 | 6.78 |
| 12.1 | | 8.73 | 7.76 | 8.75 | 8.02 |
| 24.2 | | 8.93 | 7.17 | 5.17 | 8.16 |
| 48.5 | | 6.9 | 9.22 | 8.3 | 9.04 |
| 97 | | 7.16 | 7.13 | 6.54 | 5.95 |

**EC Lemna Growth Inhibition Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 01-1949-4530 | **Endpoint:** | Total Dry Weight-mg | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 17 Aug-23 14:56 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 17 Aug-23 14:53 | **MD5 Hash:** | 19FFE5F78638CF41E7AA862F8B731D70 | **Editor ID:** | |

**Graphics**



# APPENDIX D – *Pseudokirchneriella subcapitata* Toxicity Test Data

## *Pseudokirchneriella subcapitata* Summary Sheet

Client: Millenium Ems Solutions
Work Order No.: 231316

Start Date: Aug 2/23
Set up by: MG

**Sample Information:**

Sample ID: SW23-05 Tox
Sample Date: July 30/23
Date Received: July 31/23
Sample Volume: 4x10L

**Test Organism Information:**

Culture Date: July 28/23
Age of culture (Day 0): 5 days

**Zinc Reference Toxicant Results:**

Reference Toxicant ID: SC252
Stock Solution ID: 23Zn01
Date Initiated: July 27/23

72-h IC50 (95% CL): 29.4 (27.3 - 31.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 30.3 (23.7 - 38.7) ug/L Zn CV (%): 12

Test Results:

| | Algal Growth |
|---|---|
| IC25 %(v/v) (95% CL) | >95.2 |
| IC50 %(v/v) (95% CL) | 795.2 |

Reviewed by: EMM

Date reviewed: Sept 8/23

# 72-h Algal Growth Inhibition Toxicity Test
## Water Quality Measurements

**Client:** Millenium EMS Solutions **Setup by:** MG

**Sample ID:** SW23-05TOX **Test Date/Time:** Aug 2/23 @ 1030h

**Work Order No.:** 23316 **CER #:** 4

**Test Species:** *Pseudokirchneriella subcapitata*

**Culture Date:** July 28/23 **Age of Culture:** 5d **Culture Health:** Good

**Culture Count:** 1 195 2 205 **Average:** 200 **Culture Cell Density (c1):** 200 x 10⁴ cells/mL

**v1 =** 220,000 cells/ml x 20 ml / (c1) 200 x 10⁴ cells/ml = 2.2 mL

**Time Zero Counts:** 1 20 2 21 **Average:** 20.5

**No. of Cells/mL:** 20.5 x 10⁴ **Initial Density:** # cells/mL ÷ 220 µL x 10 µL = 9318 cells/mL

| Concentration %(v/v) | Water Quality | | Incubator Temperature (°C) | | | | Microplates rotated 2X per day? | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | pH | Temp (°C) | | | | | | | | |
| | 0 h | 0 h | 0 h | 24 h | 48 h | 72 h | 0 h | 24 h | 48 h | 72 h |
| Control | 6.9 | 24.0 | 23.0 | 23.0 | 23.0 | 23.0 | ✓ | ✓ | ✓ | ✓ |
| 1.5 | 6.9 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 3 | 7.0 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 6 | 7.2 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 11.9 | 7.4 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 23.8 | 7.6 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 47.6 | 7.6 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 95.2 | 7.6 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Initials | MG | MG | MG | MG | MG | JZL | MG | MG | MG | JZL |

**Initial control pH:** Well 1: 6.9 Well 2: 6.9

**Final control pH:** Well 1: 6.6 Well 2: 6.6

**Light intensity (lux):** 4080 **Date measured:** Aug 2/23

**Thermometer:** CER#4 **Light meter:** 1 **pH meter/probe:** 1 / 1

**Sample Description:** dark brown, turbid, organic smell w native organisms and particulates

**Comments:**

**Reviewed:** EMM **Date reviewed:** Sept 8/23

## *Pseudokirchneriella subcapitata* Toxicity Test Data Sheet
## 72-h Algal Cell Counts

Client: Millenium EMS Solutions
Work Order #: 231316
Sample ID: SW23-05Tox
%(v/v)

Start Date/Time: Aug 2/23@1030h
Termination Date: Aug 5/23@1030h
Test set up by: MG

| Concentration | Rep | Count 1 | Count 2 | Count 3 | Count 4 | Comments | Initials |
|---|---|---|---|---|---|---|---|
| Control | A | 40 | | | | | MG |
| | B | 41 | | | | | |
| | C | 44 | | | | | |
| | D | 38 | | | | | |
| | E | 36 | | | | | |
| | F | 38 | | | | | |
| | G | 42 | | | | | |
| | H | 37 | | | | | |
| 1.5 | A | 52 | | | | | |
| | B | 54 | | | | | |
| | C | 64 | | | | | |
| | D | 59 | | | | | |
| 3 | A | 102 | | | | | |
| | B | 98 | | | | | |
| | C | 108 | | | | | |
| | D | 103 | | | | | |
| 6 | A | 109 | | | | | |
| | B | 108 | | | | | |
| | C | 98 | | | | | |
| | D | 100 | | | | | |
| 11.9 | A | 120 | | | | | |
| | B | 105 | | | | | |
| | C | 118 | | | | | |
| | D | 111 | | | | | |
| 23.8 | A | 132 | | | | | |
| | B | 129 | | | | | |
| | C | 121 | | | | | |
| | D | 125 | | | | | |
| 47.6 | A | 130 | | | | | |
| | B | 122 | | | | | |
| | C | 125 | | | | | |
| | D | 121 | | | | | |
| 95.2 | A | 123 | | | | | |
| | B | 126 | | | | | |
| | C | 121 | | | | | |
| | D | 128 | | | | | |

Comments:

Reviewed by: EMM Date Reviewed: Sept 8/23

## *Pseudokirchneriella subcapitata* Algal Counts

Client: Millenium EMS Solutions
WO#: 231316
Sample ID: SW23-05TOX

Start Date/Time: 2-Aug-23 @ 1030h
Termination Date/Time: 5-Aug-23 @ 1030h

Initial Cell Density: 9318 cell/mL

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 205000 |
| | | | | | | | | | 0.22 |
| | | | | | | | | | 0.01 |
| Concentration %(v/v) | Rep | Count 1 (x $10^4$) | Count 2 (x $10^4$) | Count 3 (x $10^4$) | Count 4 (x $10^4$) | Mean (x $10^4$) | Cell Yield (x $10^4$) cell/mL | | 9318.182 |
| Control | A | 40 | | | | 40 | 39.1 | mean | 38.6 |
| | B | 41 | | | | 41 | 40.1 | SD | 2.725541 |
| | C | 44 | | | | 44 | 43.1 | CV | 7.066811 |
| | D | 38 | | | | 38 | 37.1 | | |
| | E | 36 | | | | 36 | 35.1 | | |
| | F | 38 | | | | 38 | 37.1 | | |
| | G | 42 | | | | 42 | 41.1 | | |
| | H | 37 | | | | 37 | 36.1 | | |
| 1.5 | A | 52 | | | | 52 | 51.1 | | |
| | B | 54 | | | | 54 | 53.1 | | |
| | C | 64 | | | | 64 | 63.1 | | |
| | D | 59 | | | | 59 | 58.1 | | |
| 3 | A | 102 | | | | 102 | 101.1 | | |
| | B | 98 | | | | 98 | 97.1 | | |
| | C | 108 | | | | 108 | 107.1 | | |
| | D | 103 | | | | 103 | 102.1 | | |
| 6 | A | 109 | | | | 109 | 108.1 | | |
| | B | 108 | | | | 108 | 107.1 | | |
| | C | 98 | | | | 98 | 97.1 | | |
| | D | 100 | | | | 100 | 99.1 | | |
| 11.9 | A | 120 | | | | 120 | 119.1 | | |
| | B | 105 | | | | 105 | 104.1 | | |
| | C | 118 | | | | 118 | 117.1 | | |
| | D | 111 | | | | 111 | 110.1 | | |
| 23.8 | A | 132 | | | | 132 | 131.1 | | |
| | B | 129 | | | | 129 | 128.1 | | |
| | C | 121 | | | | 121 | 120.1 | | |
| | D | 125 | | | | 125 | 124.1 | | |
| 47.6 | A | 130 | | | | 130 | 129.1 | | |
| | B | 122 | | | | 122 | 121.1 | | |
| | C | 125 | | | | 125 | 124.1 | | |
| | D | 121 | | | | 121 | 120.1 | | |
| 95.2 | A | 123 | | | | 123 | 122.1 | | |
| | B | 126 | | | | 126 | 125.1 | | |
| | C | 121 | | | | 121 | 120.1 | | |
| | D | 128 | | | | 128 | 127.1 | | |

Reviewed by: EMM

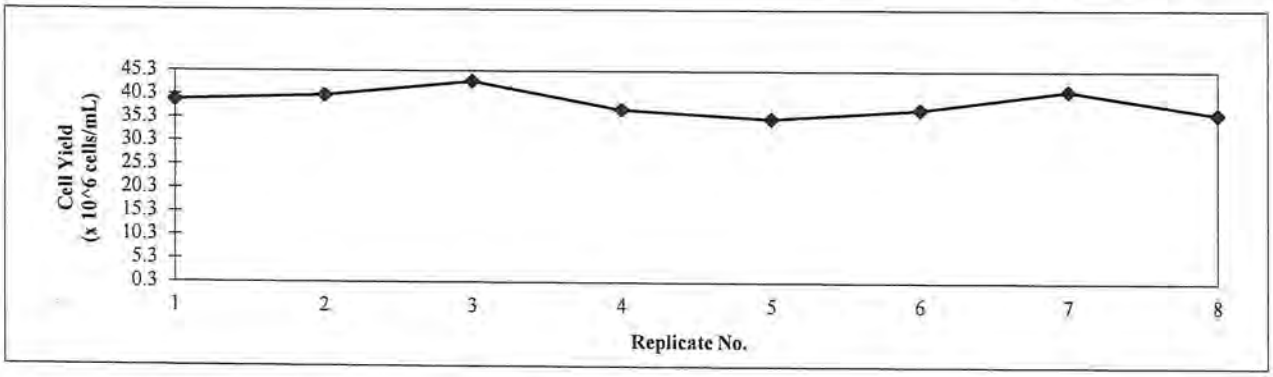
Date reviewed: Sept 8/23

## 72-h *Pseudokirchneriella subcapitata* Test - Trend Analysis by Mann-Kendall Test.

**Instructions:**
1. Enter the project number, work order number and sample ID in the highlighted cells.
2. Enter the negative control cell yield data (X x $10^6$ cells/mL) into the highlighted spreadsheet cells.
3. Compare the calculated S value to the table of critical S values at the bottom of the page.
4. If the calculated S value is smaller than the S value in the table, there is no statistically significant trend.

**Client:** Millenium EMS Solutions
**W.O. No.:** 231316
**Sample ID:** SW23-05TOX
**Test Date:** 2-Aug-23 @ 1030h

| Rep No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Count of | Count of |
|---|---|---|---|---|---|---|---|---|---|---|
| Data Value | 39.1 | 40.1 | 43.1 | 37.1 | 35.1 | 37.1 | 41.1 | 36.1 | + Signs | - Signs |
| (- Rep 1) | | 1.000 | 4.000 | -2.000 | -4.000 | -2.000 | 2.000 | -3.000 | 3 | 4 |
| (- Rep 2) | | | 3.000 | -3.000 | -5.000 | -3.000 | 1.000 | -4.000 | 2 | 4 |
| (- Rep 3) | | | | -6.000 | -8.000 | -6.000 | -2.000 | -7.000 | 0 | 5 |
| (- Rep 4) | | | | | -2.000 | 0.000 | 4.000 | -1.000 | 1 | 2 |
| (- Rep 5) | | | | | | 2.000 | 6.000 | 1.000 | 3 | 0 |
| (- Rep 6) | | | | | | | 4.000 | -1.000 | 1 | 1 |
| (- Rep 7) | | | | | | | | -5.000 | 0 | 1 |
| | | | | | | | | Totals | 10 | 17 |
| | | | | | | | | | S = | -7 |




**Critical values of (S) at a probability of p = 0.05, when the number of replicates (n) is 10 or less.**

| n | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|
| S | 4 | 6 | 9 | 11 | 14 | 16 | 19 |

emm 8/7/23

If your calculated value for S (for the applicable number of replicates) is equal to or less than the corresponding value for S in the above table, then there is no statistically significant trend present. Refer to Gilbert (1987) for complete table of probabilities for the Mann-Kendall test.

Reference:
Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, NY. 320 pp.

# CETIS Summary Report


Test Code/ID: 231316 / 19-8706-5552

**EC Alga Growth Inhibition Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 15-1680-5333 | **Test Type:** | Cell Growth | **Analyst:** | Mimi Tran |
| **Start Date:** | 02 Aug-23 10:30 | **Protocol:** | EC/EPS 1/RM/25 | **Diluent:** | Deionized Water + nutrients |
| **Ending Date:** | 05 Aug-23 10:30 | **Species:** | Pseudokirchneriella subcapitata | **Brine:** | |
| **Test Length:** | 72h | **Taxon:** | Chlorophyta | **Source:** | In-House Culture **Age:** 5d |
| **Sample ID:** | 16-4549-4470 | **Code:** | SW23-05TOX | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 71h (0.3 °C) | **Client:** | Millennium | | |

**Multiple Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | ✓ | NOEL | LOEL | TOEL | PMSD | TU | S |
|---|---|---|---|---|---|---|---|---|---|
| 20-4468-4029 | Cell Yield | Dunnett Multiple Comparison Test | | <1.5 | 1.5 | --- | 18.1% | >66.7 | 1 |

**Point Estimate Summary**

| Analysis ID | Endpoint | Point Estimate Method | ✓ | Level | % | 95% LCL | 95% UCL | TU | S |
|---|---|---|---|---|---|---|---|---|---|
| 17-1981-8788 | Cell Yield | Linear Interpolation (ICPIN) | | IC15 | >95.2 | --- | --- | <1.1 | 1 |
| | | | | IC20 | >95.2 | --- | --- | <1.1 | |
| | | | | IC25 | >95.2 | --- | --- | <1.1 | |
| | | | | IC40 | >95.2 | --- | --- | <1.1 | |
| | | | | IC50 | >95.2 | --- | --- | <1.1 | |

**Cell Yield Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 8 | 38.5 | 36.22 | 40.78 | 35 | 43 | 0.9636 | 2.726 | 7.08% | 0.00% |
| 1.5 | | 4 | 56.25 | 47.69 | 64.81 | 51 | 63 | 2.689 | 5.377 | 9.56% | -46.10% |
| 3 | | 4 | 101.8 | 95.21 | 108.3 | 97 | 107 | 2.056 | 4.113 | 4.04% | -164.29% |
| 6 | | 4 | 102.8 | 93.9 | 111.6 | 97 | 108 | 2.78 | 5.56 | 5.41% | -166.88% |
| 11.9 | | 4 | 112.5 | 101.6 | 123.4 | 104 | 119 | 3.428 | 6.856 | 6.09% | -192.21% |
| 23.8 | | 4 | 125.8 | 118.1 | 133.4 | 120 | 131 | 2.394 | 4.787 | 3.81% | -226.62% |
| 47.6 | | 4 | 123.5 | 117.1 | 129.9 | 120 | 129 | 2.021 | 4.041 | 3.27% | -220.78% |
| 95.2 | | 4 | 123.5 | 118.6 | 128.4 | 120 | 127 | 1.555 | 3.109 | 2.52% | -220.78% |

**Cell Yield Detail** MD5: 99287599CDEBF6154624BC68FF8DECF3

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 39 | 40 | 43 | 37 | 35 | 37 | 41 | 36 |
| 1.5 | | 51 | 53 | 63 | 58 | | | | |
| 3 | | 101 | 97 | 107 | 102 | | | | |
| 6 | | 108 | 107 | 97 | 99 | | | | |
| 11.9 | | 119 | 104 | 117 | 110 | | | | |
| 23.8 | | 131 | 128 | 120 | 124 | | | | |
| 47.6 | | 129 | 121 | 124 | 120 | | | | |
| 95.2 | | 122 | 125 | 120 | 127 | | | | |

# CETIS Analytical Report



**EC Alga Growth Inhibition Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 17-1981-8788 | **Endpoint:** | Cell Yield | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 06 Sep-23 17:41 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | | **MD5 Hash:** | 99287599CDEBF6154624BC68FF8DECF3 | **Editor ID:** | |
| **Batch ID:** | 15-1680-5333 | **Test Type:** | Cell Growth | **Analyst:** | Mimi Tran |
| **Start Date:** | 02 Aug-23 10:30 | **Protocol:** | EC/EPS 1/RM/25 | **Diluent:** | Deionized Water + nutrients |
| **Ending Date:** | 05 Aug-23 10:30 | **Species:** | Pseudokirchneriella subcapitata | **Brine:** | |
| **Test Length:** | 72h | **Taxon:** | Chlorophyta | **Source:** | In-House Culture **Age:** 5d |
| **Sample ID:** | 16-4549-4470 | **Code:** | SW23-05TOX | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 71h (0.3 °C) | **Client:** | Millennium | | |

**Linear Interpolation Options**

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 53287 | 200 | Yes | Two-Point Interpolation |

**Point Estimates**

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | >95.2 | --- | --- | <1.1 | --- | --- |
| IC20 | >95.2 | --- | --- | <1.1 | --- | --- |
| IC25 | >95.2 | --- | --- | <1.1 | --- | --- |
| IC40 | >95.2 | --- | --- | <1.1 | --- | --- |
| IC50 | >95.2 | --- | --- | <1.1 | --- | --- |

**Cell Yield Summary**

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | Mean | %Effect |
| 0 | N | 8 | 38.5 | 37.67 | 35 | 43 | 7.08% | 0.00% | 98.06 | 0.00% |
| 1.5 | | 4 | 56.25 | 55.5 | 51 | 63 | 9.56% | -46.10% | 98.06 | 0.00% |
| 3 | | 4 | 101.8 | 101.5 | 97 | 107 | 4.04% | -164.29% | 98.06 | 0.00% |
| 6 | | 4 | 102.8 | 103 | 97 | 108 | 5.41% | -166.88% | 98.06 | 0.00% |
| 11.9 | | 4 | 112.5 | 113.5 | 104 | 119 | 6.09% | -192.21% | 98.06 | 0.00% |
| 23.8 | | 4 | 125.8 | 126 | 120 | 131 | 3.81% | -226.62% | 98.06 | 0.00% |
| 47.6 | | 4 | 123.5 | 122.5 | 120 | 129 | 3.27% | -220.78% | 98.06 | 0.00% |
| 95.2 | | 4 | 123.5 | 123.5 | 120 | 127 | 2.52% | -220.78% | 98.06 | 0.00% |

**Cell Yield Detail**

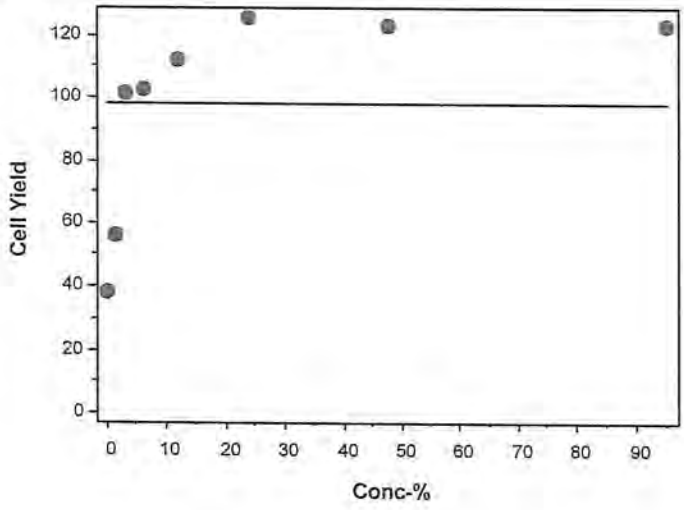
| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 39 | 40 | 43 | 37 | 35 | 37 | 41 | 36 |
| 1.5 | | 51 | 53 | 63 | 58 | | | | |
| 3 | | 101 | 97 | 107 | 102 | | | | |
| 6 | | 108 | 107 | 97 | 99 | | | | |
| 11.9 | | 119 | 104 | 117 | 110 | | | | |
| 23.8 | | 131 | 128 | 120 | 124 | | | | |
| 47.6 | | 129 | 121 | 124 | 120 | | | | |
| 95.2 | | 122 | 125 | 120 | 127 | | | | |

## EC Alga Growth Inhibition Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 17-1981-8788 | **Endpoint:** | Cell Yield | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 06 Sep-23 17:41 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | | **MD5 Hash:** | 99287599CDEBF6154624BC68FF8DECF3 | **Editor ID:** | |

**Graphics**



# CETIS Analytical Report



**EC Alga Growth Inhibition Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 20-4468-4029 | **Endpoint:** | Cell Yield | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 06 Sep-23 17:41 | **Analysis:** | Parametric-Control vs Treatments | **Status Level:** | 1 |
| **Edit Date:** | | **MD5 Hash:** | 99287599CDEBF6154624BC68FF8DECF3 | **Editor ID:** | |
| **Batch ID:** | 15-1680-5333 | **Test Type:** | Cell Growth | **Analyst:** | Mimi Tran |
| **Start Date:** | 02 Aug-23 10:30 | **Protocol:** | EC/EPS 1/RM/25 | **Diluent:** | Deionized Water + nutrients |
| **Ending Date:** | 05 Aug-23 10:30 | **Species:** | Pseudokirchneriella subcapitata | **Brine:** | |
| **Test Length:** | 72h | **Taxon:** | Chlorophyta | **Source:** | In-House Culture **Age:** 5d |
| **Sample ID:** | 16-4549-4470 | **Code:** | SW23-05TOX | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 71h (0.3 °C) | **Client:** | Millennium | | |

| Data Transform | Alt Hyp | NOEL | LOEL | TOEL | Tox Units | MSDu | PMSD |
|---|---|---|---|---|---|---|---|
| Untransformed | C < T | <1.5 | 1.5 | --- | >66.7 | 6.98 | 18.13% |

**Dunnett Multiple Comparison Test**

| Control | vs | Conc-% | df | Test Stat | Critical | MSD | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Negative Control | | 1.5* | 10 | 6.424 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 3* | 10 | 22.89 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 6* | 10 | 23.25 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 11.9* | 10 | 26.78 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 23.8* | 10 | 31.58 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 47.6* | 10 | 30.76 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 95.2* | 10 | 30.76 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |

**Auxiliary Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|
| Outlier | Grubbs Extreme Value Test | 2.106 | 2.991 | 1.0000 | No Outliers Detected |
| Control Trend | Mann-Kendall Trend Test | 0.4674 | 0.05 | 0.4674 | Non-Significant Control Trend |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 43016.9 | 6145.27 | 7 | 301.9 | <1.0E-05 | Significant Effect |
| Error | 570 | 20.3571 | 28 | | | |
| Total | 43586.9 | | 35 | | | |

**ANOVA Assumptions Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variance | Bartlett Equality of Variance Test | 4.78 | 18.48 | 0.6868 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9612 | 0.9166 | 0.2342 | Normal Distribution |

**Cell Yield Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 8 | 38.5 | 36.22 | 40.78 | 37.67 | 35 | 43 | 0.9636 | 7.08% | 0.00% |
| 1.5 | | 4 | 56.25 | 47.69 | 64.81 | 55.5 | 51 | 63 | 2.689 | 9.56% | -46.10% |
| 3 | | 4 | 101.8 | 95.21 | 108.3 | 101.5 | 97 | 107 | 2.056 | 4.04% | -164.29% |
| 6 | | 4 | 102.8 | 93.9 | 111.6 | 103 | 97 | 108 | 2.78 | 5.41% | -166.88% |
| 11.9 | | 4 | 112.5 | 101.6 | 123.4 | 113.5 | 104 | 119 | 3.428 | 6.09% | -192.21% |
| 23.8 | | 4 | 125.8 | 118.1 | 133.4 | 126 | 120 | 131 | 2.394 | 3.81% | -226.62% |
| 47.6 | | 4 | 123.5 | 117.1 | 129.9 | 122.5 | 120 | 129 | 2.021 | 3.27% | -220.78% |
| 95.2 | | 4 | 123.5 | 118.6 | 128.4 | 123.5 | 120 | 127 | 1.555 | 2.52% | -220.78% |

## EC Alga Growth Inhibition Test

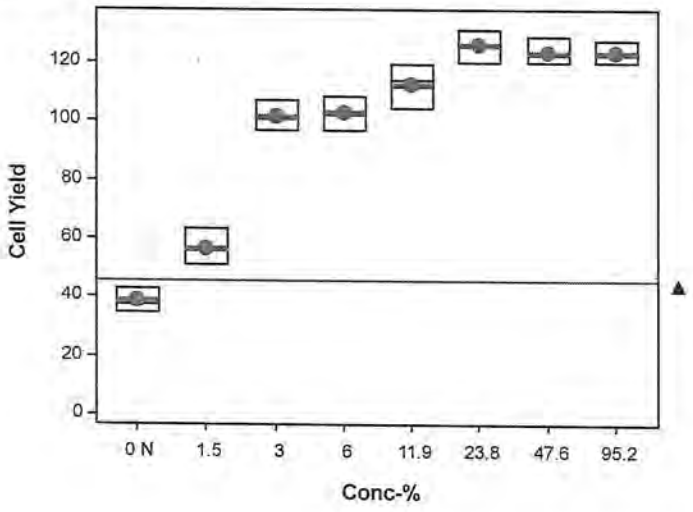
Nautilus Environmental

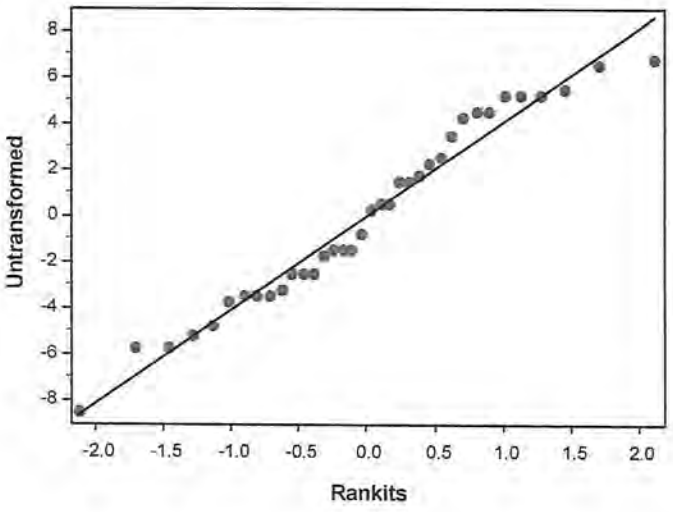
| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 20-4468-4029 | **Endpoint:** | Cell Yield | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 06 Sep-23 17:41 | **Analysis:** | Parametric-Control vs Treatments | **Status Level:** | 1 |
| **Edit Date:** | | **MD5 Hash:** | 99287599CDEBF6154624BC68FF8DECF3 | **Editor ID:** | |

### Cell Yield Detail

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 39 | 40 | 43 | 37 | 35 | 37 | 41 | 36 |
| 1.5 | | 51 | 53 | 63 | 58 | | | | |
| 3 | | 101 | 97 | 107 | 102 | | | | |
| 6 | | 108 | 107 | 97 | 99 | | | | |
| 11.9 | | 119 | 104 | 117 | 110 | | | | |
| 23.8 | | 131 | 128 | 120 | 124 | | | | |
| 47.6 | | 129 | 121 | 124 | 120 | | | | |
| 95.2 | | 122 | 125 | 120 | 127 | | | | |

### Graphics



# APPENDIX E – Chain-of-Custody Form

NAUTILUS ENVIRONMENTAL

**TESTING LOCATION (Please Circle)**

**Burnaby** (●)
8664 Commerce Court
Burnaby, British Columbia, Canada
V5A 4N7
Phone 604.420.8773

**Calgary** ( )
10823 27 Street SE
Calgary, Alberta, Canada
T2Z 3V9
Phone 403.253.7121

**Point Edward** ( )
704 Mara Street, Suite 122
Point Edward, Ontario, Canada
N7V 1X4
Phone 519.339.8787

# Chain of Custody

Date 31/07/23 Page 1 of 1

| **Report to:** | |
|---|---|
| **Company** | Millennium EMS Solutions Ltd. (MEMS) |
| **Address** | #148 – 2257 Premier Way |
| **City/Prov/PC** | Sherwood Park, AB T8H 2M8 |
| **Contact** | Jeff Belecky |
| **Phone** | 780.554.3280 |
| **Email** | jbelecky@mems.ca |

| **Invoice To:** | |
|---|---|
| **Company** | Paramount Resources Ltd. c/o MEMS |
| **Address** | 888 3 St SW #4700 |
| **City/Prov/PC** | Calgary, AB T2P 5C5 |
| **Contact** | Jeff Belecky |
| **Phone** | 780.554.3280 |
| **Email** | jbelecky@mems.ca |
| **PO No.** | 23SR0061 |

**Sample Collection By:** Drew MacPhail (MEMS) **Sample Type:** Grab (●) OR Composite ( )

| | SAMPLE ID | DATE (DD/MM/YY) | TIME | MATRIX | # OF CONTAINERS AND VOLUME (e.g. 1 x 20 L) | COMMENTS | ANALYSES REQUIRED: 7-day C. dubia (water flea) survival and reproduction | 7-day P. promelas (fathead minnow) survival and growth | 7-day L. minor (common duckweed) growth inhibition | 72-hour P. subcapitata (algae) growth inhibition | Receipt Temperature (°C) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SW23-05TOX | 30/07/23 | 11:00 | Water | 4 x 10 L Bladders | Containers are not labeled with sample ID | ✓ | ✓ | ✓ | ✓ | 0.3-4.3 |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | 3 | 4 | 5 | 6 | |
| 6 | | | | | | | 1 | 1 | 1 | 1 | |
| 7 | | | | | | | 3 | 3 | 3 | 3 | |
| 8 | | | | | | | 1 | 1 | 1 | 1 | |
| 9 | | | | | | | 3 | 3 | 3 | 3 | |
| 10 | | | | | | | 2 | 2 | 2 | 2 | |

**SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)**

Note short hold time (72 hr) on select tests

**SAMPLE RECEIPT DETAILS (LABORATORY)**

| | | | |
|---|---|---|---|
| 1. Total No. of Containers | 4 | 4. Ice Present in Cooler? | (Y) / N |
| 2. Courier | Ambitious | 5. Seal Present? | Y / (N) |
| 3. Good Condition? | (Y) / N | 6. Initials Present on Seal? | Y / (N) |

**SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)**

Dark brown, turbid, organic smell, w/ native organisms and particulates

**RELINQUISHED BY (CLIENT)**

DREW MACPHAIL (Printed Name) DM (Signature)

MEMS (Company) 31/07/23 @ 17:00 (expected) (Date DD/MM/YY and Time)

**RECEIVED BY (LABORATORY)**

Tyrone (Printed Name) TH (Signature)

Nautilus (Company) July 31/23 @ 16:49 (Date DD/MM/YY and Time)

Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling, or transport of the sample, application or interpretation of the test data or results in part or in whole.

**Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.**

**END OF REPORT**

# Toxicity testing on sample SW23-05TOX

Collected on July 30, 2023

Final Report

November 2, 2023

Submitted to: **Millenium EMS Solutions Ltd. (MEMS)**
Sherwood Park, AB

8664 Commerce Court, Burnaby, BC V5A 4N7

## TABLE OF CONTENTS



## List of Tables

## List of Appendices

## SIGNATURE PAGE

Report By:
Rachel Sakurdeep, B.Sc.
Senior Biologist

Reviewed By:
Mimi Tran, Dipl. T.
Senior Biologist

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

## SUMMARY

### Sample Information and Test Type

| | |
|---|---|
| Sample ID | SW23-05TOX |
| Sample collection date | July 30, 2023 |
| Sample receipt date | July 31, 2023 |
| Sample receipt temperature | 0.3 – 4.3°C |
| Test types | *Ceriodaphnia dubia* survival and reproduction |
| | 7-d fathead minnow (*Pimephales promelas*) survival and growth |
| | 7-d *Lemna minor* growth inhibition |
| | 72-h *Pseudokirchneriella subcapitata* growth inhibition |

## Summary of Results

| Endpoint | SW23-05TOX<br>% v/v (95% CL) |
|---|---|
| *Ceriodaphnia dubia* | |
| Survival LC50 | >100 |
| Reproduction IC25 | 27.1 (9.8 – N/A) |
| Reproduction IC50 | >100 |
| *Pimephales promelas* | |
| Survival LC25 | >100 |
| Survival LC50 | >100 |
| Biomass IC25 | >100 |
| Biomass IC50 | >100 |
| *Lemna minor* | |
| Frond count IC25 | 14.5 (N/A – 70.6) |
| Frond count IC50 | 92.8 (30.9 – N/A) |
| Dry weight IC25 | >97.0 |
| Dry weight IC50 | >97.0 |
| *Pseudokirchneriella subcapitata* | |
| Growth IC25 | >95.2 |
| Growth IC50 | >95.2 |

LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, N/A = Not Available

## 1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted sub-lethal toxicity tests for Millenium EMS Solutions Ltd. (MEMS) on a sample identified as SW23-05TOX. The sample was collected on July 30, 2023, and delivered to the Nautilus Environmental laboratory in Burnaby, BC on July 31, 2023. The sample was transported in four 10-L plastic containers. The sample was received at temperatures ranging between 0.3 – 4.3°C and was stored in the dark at 4 ± 2°C prior to testing. The following sub-lethal toxicity tests were performed:

- *Ceriodaphnia dubia* survival and reproduction
- 7-d fathead minnow (*Pimephales promelas*) survival and growth
- 7-d *Lemna minor* growth inhibition
- 72-h *Pseudokirchneriella subcapitata* growth inhibition

Testing for *C. dubia* was initiated on August 1, 2023 and *O. mykiss, L. minor* and *P. subcapitata* were initiated on August 2, 2023. This report describes the results of these toxicity tests. Copies of raw laboratory datasheets and statistical analyses for each test species are provided in Appendices A to D. The chain-of-custody form is provided in Appendix E.

## 2.0 METHODS

Methods for the toxicity tests are summarized in Tables 1 to 4. Testing was conducted according to procedures described by Environment Canada (2007a, 2007b, 2007c and 2011). Statistical analyses for the tests were performed using CETIS (Tidepool Scientific Software, 2021).

**Table 1. Summary of test conditions: *Ceriodaphnia dubia* survival and reproduction test.**

| | |
|---|---|
| Test species | *Ceriodaphnia dubia* |
| Organism source | In-house culture |
| Organism age | <24 hour old neonates, produced within a 12 hour window |
| Test type | Static-renewal |
| Test duration | 7 ± 1 day |
| Test vessel | 20-mL glass test tube |
| Test volume | 15 mL |
| Test solution depth | 10 cm |
| Test concentrations | Seven concentrations, plus laboratory control |
| Test replicates | 10 per treatment |
| Number of organisms | 1 per replicate |
| Control/dilution water | 20% Perrier water and 80% deionized water + 5 µg/L Se and 2 µg/L vitamin B12 |
| Test solution renewal | Daily (100% renewal) |
| Test temperature | 25 ± 1°C |
| Feeding | Daily with *Pseudokirchneriella subcapitata* and TCC[1] (3:1 ratio) |
| Light intensity | 100 to 600 lux at water surface |
| Photoperiod | 16 hours light / 8 hours dark |
| Aeration | None |
| Test measurements | Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival and reproduction recorded daily |
| Test protocol | Environment Canada (2007a), EPS 1/RM/21 |
| Statistical software | CETIS Version 2.1.4 |
| Test endpoints | Survival and reproduction |
| Test acceptability criteria for controls | ≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods; no ephippia present |
| Reference toxicant | Sodium chloride (NaCl) |

[1] TCC = Trout chow and Cerophyll

**Table 2. Summary of test conditions: fathead minnow *(Pimephales promelas)* survival and growth test.**

| | |
|---|---|
| Test species | *Pimephales promelas* |
| Organism source | Aquatic BioSystems, Fort Collins, CO |
| Organism age | <24 hours post-hatch |
| Test type | Static-renewal |
| Test duration | 7 days |
| Test vessel | 375-mL glass container |
| Test volume | 250 mL |
| Test solution depth | 6.5 cm |
| Test concentrations | Seven concentrations, plus laboratory control |
| Test replicates | 3 per treatment |
| Number of organisms | 10 per replicate |
| Control/dilution water | Moderately-hard reconstituted water |
| Test solution renewal | Daily (80% renewal) |
| Test temperature | 25 ± 1°C |
| Feeding | Twice a day with approximately 1500-2250 newly hatched brine shrimp nauplii (*Artemia sp.*) in each test container |
| Light intensity | 100 to 500 lux |
| Photoperiod | 16 hours light / 8 hours dark |
| Aeration | None, unless dissolved oxygen falls to <40% saturation |
| Test measurements | Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival checked daily |
| Test protocol | Environment Canada (2011), EPS 1/RM/22 |
| Statistical software | CETIS Version 2.1.4 |
| Test endpoints | Survival and biomass |
| Test acceptability criteria for controls | ≥80% survival; ≥250 µg mean dry weight |
| Reference toxicant | Sodium chloride (NaCl) |

**Table 3. Summary of test conditions: *Lemna minor* growth inhibition test.**

| | |
|---|---|
| Test species | *Lemna minor*, strain CPCC# 490 |
| Organism source | In-house axenic culture, obtained from Canadian Phycological Culture Centre, and originally isolated from Wainfleet, Stinking Barn, Niagara Peninsula, Ontario, Canada |
| Organism age | 7- to 10-day old culture |
| Test type | Static |
| Test duration | 7 days |
| Test vessel | 250-mL glass container |
| Test volume | 100 mL |
| Test solution depth | 4 cm |
| Test concentrations | Seven concentrations, plus laboratory control |
| Test replicates | 4 per treatment |
| Number of organisms | Two 3-frond plants per replicate |
| Control/dilution water | Modified APHA media (deionized water plus 1% of each APHA stock solution A, B and C) |
| Test solution renewal | None |
| Test temperature | 25 ± 2°C |
| Feeding | None |
| Light intensity | 4000 to 5600 lux |
| Photoperiod | 24 hours light |
| Aeration | None |
| Test measurements | Test area temperature measured daily; temperature, pH and conductivity measured in all concentrations at test initiation; dissolved oxygen of highest concentration measured at test initiation; temperature and pH measured at test termination |
| Test protocol | Environment Canada (2007b), EPS 1/RM/37 |
| Statistical software | CETIS Version 2.1.4 |
| Test endpoints | Number of fronds and dry weight |
| Test acceptability criterion for controls | ≥ 8-fold increase in number of fronds |
| Reference toxicant | Potassium chloride (KCl) |

**Table 4. Summary of test conditions: *Pseudokirchneriella subcapitata* growth inhibition test.**

| | |
|---|---|
| Test species | *Pseudokirchneriella subcapitata*, strain CPCC# 37 |
| Organism source | In-house axenic culture, obtained from Canadian Phycological Culture Center, and originally isolated from Nivelta River, Norway. |
| Organism age | 3-to 7-day old culture in logarithmic growth phase |
| Test type | Static |
| Test duration | 72 hours |
| Test vessel | Microplate |
| Test volume | 220 µL |
| Test concentrations | Seven concentrations, plus laboratory control |
| Test replicates | 4 per treatment; 8 for laboratory control |
| Number of organisms | 10,000 cells/mL |
| Control/dilution water | Deionized water supplemented with nutrients |
| Test solution renewal | None |
| Test temperature | 24 ± 2°C |
| Feeding | None |
| Light intensity | 3600 to 4400 lux |
| Photoperiod | 24 hours light |
| Aeration | None |
| Test measurements | Test area temperature measured daily; temperature and pH measured at test initiation; pH of two control wells measured at test termination |
| Test protocol | Environment Canada (2007c), EPS 1/RM/25 |
| Statistical software | CETIS Version 2.1.4 |
| Test endpoint | Algal cell growth inhibition |
| Test acceptability criteria for controls | >16-fold increase in number of algal cells; CV ≤ 20%; no trend when analyzed using Mann-Kendall test |
| Reference toxicant | Zinc (added as $ZnSO_4$) |

## 3.0 RESULTS

Results of the toxicity tests are summarized in Tables 5 to 8. There was no adverse effect observed on survival of *C. dubia* (Table 5). However, there was an inhibitory effect observed on reproduction, which resulted in an IC25 value of 27.1%. There was no adverse effect observed on the dry weight of *L. minor*, but a reduction in frond count was observed, resulting in IC25 values of 97 and 14.5%, respectively (Table 7). There were no adverse effects observed on survival and biomass of *P. promelas* (Table 6) and cell yield of *P. subcapitata* (Table 8), resulting in IC25 and LC50 values greater than the highest concentration tested. Significant stimulation was observed in *P. subcapitata* cell yield in all test concentrations, with percent stimulation ranging from 46.1% to 226.6%.

**Table 5. Results: *Ceriodaphnia dubia* survival and reproduction test.**

| Concentration (% v/v) | Survival (%) | Reproduction (Mean ± SD) |
|---|---|---|
| Laboratory Control | 100 | 20.9 ± 2.2 |
| 1.56 | 90 | 18.8 ± 5.3 |
| 3.12 | 100 | 20.6 ± 5.2 |
| 6.25 | 90 | 20.0 ± 2.9 |
| 12.5 | 80 | 15.7 ± 8.4 |
| 25 | 100 | 15.8 ± 5.3 |
| 50 | 90 | 14.8 ± 6.2 |
| 100 | 100 | 15.4 ± 6.7 |
| **Test endpoint (% v/v)** | | |
| LC50 | >100 | -- |
| IC25 (95% CL) | -- | 27.1 (9.8 – N/A) |
| IC50 | -- | >100 |

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, N/A = Not Available

**Table 6. Results: fathead minnow (*Pimephales promelas*) survival and growth test.**

| Concentration (%v/v) | Survival (%) Mean ± SD | Biomass (mg) Mean ± SD |
|---|---|---|
| Laboratory Control | 96.7 ± 5.8 | 0.59 ± 0.03 |
| 1.56 | 96.7 ± 5.8 | 0.57 ± 0.04 |
| 3.12 | 93.3 ± 5.8 | 0.68 ± 0.05 |
| 6.25 | 86.7 ± 5.8 | 0.61 ± 0.02 |
| 12.5 | 86.7 ± 11.6 | 0.56 ± 0.03 |
| 25 | 93.3 ± 5.8 | 0.58 ± 0.01 |
| 50 | 100 ± 0.0 | 0.58 ± 0.01 |
| 100 | 100 ± 0.0 | 0.68 ± 0.04 |
| **Test endpoint (% v/v)** | | |
| LC25 | >100 | -- |
| LC50 | >100 | -- |
| IC25 | -- | >100 |
| IC50 | -- | >100 |

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration

**Table 7. Results: *Lemna minor* growth inhibition test.**

| Concentration (% v/v) | Frond Count (Mean ± SD) | Dry Weight (mg) (Mean ± SD) |
|---|---|---|
| Laboratory Control | 102.5 ± 25.8 | 7.8 ± 2.0 |
| 1.5 | 90.8 ± 14.9 | 6.9 ± 0.9 |
| 3.0 | 78.2 ± 4.9 | 6.2 ± 0.7 |
| 6.1 | 74.8 ± 11.0 | 6.2 ± 0.9 |
| 12.1 | 83.2 ± 4.5 | 8.3 ± 0.5 |
| 24.2 | 71.5 ± 10.3 | 7.4 ± 1.6 |
| 48.5 | 62.2 ± 4.6 | 8.4 ± 1.1 |
| 97.0 | 50.5 ± 1.7 | 6.7 ± 0.6 |
| **Test endpoint (% v/v)** | | |
| IC25 (95% CL) | 14.5 (N/A – 70.6) | >97.0 |
| IC50 (95% CL) | 92.8 (30.9 – N/A) | >97.0 |

SD = Standard Deviation, IC = Inhibition Concentration, CL = Confidence Limits, N/A = Not Available

**Table 8. Results: *Pseudokirchneriella subcapitata* growth inhibition test.**

| Concentration (% v/v) | Cell Yield (x $10^4$ cells/mL) (Mean ± SD) | Stimulation (%) |
|---|---|---|
| Laboratory Control | 38.5 ± 2.7 | -- |
| 1.5 | 56.2 ± 5.4* | 46.1 |
| 3.0 | 101.8 ± 4.1* | 164.3 |
| 6.0 | 102.8 ± 5.6* | 166.9 |
| 11.9 | 112.5 ± 6.9* | 192.2 |
| 23.8 | 125.8 ± 4.8* | 226.6 |
| 47.6 | 123.5 ± 4.0* | 220.8 |
| 95.2 | 123.5 ± 3.1* | 220.8 |
| **Test endpoint (% v/v)** | | |
| IC25 | >95.2 | -- |
| IC50 | >95.2 | -- |

SD = Standard Deviation, IC = Inhibition Concentration
* = Indicates the cell yield was significantly greater than the lab control

## 4.0 QA/QC

The health history of the test organisms used in the exposures was acceptable and met the requirements of the Environment Canada protocols. The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocols throughout the tests. Uncertainty associated with the test is best described by the standard deviation around the mean and/or the confidence intervals around the point estimates.

Results of the reference toxicant tests conducted during the testing program are summarized in Table 9. Results for these tests fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with these tests, with the exception of the *C. dubia* reference toxicant. The *C. dubia* reproduction point estimate fell marginally outside the baseline historical range of mean ± two standard deviations. This was not an indication that the organism's sensitivity was inappropriate, but rather a variation in reference toxicant results falling outside narrow warning limits as a consequence of the Coefficient of Variation (% CV) being low (9%). Exceedance of the two standard deviation range is expected to occur in 5% of cases by chance alone. The reference toxicant tests were performed under the same conditions as those used for the sample.

**Table 9. Reference toxicant test results.**

| Test Species | Endpoint | Historical Mean (2 SD Range) | CV (%) | Test Date |
|---|---|---|---|---|
| *C. dubia* | Survival (LC50): 2.0 g/L NaCl | 2.0 (1.9 – 2.2) g/L NaCl | 4 | August 7, 2023 |
| | Reproduction (IC50): 1.5 g/L NaCl | 1.8 (1.5 – 2.2) g/L NaCl | 9 | |
| *P. promelas* | Survival (LC50): 3.9 g/L NaCl | 4.9 (3.6 – 6.5) g/L NaCl | 15 | August 2, 2023 |
| | Biomass (IC50): 3.8 g/L NaCl | 4.1 (3.2 – 5.2) g/L NaCl | 12 | |
| *L. minor* | No. of Fronds (IC50): 2.9 g/L KCl | 3.1 (2.7 – 3.6) g/L KCl | 7 | July 20, 2023 |
| *P. subcapitata* | Growth (IC50): 29.4 µg/L Zn | 30.3 (23.7 – 38.7) µg/L Zn | 12 | July 27, 2023 |

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration

## 5.0 REFERENCES


Environment Canada. 2007a. Biological test method: test of reproduction and survival using the cladoceran *Ceriodaphnia dubia*. Environmental Protection Series, Report EPS 1/RM/21, Second Edition, February 2007. Environment Canada, Method Development and Application Section, Environmental Science and Technology Centre, Science and Technology Branch, Ottawa, ON. 74 pp.

Environment Canada. 2007b. Biological test method: tests for measuring the inhibition of growth using the freshwater macrophyte, *Lemna minor*. Environmental Protection Series, Report EPS 1/RM/37, Second Edition, January 2007. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 112 pp.

Environment Canada. 2007c. Biological test method: growth inhibition test using the freshwater alga. Environmental Protection Series, Report EPS 1/RM/25, Second Edition, March 2007. Environment Canada, Method Development and Application Section, Environmental Science and Technology Centre, Science and Technology Branch, Ottawa, ON. 53 pp.

Environment Canada. 2011. Biological test method: test of larval growth and survival using fathead minnows. Environmental Protection Series, Report EPS 1/RM/22, February 2011. Environment Canada, Environmental Protection, Conservation and Protection, Ottawa, ON. 73 pp.

Tidepool Scientific Software. 2021. CETIS comprehensive environmental toxicity information system, version 2.1.4 Tidepool Scientific Software, McKinleyville, CA. 303 pp.

# APPENDIX A – *Ceriodaphnia dubia* Toxicity Test Data

# *Ceriodaphnia dubia* Summary Sheet

Client: Millenium EMS Solutions Ltd. Start Date/Time: Aug 1, 2023 @ 1400 h
Work Order No.: 231313 Set up by: KYL

**Sample Information:**

Sample ID: SW23-05TOX
Sample Date: July 30, 2023
Date Received: July 31, 2023
Sample Volume: 4 x 10 L

**Test Validity Criteria:**

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

**WQ Ranges:**

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

**Test Organism Information:**

Broodstock No.: BB072023 ; BB072723
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 20
Mortality (%) in previous 7 d: 0
Individual female # used ≥8 young on test day: # 2-7 : 1, 2, 4, 5, 19

**NaCl Reference Toxicant Results:**

Reference Toxicant ID: Cd337
Stock Solution ID: 23NaCl
Date Initiated: Aug 7, 2023

7-d LC50 (95% CL): 2.0 (1.7-2.3) g/L NaCl
7-d IC50 (95% CL): ~~1.4 (1.3-1.6)~~ J72 ~~1.5~~ 1.5 (1.3-1.7) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.9-2.2) g/L NaCl CV (%): 4
7-d IC50 Reference Toxicant Mean and Historical Range: 1.8 (1.5-2.2) g/L NaCl CV (%): 9

Test Results:

| | Survival | Reproduction |
|---|---|---|
| LC50 % (v/v) (95% CL) | >100 | |
| IC25 % (v/v) (95% CL) | | 27.1 (9.8 - N/A) |
| IC50 % (v/v) (95% CL) | | >100 |

Reviewed by: EMM Date reviewed: Sept 22/23

# Chronic Freshwater Toxicity Test
## Initial and Final Water Quality Measurements

**Client:** Millenium EMS Solutions Ltd.
**Sample ID:** SW23-05TOX
**Work Order #:** 231313
**Start Date & Time:** Aug. 1/23 @ 1400 h
**Stop Date & Time:** Aug. 8/23 @ 1430 h
**CER #:** 4
**Test Species:** *Ceriodaphnia dubia*

%(v/v)

| Concentration (control) | Days | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 26.0 | 25.5 | 25.0 | 26.0 | 25.0 | 26.0 | 25.5 | 26.0 | 25.5 | 26.0 | 25.5 | 26.0 | 25.5 | 26.0 |
| DO (mg/L) | 7.8 | 6.8 | 7.9 | 6.1 | 7.9 | 5.8 | 8.0 | 5.2 | 8.0 | 4.0 | 7.9 | 6.1 | 7.9 | 6.1 |
| pH | 8.3 | 7.8 | 8.0 | 7.6 | 8.2 | 7.3 | 8.2 | 7.2 | 8.2 | 7.3 | 8.3 | 7.5 | 8.0 | 7.7 |
| Cond. (µS/cm) | 207 | 213 | | 208 | | 207 | | 210 | | 210 | | 211 | | 218 |
| Initials | JZL | JZL | | AHS | | AHS | | JZL | | RZS | | RZS | | KYL |

| Concentration 1.56 | Days | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 24.5 | 25.5 | 25.5 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 |
| DO (mg/L) | 7.5 | 6.9 | 7.2 | 6.2 | 7.8 | 6.0 | 7.7 | 5.5 | 7.3 | 4.9 | 7.1 | 5.9 | 7.6 | 6.1 |
| pH | 8.0 | 7.8 | 7.9 | 7.7 | 7.9 | 7.4 | 7.9 | 7.4 | 8.1 | 7.4 | 7.9 | 7.5 | 8.2 | 7.7 |
| Cond. (µS/cm) | 254 | 256 | | 250 | | 252 | | 248 | | 248 | | 247 | | 250 |
| Initials | JZL | AHS | | AHS | | AHS | | JZL | | RZS | | RZS | | KYL |

| Concentration 12.5 | Days | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 24.5 | 26.0 | 25.5 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 |
| DO (mg/L) | 7.6 | 6.9 | 7.3 | 6.3 | 7.9 | 5.5 | 7.7 | 5.2 | 7.4 | 4.8 | 7.1 | 5.8 | 7.7 | 6.0 |
| pH | 8.0 | 7.8 | 8.0 | 7.8 | 8.0 | 7.4 | 8.0 | 7.4 | 8.1 | 7.4 | 7.9 | 7.5 | 8.0 | 7.7 |
| Cond. (µS/cm) | 526 | 538 | | 502 | | 528 | | 516 | | 519 | | 505 | | 502 |
| Initials | JZL | AHS | | AHS | | AHS | | JZL | | RZS | | RZS | | KYL |

| Concentration 100 | Days | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 26.0 | 26.0 | 25.5 | 26.0 | 24.5 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 | 25.0 | 26.0 |
| DO (mg/L) | 6.5 | 4.6 | 7.4 | 5.0 | 7.9 | 5.5 | 7.5 | 4.7 | 7.3 | 4.2 | 7.0 | 4.5 | 4.7 | 4.6 |
| pH | 7.3 | 7.4 | 7.8 | 7.8 | 7.6 | 7.6 | 7.5 | 7.7 | 7.6 | 7.6 | 7.7 | 7.7 | 7.5 | 7.8 |
| Cond. (µS/cm) | 2410 | 2400 | | 2280 | | 2350 | | 2380 | | 2420 | | 2270 | | 2180 |
| Initials | JZL | AHS | | AHS | | AHS | | JZL | | RZS | | RZS | | KYL |

Thermometer: CER #4 DO meter/probe: 1 / 1 pH meter/probe: 1 / 1 Conductivity meter/probe: 1 / 1

| | Control | 100% | | |
|---|---|---|---|---|
| Hardness* | 100 | 1040 | | |
| Alkalinity* | 92 | 190 | | |

* mg/L as CaCO3

**Analysts:** JZL, AHS, RZS, KYL, GJU, PYK
**Reviewed by:** EMM
**Date reviewed:** Sept 28/23

**Sample Description:** Dark brown, turbid, organic smell w/ native organisms and particulates.

**Comments:** Broodboard Used: BB072023 # 2-7 ; BB072723 # 1, 2, 4, 5, 19

# Chronic Freshwater Toxicity Test
## *C. dubia* Reproduction Data

**Client:** Millenium EMS Solutions Ltd.
**Sample ID:** SW23-05TOX
**Work Order:** 231313

**Start Date & Time:** Aug 1/23 @ 1400h
**Stop Date & Time:** Aug 8/23 @ 1430h
**Set up by:** BML

%(v/v)

| Days | Concentration: Control | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | / | / | 3 | / | / | / | / | / | / | / | GDM |
| 5 | 2 | 4 | / | 2 | 5 | 3 | 2 | 5 | 2 | 3 | RZS |
| 6 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 9 | 6 | 6 | PKM |
| 7 | 11 | 9 | 10 | 11 | 9 | 10 | 12 | 11 | 10 | 9 | BML |
| 8 | | | | | | | | | | | |
| Total | 19 | 23 | 21 | 21 | 22 | 21 | 21 | 25 | 18 | 18 | AHS |

| Days | Concentration: 1.56 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 5 | 4 | 6 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | GDM |
| 5 | 10 | 5 | X | 11 | 9 | 7 | 9 | 8 | 8 | 8 | RZS |
| 6 | 10 | 11 | \| | 8 | 8 | 7 | 10 | 4 | 6 | 9 | PKM |
| 7 | 7 | 9 | \| | 5 | 2 | 8 | 9 | / | 6 | 5 | BML |
| 8 | | | ↓ | | | | | | | | |
| Total | 25 | 20 | 6× | 23 | 20 | 18 | 23 | 16 | 17 | 20 | AHS |

| Days | Concentration: 3.12 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 4 | 5 | 4 | 4 | 5 | 3 | 3 | 5 | 3 | 5 | GDM |
| 5 | 10 | 9 | 3 | 9 | 9 | 6 | 10 | 9 | / | 9 | RZS |
| 6 | 11 | 2 | 7 | 8 | 11 | 11 | 9 | 11 | 9 | 11 | PKM |
| 7 | 8 | 9 | 5 | 7 | 8 | 9 | 6 | 8 | 6 | 9 | BML |
| 8 | | | | | | | | | | | |
| Total | 25 | 16 | 9 | 21 | 25 | 20 | 22 | 25 | 18 | 25 | AHS |

| Days | Concentration: 6.25 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 4 | 4 | 4 | 3 | / | 2 | 3 | 2 | 3 | / | GDM |
| 5 | 6 | 7 | / | / | 7 | 3 | 8 | 7 | 7 | / | RZS |
| 6 | 11 | 9 | 8 | 10 | 7 | 10 | 9 | 12 | 10 | 8 | PKM |
| 7 | 6 | 4 | 9 | 8 | 4× | 6 | 4 | 11 | 8 | 9 | BML |
| 8 | | | | | ↓ | | | | | | |
| Total | 21 | 20 | 21 | 21 | 18× | 15 | 20 | 21 | 26 | 17 | AHS |

| Days | Concentration: 12.5 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 4 | 4 | 4 | 3 | 6 | 3 | 2 | × | 3× | 4 | GDM |
| 5 | 9 | 11 | 4 | 10 | 10 | / | / | \| | \| | 7 | RZS |
| 6 | 6 | 5 | 4 | 12 | 3 | 14 | 9 | \| | \| | 9 | PKM |
| 7 | 5 | 6 | 9 | 10 | 4 | #7 | 4 | ↓ | ↓ | 6 | BML |
| 8 | | | | | | | | | | | |
| Total | 19 | 20 | 12 | 25 | 19 | 24 | 15 | 0× | 3× | 20 | AHS |

| Days | Concentration: 25 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 3 | 4 | 5 | 4 | 3 | 6 | 2 | 4 | / | 4 | GDM |
| 5 | 2 | / | 5 | / | / | 4 | / | 3 | / | 5 | RZS |
| 6 | 7 | 11 | 9 | 4 | 6 | 4 | 8 | 4 | / | 11 | PKM |
| 7 | 6 | 10 | 10 | 8 | 9 | 4 | 7 | 6 | 6 | 4 | BML |
| 8 | | | | | | | | | | | |
| Total | 12 | 25 | 19 | 16 | 18 | 14 | 17 | 11 | 6 | 20 | AHS |

| Days | Concentration: 50 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 3 | 5 | 2 | / | / | / | 4 | 3 | 4 | 4 | GDM |
| 5 | / | 2 | 5 | / | / | X | / | / | / | 2 | RZS |
| 6 | 9 | 10 | / | 7 | 11 | \| | 12 | 8 | 8 | 10 | RZS |
| 7 | 6 | 7 | 9 | 8 | 4 | \| | 8 | 4 | 6 | 6 | BML |
| 8 | | | | | | ↓ | | | | | |
| Total | 17 | 17 | 16 | 10 | 15 | 0× | 24 | 15 | 18 | 16 | AHS |

| Days | Concentration: 100 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | / | / | / | / | / | / | / | / | / | / | JZL |
| 2 | / | / | / | / | / | / | / | / | / | / | GDM |
| 3 | / | / | / | / | / | / | / | / | / | / | GDM |
| 4 | 4 | 5 | 6 | 4 | / | 4 | 4 | 4 | 4 | / | GDM |
| 5 | 4 | 7 | 9 | 3 | / | / | 3 | 5 | 3 | / | RZS |
| 6 | 11 | 9 | 6 | #10 | 2 | 11 | 9 | 10 | 8 | / | RZS |
| 7 | 8 | 7 | 8 | 4 | 6 | 4 | 7 | 6 | 4 | / | BML |
| 8 | | | | | | | | | | | |
| Total | 19 | 21 | 21 | 17 | 8 | 19 | 16 | 19 | 14 | 0 | AHS |

| Days | Concentration: | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | Init |
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| Total | | | | | | | | | | | |

Notes: X = mortality.

**Comments:** 1. Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

2. Ephippia present in Controls (Y), (N)?

**Reviewed by:** EMM

**Date reviewed:** Sept 22/23

# CETIS Summary Report



**Ceriodaphnia 7-d Survival and Reproduction Test** — **Nautilus Environmental**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Batch ID:** | 05-0954-2319 | **Test Type:** | Reproduction-Survival (7d) | **Analyst:** | Stephanie Hans | | |
| **Start Date:** | 01 Aug-23 14:00 | **Protocol:** | ~~EPA/821/R-02-013 (2002)~~ SMH EPS1/RM/21 | **Diluent:** | 20% Perrier Water | | |
| **Ending Date:** | 08 Aug-23 14:30 | **Species:** | Ceriodaphnia dubia | **Brine:** | | | |
| **Test Length:** | 7d 0h | **Taxon:** | Branchiopoda | **Source:** | In-House Culture | **Age:** | <24 h |

| | | | | | |
|---|---|---|---|---|---|
| **Sample ID:** | 05-5034-7669 | **Code:** | 20CDA395 | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 51h (0.3 °C) | **Client:** | Millennium EMS Solutions | | |

## Point Estimate Summary

| Analysis ID | Endpoint | Point Estimate Method | ✓ | Level | % | 95% LCL | 95% UCL | TU | S |
|---|---|---|---|---|---|---|---|---|---|
| 10-9405-5295 | 7d Survival Rate | Linear Interpolation (ICPIN) | | EC15 | >100 | --- | --- | <1 | 1 |
| | | | | EC20 | >100 | --- | --- | <1 | |
| | | | | EC25 | >100 | --- | --- | <1 | |
| | | | ✓ | EC40 | >100 | --- | --- | <1 | |
| | | | ✓ | EC50 | >100 | --- | --- | <1 | |
| 04-2315-9167 | Reproduction | Linear Interpolation (ICPIN) | ✓ | IC15 | 8.908 | 1.435 | 27.5 | 11.2 | 1 |
| | | | ✓ | IC20 | 10.63 | 7.877 | --- | 9.4 | |
| | | | ✓ | IC25 | 27.1 | 9.812 | --- | 3.7 | |
| | | | ✓ | IC40 | >100 | --- | --- | <1 | |
| | | | ✓ | IC50 | >100 | --- | --- | <1 | |

## Test Acceptability

| Analysis ID | Endpoint | Attribute | Test Stat | TAC Limits Lower | TAC Limits Upper | Overlap | Decision |
|---|---|---|---|---|---|---|---|
| 10-9405-5295 | 7d Survival Rate | Control Resp | 1 | 0.8 | << | Yes | Passes Criteria |
| 04-2315-9167 | Reproduction | Control Resp | 20.9 | 15 | << | Yes | Passes Criteria |

## 7d Survival Rate Summary

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | 0.00% |
| 1.56 | | 10 | 0.9000 | 0.6738 | 1.1260 | 0.0000 | 1.0000 | 0.1000 | 0.3162 | 35.14% | 10.00% |
| 3.12 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | 0.00% |
| 6.25 | | 10 | 0.9000 | 0.6738 | 1.1260 | 0.0000 | 1.0000 | 0.1000 | 0.3162 | 35.14% | 10.00% |
| 12.5 | | 10 | 0.8000 | 0.4984 | 1.1020 | 0.0000 | 1.0000 | 0.1333 | 0.4216 | 52.70% | 20.00% |
| 25 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | 0.00% |
| 50 | | 10 | 0.9000 | 0.6738 | 1.1260 | 0.0000 | 1.0000 | 0.1000 | 0.3162 | 35.14% | 10.00% |
| 100 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | 0.00% |

## Reproduction Summary

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 10 | 20.9 | 19.34 | 22.46 | 18 | 25 | 0.6904 | 2.183 | 10.45% | 0.00% |
| 1.56 | | 10 | 18.8 | 15 | 22.6 | 6 | 25 | 1.679 | 5.308 | 28.24% | 10.05% |
| 3.12 | | 10 | 20.6 | 16.89 | 24.31 | 9 | 25 | 1.641 | 5.19 | 25.19% | 1.44% |
| 6.25 | | 10 | 20 | 17.89 | 22.11 | 15 | 26 | 0.9309 | 2.944 | 14.72% | 4.31% |
| 12.5 | | 10 | 15.7 | 9.686 | 21.71 | 0 | 25 | 2.659 | 8.407 | 53.55% | 24.88% |
| 25 | | 10 | 15.8 | 11.99 | 19.61 | 6 | 25 | 1.685 | 5.329 | 33.73% | 24.40% |
| 50 | | 10 | 14.8 | 10.34 | 19.26 | 0 | 24 | 1.971 | 6.233 | 42.11% | 29.19% |
| 100 | | 10 | 15.4 | 10.64 | 20.16 | 0 | 21 | 2.104 | 6.653 | 43.20% | 26.32% |

**Ceriodaphnia 7-d Survival and Reproduction Test** — **Nautilus Environmental**

## 7d Survival Rate Detail

MD5: 07B20B6829247647642F83A83C7D9AFD

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 1.56 | | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 3.12 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 6.25 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 12.5 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 1.0000 |
| 25 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 50 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 100 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

## Reproduction Detail

MD5: E66F5D895F28AE7ACDA3A6F201A068F8

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 19 | 23 | 21 | 21 | 22 | 21 | 21 | 25 | 18 | 18 |
| 1.56 | | 25 | 20 | 6 | 23 | 20 | 18 | 23 | 16 | 17 | 20 |
| 3.12 | | 25 | 16 | 9 | 21 | 25 | 20 | 22 | 25 | 18 | 25 |
| 6.25 | | 21 | 20 | 21 | 21 | 18 | 15 | 20 | 21 | 26 | 17 |
| 12.5 | | 19 | 20 | 12 | 25 | 19 | 24 | 15 | 0 | 3 | 20 |
| 25 | | 12 | 25 | 19 | 16 | 18 | 14 | 17 | 11 | 6 | 20 |
| 50 | | 17 | 17 | 16 | 10 | 15 | 0 | 24 | 15 | 18 | 16 |
| 100 | | 19 | 21 | 21 | 17 | 8 | 19 | 16 | 19 | 14 | 0 |

## 7d Survival Rate Binomials

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 1.56 | | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 3.12 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 6.25 | | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 12.5 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 0/1 | 1/1 |
| 25 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 50 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 100 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |

# CETIS Analytical Report



**Ceriodaphnia 7-d Survival and Reproduction Test** — Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 10-9405-5295 | **Endpoint:** | 7d Survival Rate | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 20 Sep-23 15:10 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 20 Sep-23 15:07 | **MD5 Hash:** | 07B20B6829247647642F83A83C7D9AFD | **Editor ID:** | 002-888-235-1 |
| **Batch ID:** | 05-0954-2319 | **Test Type:** | Reproduction-Survival (7d) | **Analyst:** | Stephanie Hans |
| **Start Date:** | 01 Aug-23 14:00 | **Protocol:** | ~~EPA/821/R-02-013 (2002)~~ SMH EPS1/RM/21 | **Diluent:** | 20% Perrier Water |
| **Ending Date:** | 08 Aug-23 14:30 | **Species:** | Ceriodaphnia dubia | **Brine:** | |
| **Test Length:** | 7d 0h | **Taxon:** | Branchiopoda | **Source:** | In-House Culture Age: <24 h |
| **Sample ID:** | 05-5034-7669 | **Code:** | 20CDA395 | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 51h (0.3 °C) | **Client:** | Millennium EMS Solutions | | |

**Linear Interpolation Options**

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 1632267 | 200 | Yes | Two-Point Interpolation |

**Test Acceptability Criteria**

| | | TAC Limits | | | |
|---|---|---|---|---|---|
| **Attribute** | **Test Stat** | **Lower** | **Upper** | **Overlap** | **Decision** |
| Control Resp | 1 | 0.8 | << | Yes | Passes Criteria |

**Point Estimates**

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| EC15 | >100 | --- | --- | <1 | --- | --- |
| EC20 | >100 | --- | --- | <1 | --- | --- |
| EC25 | >100 | --- | --- | <1 | --- | --- |
| EC40 | >100 | --- | --- | <1 | --- | --- |
| EC50 | >100 | --- | --- | <1 | --- | --- |

**7d Survival Rate Summary**

| | | | Calculated Variate(A/B) | | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Conc-%** | **Code** | **Count** | **Mean** | **Median** | **Min** | **Max** | **CV%** | **%Effect** | **ΣA/ΣB** | **Mean** | **%Effect** |
| 0 | N | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | 0.00% | 10/10 | 1.0000 | 0.00% |
| 1.56 | | 10 | 0.9000 | 1.0000 | 0.0000 | 1.0000 | 35.14% | 10.00% | 9/10 | 0.9500 | 5.00% |
| 3.12 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | 0.00% | 10/10 | 0.9500 | 5.00% |
| 6.25 | | 10 | 0.9000 | 1.0000 | 0.0000 | 1.0000 | 35.14% | 10.00% | 9/10 | 0.9200 | 8.00% |
| 12.5 | | 10 | 0.8000 | 1.0000 | 0.0000 | 1.0000 | 52.70% | 20.00% | 8/10 | 0.9200 | 8.00% |
| 25 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | 0.00% | 10/10 | 0.9200 | 8.00% |
| 50 | | 10 | 0.9000 | 1.0000 | 0.0000 | 1.0000 | 35.14% | 10.00% | 9/10 | 0.9200 | 8.00% |
| 100 | | 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | 0.00% | 10/10 | 0.9200 | 8.00% |

**7d Survival Rate Detail**

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 1.56 | | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 3.12 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 6.25 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 12.5 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 1.0000 |
| 25 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 50 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 100 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

## Ceriodaphnia 7-d Survival and Reproduction Test

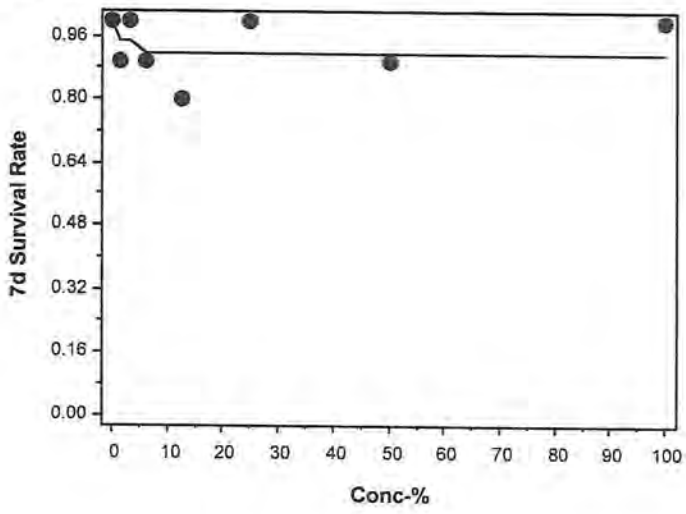
Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 10-9405-5295 | **Endpoint:** | 7d Survival Rate | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 20 Sep-23 15:10 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 20 Sep-23 15:07 | **MD5 Hash:** | 07B20B6829247647642F83A83C7D9AFD | **Editor ID:** | 002-888-235-1 |

### 7d Survival Rate Binomials

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 1.56 | | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 3.12 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 6.25 | | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 12.5 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 0/1 | 1/1 |
| 25 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 50 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 0/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| 100 | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |

### Graphics



## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 04-2315-9167 | **Endpoint:** | Reproduction | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 20 Sep-23 15:11 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 20 Sep-23 15:07 | **MD5 Hash:** | E66F5D895F28AE7ACDA3A6F201A068F8 | **Editor ID:** | 002-888-235-1 |
| **Batch ID:** | 05-0954-2319 | **Test Type:** | Reproduction-Survival (7d) SMH | **Analyst:** | Stephanie Hans |
| **Start Date:** | 01 Aug-23 14:00 | **Protocol:** | ~~EPA/821/R-02-013 (2002)~~ EPS1/RM/21 | **Diluent:** | 20% Perrier Water |
| **Ending Date:** | 08 Aug-23 14:30 | **Species:** | Ceriodaphnia dubia | **Brine:** | |
| **Test Length:** | 7d 0h | **Taxon:** | Branchiopoda | **Source:** | In-House Culture **Age:** <24 h |
| **Sample ID:** | 05-5034-7669 | **Code:** | 20CDA395 | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 51h (0.3 °C) | **Client:** | Millennium EMS Solutions | | |

### Linear Interpolation Options

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 890486 | 200 | Yes | Two-Point Interpolation |

### Test Acceptability Criteria

| | | TAC Limits | | | |
|---|---|---|---|---|---|
| **Attribute** | **Test Stat** | **Lower** | **Upper** | **Overlap** | **Decision** |
| Control Resp | 20.9 | 15 | << | Yes | Passes Criteria |

### Point Estimates

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | 8.908 | 1.435 | 27.5 | 11.2 | 3.6 | 69.7 |
| IC20 | 10.63 | 7.877 | --- | 9.4 | --- | 12.7 |
| IC25 | 27.1 | 9.812 | --- | 3.7 | --- | 10.2 |
| IC40 | >100 | --- | --- | <1 | --- | --- |
| IC50 | >100 | --- | --- | <1 | --- | --- |

### Reproduction Summary

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Conc-%** | **Code** | **Count** | **Mean** | **Median** | **Min** | **Max** | **CV%** | **%Effect** | **Mean** | **%Effect** |
| 0 | N | 10 | 20.9 | 21 | 18 | 25 | 10.45% | 0.00% | 20.9 | 0.00% |
| 1.56 | | 10 | 18.8 | 20 | 6 | 25 | 28.24% | 10.05% | 19.8 | 5.26% |
| 3.12 | | 10 | 20.6 | 21.5 | 9 | 25 | 25.19% | 1.44% | 19.8 | 5.26% |
| 6.25 | | 10 | 20 | 20.67 | 15 | 26 | 14.72% | 4.31% | 19.8 | 5.26% |
| 12.5 | | 10 | 15.7 | 19 | 0 | 25 | 53.55% | 24.88% | 15.75 | 24.64% |
| 25 | | 10 | 15.8 | 16.5 | 6 | 25 | 33.73% | 24.40% | 15.75 | 24.64% |
| 50 | | 10 | 14.8 | 16 | 0 | 24 | 42.11% | 29.19% | 15.1 | 27.75% |
| 100 | | 10 | 15.4 | 18.5 | 0 | 21 | 43.20% | 26.32% | 15.1 | 27.75% |

### Reproduction Detail

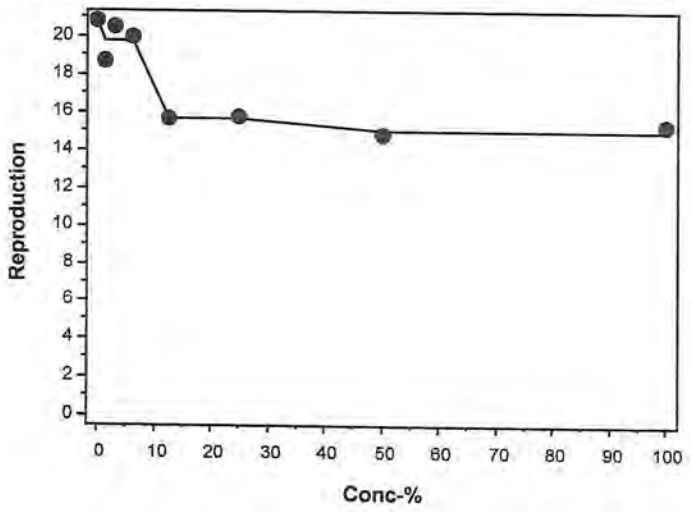
| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 | Rep 9 | Rep 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 19 | 23 | 21 | 21 | 22 | 21 | 21 | 25 | 18 | 18 |
| 1.56 | | 25 | 20 | 6 | 23 | 20 | 18 | 23 | 16 | 17 | 20 |
| 3.12 | | 25 | 16 | 9 | 21 | 25 | 20 | 22 | 25 | 18 | 25 |
| 6.25 | | 21 | 20 | 21 | 21 | 18 | 15 | 20 | 21 | 26 | 17 |
| 12.5 | | 19 | 20 | 12 | 25 | 19 | 24 | 15 | 0 | 3 | 20 |
| 25 | | 12 | 25 | 19 | 16 | 18 | 14 | 17 | 11 | 6 | 20 |
| 50 | | 17 | 17 | 16 | 10 | 15 | 0 | 24 | 15 | 18 | 16 |
| 100 | | 19 | 21 | 21 | 17 | 8 | 19 | 16 | 19 | 14 | 0 |

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 04-2315-9167 | **Endpoint:** | Reproduction | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 20 Sep-23 15:11 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 20 Sep-23 15:07 | **MD5 Hash:** | E66F5D895F28AE7ACDA3A6F201A068F8 | **Editor ID:** | 002-888-235-1 |

**Graphics**



# APPENDIX B – *Pimephales promelas* Toxicity Test Data

# Fathead Minnow Test Summary Sheet

(7-d *Pimephales promelas* Survival and Growth Test)

Client: Millenium EMS Solutions Ltd. (MEMS)
Work Order No.: 231314

Start Date/Time: August 2, 2023 / 18:00
Test Species: P. promelas

**Test Validity Criteria:**
The test is invalid if :

1) for the control solutions, the combined and cumulative incidence of any mortalities, or fish showing loss of equilibrium or other signs of atypical swimming behavior, is >20%

2) the average dry weight of the surviving control fish does not attain 250 ug when the fish are dried and weighed.

**WQ Ranges:**
T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4; pH = 6.5 to 8.5

**Sample Information:**

Sample ID: SW23-OSTOX
Sample Date: July 30 2023
Date Received: July 31, 2023
Sample Volume: 4x10L

**Dilution Water** (initial water quality):

Type: Moderately Hard Water
Temperature (°C): 25.5
pH: 7.9
Dissolved Oxygen (mg/L): 7.8
Hardness (mg/L $CaCO_3$): 96
Alkalinity (mg/L $CaCO_3$): 76

**Test Organism Information:**

Batch No.: 080123
Source: Aquatic Biosystems, CO
Age: <24h
Receipt temperature: 23.5
Acclimation rate: <3.0°C/day

Mortality prior to test initiation: 3.9%
Swim bladder inflated at test initiation? (Y/N): Y
Breeding stock mortality during the week prior to test initiation (%): <1%
Breeding stock mortality on weekly basis: <1%
Incidence of disease: None

**NaCl Reference Toxicant Results:**

Reference Toxicant ID: PP218
NaCl Lot #: 22A1562L4
Date Initiated: August 2, 2023
7-d EC50 (95% CL): 3.9 (3.4 – 4.5) g/L NaCl
7-d IC50 (95% CL): 3.8 (3.4 – 4.2) g/L NaCl

**Survival:**
Reference Toxicant Mean and Historical Range: 4.9 (3.6 – 6.5) NaCl (g/L) 15 CV (%)

**Biomass:**
Reference Toxicant Mean and Historical Range: 4.1 (3.2 – 5.2) NaCl (g/L) 12.2 CV (%)

**Test Results:**

| | Survival | Biomass |
|---|---|---|
| LC25 % (v/v) (95% CL) | >100 | |
| LC50 % (v/v) (95% CL) | >100 | |
| IC25 % (v/v) (95% CL) | | >100 |
| IC50 % (v/v) (95% CL) | | >100 |

Reviewed by: ML
Date reviewed: 08/27/23

# 7-d Chronic Freshwater Toxicity Test
## Initial and Final Water Quality Measurements

Client:
Sample ID: Millenium SW23-OSTOX
Work Order #: 231314

Start Date & Time: Aug 2, 2023 / ~~11:00~~ 11:00
Stop Date & Time: Aug 9, 2023 / ~~13:00~~ 13:00
CER #: 11
Test Species: *Pimephales promelas*

| % (v/v) Concentration (control) | Days | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 25.5 | 25.0 | 26.0 | 25.0 | 25.5 | 25.0 | 25.0 | 25.0 | 25.0 | 24.5 | 24.0 | 24.5 | 24.0 | 24.0 |
| DO (mg/L) | 7.8 | 7.3 | 8.0 | 5.7 | 8.1 | 4.9 | 8.0 | 3.9 | 8.1 | 5.0 | 8.1 | 5.2 | 8.1 | 5.1 |
| pH | 7.9 | 7.7 | 8.2 | 7.5 | 8.0 | 7.4 | 8.0 | 7.5 | 8.0 | 7.5 | ~~8.0~~ 8.0 | 7.3 | 8.0 | 7.4 |
| Cond. (µS/cm) | 358 | 355 | | 355 | | 357 | | 356 | | 355 | | 355 | | 385 |
| Initials | PYH | LSR/PYH | | PYH | | IMC | | T.C./IMC | | PYH | | LSR/PYH | | PYH |

| Concentration 1.56 | Days | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 25.5 | 25.0 | 25.5 | 25.0 | 25.5 | 25.0 | 25.0 | 25.0 | 25.0 | 24.5 | 24.5 | 24.5 | 24.0 | 24.0 |
| DO (mg/L) | 8.0 | 7.4 | 8.0 | 5.4 | 7.9 | 5.0 | 7.8 | 3.5 | 7.9 | 5.0 | 8.1 | 5.4 | 8.2 | 5.2 |
| pH | ~~8.01~~ 8.0 | 7.9 | 8.0 | 7.4 | 8.0 | 7.5 | 7.9 | 7.5 | 8.0 | 7.7 | 8.0 | 7.4 | 7.9 | 7.4 |
| Cond. (µS/cm) | 394 | 393 | | 390 | | ~~2389~~ 389 | | 396 | | 392 | | 397 | | 416 |
| Initials | PYH | LSR/ | | PYH | | IMC | | T.C/IMC | | PYH | | LSR/PYH | | PYH |

| Concentration 12.5 | Days | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 25.5 | 25.0 | 25.5 | 25.0 | 25.5 | 25.0 | 25.0 | 25.0 | 25.0 | 24.5 | 24.5 | 24.5 | 24.0 | 24.0 |
| DO (mg/L) | 8.0 | 7.3 | 8.0 | 5.7 | 8.0 | 4.7 | 8.0 | 4.4 | 8.1 | 5.4 | 8.1 | 5.9 | 8.2 | 5.5 |
| pH | 8.0 | 7.9 | 8.0 | 7.5 | 8.0 | 7.3 | 7.8 | 7.3 | 8.0 | 7.5 | 7.9 | 7.5 | 7.9 | 7.4 |
| Cond. (µS/cm) | 637 | 639 | | 634 | | 626 | | 643 | | 646 | | 663 | | 679 |
| Initials | PYH | LSR/ | | PYH | | IMC | | TC/IMC | | PYH | | LSR/PYH | | PYH |

| Concentration 100 | Days | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | init. | old | new | old | new | old | new | old | new | old | new | old | new | final |
| Temperature (°C) | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 24.5 | 24.5 | 24.5 | 24.5 | 24.0 |
| DO (mg/L) | 6.8 | 6.5 | 7.6 | 5.0 | 8.0 | 3.6 | 7.9 | 3.4 | 8.1 | 4.8 | 8.2 | 5.2 | 8.2 | 3.8 |
| pH | 7.4 | 8.0 | 7.3 | 7.9 | 7.9 | 7.7 | 7.8 | 7.6 | 7.9 | ~~7.7~~ 7.7 | 7.5 | 7.8 | 7.1 | 7.6 |
| Cond. (µS/cm) | 2260 | 2290 | | 2330 | | 2330 | | 2310 | | 2370 | | 2400 | | 2400 |
| Initials | PYH | LSR/PYH | | PYH | | IMC | | TC/IMC | | PYH | | LSR/PYH | | PYH |

Thermometer: CER#11 DO meter/probe: 4 / 4 pH meter/probe: 4 / 4 Conductivity meter/probe: 4 / 4

| | Control | SW23-OSTOX | (100% v/v) | |
|---|---|---|---|---|
| Hardness* | 96 | 1040 | | |
| Alkalinity* | 76 | 190 | | |

* mg/L as CaCO3

Analysts: PYH, LSR, IMC, TC
Reviewed by: KYL
Date reviewed: MG Oct 26/23

Sample Description: Dark brown, turbid, organic odour, liquid w/ native organisms & particulates

Comments: ① 8.1 (pH)

# 7-d Fathead Minnow Toxicity Test
## Daily Survival

**Client:** Millerdale
**Sample ID:** SW23-0510x
**Work Order #:** ~~23~~ 231314

**Start Date & Time:** Aug 2, 2023 / 11:00h
**Stop Date & Time:** Aug 9, 2023 / 13:00
**Test Species:** *Pimephales promelas*

| Concentration % (v/v) | Rep | Day of Test - Percent Survival | | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Control | A | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| | B | ↓ | ↓ | 100 | 100 | 100 | 100 | ↓ | |
| | C | ↓ | ↓ | 90 | 90 | 90 | 90 | 90 | |
| 1.56 | A | ↓ | ↓ | 100 | 100 | 100 | 100 | 100 | |
| | B | ↓ | ↓ | ↓ | 100 | 100 | 100 | ↓ | |
| | C | ↓ | ↓ | ↓ | 90 | 90 | 90 | 90 | |
| 3.12 | A | ↓ | ↓ | 90 | 90 | 90 | ↓ | ↓ | |
| | B | ↓ | ↓ | 100 | 100 | 90 | ↓ | ↓ | |
| | C | ↓ | ↓ | 100 | 100 | 100 | 100 | 100 | |
| 6.25 | A | ↓ | ↓ | 90 | 90 | 90 | 90 | 90 | |
| | B | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 80 | |
| | C | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 90 | |
| 12.5 | A | ↓ | ↓ | 100 | 100 | 100 | 100 | 100 | |
| | B | ↓ | ↓ | 80 | 80 | 80 | 80 | 80 | |
| | C | ↓ | ↓ | 90 | 90 | 90 | 80 | 80 | |
| 25 | A | ↓ | ↓ | 100 | 100 | 100 | 100 | 100 | |
| | B | ↓ | ↓ | 100 | 90 | 90 | 90 | 90 | |
| | C | ↓ | ↓ | 90 | 90 | 90 | ~~100~~ 90 | 90 | |
| 50 | A | ↓ | ↓ | 100 | 100 | 100 | AE 100 | 100 | |
| | B | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| | C | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| 100 | A | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| | B | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| | C | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| Tech Initials | | PM | PM | TMC | T.C/KM | PM | PM | PM | |

**Legend:**
1- Fish dying
2- Fish showing loss of equilibrium
3- Fish showing atypical swimming

**Test solution depth:** ~6.5 cm
**Comments:** Remaining fish appear normal at termination

**Reviewed by:** MG
**Date reviewed:** Oct 26/23

# Fathead Minnow Toxicity Test Data Sheet

## Dry Weight Data

Client: Millennium

Sample ID: SW23-0590

Work Order No.: 231314

Start Date & Time: Aug 2, 2023 @ 1100h

Termination Date & Time: Aug 9, 2023 @ 1310h

Balance ID: Bal - 6

Oven ID: 2

C Blue

| Concentration %(v/v) | Rep | Pan No. | No. alive | Initials | Pan weight (mg) | Pan + organism (mg) | No. weighed | Initials |
|---|---|---|---|---|---|---|---|---|
| Control | A | 1 | 10 | AJD | 980.84 | 986.97 | 10 | AJD / AJD |
| | B | 2 | ↓ | \| | 993.09 | 999.01 | ↓ | \| |
| | C | 3 | 9 | \| | 1000.09 | 1005.69 | 9 | \| |
| 1.56 | A | 4 | 10 | \| | 993.59 | 998.96 | 10 | \| |
| | B | 5 | 10 | \| | 977.99 | 984.10 | ↓ | \| |
| | C | 6 | 9 | \| | 985.77 | 991.37 | 9 | \| |
| 3.12 | A | 7 | \| | \| | 989.06 | 995.79 | \| | \| |
| | B | 8 | ↓ | \| | 984.36 | 990.70 | ↓ | \| |
| | C | 9 | 10 | \| | 987.24 | 994.50 | 10 | \| |
| 6.25 | A | 10 | 9 | \| | 1026.82 | 1032.49 | 8① | \| |
| | B | 11 | 8 | \| | 999.87 | 1005.75 | 8 | \| |
| | C | 12 | 9 | \| | 1004.67 | 1010.87 | 9 | \| |
| 12.5 | A | 13 | 10 | \| | 1031.08 | 1036.81 | 10 | \| |
| | B | 14 | 8 | \| | 969.99 | 975.35 | 8 | \| |
| | C | 15 | 8 | \| | 985.81 | 991.65 | 8 | \| |
| ~~50~~ 25 | A | 16 | 10 | \| | 987.09 | 992.80 | 10 | \| |
| | B | 17 | 9 | \| | 974.67 | 980.41 | 9 | \| |
| | C | 18 | 9 | \| | 989.27 | 995.17 | ↓ | \| |
| 50 | A | 19 | 10 | \| | 995.29 | 1001.07 | 10 | \| |
| | B | 20 | \| | \| | 992.16 | 998.13 | \| | \| |
| | C | 21 | \| | \| | 1005.14 | 1010.85 | \| | \| |
| 100 | A | 22 | \| | \| | 1008.43 | 1015.73 | \| | \| |
| | B | ~~23~~ 8 | \| | \| | 1009.01 | 1015.81 | \| | \| |
| | C | 24 | ↓ | ↓ | 1008.39 | 1014.80 | ↓ | ↓ |

Date/time pan placed in oven: Aug 1/23 @ 0900h

Date/time pan + organisms placed in oven: Aug 9/23 @ 1330h

Date/time pan removed from oven: Aug 2/23 @ 0930h

Date/time pan + organisms removed from oven: Aug 10/23 @ 1330h

Comments: (1) lost in transfer

10% re-weigh: Pan #8: 998.92mg Pan #21: 1010.36mg

Reviewed by: MG

Date Reviewed: Oct 26/23

# CETIS Summary Report

Report Date: 27 Oct-23 14:25 (p 1 of 1)
Test Code/ID: 231314 / 15-7078-4980

**Fathead Minnow 7-d Larval Survival and Growth Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| Batch ID: | 08-5572-9747 | Test Type: | Growth-Survival (7d) | Analyst: | Pierre Koelich |
| Start Date: | 02 Aug-23 11:00 | Protocol: | EC/EPS 1/RM/22 | Diluent: | Mod-Hard Synthetic Water |
| Ending Date: | 09 Aug-23 13:00 | Species: | Pimephales promelas | Brine: | |
| Test Length: | 7d 2h | Taxon: | Actinopterygii | Source: | Aquatic Biosystems, CO Age: <24h |
| Sample ID: | 05-5034-7669 | Code: | 20CDA395 | Project: | |
| Sample Date: | 30 Jul-23 11:00 | Material: | Water Sample | Source: | Millennium EMS Solutions |
| Receipt Date: | 31 Jul-23 16:49 | CAS (PC): | | Station: | SW23-05TOX |
| Sample Age: | 72h (0.3 °C) | Client: | Millennium EMS Solutions | | |

**Point Estimate Summary**

| Analysis ID | Endpoint | Point Estimate Method | Level | % | 95% LCL | 95% UCL | TU | S |
|---|---|---|---|---|---|---|---|---|
| 01-7246-7026 | 7d Survival Rate | Linear Interpolation (ICPIN) | EC15 | >100 | --- | --- | <1 | 1 |
| | | | EC20 | >100 | --- | --- | <1 | |
| | | | EC25 | >100 | --- | --- | <1 | |
| | | | EC40 | >100 | --- | --- | <1 | |
| | | | EC50 | >100 | --- | --- | <1 | |

**7d Survival Rate Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | LC | 3 | 0.9667 | 0.8232 | 1.1100 | 0.9000 | 1.0000 | 0.0333 | 0.0577 | 5.97% | 0.00% |
| 1.56 | | 3 | 0.9667 | 0.8232 | 1.1100 | 0.9000 | 1.0000 | 0.0333 | 0.0577 | 5.97% | 0.00% |
| 3.12 | | 3 | 0.9333 | 0.7899 | 1.0770 | 0.9000 | 1.0000 | 0.0333 | 0.0577 | 6.19% | 3.45% |
| 6.25 | | 3 | 0.8667 | 0.7232 | 1.0100 | 0.8000 | 0.9000 | 0.0333 | 0.0577 | 6.66% | 10.34% |
| 12.5 | | 3 | 0.8667 | 0.5798 | 1.1540 | 0.8000 | 1.0000 | 0.0667 | 0.1155 | 13.32% | 10.34% |
| 25 | | 3 | 0.9333 | 0.7899 | 1.0770 | 0.9000 | 1.0000 | 0.0333 | 0.0577 | 6.19% | 3.45% |
| 50 | | 3 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | -3.45% |
| 100 | | 3 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.00% | -3.45% |

**7d Survival Rate Detail**

MD5: 342CF60E98BB2F664600869E1BD26391

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 1.0000 | 1.0000 | 0.9000 |
| 1.56 | | 1.0000 | 1.0000 | 0.9000 |
| 3.12 | | 0.9000 | 0.9000 | 1.0000 |
| 6.25 | | 0.9000 | 0.8000 | 0.9000 |
| 12.5 | | 1.0000 | 0.8000 | 0.8000 |
| 25 | | 1.0000 | 0.9000 | 0.9000 |
| 50 | | 1.0000 | 1.0000 | 1.0000 |
| 100 | | 1.0000 | 1.0000 | 1.0000 |

**7d Survival Rate Binomials**

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 10/10 | 10/10 | 9/10 |
| 1.56 | | 10/10 | 10/10 | 9/10 |
| 3.12 | | 9/10 | 9/10 | 10/10 |
| 6.25 | | 9/10① | 8/10 | 9/10 |
| 12.5 | | 10/10 | 8/10 | 8/10 |
| 25 | | 10/10 | 9/10 | 9/10 |
| 50 | | 10/10 | 10/10 | 10/10 |
| 100 | | 10/10 | 10/10 | 10/10 |

① 1 lost in transfer ∴ 8

# CETIS Summary Report



**Fathead Minnow 7-d Larval Survival and Growth Test** — **Nautilus Environmental**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Batch ID:** | 08-5572-9747 | **Test Type:** | Growth-Survival (7d) | **Analyst:** | Pierre Koelich | | |
| **Start Date:** | 02 Aug-23 11:00 | **Protocol:** | EC/EPS 1/RM/22 | **Diluent:** | Mod-Hard Synthetic Water | | |
| **Ending Date:** | 09 Aug-23 13:00 | **Species:** | Pimephales promelas | **Brine:** | | | |
| **Test Length:** | 7d 2h | **Taxon:** | Actinopterygii | **Source:** | Aquatic Biosystems, CO | **Age:** | <24 h |
| **Sample ID:** | 05-5034-7669 | **Code:** | 20CDA395 | **Project:** | | | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions | | |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX | | |
| **Sample Age:** | 72h (0.3 °C) | **Client:** | Millennium EMS Solutions | | | | |

**Point Estimate Summary**

| Analysis ID | Endpoint | Point Estimate Method | ✓ | Level | % | 95% LCL | 95% UCL | TU | S |
|---|---|---|---|---|---|---|---|---|---|
| ✓ 06-1805-6512 | Mean Dry Biomass-mg | Linear Interpolation (ICPIN) | ✓ | IC15 | >100 | --- | --- | <1 | 1 |
| | | | ✓ | IC20 | >100 | --- | --- | <1 | |
| | | | ✓ | IC25 | >100 | --- | --- | <1 | |
| | | | ✓ | IC40 | >100 | --- | --- | <1 | |
| | | | ✓ | IC50 | >100 | --- | --- | <1 | |
| ✓ 20-7618-7278 | Mean Dry Weight-mg | Linear Interpolation (ICPIN) | ✓ | IC15 | >100 | --- | --- | <1 | 1 |
| | | | ✓ | IC20 | >100 | --- | --- | <1 | |
| | | | ✓ | IC25 | >100 | --- | --- | <1 | |
| | | | ✓ | IC40 | >100 | --- | --- | <1 | |
| | | | ✓ | IC50 | >100 | --- | --- | <1 | |

**Mean Dry Biomass-mg Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | LC | 3 | 0.5883 ✓ | 0.522 | 0.6546 | 0.56 | 0.613 | 0.01541 | 0.02669 | 4.54% | 0.00% |
| 1.56 | | 3 | 0.5693 | 0.4753 | 0.6634 | 0.537 | 0.611 | 0.02187 | 0.03787 | 6.65% | 3.23% |
| 3.12 | | 3 | 0.6777 | 0.563 | 0.7924 | 0.634 | 0.726 | 0.02666 | 0.04618 | 6.81% | -15.18% |
| 6.25 | | 3 | 0.6127 | 0.5582 | 0.6672 | 0.588 | 0.63 | 0.01267 | 0.02194 | 3.58% | -4.14% |
| 12.5 | | 3 | 0.5643 | 0.5019 | 0.6268 | 0.536 | 0.584 | 0.01452 | 0.02515 | 4.46% | 4.08% |
| 25 | | 3 | 0.5783 | 0.553 | 0.6037 | 0.571 | 0.59 | 0.005897 | 0.01021 | 1.77% | 1.70% |
| 50 | | 3 | 0.582 | 0.5486 | 0.6154 | 0.571 | 0.597 | 0.007769 | 0.01346 | 2.31% | 1.08% |
| 100 | | 3 | 0.6837 | 0.5728 | 0.7945 | 0.641 | 0.73 | 0.02576 | 0.04461 | 6.53% | -16.20% |

**Mean Dry Weight-mg Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | LC | 3 | 0.6091 ✓ | 0.5706 | 0.6475 | 0.592 | 0.6222 | 0.008942 | 0.01549 | 2.54% | 0.00% |
| 1.56 | | 3 | 0.5901 | 0.475 | 0.7051 | 0.537 | 0.6222 | 0.02673 | 0.0463 | 7.85% | 3.12% |
| 3.12 | | 3 | 0.7261 | 0.6723 | 0.7799 | 0.7044 | 0.7478 | 0.01251 | 0.02166 | 2.98% | -19.21% |
| 6.25 | | 3 | 0.7109 | 0.6534 | 0.7683 | 0.6889 | 0.735 | 0.01335 | 0.02313 | 3.25% | -16.72% |
| 12.5 | | 3 | 0.6577 | 0.4609 | 0.8545 | 0.573 | 0.73 | 0.04574 | 0.07922 | 12.05% | -7.98% |
| 25 | | 3 | 0.6214 | 0.5107 | 0.7322 | 0.571 | 0.6556 | 0.02574 | 0.04458 | 7.17% | -2.03% |
| 50 | | 3 | 0.582 | 0.5486 | 0.6154 | 0.571 | 0.597 | 0.007769 | 0.01346 | 2.31% | 4.44% |
| 100 | | 3 | 0.6837 | 0.5728 | 0.7945 | 0.641 | 0.73 | 0.02576 | 0.04461 | 6.53% | -12.25% |

## Mean Dry Biomass-mg Detail

MD5: 65721FF2F768C737EF04884BFF159C61

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 0.613 | 0.592 | 0.56 |
| 1.56 | | 0.537 | 0.611 | 0.56 |
| 3.12 | | 0.673 | 0.634 | 0.726 |
| 6.25 | | 0.63 | 0.588 | 0.62 |
| 12.5 | | 0.573 | 0.536 | 0.584 |
| 25 | | 0.571 | 0.574 | 0.59 |
| 50 | | 0.578 | 0.597 | 0.571 |
| 100 | | 0.73 | 0.68 | 0.641 |

## Mean Dry Weight-mg Detail

MD5: C3190A524DD8067C236846928976A585

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 0.613 | 0.592 | 0.6222 |
| 1.56 | | 0.537 | 0.611 | 0.6222 |
| 3.12 | | 0.7478 | 0.7044 | 0.726 |
| 6.25 | | 0.7088 | 0.735 | 0.6889 |
| 12.5 | | 0.573 | 0.67 | 0.73 |
| 25 | | 0.571 | 0.6378 | 0.6556 |
| 50 | | 0.578 | 0.597 | 0.571 |
| 100 | | 0.73 | 0.68 | 0.641 |

# CETIS Analytical Report



**Fathead Minnow 7-d Larval Survival and Growth Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 01-7246-7026 | **Endpoint:** | 7d Survival Rate | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 27 Oct-23 14:11 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 27 Oct-23 14:10 | **MD5 Hash:** | 342CF60E98BB2F664600869E1BD26391 | **Editor ID:** | 004-311-246-8 |
| **Batch ID:** | 08-5572-9747 | **Test Type:** | Growth-Survival (7d) | **Analyst:** | Pierre Koelich |
| **Start Date:** | 02 Aug-23 11:00 | **Protocol:** | EC/EPS 1/RM/22 | **Diluent:** | Mod-Hard Synthetic Water |
| **Ending Date:** | 09 Aug-23 13:00 | **Species:** | Pimephales promelas | **Brine:** | |
| **Test Length:** | 7d 2h | **Taxon:** | Actinopterygii | **Source:** | Aquatic Biosystems, CO **Age:** <24h |
| **Sample ID:** | 05-5034-7669 | **Code:** | 20CDA395 | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 72h (0.3 °C) | **Client:** | Millennium EMS Solutions | | |

**Linear Interpolation Options**

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 1427641 | 200 | Yes | Two-Point Interpolation |

**Point Estimates**

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| EC15 | >100 | --- | --- | <1 | --- | --- |
| EC20 | >100 | --- | --- | <1 | --- | --- |
| EC25 | >100 | --- | --- | <1 | --- | --- |
| EC40 | >100 | --- | --- | <1 | --- | --- |
| EC50 | >100 | --- | --- | <1 | --- | --- |

**7d Survival Rate Summary**

| | | | Calculated Variate(A/B) | | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | ΣA/ΣB | Mean | %Effect |
| 0 | LC | 3 | 0.9667 | 1.0000 | 0.9000 | 1.0000 | 5.97% | 0.00% | 29/30 | 0.9667 | 0.00% |
| 1.56 | | 3 | 0.9667 | 1.0000 | 0.9000 | 1.0000 | 5.97% | 0.00% | 29/30 | 0.9667 | 0.00% |
| 3.12 | | 3 | 0.9333 | 0.9000 | 0.9000 | 1.0000 | 6.19% | 3.45% | 28/30 | 0.9333 | 3.46% |
| 6.25 | | 3 | 0.8667 | 0.9000 | 0.8000 | 0.9000 | 6.66% | 10.34% | 26/30 | 0.9333 | 3.46% |
| 12.5 | | 3 | 0.8667 | 0.8000 | 0.8000 | 1.0000 | 13.32% | 10.34% | 26/30 | 0.9333 | 3.46% |
| 25 | | 3 | 0.9333 | 0.9000 | 0.9000 | 1.0000 | 6.19% | 3.45% | 28/30 | 0.9333 | 3.46% |
| 50 | | 3 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | -3.45% | 30/30 | 0.9333 | 3.46% |
| 100 | | 3 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.00% | -3.45% | 30/30 | 0.9333 | 3.46% |

**7d Survival Rate Detail**

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 1.0000 | 1.0000 | 0.9000 |
| 1.56 | | 1.0000 | 1.0000 | 0.9000 |
| 3.12 | | 0.9000 | 0.9000 | 1.0000 |
| 6.25 | | 0.9000 | 0.8000 | 0.9000 |
| 12.5 | | 1.0000 | 0.8000 | 0.8000 |
| 25 | | 1.0000 | 0.9000 | 0.9000 |
| 50 | | 1.0000 | 1.0000 | 1.0000 |
| 100 | | 1.0000 | 1.0000 | 1.0000 |

**7d Survival Rate Binomials**

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 10/10 | 10/10 | 9/10 |
| 1.56 | | 10/10 | 10/10 | 9/10 |
| 3.12 | | 9/10 | 9/10 | 10/10 |
| 6.25 | | 9/10① | 8/10 | 9/10 |
| 12.5 | | 10/10 | 8/10 | 8/10 |
| 25 | | 10/10 | 9/10 | 9/10 |
| 50 | | 10/10 | 10/10 | 10/10 |
| 100 | | 10/10 | 10/10 | 10/10 |

① 1 lost in transfer ∴ 8

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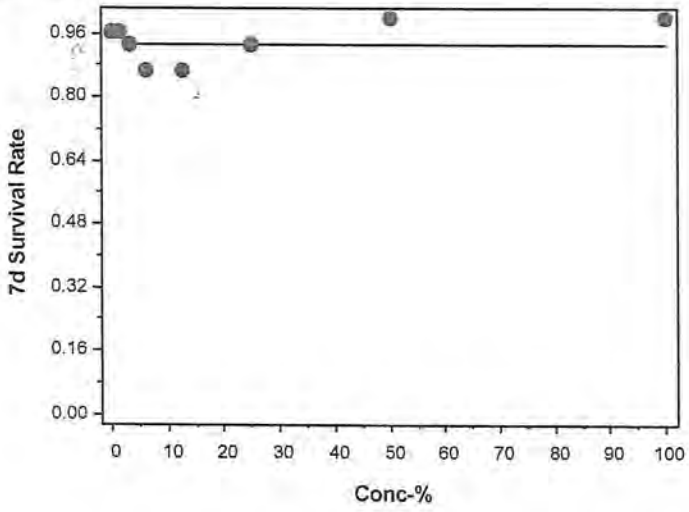
## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 01-7246-7026 | **Endpoint:** | 7d Survival Rate | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 27 Oct-23 14:11 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 27 Oct-23 14:10 | **MD5 Hash:** | 342CF60E98BB2F664600869E1BD26391 | **Editor ID:** | 004-311-246-8 |

**Graphics**



# CETIS Analytical Report



## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| Analysis ID: | 06-1805-6512 | Endpoint: | Mean Dry Biomass-mg | CETIS Version: | CETISv2.1.4 |
| Analyzed: | 17 Oct-23 14:08 | Analysis: | Linear Interpolation (ICPIN) | Status Level: | 1 |
| Edit Date: | 17 Oct-23 14:04 | MD5 Hash: | 65721FF2F768C737EF04884BFF159C61 | Editor ID: | 004-311-246-8 |
| Batch ID: | 08-5572-9747 | Test Type: | Growth-Survival (7d) | Analyst: | Pierre Koelich |
| Start Date: | 02 Aug-23 11:00 | Protocol: | EC/EPS 1/RM/22 | Diluent: | Mod-Hard Synthetic Water |
| Ending Date: | 09 Aug-23 13:00 | Species: | Pimephales promelas | Brine: | |
| Test Length: | 7d 2h | Taxon: | Actinopterygii | Source: | Aquatic Biosystems, CO Age: <24h |
| Sample ID: | 05-5034-7669 | Code: | 20CDA395 | Project: | |
| Sample Date: | 30 Jul-23 11:00 | Material: | Water Sample | Source: | Millennium EMS Solutions |
| Receipt Date: | 31 Jul-23 16:49 | CAS (PC): | | Station: | SW23-05TOX |
| Sample Age: | 72h (0.3 °C) | Client: | Millennium EMS Solutions | | |

### Linear Interpolation Options

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 1396914 | 200 | Yes | Two-Point Interpolation |

### Point Estimates

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | >100 | --- | --- | <1 | --- | --- |
| IC20 | >100 | --- | --- | <1 | --- | --- |
| IC25 | >100 | --- | --- | <1 | --- | --- |
| IC40 | >100 | --- | --- | <1 | --- | --- |
| IC50 | >100 | --- | --- | <1 | --- | --- |

### Mean Dry Biomass-mg Summary

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | Mean | %Effect |
| 0 | LC | 3 | 0.5883 | 0.592 | 0.56 | 0.613 | 4.54% | 0.00% | 0.612 | 0.00% |
| 1.56 | | 3 | 0.5693 | 0.56 | 0.537 | 0.611 | 6.65% | 3.23% | 0.612 | 0.00% |
| 3.12 | | 3 | 0.6777 | 0.673 | 0.634 | 0.726 | 6.81% | -15.18% | 0.612 | 0.00% |
| 6.25 | | 3 | 0.6127 | 0.62 | 0.588 | 0.63 | 3.58% | -4.14% | 0.612 | 0.00% |
| 12.5 | | 3 | 0.5643 | 0.573 | 0.536 | 0.584 | 4.46% | 4.08% | 0.6021 | 1.62% |
| 25 | | 3 | 0.5783 | 0.574 | 0.571 | 0.59 | 1.77% | 1.70% | 0.6021 | 1.62% |
| 50 | | 3 | 0.582 | 0.578 | 0.571 | 0.597 | 2.31% | 1.08% | 0.6021 | 1.62% |
| 100 | | 3 | 0.6837 | 0.68 | 0.641 | 0.73 | 6.53% | -16.20% | 0.6021 | 1.62% |

### Mean Dry Biomass-mg Detail

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 0.613 | 0.592 | 0.56 |
| 1.56 | | 0.537 | 0.611 | 0.56 |
| 3.12 | | 0.673 | 0.634 | 0.726 |
| 6.25 | | 0.63 | 0.588 | 0.62 |
| 12.5 | | 0.573 | 0.536 | 0.584 |
| 25 | | 0.571 | 0.574 | 0.59 |
| 50 | | 0.578 | 0.597 | 0.571 |
| 100 | | 0.73 | 0.68 | 0.641 |

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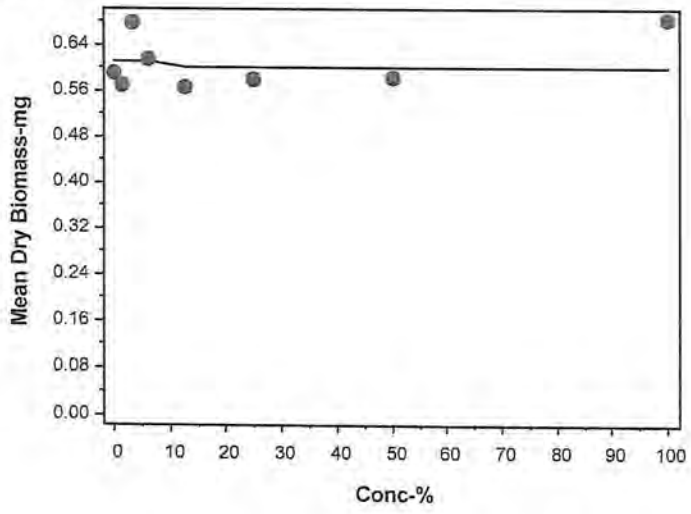
| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 06-1805-6512 | **Endpoint:** | Mean Dry Biomass-mg | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 17 Oct-23 14:08 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 17 Oct-23 14:04 | **MD5 Hash:** | 65721FF2F768C737EF04884BFF159C61 | **Editor ID:** | 004-311-246-8 |

**Graphics**



# CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| Analysis ID: | 20-7618-7278 | Endpoint: | Mean Dry Weight-mg | CETIS Version: | CETISv2.1.4 |
| Analyzed: | 17 Oct-23 14:08 | Analysis: | Linear Interpolation (ICPIN) | Status Level: | 1 |
| Edit Date: | 17 Oct-23 14:04 | MD5 Hash: | C3190A524DD8067C236846928976A585 | Editor ID: | 004-311-246-8 |
| Batch ID: | 08-5572-9747 | Test Type: | Growth-Survival (7d) | Analyst: | Pierre Koelich |
| Start Date: | 02 Aug-23 11:00 | Protocol: | EC/EPS 1/RM/22 | Diluent: | Mod-Hard Synthetic Water |
| Ending Date: | 09 Aug-23 13:00 | Species: | Pimephales promelas | Brine: | |
| Test Length: | 7d 2h | Taxon: | Actinopterygii | Source: | Aquatic Biosystems, CO Age: <24 h |
| Sample ID: | 05-5034-7669 | Code: | 20CDA395 | Project: | |
| Sample Date: | 30 Jul-23 11:00 | Material: | Water Sample | Source: | Millennium EMS Solutions |
| Receipt Date: | 31 Jul-23 16:49 | CAS (PC): | | Station: | SW23-05TOX |
| Sample Age: | 72h (0.3 °C) | Client: | Millennium EMS Solutions | | |

**Linear Interpolation Options**

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 1178966 | 200 | Yes | Two-Point Interpolation |

**Point Estimates**

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | >100 | --- | --- | <1 | --- | --- |
| IC20 | >100 | --- | --- | <1 | --- | --- |
| IC25 | >100 | --- | --- | <1 | --- | --- |
| IC40 | >100 | --- | --- | <1 | --- | --- |
| IC50 | >100 | --- | --- | <1 | --- | --- |

**Mean Dry Weight-mg Summary**

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | Mean | %Effect |
| 0 | LC | 3 | 0.6091 | 0.613 | 0.592 | 0.6222 | 2.54% | 0.00% | 0.659 | 0.00% |
| 1.56 | | 3 | 0.5901 | 0.611 | 0.537 | 0.6222 | 7.85% | 3.12% | 0.659 | 0.00% |
| 3.12 | | 3 | 0.7261 | 0.726 | 0.7044 | 0.7478 | 2.98% | -19.21% | 0.659 | 0.00% |
| 6.25 | | 3 | 0.7109 | 0.7088 | 0.6889 | 0.735 | 3.25% | -16.72% | 0.659 | 0.00% |
| 12.5 | | 3 | 0.6577 | 0.67 | 0.573 | 0.73 | 12.05% | -7.98% | 0.6577 | 0.20% |
| 25 | | 3 | 0.6214 | 0.6378 | 0.571 | 0.6556 | 7.17% | -2.03% | 0.629 | 4.55% |
| 50 | | 3 | 0.582 | 0.578 | 0.571 | 0.597 | 2.31% | 4.44% | 0.629 | 4.55% |
| 100 | | 3 | 0.6837 | 0.68 | 0.641 | 0.73 | 6.53% | -12.25% | 0.629 | 4.55% |

**Mean Dry Weight-mg Detail**

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 |
|---|---|---|---|---|
| 0 | LC | 0.613 | 0.592 | 0.6222 |
| 1.56 | | 0.537 | 0.611 | 0.6222 |
| 3.12 | | 0.7478 | 0.7044 | 0.726 |
| 6.25 | | 0.7088 | 0.735 | 0.6889 |
| 12.5 | | 0.573 | 0.67 | 0.73 |
| 25 | | 0.571 | 0.6378 | 0.6556 |
| 50 | | 0.578 | 0.597 | 0.571 |
| 100 | | 0.73 | 0.68 | 0.641 |

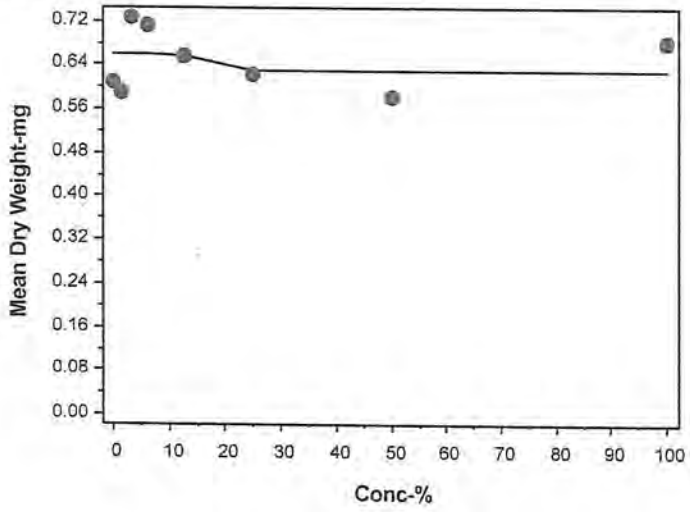
Oct 27/23

## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 20-7618-7278 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 17 Oct-23 14:08 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 17 Oct-23 14:04 | **MD5 Hash:** | C3190A524DD8067C236846928976A585 | **Editor ID:** | 004-311-246-8 |

**Graphics**






Analyst: PYN

QA: MG

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# APPENDIX C – *Lemna minor* Toxicity Test Data

# *Lemna minor* Summary Sheet

Client: Millennium EMS Solutions Ltd (MEMS) Start Date/Time: Aug 2/23 @ 1330h
Work Order No.: 231315 Set up by: GSL

**Sample Information:**

Sample ID: SW23-05TDX
Sample Date: July. 30/23
Date Received: July. 31/23
Sample Volume: 4 x 10 L

**Test Organism Information:**

Culture Date: July. 26/23
Age of culture (Day 0): 7 days
≥8X growth in APHA?: y (74 fronds)

**KCl Reference Toxicant Results:**

Reference Toxicant ID: Lm246
Date Initiated: July. 20/23

7-d No. of Fronds IC50 (95% CL): 2.9 (1.6 - 3.5) g/L KCl

7-d No. Fronds IC50 Reference Toxicant Mean (2 SD Range): 3.1 (2.7 - 3.6) g/L KCl CV (%): 7

| | | Number of Fronds | Dry Weight |
|---|---|---|---|
| Test Results: | IC25 %(v/v) (95% CL) | 14.5 (N/A - 70.6) | 7.97 |
| | IC50 %(v/v) (95% CL) | 92.8 (30.9 - N/A) | 7.97 |

Reviewed by: ML Date reviewed: Oct 1/23

# Plant Growth Inhibition Toxicity Test
## Water Quality Measurements

**Client :** Millennium EMS Solutions Ltd. (MEMS) **Setup by:** GSM

**Sample ID:** SW23 - 05TOX **Test Date & Time:** Aug. 2/23 @ 1330h

**Work Order No.:** 231315 **CER #:** 9

**Culture Source:** CPCC #490 **Test Species:** *Lemna minor*

**Test Culture Age:** 7 days **> 8X Growth? (Y/N):** y (74 fronds)

**Light Intensity Range:** 4870 – 5500 lux **Date Measured:** Aug. 2/23

| Day | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Shelf Temp (°C) | 25.5 | 25.5 | 26.0 | 25.5 | 25.5 | 26.0 | 25.5 | 26.0 |
| Initials | GSM | GSM | GSM | GSM | KML | KML | RZJ | GSM |

| Sample Characteristics: | Initial Water Quality | | Adjusted Water Quality |
|---|---|---|---|
| Temperature (°C) | 26.0 | Aeration?: 20 min | 24.0 |
| DO (mg/L) | 2.3 | Nutrients added?[1]: | 6.9 |
| pH | 6.9 | y | 7.6 |
| Conductivity (µS) | 2330 | | 2950 |

[1] 10 mL of each APHA stock (A,B and C) added to 970 mL sample.

| Concentration % (v/v) | Temperature (°C) | | pH | | Conductivity (µS) |
|---|---|---|---|---|---|
| | Day 0 | Day 7 | Day 0 | Day 7 | 0 h |
| Control | 24.5 | 26.0 | 8.3 | 9.0 | 870 |
| 1.5 | 25.0 | 26.0 | 8.3 | GSM 10.8 | 924 |
| 3.0 | 25.5 | 26.0 | 8.3 | 11.1 | 957 |
| 6.1 | 25.5 | 26.0 | 8.3 | 11.3 | 1029 |
| 12.1 | 25.5 | 26.0 | 8.3 | 10.8 | 1173 |
| 24.2 | 25.0 | 26.0 | 8.2 | 10.8 | 1455 |
| 48.5 | 25.0 | 26.0 | 8.1 | 10.9 | 1974 |
| 97 | 24.0 | 26.0 | 7.6 | 10.6 | 2950 |
| Initials | GSM | GSM | GSM | GSM | GSM |

**Thermometer:** CPCC #9 **Light meter:** 1 **pH meter/probe:** 1 / 1 **DO meter/probe:** 1 / 1 **Conductivity meter/probe:** 1 / 1

**Sample Description:** ~~light~~ dark brown, turbid, organic smell, ~~y~~ native organisms and particulates GSM

**Comments:**

**Reviewed:** MK **Date Reviewed:** Sept 26/23

# *Lemna minor* Toxicity Test Data Sheet - 7-d Frond Counts

Client: Millennium EMS Solutions Ltd (MEMS)
Sample ID: SW23 - 05TOX
Work Order #: 231315

Start Date & Time: Aug. 2/23 @ 1330h
Termination Date: Aug. 9/23
Test set up by: GM

| Concentration % (v/v) | Rep | No. of fronds | | Chlorosis | Necrosis | Yellow | Abnormal size | Gibbosity | Single fronds | Root destruction | Loss of buoyancy | Comments | Initials |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day 0 | Day 7 | | | | | | | | | | |
| control | A | 6 | 70 | | | | | | | | | pH: 9.5; conductivity = 894 | GM |
| | B | ↓ | 119 | | | | | | | | | | ↓ |
| | C | | 121 | | | | | | | | | | |
| | D | | 124 | | | | | | | | | | |
| 1.5 | A | | 116 | | | | | | | | | pH: 10.5; conductivity = 923 ① | |
| | B | | 93 | | | | | | | | | | |
| | C | | 98 | | | | | | | | | | |
| | D | | 80 | × | | × | | | | | | | |
| 3.0 | A | | 77 | | | × | | | | | | | |
| | B | | 86 | × | | × | | | | | | | |
| | C | | 87 | × | | × | | | | | | | |
| | D | | 87 | × | | × | | | | | | | |
| 6.1 | A | | 79 | | | × | | | | | | | |
| | B | | 91 | | | × | | | | | | | |
| | C | | 66 | | | | | | | | | | |
| | D | | 87 | × | | × | | | | | | | |
| 12.1 | A | | 93 | | | | | | | | | | |
| | B | | 83 | | | × | | | | | | | |
| | C | | 92 | | | | | | | | | | |
| | D | | 89 | | | | | | | | | | |
| 24.2 | A | | 89 | | | | | | | | | | |
| | B | | 78 | | | | | | | | | | |
| | C | | 64 | | | | | | | | | | |
| | D | ↓ | 79 | | | | | | | | | | ↓ |

Comments: ① Algae present

Reviewed by: MJ

Date Reviewed: Sept 26/23

## *Lemna minor* Toxicity Test Data Sheet - 7-d Frond Counts

Client: Millennium EHS Solutions Ltd (MEHS)
Sample ID: SW23-05TOX
Work Order #: 231315

Start Date & Time: Aug. 2/23 @ 1330h
Termination Date: Aug. 9/23
Test set up by: CSM

| Concentration % (v/v) | Rep | No. of fronds | | Chlorosis | Necrosis | Yellow | Abnormal size | Gibbosity | Single fronds | Root destruction | Loss of buoyancy | Comments | Initials |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day 0 | Day 7 | | | | | | | | | | |
| 48.5 97 | A | 6 | 62 | | | | | | | | | ① | GSM |
| | B | ↓ | 73 | | | | | | | | | ↓ | ↓ |
| | C | | 70 | | | | | | | | | | |
| | D | | 68 | | | | | | | | | | |
| 97 | A | | 54 | | | | | | | | | | |
| | B | | 58 | | | | | | | | | | |
| | C | | 57 | | | | | | | | | | |
| | D | ↓ | 57 | | | | | | | | | ↓ | ↓ |
| | A | | | | | | | | | | | | |
| | B | | | | | | | | | | | | |
| | C | | | | | | | | | | | | |
| | D | | | | | | | | | | | | |
| | A | | | | | | | | | | | | |
| | B | | | | | | | | | | | | |
| | C | | | | | | | | | | | | |
| | D | | | | | | | | | | | | |
| | A | | | | | | | | | | | | |
| | B | | | | | | | | | | | | |
| | C | | | | | | | | | | | | |
| | D | | | | | | | | | | | | |
| | A | | | | | | | | | | | | |
| | B | | | | | | | | | | | | |
| | C | | | | | | | | | | | | |
| | D | | | | | | | | | | | | |

Comments: ① Algae present

Reviewed by: WC

Date Reviewed: Sept 26/23

# 7-d *Lemna minor* Weight Data Sheet

Client: Millennium EMS Solutions Ltd (MEMS) Start Date & Time: Aug. 2/23 @ 1330h

Sample ID: SW23 - 05TOX Termination Date: Aug. 9/23

WO #: 231315 Balance ID: Bal - 6

% (v/v) BA blue

| Concentration | Rep | Pan No. | Pan weight (mg) | Pan + plant (mg) | Initials |
|---|---|---|---|---|---|
| control | A | 1 | 1011.12 | 1015.99 | LSR / AJD |
| | B | 2 | 1023.13 | 1031.64 | |
| | C | 3 | 1025.36 | 1034.36 | |
| | D | 4 | 1008.68 | 1017.60 | |
| 1.5 | A | 5 | 1004.52 | 1012.55 | |
| | B | 6 | 1003.15 | 1009.97 | |
| | C | 7 | 997.56 | 1004.59 | |
| | D | 8 | 1019.04 | 1024.89 | |
| 3.0 | A | 9 | 1022.39 | 1027.61 | |
| | B | 10 | 1024.34 | 1030.76 | |
| | C | 11 | 1003.81 | 1010.36 | |
| | D | 12 | 995.67 | 1002.36 | |
| 6.1 | A | 13 | 988.33 | 994.13 | |
| | B | 14 | 991.82 | 998.77 | |
| | C | 15 | 983.09 | 988.17 | |
| | D | 16 | 998.33 | 1005.11 | |
| 12.1 | A | 17 | 986.52 | 995.25 | |
| | B | 18 | 987.83 | 995.59 | |
| | C | 19 | 992.77 | 1001.52 | |
| | D | 20 | 1007.14 | 1015.16 | |
| 24.2 | A | 21 | 1001.59 | 1010.52 | |
| | B | 22 | 1004.05 | 1011.22 | |
| | C | 23 | 992.64 | 997.81 | |
| | D | 24 | 1002.44 | 1010.60 | |
| 48.5 | A | 25 | 997.83 | 1004.73 | |
| | B | 26 | 996.91 | 1006.13 | |
| | C | 27 | 982.71 | 991.01 | |
| | D | 28 | 985.10 | 994.14 | ↓ |

Date/time pan placed in oven: July 31/23 @ 1030h

Date/time pan + organisms placed in oven: Aug. 9/23 @ 1130h

Date/time pan removed from oven: Aug. 1/23 @ 1030h

Date/time pan + organisms removed from oven: Aug. 10/23 @ 1130h

Comments: 10% reweigh pan #5: 1012.38 mg pan #17: 995.14

pan #30: 1022.80 mg

Reviewed by: MC Date Reviewed: Oct 1/23

# 7-d *Lemna minor* Weight Data Sheet

Client: Hüllenmium EHS Solutions Ltd (ALEXS) Start Date & Time: Aug. 2/23 @ 1330h

Sample ID: SW23-05TOX Termination Date: Aug. 9/23

WO #: 231315 Balance ID: Bal - 6

7.(%) BA blue

| Concentration | Rep | Pan No. | Pan weight (mg) | Pan + plant (mg) | Initials |
|---|---|---|---|---|---|
| 97 | A | 29 | 1023.79 | 1030.95 | LSR / AJD |
| | B | 30 | 1015.79 | 1022.92 | ↓ |
| | C | 31 | 1007.58 | 1014.12 | |
| | D | 32 | 1006.91 | 1012.86 | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |
| | A | | | | |
| | B | | | | |
| | C | | | | |
| | D | | | | |

Date/time pan placed in oven: July. 31/23 @ 1030h

Date/time pan + organisms placed in oven: Aug. 9/23 @ 1130h

Date/time pan removed from oven: Aug. 1/23 @ 1030h

Date/time pan + organisms removed from oven: Aug. 10/23 @ 1130h.

Comments:

Reviewed by: MCT Date Reviewed: Oct 1/23

# CETIS Summary Report



**EC Lemna Growth Inhibition Test** — **Nautilus Environmental**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Batch ID:** | 18-5520-3472 | **Test Type:** | Lemna Growth | **Analyst:** | Gabriella Utomo | | |
| **Start Date:** | 02 Aug-23 13:30 ✓ | **Protocol:** | EC/EPS 1/RM/37 ✓ | **Diluent:** | Modified APHA ✓ | | |
| **Ending Date:** | 09 Aug-23 ✓ | **Species:** | Lemna minor ✓ | **Brine:** | | | |
| **Test Length:** | 6d 10h | **Taxon:** | Tracheophyta | **Source:** | CPCC#490 ✓ | **Age:** | 7d ✓ |

| | | | | | |
|---|---|---|---|---|---|
| **Sample ID:** | 16-4549-4470 | **Code:** | SW23-05TOX | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 ✓ | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions ✓ |
| **Receipt Date:** | 31 Jul-23 16:49 ✓ | **CAS (PC):** | | **Station:** | SW23-05TOX ✓ |
| **Sample Age:** | 74h (0.3 °C) ✓ | **Client:** | Millennium | | |

**Point Estimate Summary**

| Analysis ID | Endpoint | Point Estimate Method | ✓ | Level | % | 95% LCL | 95% UCL | TU | S |
|---|---|---|---|---|---|---|---|---|---|
| ✓08-2397-8843 | Frond Count | Linear Interpolation (ICPIN) | | IC15 | 1.881 | --- | 38.4 | 53.2 | 1 |
| | | | | IC20 | 2.522 | --- | 51.38 | 39.7 | |
| | | | ✓ | IC25 | 14.52 | --- | 70.57 | 6.9 | |
| | | | | IC40 | 50.71 | 1.41 | 123 | 2 | |
| | | | ✓ | IC50 | 92.82 | 30.88 | --- | 1.1 | |
| ✓01-1949-4530 | Total Dry Weight-mg | Linear Interpolation (ICPIN) | | IC15 | >97 | --- | --- | <1 | 1 |
| | | | | IC20 | >97 | --- | --- | <1 | |
| | | | ✓ | IC25 | >97 | --- | --- | <1 | |
| | | | | IC40 | >97 | --- | --- | <1 | |
| | | | ✓ | IC50 | >97 | --- | --- | <1 | |

**Frond Count Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 4 | 102.5 | 61.53 | 143.5 | 64 | 118 | 12.87 | 25.75 | 25.12% | 0.00% |
| 1.5 | | 4 | 90.75 | 67.03 | 114.5 | 74 | 110 | 7.454 | 14.91 | 16.43% | 11.46% |
| 3 | | 4 | 78.25 | 70.52 | 85.98 | 71 | 81 | 2.428 | 4.856 | 6.21% | 23.66% |
| 6.1 | | 4 | 74.75 | 57.2 | 92.3 | 60 | 85 | 5.513 | 11.03 | 14.75% | 27.07% |
| 12.1 | | 4 | 83.25 | 76.09 | 90.41 | 77 | 87 | 2.25 | 4.5 | 5.41% | 18.78% |
| 24.2 | | 4 | 71.5 | 55.14 | 87.86 | 58 | 83 | 5.14 | 10.28 | 14.38% | 30.24% |
| 48.5 | | 4 | 62.25 | 54.86 | 69.64 | 56 | 67 | 2.323 | 4.646 | 7.46% | 39.27% |
| 97 | | 4 | 50.5 | 47.74 | 53.26 | 48 | 52 | 0.866 | 1.732 | 3.43% | 50.73% |

**Total Dry Weight-mg Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 4 | 7.83 | 4.673 | 10.99 | 4.87 | 9 | 0.992 | 1.984 | 25.34% | 0.00% |
| 1.5 | | 4 | 6.932 | 5.51 | 8.355 | 5.85 | 8.03 | 0.4471 | 0.8941 | 12.90% | 11.46% |
| 3 | | 4 | 6.22 | 5.145 | 7.295 | 5.22 | 6.69 | 0.3379 | 0.6757 | 10.86% | 20.56% |
| 6.1 | | 4 | 6.152 | 4.758 | 7.547 | 5.08 | 6.95 | 0.4382 | 0.8764 | 14.25% | 21.42% |
| 12.1 | | 4 | 8.315 | 7.516 | 9.114 | 7.76 | 8.75 | 0.2511 | 0.5022 | 6.04% | -6.19% |
| 24.2 | | 4 | 7.357 | 4.769 | 9.946 | 5.17 | 8.93 | 0.8133 | 1.627 | 22.11% | 6.03% |
| 48.5 | | 4 | 8.365 | 6.687 | 10.04 | 6.9 | 9.22 | 0.5274 | 1.055 | 12.61% | -6.83% |
| 97 | | 4 | 6.695 | 5.783 | 7.607 | 5.95 | 7.16 | 0.2864 | 0.5728 | 8.56% | 14.50% |

EC Lemna Growth Inhibition Test — Nautilus Environmental

**Frond Count Detail** — MD5: 2955C77A865BD22B9694060EF1AFD10B

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
|---|---|---|---|---|---|
| 0 | N | 64 | 113 | 115 | 118 |
| 1.5 | | 110 | 87 | 92 | 74 |
| 3 | | 71 | 80 | 81 | 81 |
| 6.1 | | 73 | 85 | 60 | 81 |
| 12.1 | | 87 | 77 | 86 | 83 |
| 24.2 | | 83 | 72 | 58 | 73 |
| 48.5 | | 56 | 67 | 64 | 62 |
| 97 | | 48 | 52 | 51 | 51 |

**Total Dry Weight-mg Detail** — MD5: 19FFE5F78638CF41E7AA862F8B731D70

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
|---|---|---|---|---|---|
| 0 | N | 4.87 | 8.53 | 9 | 8.92 |
| 1.5 | | 8.03 | 6.82 | 7.03 | 5.85 |
| 3 | | 5.22 | 6.42 | 6.55 | 6.69 |
| 6.1 | | 5.8 | 6.95 | 5.08 | 6.78 |
| 12.1 | | 8.73 | 7.76 | 8.75 | 8.02 |
| 24.2 | | 8.93 | 7.17 | 5.17 | 8.16 |
| 48.5 | | 6.9 | 9.22 | 8.3 | 9.04 |
| 97 | | 7.16 | 7.13 | 6.54 | 5.95 |

## EC Lemna Growth Inhibition Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| Analysis ID: | 08-2397-8843 | Endpoint: | Frond Count | CETIS Version: | CETISv2.1.4 |
| Analyzed: | 17 Aug-23 14:55 | Analysis: | Linear Interpolation (ICPIN) | Status Level: | 1 |
| Edit Date: | 17 Aug-23 14:53 | MD5 Hash: | 2955C77A865BD22B9694060EF1AFD10B | Editor ID: | |
| Batch ID: | 18-5520-3472 | Test Type: | Lemna Growth | Analyst: | Gabriella Utomo |
| Start Date: | 02 Aug-23 13:30 | Protocol: | EC/EPS 1/RM/37 | Diluent: | Modified APHA |
| Ending Date: | 09 Aug-23 | Species: | Lemna minor | Brine: | |
| Test Length: | 6d 10h | Taxon: | Tracheophyta | Source: | CPCC#490 Age: 7d |
| Sample ID: | 16-4549-4470 | Code: | SW23-05TOX | Project: | |
| Sample Date: | 30 Jul-23 11:00 | Material: | Water Sample | Source: | Millennium EMS Solutions |
| Receipt Date: | 31 Jul-23 16:49 | CAS (PC): | | Station: | SW23-05TOX |
| Sample Age: | 74h (0.3 °C) | Client: | Millennium | | |

### Linear Interpolation Options

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 1378069 | 200 | Yes | Two-Point Interpolation |

### Point Estimates

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | 1.881 | --- | 38.4 | 53.2 | 2.6 | --- |
| IC20 | 2.522 | --- | 51.38 | 39.7 | 1.9 | --- |
| IC25 | 14.52 | --- | 70.57 | 6.9 | 1.4 | --- |
| IC40 | 50.71 | 1.41 | 123 | 2 | 0.8 | 70.9 |
| IC50 | 92.82 | 30.88 | --- | 1.1 | --- | 3.2 |

### Frond Count Summary

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | Mean | %Effect |
| 0 | N | 4 | 102.5 | 114 | 64 | 118 | 25.12% | 0.00% | 102.5 | 0.00% |
| 1.5 | | 4 | 90.75 | 89.5 | 74 | 110 | 16.43% | 11.46% | 90.75 | 11.46% |
| 3 | | 4 | 78.25 | 80.67 | 71 | 81 | 6.21% | 23.66% | 78.75 | 23.17% |
| 6.1 | | 4 | 74.75 | 77 | 60 | 85 | 14.75% | 27.07% | 78.75 | 23.17% |
| 12.1 | | 4 | 83.25 | 84.5 | 77 | 87 | 5.41% | 18.78% | 78.75 | 23.17% |
| 24.2 | | 4 | 71.5 | 72.5 | 58 | 83 | 14.38% | 30.24% | 71.5 | 30.24% |
| 48.5 | | 4 | 62.25 | 63 | 56 | 67 | 7.46% | 39.27% | 62.25 | 39.27% |
| 97 | | 4 | 50.5 | 51 | 48 | 52 | 3.43% | 50.73% | 50.5 | 50.73% |

### Frond Count Detail

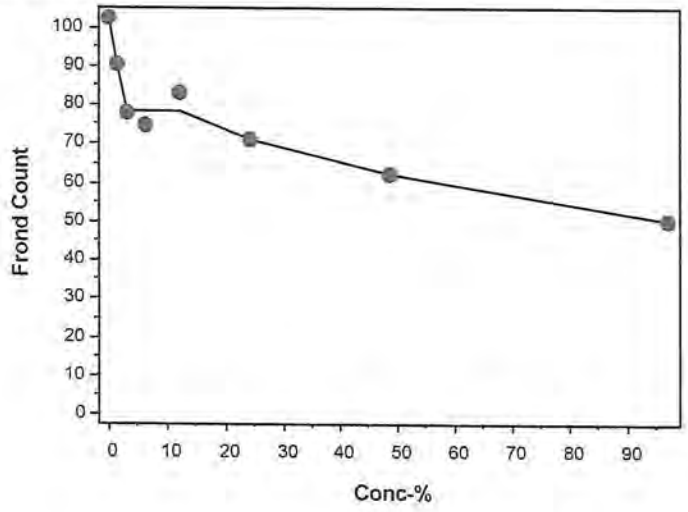
| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
|---|---|---|---|---|---|
| 0 | N | 64 | 113 | 115 | 118 |
| 1.5 | | 110 | 87 | 92 | 74 |
| 3 | | 71 | 80 | 81 | 81 |
| 6.1 | | 73 | 85 | 60 | 81 |
| 12.1 | | 87 | 77 | 86 | 83 |
| 24.2 | | 83 | 72 | 58 | 73 |
| 48.5 | | 56 | 67 | 64 | 62 |
| 97 | | 48 | 52 | 51 | 51 |

## EC Lemna Growth Inhibition Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 08-2397-8843 | **Endpoint:** | Frond Count | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 17 Aug-23 14:55 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 17 Aug-23 14:53 | **MD5 Hash:** | 2955C77A865BD22B9694060EF1AFD10B | **Editor ID:** | |

**Graphics**



## EC Lemna Growth Inhibition Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 01-1949-4530 | **Endpoint:** | Total Dry Weight-mg | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 17 Aug-23 14:56 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 17 Aug-23 14:53 | **MD5 Hash:** | 19FFE5F78638CF41E7AA862F8B731D70 | **Editor ID:** | |
| **Batch ID:** | 18-5520-3472 | **Test Type:** | Lemna Growth | **Analyst:** | Gabriella Utomo |
| **Start Date:** | 02 Aug-23 13:30 | **Protocol:** | EC/EPS 1/RM/37 | **Diluent:** | Modified APHA |
| **Ending Date:** | 09 Aug-23 | **Species:** | Lemna minor | **Brine:** | |
| **Test Length:** | 6d 10h | **Taxon:** | Tracheophyta | **Source:** | CPCC#490 **Age:** 7d |
| **Sample ID:** | 16-4549-4470 | **Code:** | SW23-05TOX | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 74h (0.3 °C) | **Client:** | Millennium | | |

### Linear Interpolation Options

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 147551 | 200 | Yes | Two-Point Interpolation |

### Point Estimates

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | >97 | --- | --- | <1 | --- | --- |
| IC20 | >97 | --- | --- | <1 | --- | --- |
| IC25 | >97 | --- | --- | <1 | --- | --- |
| IC40 | >97 | --- | --- | <1 | --- | --- |
| IC50 | >97 | --- | --- | <1 | --- | --- |

### Total Dry Weight-mg Summary

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | Mean | %Effect |
| 0 | N | 4 | 7.83 | 8.725 | 4.87 | 9 | 25.34% | 0.00% | 7.83 | 0.00% |
| 1.5 | | 4 | 6.932 | 6.925 | 5.85 | 8.03 | 12.90% | 11.46% | 7.224 | 7.74% |
| 3 | | 4 | 6.22 | 6.485 | 5.22 | 6.69 | 10.86% | 20.56% | 7.224 | 7.74% |
| 6.1 | | 4 | 6.152 | 6.29 | 5.08 | 6.95 | 14.25% | 21.42% | 7.224 | 7.74% |
| 12.1 | | 4 | 8.315 | 8.375 | 7.76 | 8.75 | 6.04% | -6.19% | 7.224 | 7.74% |
| 24.2 | | 4 | 7.357 | 7.665 | 5.17 | 8.93 | 22.11% | 6.03% | 7.224 | 7.74% |
| 48.5 | | 4 | 8.365 | 8.67 | 6.9 | 9.22 | 12.61% | -6.83% | 7.224 | 7.74% |
| 97 | | 4 | 6.695 | 6.835 | 5.95 | 7.16 | 8.56% | 14.50% | 6.695 | 14.50% |

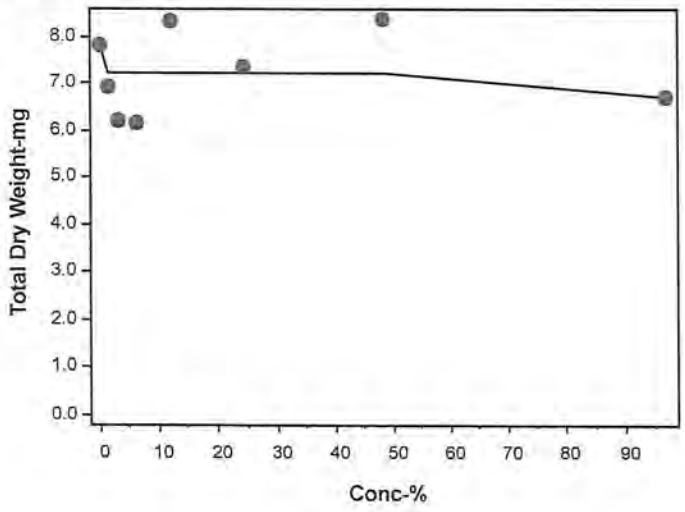
### Total Dry Weight-mg Detail

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
|---|---|---|---|---|---|
| 0 | N | 4.87 | 8.53 | 9 | 8.92 |
| 1.5 | | 8.03 | 6.82 | 7.03 | 5.85 |
| 3 | | 5.22 | 6.42 | 6.55 | 6.69 |
| 6.1 | | 5.8 | 6.95 | 5.08 | 6.78 |
| 12.1 | | 8.73 | 7.76 | 8.75 | 8.02 |
| 24.2 | | 8.93 | 7.17 | 5.17 | 8.16 |
| 48.5 | | 6.9 | 9.22 | 8.3 | 9.04 |
| 97 | | 7.16 | 7.13 | 6.54 | 5.95 |

**EC Lemna Growth Inhibition Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 01-1949-4530 | **Endpoint:** | Total Dry Weight-mg | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 17 Aug-23 14:56 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | 17 Aug-23 14:53 | **MD5 Hash:** | 19FFE5F78638CF41E7AA862F8B731D70 | **Editor ID:** | |

**Graphics**



# APPENDIX D – *Pseudokirchneriella subcapitata* Toxicity Test Data

## *Pseudokirchneriella subcapitata* Summary Sheet

Client: Millenium Ems Solutions
Work Order No.: 231316

Start Date: Aug 2/23
Set up by: MG

**Sample Information:**

Sample ID: SW23-05 Tox
Sample Date: July 30/23
Date Received: July 31/23
Sample Volume: 4x10L

**Test Organism Information:**

Culture Date: July 28/23
Age of culture (Day 0): 5 days

**Zinc Reference Toxicant Results:**

Reference Toxicant ID: SC252
Stock Solution ID: 23Zn01
Date Initiated: July 27/23

72-h IC50 (95% CL): 29.4 (27.3 - 31.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 30.3 (23.7 - 38.7) ug/L Zn CV (%): 12

Test Results:

| | Algal Growth |
|---|---|
| IC25 %(v/v) (95% CL) | >95.2 |
| IC50 %(v/v) (95% CL) | 795.2 |

Reviewed by: EMM

Date reviewed: Sept 8/23

# 72-h Algal Growth Inhibition Toxicity Test
## Water Quality Measurements

**Client:** Millenium EMS Solutions **Setup by:** MG

**Sample ID:** SW23-05TOX **Test Date/Time:** Aug 2/23 @ 1030h

**Work Order No.:** 23316 **CER #:** 4

**Test Species:** *Pseudokirchneriella subcapitata*

**Culture Date:** July 28/23 **Age of Culture:** 5d **Culture Health:** Good

**Culture Count:** 1 195 2 205 **Average:** 200 **Culture Cell Density (c1):** 200 x 10⁴ cells/mL

**v1 =** 220,000 cells/ml x 20 ml / (c1) 200 x 10⁴ cells/ml = 2.2 mL

**Time Zero Counts:** 1 20 2 21 **Average:** 20.5

**No. of Cells/mL:** 20.5 x 10⁴ **Initial Density:** # cells/mL ÷ 220 µL x 10 µL = 9318 cells/mL

| Concentration %(v/v) | Water Quality | | Incubator Temperature (°C) | | | | Microplates rotated 2X per day? | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | pH | Temp (°C) | | | | | | | | |
| | 0 h | 0 h | 0 h | 24 h | 48 h | 72 h | 0 h | 24 h | 48 h | 72 h |
| Control | 6.9 | 24.0 | 23.0 | 23.0 | 23.0 | 23.0 | ✓ | ✓ | ✓ | ✓ |
| 1.5 | 6.9 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 3 | 7.0 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 6 | 7.2 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 11.9 | 7.4 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 23.8 | 7.6 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 47.6 | 7.6 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| 95.2 | 7.6 | 24.0 | ↓ | ↓ | ↓ | ↓ | ✓ | ✓ | ✓ | ↓ |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Initials | MG | MG | MG | MG | MG | JZL | MG | MG | MG | JZL |

**Initial control pH:** Well 1: 6.9 Well 2: 6.9

**Final control pH:** Well 1: 6.6 Well 2: 6.6

**Light intensity (lux):** 4080 **Date measured:** Aug 2/23

**Thermometer:** CER#4 **Light meter:** 1 **pH meter/probe:** 1 / 1

**Sample Description:** dark brown, turbid, organic smell w native organisms and particulates

**Comments:**

**Reviewed:** EMM **Date reviewed:** Sept 8/23

## *Pseudokirchneriella subcapitata* Toxicity Test Data Sheet
## 72-h Algal Cell Counts

Client: Millenium EMS Solutions
Work Order #: 231316
Sample ID: SW23-05Tox
%(v/v)

Start Date/Time: Aug 2/23@1030h
Termination Date: Aug 5/23@1030h
Test set up by: MG

| Concentration | Rep | Count 1 | Count 2 | Count 3 | Count 4 | Comments | Initials |
|---|---|---|---|---|---|---|---|
| Control | A | 40 | | | | | MG |
| | B | 41 | | | | | |
| | C | 44 | | | | | |
| | D | 38 | | | | | |
| | E | 36 | | | | | |
| | F | 38 | | | | | |
| | G | 42 | | | | | |
| | H | 37 | | | | | |
| 1.5 | A | 52 | | | | | |
| | B | 54 | | | | | |
| | C | 64 | | | | | |
| | D | 59 | | | | | |
| 3 | A | 102 | | | | | |
| | B | 98 | | | | | |
| | C | 108 | | | | | |
| | D | 103 | | | | | |
| 6 | A | 109 | | | | | |
| | B | 108 | | | | | |
| | C | 98 | | | | | |
| | D | 100 | | | | | |
| 11.9 | A | 120 | | | | | |
| | B | 105 | | | | | |
| | C | 118 | | | | | |
| | D | 111 | | | | | |
| 23.8 | A | 132 | | | | | |
| | B | 129 | | | | | |
| | C | 121 | | | | | |
| | D | 125 | | | | | |
| 47.6 | A | 130 | | | | | |
| | B | 122 | | | | | |
| | C | 125 | | | | | |
| | D | 121 | | | | | |
| 95.2 | A | 123 | | | | | |
| | B | 126 | | | | | |
| | C | 121 | | | | | |
| | D | 128 | | | | | |

Comments:

Reviewed by: EMM Date Reviewed: Sept 8/23

## *Pseudokirchneriella subcapitata* Algal Counts

Client: Millenium EMS Solutions
WO#: 231316
Sample ID: SW23-05TOX

Start Date/Time: 2-Aug-23 @ 1030h
Termination Date/Time: 5-Aug-23 @ 1030h

Initial Cell Density: 9318 cell/mL

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 205000 |
| | | | | | | | | | 0.22 |
| | | | | | | | | | 0.01 |
| Concentration %(v/v) | Rep | Count 1 (x $10^4$) | Count 2 (x $10^4$) | Count 3 (x $10^4$) | Count 4 (x $10^4$) | Mean (x $10^4$) | Cell Yield (x $10^4$) cell/mL | | 9318.182 |
| Control | A | 40 | | | | 40 | 39.1 | mean | 38.6 |
| | B | 41 | | | | 41 | 40.1 | SD | 2.725541 |
| | C | 44 | | | | 44 | 43.1 | CV | 7.066811 |
| | D | 38 | | | | 38 | 37.1 | | |
| | E | 36 | | | | 36 | 35.1 | | |
| | F | 38 | | | | 38 | 37.1 | | |
| | G | 42 | | | | 42 | 41.1 | | |
| | H | 37 | | | | 37 | 36.1 | | |
| 1.5 | A | 52 | | | | 52 | 51.1 | | |
| | B | 54 | | | | 54 | 53.1 | | |
| | C | 64 | | | | 64 | 63.1 | | |
| | D | 59 | | | | 59 | 58.1 | | |
| 3 | A | 102 | | | | 102 | 101.1 | | |
| | B | 98 | | | | 98 | 97.1 | | |
| | C | 108 | | | | 108 | 107.1 | | |
| | D | 103 | | | | 103 | 102.1 | | |
| 6 | A | 109 | | | | 109 | 108.1 | | |
| | B | 108 | | | | 108 | 107.1 | | |
| | C | 98 | | | | 98 | 97.1 | | |
| | D | 100 | | | | 100 | 99.1 | | |
| 11.9 | A | 120 | | | | 120 | 119.1 | | |
| | B | 105 | | | | 105 | 104.1 | | |
| | C | 118 | | | | 118 | 117.1 | | |
| | D | 111 | | | | 111 | 110.1 | | |
| 23.8 | A | 132 | | | | 132 | 131.1 | | |
| | B | 129 | | | | 129 | 128.1 | | |
| | C | 121 | | | | 121 | 120.1 | | |
| | D | 125 | | | | 125 | 124.1 | | |
| 47.6 | A | 130 | | | | 130 | 129.1 | | |
| | B | 122 | | | | 122 | 121.1 | | |
| | C | 125 | | | | 125 | 124.1 | | |
| | D | 121 | | | | 121 | 120.1 | | |
| 95.2 | A | 123 | | | | 123 | 122.1 | | |
| | B | 126 | | | | 126 | 125.1 | | |
| | C | 121 | | | | 121 | 120.1 | | |
| | D | 128 | | | | 128 | 127.1 | | |

Reviewed by: EMM

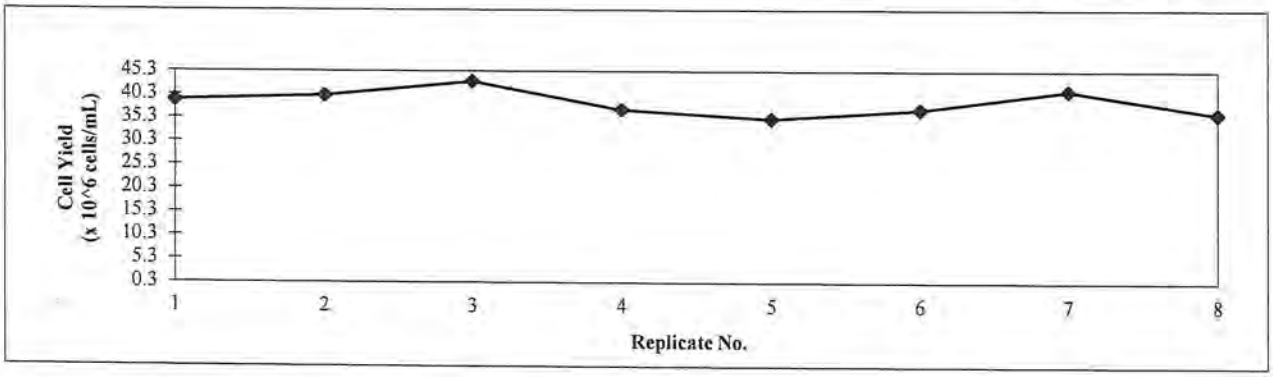
Date reviewed: Sept 8/23

## 72-h *Pseudokirchneriella subcapitata* Test - Trend Analysis by Mann-Kendall Test.

**Instructions:**
1. Enter the project number, work order number and sample ID in the highlighted cells.
2. Enter the negative control cell yield data (X x $10^6$ cells/mL) into the highlighted spreadsheet cells.
3. Compare the calculated S value to the table of critical S values at the bottom of the page.
4. If the calculated S value is smaller than the S value in the table, there is no statistically significant trend.

**Client:** Millenium EMS Solutions
**W.O. No.:** 231316
**Sample ID:** SW23-05TOX
**Test Date:** 2-Aug-23 @ 1030h

| Rep No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Count of | Count of |
|---|---|---|---|---|---|---|---|---|---|---|
| Data Value | 39.1 | 40.1 | 43.1 | 37.1 | 35.1 | 37.1 | 41.1 | 36.1 | + Signs | - Signs |
| (- Rep 1) | | 1.000 | 4.000 | -2.000 | -4.000 | -2.000 | 2.000 | -3.000 | 3 | 4 |
| (- Rep 2) | | | 3.000 | -3.000 | -5.000 | -3.000 | 1.000 | -4.000 | 2 | 4 |
| (- Rep 3) | | | | -6.000 | -8.000 | -6.000 | -2.000 | -7.000 | 0 | 5 |
| (- Rep 4) | | | | | -2.000 | 0.000 | 4.000 | -1.000 | 1 | 2 |
| (- Rep 5) | | | | | | 2.000 | 6.000 | 1.000 | 3 | 0 |
| (- Rep 6) | | | | | | | 4.000 | -1.000 | 1 | 1 |
| (- Rep 7) | | | | | | | | -5.000 | 0 | 1 |
| | | | | | | | | Totals | 10 | 17 |
| | | | | | | | | | S = | -7 |




**Critical values of (S) at a probability of p = 0.05, when the number of replicates (n) is 10 or less.**

| n | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|
| S | 4 | 6 | 9 | 11 | 14 | 16 | 19 |

emm 8/7/23

If your calculated value for S (for the applicable number of replicates) is equal to or less than the corresponding value for S in the above table, then there is no statistically significant trend present. Refer to Gilbert (1987) for complete table of probabilities for the Mann-Kendall test.

Reference:
Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, NY. 320 pp.

# CETIS Summary Report


Test Code/ID: 231316 / 19-8706-5552

**EC Alga Growth Inhibition Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 15-1680-5333 | **Test Type:** | Cell Growth | **Analyst:** | Mimi Tran |
| **Start Date:** | 02 Aug-23 10:30 | **Protocol:** | EC/EPS 1/RM/25 | **Diluent:** | Deionized Water + nutrients |
| **Ending Date:** | 05 Aug-23 10:30 | **Species:** | Pseudokirchneriella subcapitata | **Brine:** | |
| **Test Length:** | 72h | **Taxon:** | Chlorophyta | **Source:** | In-House Culture **Age:** 5d |
| **Sample ID:** | 16-4549-4470 | **Code:** | SW23-05TOX | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 71h (0.3 °C) | **Client:** | Millennium | | |

**Multiple Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | ✓ | NOEL | LOEL | TOEL | PMSD | TU | S |
|---|---|---|---|---|---|---|---|---|---|
| 20-4468-4029 | Cell Yield | Dunnett Multiple Comparison Test | | <1.5 | 1.5 | --- | 18.1% | >66.7 | 1 |

**Point Estimate Summary**

| Analysis ID | Endpoint | Point Estimate Method | ✓ | Level | % | 95% LCL | 95% UCL | TU | S |
|---|---|---|---|---|---|---|---|---|---|
| 17-1981-8788 | Cell Yield | Linear Interpolation (ICPIN) | | IC15 | >95.2 | --- | --- | <1.1 | 1 |
| | | | | IC20 | >95.2 | --- | --- | <1.1 | |
| | | | | IC25 | >95.2 | --- | --- | <1.1 | |
| | | | | IC40 | >95.2 | --- | --- | <1.1 | |
| | | | | IC50 | >95.2 | --- | --- | <1.1 | |

**Cell Yield Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 8 | 38.5 | 36.22 | 40.78 | 35 | 43 | 0.9636 | 2.726 | 7.08% | 0.00% |
| 1.5 | | 4 | 56.25 | 47.69 | 64.81 | 51 | 63 | 2.689 | 5.377 | 9.56% | -46.10% |
| 3 | | 4 | 101.8 | 95.21 | 108.3 | 97 | 107 | 2.056 | 4.113 | 4.04% | -164.29% |
| 6 | | 4 | 102.8 | 93.9 | 111.6 | 97 | 108 | 2.78 | 5.56 | 5.41% | -166.88% |
| 11.9 | | 4 | 112.5 | 101.6 | 123.4 | 104 | 119 | 3.428 | 6.856 | 6.09% | -192.21% |
| 23.8 | | 4 | 125.8 | 118.1 | 133.4 | 120 | 131 | 2.394 | 4.787 | 3.81% | -226.62% |
| 47.6 | | 4 | 123.5 | 117.1 | 129.9 | 120 | 129 | 2.021 | 4.041 | 3.27% | -220.78% |
| 95.2 | | 4 | 123.5 | 118.6 | 128.4 | 120 | 127 | 1.555 | 3.109 | 2.52% | -220.78% |

**Cell Yield Detail** MD5: 99287599CDEBF6154624BC68FF8DECF3

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 39 | 40 | 43 | 37 | 35 | 37 | 41 | 36 |
| 1.5 | | 51 | 53 | 63 | 58 | | | | |
| 3 | | 101 | 97 | 107 | 102 | | | | |
| 6 | | 108 | 107 | 97 | 99 | | | | |
| 11.9 | | 119 | 104 | 117 | 110 | | | | |
| 23.8 | | 131 | 128 | 120 | 124 | | | | |
| 47.6 | | 129 | 121 | 124 | 120 | | | | |
| 95.2 | | 122 | 125 | 120 | 127 | | | | |

# CETIS Analytical Report



**EC Alga Growth Inhibition Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 17-1981-8788 | **Endpoint:** | Cell Yield | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 06 Sep-23 17:41 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | | **MD5 Hash:** | 99287599CDEBF6154624BC68FF8DECF3 | **Editor ID:** | |
| **Batch ID:** | 15-1680-5333 | **Test Type:** | Cell Growth | **Analyst:** | Mimi Tran |
| **Start Date:** | 02 Aug-23 10:30 | **Protocol:** | EC/EPS 1/RM/25 | **Diluent:** | Deionized Water + nutrients |
| **Ending Date:** | 05 Aug-23 10:30 | **Species:** | Pseudokirchneriella subcapitata | **Brine:** | |
| **Test Length:** | 72h | **Taxon:** | Chlorophyta | **Source:** | In-House Culture **Age:** 5d |
| **Sample ID:** | 16-4549-4470 | **Code:** | SW23-05TOX | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 71h (0.3 °C) | **Client:** | Millennium | | |

**Linear Interpolation Options**

| X Transform | Y Transform | Seed | Resamples | Exp 95% CL | Method |
|---|---|---|---|---|---|
| Log(X+1) | Linear | 53287 | 200 | Yes | Two-Point Interpolation |

**Point Estimates**

| Level | % | 95% LCL | 95% UCL | Tox Units | 95% LCL | 95% UCL |
|---|---|---|---|---|---|---|
| IC15 | >95.2 | --- | --- | <1.1 | --- | --- |
| IC20 | >95.2 | --- | --- | <1.1 | --- | --- |
| IC25 | >95.2 | --- | --- | <1.1 | --- | --- |
| IC40 | >95.2 | --- | --- | <1.1 | --- | --- |
| IC50 | >95.2 | --- | --- | <1.1 | --- | --- |

**Cell Yield Summary**

| | | | Calculated Variate | | | | | | Isotonic Variate | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Code | Count | Mean | Median | Min | Max | CV% | %Effect | Mean | %Effect |
| 0 | N | 8 | 38.5 | 37.67 | 35 | 43 | 7.08% | 0.00% | 98.06 | 0.00% |
| 1.5 | | 4 | 56.25 | 55.5 | 51 | 63 | 9.56% | -46.10% | 98.06 | 0.00% |
| 3 | | 4 | 101.8 | 101.5 | 97 | 107 | 4.04% | -164.29% | 98.06 | 0.00% |
| 6 | | 4 | 102.8 | 103 | 97 | 108 | 5.41% | -166.88% | 98.06 | 0.00% |
| 11.9 | | 4 | 112.5 | 113.5 | 104 | 119 | 6.09% | -192.21% | 98.06 | 0.00% |
| 23.8 | | 4 | 125.8 | 126 | 120 | 131 | 3.81% | -226.62% | 98.06 | 0.00% |
| 47.6 | | 4 | 123.5 | 122.5 | 120 | 129 | 3.27% | -220.78% | 98.06 | 0.00% |
| 95.2 | | 4 | 123.5 | 123.5 | 120 | 127 | 2.52% | -220.78% | 98.06 | 0.00% |

**Cell Yield Detail**

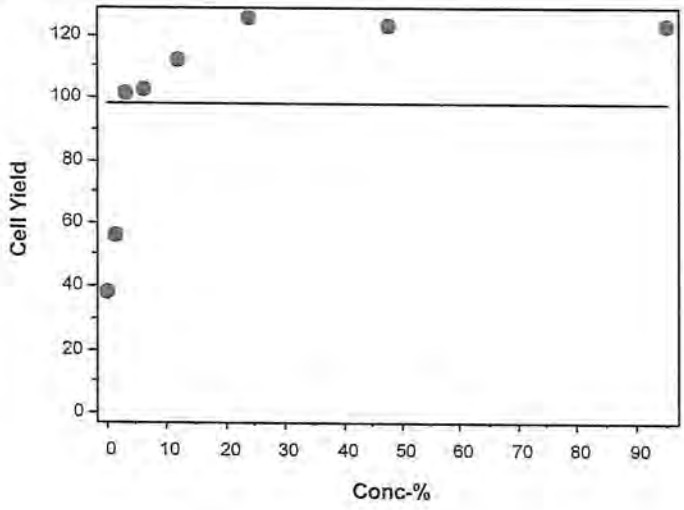
| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 39 | 40 | 43 | 37 | 35 | 37 | 41 | 36 |
| 1.5 | | 51 | 53 | 63 | 58 | | | | |
| 3 | | 101 | 97 | 107 | 102 | | | | |
| 6 | | 108 | 107 | 97 | 99 | | | | |
| 11.9 | | 119 | 104 | 117 | 110 | | | | |
| 23.8 | | 131 | 128 | 120 | 124 | | | | |
| 47.6 | | 129 | 121 | 124 | 120 | | | | |
| 95.2 | | 122 | 125 | 120 | 127 | | | | |

## EC Alga Growth Inhibition Test

Nautilus Environmental

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 17-1981-8788 | **Endpoint:** | Cell Yield | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 06 Sep-23 17:41 | **Analysis:** | Linear Interpolation (ICPIN) | **Status Level:** | 1 |
| **Edit Date:** | | **MD5 Hash:** | 99287599CDEBF6154624BC68FF8DECF3 | **Editor ID:** | |

**Graphics**



# CETIS Analytical Report



**EC Alga Growth Inhibition Test** — **Nautilus Environmental**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 20-4468-4029 | **Endpoint:** | Cell Yield | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 06 Sep-23 17:41 | **Analysis:** | Parametric-Control vs Treatments | **Status Level:** | 1 |
| **Edit Date:** | | **MD5 Hash:** | 99287599CDEBF6154624BC68FF8DECF3 | **Editor ID:** | |
| **Batch ID:** | 15-1680-5333 | **Test Type:** | Cell Growth | **Analyst:** | Mimi Tran |
| **Start Date:** | 02 Aug-23 10:30 | **Protocol:** | EC/EPS 1/RM/25 | **Diluent:** | Deionized Water + nutrients |
| **Ending Date:** | 05 Aug-23 10:30 | **Species:** | Pseudokirchneriella subcapitata | **Brine:** | |
| **Test Length:** | 72h | **Taxon:** | Chlorophyta | **Source:** | In-House Culture **Age:** 5d |
| **Sample ID:** | 16-4549-4470 | **Code:** | SW23-05TOX | **Project:** | |
| **Sample Date:** | 30 Jul-23 11:00 | **Material:** | Water Sample | **Source:** | Millennium EMS Solutions |
| **Receipt Date:** | 31 Jul-23 16:49 | **CAS (PC):** | | **Station:** | SW23-05TOX |
| **Sample Age:** | 71h (0.3 °C) | **Client:** | Millennium | | |

| Data Transform | Alt Hyp | NOEL | LOEL | TOEL | Tox Units | MSDu | PMSD |
|---|---|---|---|---|---|---|---|
| Untransformed | C < T | <1.5 | 1.5 | --- | >66.7 | 6.98 | 18.13% |

**Dunnett Multiple Comparison Test**

| Control | vs | Conc-% | df | Test Stat | Critical | MSD | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Negative Control | | 1.5* | 10 | 6.424 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 3* | 10 | 22.89 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 6* | 10 | 23.25 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 11.9* | 10 | 26.78 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 23.8* | 10 | 31.58 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 47.6* | 10 | 30.76 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |
| | | 95.2* | 10 | 30.76 | 2.526 | 6.98 | CDF | <1.0E-05 | Significant Effect |

**Auxiliary Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|
| Outlier | Grubbs Extreme Value Test | 2.106 | 2.991 | 1.0000 | No Outliers Detected |
| Control Trend | Mann-Kendall Trend Test | 0.4674 | 0.05 | 0.4674 | Non-Significant Control Trend |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 43016.9 | 6145.27 | 7 | 301.9 | <1.0E-05 | Significant Effect |
| Error | 570 | 20.3571 | 28 | | | |
| Total | 43586.9 | | 35 | | | |

**ANOVA Assumptions Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variance | Bartlett Equality of Variance Test | 4.78 | 18.48 | 0.6868 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9612 | 0.9166 | 0.2342 | Normal Distribution |

**Cell Yield Summary**

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 8 | 38.5 | 36.22 | 40.78 | 37.67 | 35 | 43 | 0.9636 | 7.08% | 0.00% |
| 1.5 | | 4 | 56.25 | 47.69 | 64.81 | 55.5 | 51 | 63 | 2.689 | 9.56% | -46.10% |
| 3 | | 4 | 101.8 | 95.21 | 108.3 | 101.5 | 97 | 107 | 2.056 | 4.04% | -164.29% |
| 6 | | 4 | 102.8 | 93.9 | 111.6 | 103 | 97 | 108 | 2.78 | 5.41% | -166.88% |
| 11.9 | | 4 | 112.5 | 101.6 | 123.4 | 113.5 | 104 | 119 | 3.428 | 6.09% | -192.21% |
| 23.8 | | 4 | 125.8 | 118.1 | 133.4 | 126 | 120 | 131 | 2.394 | 3.81% | -226.62% |
| 47.6 | | 4 | 123.5 | 117.1 | 129.9 | 122.5 | 120 | 129 | 2.021 | 3.27% | -220.78% |
| 95.2 | | 4 | 123.5 | 118.6 | 128.4 | 123.5 | 120 | 127 | 1.555 | 2.52% | -220.78% |

## EC Alga Growth Inhibition Test

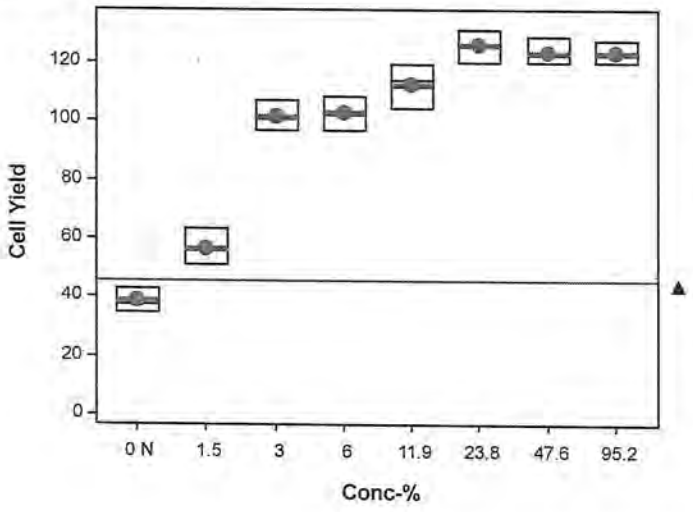
Nautilus Environmental

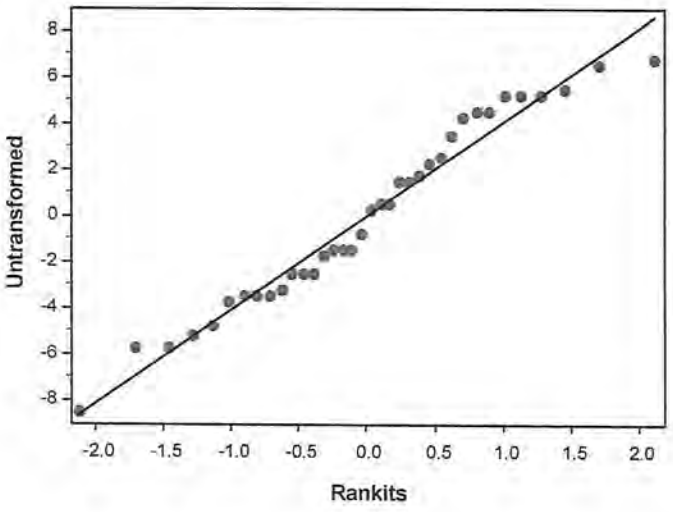
| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 20-4468-4029 | **Endpoint:** | Cell Yield | **CETIS Version:** | CETISv2.1.4 |
| **Analyzed:** | 06 Sep-23 17:41 | **Analysis:** | Parametric-Control vs Treatments | **Status Level:** | 1 |
| **Edit Date:** | | **MD5 Hash:** | 99287599CDEBF6154624BC68FF8DECF3 | **Editor ID:** | |

### Cell Yield Detail

| Conc-% | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | N | 39 | 40 | 43 | 37 | 35 | 37 | 41 | 36 |
| 1.5 | | 51 | 53 | 63 | 58 | | | | |
| 3 | | 101 | 97 | 107 | 102 | | | | |
| 6 | | 108 | 107 | 97 | 99 | | | | |
| 11.9 | | 119 | 104 | 117 | 110 | | | | |
| 23.8 | | 131 | 128 | 120 | 124 | | | | |
| 47.6 | | 129 | 121 | 124 | 120 | | | | |
| 95.2 | | 122 | 125 | 120 | 127 | | | | |

### Graphics



# APPENDIX E – Chain-of-Custody Form

NAUTILUS ENVIRONMENTAL

**TESTING LOCATION (Please Circle)**

**Burnaby** (●)
8664 Commerce Court
Burnaby, British Columbia, Canada
V5A 4N7
Phone 604.420.8773

**Calgary** ( )
10823 27 Street SE
Calgary, Alberta, Canada
T2Z 3V9
Phone 403.253.7121

**Point Edward** ( )
704 Mara Street, Suite 122
Point Edward, Ontario, Canada
N7V 1X4
Phone 519.339.8787

# Chain of Custody

Date 31/07/23 Page 1 of 1

| **Report to:** | |
|---|---|
| **Company** | Millennium EMS Solutions Ltd. (MEMS) |
| **Address** | #148 – 2257 Premier Way |
| **City/Prov/PC** | Sherwood Park, AB T8H 2M8 |
| **Contact** | Jeff Belecky |
| **Phone** | 780.554.3280 |
| **Email** | jbelecky@mems.ca |

| **Invoice To:** | |
|---|---|
| **Company** | Paramount Resources Ltd. c/o MEMS |
| **Address** | 888 3 St SW #4700 |
| **City/Prov/PC** | Calgary, AB T2P 5C5 |
| **Contact** | Jeff Belecky |
| **Phone** | 780.554.3280 |
| **Email** | jbelecky@mems.ca |
| **PO No.** | 23SR0061 |

**Sample Collection By:** Drew MacPhail (MEMS) **Sample Type:** Grab (●) OR Composite ( )

| | SAMPLE ID | DATE (DD/MM/YY) | TIME | MATRIX | # OF CONTAINERS AND VOLUME (e.g. 1 x 20 L) | COMMENTS | ANALYSES REQUIRED: 7-day C. dubia (water flea) survival and reproduction | 7-day P. promelas (fathead minnow) survival and growth | 7-day L. minor (common duckweed) growth inhibition | 72-hour P. subcapitata (algae) growth inhibition | Receipt Temperature (°C) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SW23-05TOX | 30/07/23 | 11:00 | Water | 4 x 10 L Bladders | Containers are not labeled with sample ID | ✓ | ✓ | ✓ | ✓ | 0.3-4.3 |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | 3 | 4 | 5 | 6 | |
| 6 | | | | | | | 1 | 1 | 1 | 1 | |
| 7 | | | | | | | 3 | 3 | 3 | 3 | |
| 8 | | | | | | | 1 | 1 | 1 | 1 | |
| 9 | | | | | | | 3 | 3 | 3 | 3 | |
| 10 | | | | | | | 2 | 2 | 2 | 2 | |

**SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)**

Note short hold time (72 hr) on select tests

**SAMPLE RECEIPT DETAILS (LABORATORY)**

| | | | |
|---|---|---|---|
| 1. Total No. of Containers | 4 | 4. Ice Present in Cooler? | (Y) / N |
| 2. Courier | Ambitious | 5. Seal Present? | Y / (N) |
| 3. Good Condition? | (Y) / N | 6. Initials Present on Seal? | Y / (N) |

**SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)**

Dark brown, turbid, organic smell, w/ native organisms and particulates

**RELINQUISHED BY (CLIENT)**

DREW MACPHAIL (Printed Name) DM (Signature)

MEMS (Company) 31/07/23 @ 17:00 (expected) (Date DD/MM/YY and Time)

**RECEIVED BY (LABORATORY)**

Tyrone (Printed Name) TH (Signature)

Nautilus (Company) July 31/23 @ 16:49 (Date DD/MM/YY and Time)

Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling, or transport of the sample, application or interpretation of the test data or results in part or in whole.

**Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.**

**END OF REPORT**

# APPENDIX F: ORIGINAL LABORATORY DATA

Element
#1 8822-100 Street
Fort St. John, British Columbia
V1J 3W9, Canada

T: +1 (250) 785-2731
F: +1 (250) 785-7092
E: info.FortStJohn@element.com
W: www.element.com

## Report Transmission Cover Page

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1668914** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Jul 31, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Aug 4, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2899340 |
| Sampled By: | Drew MacPhail & Darcy Meyers | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| Contact | Company | Address |
|---|---|---|
| **Drew MacPhail** | **Millennium EMS Solutions** | 202, 701 - 64 Ave SE<br>Calgary, AB T2H 2C3<br>Phone: (587) 216-6547 Fax:<br>Email: dmacphail@mems.ca |

| Delivery | Format | Deliverables |
|---|---|---|
| Email | MEMS Custom Excel | Test Report |
| Email | PDF | COC / Test Report |
| Email | Standard Crosstab With Tabs | Test Report |
| Email | Standard Crosstab Without Tabs | Test Report |
| Email - Merge | PDF | COC / Invoice |

| Contact | Company | Address |
|---|---|---|
| **Element Invoicing** | **Paramount Resources Ltd** | 7217 Roper Road<br>Edmonton, AB T6B 3J4<br>Phone: (780) 438-5522 Fax:<br>Email: invoicing.edmonton@element.com |

| Delivery | Format | Deliverables |
|---|---|---|
| Post | PDF | COC / Invoice |

| Contact | Company | Address |
|---|---|---|
| **Jeff Belecky** | **Millennium EMS Solutions** | #148, 2257 Premier Way<br>Sherwood Park, AB T8H 2M8<br>Phone: (780) 496-9048 Fax: (780) 496-9049<br>Email: jbelecky@mems.ca |

| Delivery | Format | Deliverables |
|---|---|---|
| Email | MEMS Custom Excel | Test Report |
| Email | PDF | COC / Test Report |
| Email | Standard Crosstab With Tabs | Test Report |
| Email | Standard Crosstab Without Tabs | Test Report |
| Email - Merge | PDF | COC / Invoice |

| Contact | Company | Address |
|---|---|---|
| **Lab Data** | **Millennium EMS Solutions** | #148, 2257 Premier Way<br>Sherwood Park, AB T8H 2M8<br>Phone: (780) 496-9048 Fax: (780) 496-9049<br>Email: labdata@mems.ca |

| Delivery | Format | Deliverables |
|---|---|---|
| Email | MEMS Custom Excel | Test Report |
| Email | MEMS ESDAT Chemistry File | Test Report |
| Email | MEMS ESDAT Sample File | Test Report |
| Email | PDF | COC / Test Report |
| Email | Standard Crosstab With Tabs | Test Report |
| Email | Standard Crosstab Without Tabs | Test Report |
| Email - Merge | PDF | COA / COC |
| Email - Merge | PDF | COC / Invoice |

**Notes To Clients:**

- Jul 31, 2023 - Proj ID: 21-00365-07
  Proj Name: Pointed Mountain

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E: info.FortStJohn@element.com
W: www.element.com

## Report Transmission Cover Page

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1668914** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Jul 31, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Aug 4, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2899340 |
| Sampled By: | Drew MacPhail & Darcy Meyers | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

**Notes To Clients:**

Client: Paramount Resources Ltd
Consultant: Millenium EMS Solutions Ltd

- Aug 04, 2023 - The ionic balance for samples 22 and 23 could not be calculated due to a lack of dissolved ions.

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E: info.FortStJohn@element.com
W: www.element.com

## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Drew MacPhail & Darcy Meyers
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1668914**
Control Number:
Date Received: Jul 31, 2023
Date Reported: Aug 4, 2023
Report Number: 2899340

| | | | |
|---|---|---|---|
| **Reference Number** | 1668914-1 | 1668914-2 | 1668914-4 |
| **Sample Date** | Jul 28, 2023 | Jul 28, 2023 | Jul 28, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | SW23-05 / NA | SW23-06 / NA | SW23-08 / NA |
| **Matrix** | Water | Water | Water |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Metals Dissolved** | | | | | | |
| Subsample | | | Lab Filtered | Lab Filtered | Lab Filtered | |
| **Routine Water** | | | | | | |
| pH | | | 7.64 | 7.23 | 7.37 | 1 |
| Temperature of observed pH | | °C | 20.1 | 20.1 | 20.1 | |
| Electrical Conductivity | at 25 °C | µS/cm | 1720 | 2020 | 1890 | 1 |
| Calcium | Dissolved | mg/L | 193 | 208 | 189 | 0.2 |
| Magnesium | Dissolved | mg/L | 88.2 | 115 | 103 | 0.2 |
| Sodium | Dissolved | mg/L | 65.4 | 91.8 | 83.7 | 0.4 |
| Potassium | Dissolved | mg/L | 3.9 | 3.2 | 2.9 | 0.4 |
| Iron | Dissolved | mg/L | 0.04 | 0.28 | 0.21 | 0.01 |
| Manganese | Dissolved | mg/L | <0.005 | 0.250 | 0.366 | 0.005 |
| Chloride | Dissolved | mg/L | 167 | 248 | 224 | 0.4 |
| Nitrate - N | | mg/L | 0.08 | 0.02 | <0.01 | 0.01 |
| Nitrite - N | | mg/L | <0.005 | <0.005 | <0.005 | 0.005 |
| Nitrate and Nitrite - N | | mg/L | 0.08 | 0.02 | <0.01 | 0.01 |
| Sulfate (SO4) | Dissolved | mg/L | 487 | 533 | 499 | 0.9 |
| Hydroxide | | mg/L | <5 | <5 | <5 | |
| Carbonate | | mg/L | <6 | <6 | <6 | |
| Bicarbonate | | mg/L | 357 | 353 | 349 | |
| P-Alkalinity | as CaCO3 | mg/L | <5 | <5 | <5 | 5 |
| T-Alkalinity | as CaCO3 | mg/L | 293 | 290 | 286 | 5 |
| Total Dissolved Solids | Calculated | mg/L | 1180 | 1370 | 1270 | 1 |
| Hardness | Dissolved as CaCO3 | mg/L | 846 | 993 | 896 | |
| Ionic Balance | Dissolved | % | 96 | 101 | 97 | |
| SAR | Dissolved | | 1.0 | 1.3 | 1.2 | |

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W: www.element.com

## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Drew MacPhail & Darcy Meyers
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1668914**
Control Number:
Date Received: Jul 31, 2023
Date Reported: Aug 4, 2023
Report Number: 2899340

| | | | |
|---|---|---|---|
| **Reference Number** | 1668914-6 | 1668914-7 | 1668914-8 |
| **Sample Date** | Jul 28, 2023 | Jul 28, 2023 | Jul 28, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | SW23-10 / NA | SW23-11 / NA | SW23-12 / NA |
| **Matrix** | Water | Water | Water |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Metals Dissolved** | | | | | | |
| Subsample | | | Lab Filtered | Lab Filtered | Lab Filtered | |
| **Routine Water** | | | | | | |
| pH | | | 7.30 | 7.25 | 7.34 | 1 |
| Temperature of observed pH | | °C | 20.0 | 19.8 | 19.7 | |
| Electrical Conductivity | at 25 °C | µS/cm | 2470 | 2190 | 2270 | 1 |
| Calcium | Dissolved | mg/L | 248 | 213 | 225 | 0.2 |
| Magnesium | Dissolved | mg/L | 143 | 123 | 128 | 0.2 |
| Sodium | Dissolved | mg/L | 124 | 114 | 111 | 0.4 |
| Potassium | Dissolved | mg/L | 5 | 6.2 | 4.5 | 0.4 |
| Iron | Dissolved | mg/L | 0.3 | 0.18 | 0.11 | 0.01 |
| Manganese | Dissolved | mg/L | 0.02 | 0.074 | 0.110 | 0.005 |
| Chloride | Dissolved | mg/L | 350 | 315 | 314 | 0.4 |
| Nitrate - N | | mg/L | 0.06 | <0.01 | <0.01 | 0.01 |
| Nitrite - N | | mg/L | <0.02 | <0.005 | <0.005 | 0.005 |
| Nitrate and Nitrite - N | | mg/L | 0.06 | <0.01 | <0.01 | 0.01 |
| Sulfate (SO4) | Dissolved | mg/L | 695 | 605 | 679 | 0.9 |
| Hydroxide | | mg/L | <5 | <5 | <5 | |
| Carbonate | | mg/L | <6 | <6 | <6 | |
| Bicarbonate | | mg/L | 229 | 243 | 272 | |
| P-Alkalinity | as CaCO3 | mg/L | <5 | <5 | <5 | 5 |
| T-Alkalinity | as CaCO3 | mg/L | 188 | 199 | 223 | 5 |
| Total Dissolved Solids | Calculated | mg/L | 1680 | 1500 | 1600 | 1 |
| Hardness | Dissolved as CaCO3 | mg/L | 1210 | 1040 | 1090 | |
| Ionic Balance | Dissolved | % | 106 | 102 | 98 | |
| SAR | Dissolved | | 1.6 | 1.5 | 1.5 | |

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W: www.element.com

## Analytical Report

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1668914** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Jul 31, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Aug 4, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2899340 |
| Sampled By: | Drew MacPhail & Darcy Meyers | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | | | |
|---|---|---|---|
| **Reference Number** | 1668914-11 | 1668914-13 | 1668914-14 |
| **Sample Date** | Jul 29, 2023 | Jul 29, 2023 | Jul 29, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | SW23-15 / NA | SW23-17 / NA | SW23-18 / NA |
| **Matrix** | Water | Water | Water |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Metals Dissolved** | | | | | | |
| Subsample | | | Lab Filtered | Lab Filtered | Lab Filtered | |
| **Routine Water** | | | | | | |
| pH | | | 7.34 | 7.33 | 7.41 | 1 |
| Temperature of observed pH | | °C | 19.7 | 20.0 | 20.0 | |
| Electrical Conductivity | at 25 °C | µS/cm | 2530 | 2280 | 2230 | 1 |
| Calcium | Dissolved | mg/L | 291 | 235 | 220 | 0.2 |
| Magnesium | Dissolved | mg/L | 139 | 118 | 115 | 0.2 |
| Sodium | Dissolved | mg/L | 145 | 118 | 119 | 0.4 |
| Potassium | Dissolved | mg/L | 3 | 2.1 | 1.6 | 0.4 |
| Iron | Dissolved | mg/L | 0.5 | 0.75 | 0.28 | 0.01 |
| Manganese | Dissolved | mg/L | <0.02 | 0.632 | 0.142 | 0.005 |
| Chloride | Dissolved | mg/L | 289 | 279 | 288 | 0.4 |
| Nitrate - N | | mg/L | <0.05 | 0.01 | <0.01 | 0.01 |
| Nitrite - N | | mg/L | <0.02 | <0.005 | <0.005 | 0.005 |
| Nitrate and Nitrite - N | | mg/L | <0.07 | 0.01 | <0.01 | 0.01 |
| Sulfate (SO4) | Dissolved | mg/L | 834 | 661 | 621 | 0.9 |
| Hydroxide | | mg/L | <5 | <5 | <5 | |
| Carbonate | | mg/L | <6 | <6 | <6 | |
| Bicarbonate | | mg/L | 299 | 386 | 308 | |
| P-Alkalinity | as CaCO3 | mg/L | <5 | <5 | <5 | 5 |
| T-Alkalinity | as CaCO3 | mg/L | 245 | 317 | 252 | 5 |
| Total Dissolved Solids | Calculated | mg/L | 1850 | 1600 | 1520 | 1 |
| Hardness | Dissolved as CaCO3 | mg/L | 1300 | 1070 | 1020 | |
| Ionic Balance | Dissolved | % | 107 | 96 | 98 | |
| SAR | Dissolved | | 1.7 | 1.6 | 1.6 | |

Element
#1 8822-100 Street
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V1J 3W9, Canada

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E: info.FortStJohn@element.com
W: www.element.com

## Analytical Report

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1668914** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Jul 31, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Aug 4, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2899340 |
| Sampled By: | Drew MacPhail & Darcy Meyers | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | | | |
|---|---|---|---|
| **Reference Number** | 1668914-16 | 1668914-17 | 1668914-18 |
| **Sample Date** | Jul 29, 2023 | Jul 29, 2023 | Jul 29, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | SW23-20 / NA | SW23-21 / NA | SW23-22 / NA |
| **Matrix** | Water | Water | Water |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Metals Dissolved** | | | | | | |
| Subsample | | | Lab Filtered | Lab Filtered | Lab Filtered | |
| **Routine Water** | | | | | | |
| pH | | | 7.48 | 7.49 | 7.38 | 1 |
| Temperature of observed pH | | °C | 20.0 | 20.0 | 19.9 | |
| Electrical Conductivity | at 25 °C | µS/cm | 1330 | 1220 | 1040 | 1 |
| Calcium | Dissolved | mg/L | 166 | 152 | 135 | 0.2 |
| Magnesium | Dissolved | mg/L | 93.2 | 73.1 | 62.8 | 0.2 |
| Sodium | Dissolved | mg/L | 41.9 | 32.4 | 27.4 | 0.4 |
| Potassium | Dissolved | mg/L | 5.7 | 3.3 | 4.6 | 0.4 |
| Iron | Dissolved | mg/L | 1.60 | 1.13 | 0.05 | 0.01 |
| Manganese | Dissolved | mg/L | 1.14 | 0.869 | 0.302 | 0.005 |
| Chloride | Dissolved | mg/L | 18.2 | 13.2 | 18.1 | 0.4 |
| Nitrate - N | | mg/L | <0.01 | <0.01 | <0.01 | 0.01 |
| Nitrite - N | | mg/L | <0.005 | <0.005 | 0.007 | 0.005 |
| Nitrate and Nitrite - N | | mg/L | <0.01 | <0.01 | <0.01 | 0.01 |
| Sulfate (SO4) | Dissolved | mg/L | 224 | 235 | 101 | 0.9 |
| Hydroxide | | mg/L | <5 | <5 | <5 | |
| Carbonate | | mg/L | <6 | <6 | <6 | |
| Bicarbonate | | mg/L | 721 | 626 | 622 | |
| P-Alkalinity | as CaCO3 | mg/L | <5 | <5 | <5 | 5 |
| T-Alkalinity | as CaCO3 | mg/L | 591 | 513 | 510 | 5 |
| Total Dissolved Solids | Calculated | mg/L | 904 | 817 | 655 | 1 |
| Hardness | Dissolved as CaCO3 | mg/L | 799 | 680 | 595 | |
| Ionic Balance | Dissolved | % | 106 | 98 | 103 | |
| SAR | Dissolved | | 0.6 | 0.5 | 0.5 | |

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## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Drew MacPhail & Darcy Meyers
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1668914**
Control Number:
Date Received: Jul 31, 2023
Date Reported: Aug 4, 2023
Report Number: 2899340

| | | | |
|---|---|---|---|
| **Reference Number** | 1668914-19 | 1668914-20 | 1668914-21 |
| **Sample Date** | Jul 30, 2023 | Jul 30, 2023 | Jul 30, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | SW23-23 / NA | SW23-24 / NA | SW23-25 / NA |
| **Matrix** | Water | Water | Water |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Metals Dissolved** | | | | | | |
| Subsample | | | Lab Filtered | Lab Filtered | Lab Filtered | |
| **Routine Water** | | | | | | |
| pH | | | 7.60 | 7.62 | 7.53 | 1 |
| Temperature of observed pH | | °C | 19.8 | 19.7 | 19.7 | |
| Electrical Conductivity | at 25 °C | µS/cm | 929 | 935 | 940 | 1 |
| Calcium | Dissolved | mg/L | 137 | 138 | 140 | 0.2 |
| Magnesium | Dissolved | mg/L | 45.2 | 45.7 | 46.4 | 0.2 |
| Sodium | Dissolved | mg/L | 10.2 | 10.3 | 10.6 | 0.4 |
| Potassium | Dissolved | mg/L | 2.9 | 2.9 | 3.2 | 0.4 |
| Iron | Dissolved | mg/L | 0.04 | 0.06 | 0.03 | 0.01 |
| Manganese | Dissolved | mg/L | 0.038 | 0.008 | 0.059 | 0.005 |
| Chloride | Dissolved | mg/L | 5.5 | 5.4 | 5.7 | 0.4 |
| Nitrate - N | | mg/L | <0.01 | <0.01 | <0.01 | 0.01 |
| Nitrite - N | | mg/L | <0.005 | <0.005 | <0.005 | 0.005 |
| Nitrate and Nitrite - N | | mg/L | <0.01 | <0.01 | <0.01 | 0.01 |
| Sulfate (SO4) | Dissolved | mg/L | 259 | 266 | 251 | 0.9 |
| Hydroxide | | mg/L | <5 | <5 | <5 | |
| Carbonate | | mg/L | <6 | <6 | <6 | |
| Bicarbonate | | mg/L | 353 | 350 | 366 | |
| P-Alkalinity | as CaCO3 | mg/L | <5 | <5 | <5 | 5 |
| T-Alkalinity | as CaCO3 | mg/L | 290 | 287 | 300 | 5 |
| Total Dissolved Solids | Calculated | mg/L | 634 | 641 | 637 | 1 |
| Hardness | Dissolved as CaCO3 | mg/L | 528 | 532 | 540 | |
| Ionic Balance | Dissolved | % | 98 | 98 | 100 | |
| SAR | Dissolved | | 0.2 | 0.2 | 0.2 | |

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## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Drew MacPhail & Darcy Meyers
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1668914**
Control Number:
Date Received: Jul 31, 2023
Date Reported: Aug 4, 2023
Report Number: 2899340

| | | | |
|---|---|---|---|
| **Reference Number** | | 1668914-22 | 1668914-23 |
| **Sample Date** | | | Jul 29, 2023 |
| **Sample Time** | | | NA |
| **Sample Location** | | | |
| **Sample Description** | | Trip Blank / NA | Field Blank / NA |
| **Matrix** | | Water | Water |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Metals Dissolved** | | | | | | |
| Subsample | | | Lab Filtered | Lab Filtered | | |
| **Routine Water** | | | | | | |
| pH | | | 6.11 | 6.63 | | 1 |
| Temperature of observed pH | | °C | 20.0 | 20.1 | | |
| Electrical Conductivity | at 25 °C | µS/cm | 1 | 1 | | 1 |
| Calcium | Dissolved | mg/L | <0.2 | <0.2 | | 0.2 |
| Magnesium | Dissolved | mg/L | <0.2 | <0.2 | | 0.2 |
| Sodium | Dissolved | mg/L | <0.4 | <0.4 | | 0.4 |
| Potassium | Dissolved | mg/L | <0.4 | <0.4 | | 0.4 |
| Iron | Dissolved | mg/L | <0.01 | <0.01 | | 0.01 |
| Manganese | Dissolved | mg/L | <0.005 | <0.005 | | 0.005 |
| Chloride | Dissolved | mg/L | <0.4 | <0.4 | | 0.4 |
| Nitrate - N | | mg/L | <0.01 | <0.01 | | 0.01 |
| Nitrite - N | | mg/L | <0.005 | <0.005 | | 0.005 |
| Nitrate and Nitrite - N | | mg/L | <0.01 | <0.01 | | 0.01 |
| Sulfate (SO4) | Dissolved | mg/L | <0.9 | <0.9 | | 0.9 |
| Hydroxide | | mg/L | <5 | <5 | | |
| Carbonate | | mg/L | <6 | <6 | | |
| Bicarbonate | | mg/L | <5 | <5 | | |
| P-Alkalinity | as CaCO3 | mg/L | <5 | <5 | | 5 |
| T-Alkalinity | as CaCO3 | mg/L | <5 | <5 | | 5 |
| Total Dissolved Solids | Calculated | mg/L | <6 | <6 | | 1 |
| Hardness | Dissolved as CaCO3 | mg/L | <1.3 | <1.3 | | |
| Ionic Balance | Dissolved | % | NA | NA | | |
| SAR | Dissolved | | NA | NA | | |

Approved by:

Abhishek Suryawanshi
Operations Manager

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
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## Quality Control

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1668914** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Jul 31, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Aug 4, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2899340 |
| Sampled By: | Drew MacPhail & Darcy Meyers | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

### Metals Dissolved

| Blanks | Units | Measured | Lower Limit | Upper Limit | | Passed QC |
|---|---|---|---|---|---|---|
| Sulfur | mg/L | 0.0311584 | -0.3 | 0.2 | | yes |
| Date Acquired: | August 02, 2023 | | | | | |
| **Control Sample** | **Units** | **Measured** | **Lower Limit** | **Upper Limit** | | **Passed QC** |
| Sulfur | mg/L | 156 | 141.6 | 156.6 | | yes |
| Date Acquired: | August 02, 2023 | | | | | |
| Sulfur | mg/L | 10.1 | 9.1 | 10.6 | | yes |
| Date Acquired: | August 02, 2023 | | | | | |
| Sulfur | mg/L | 2.9 | 2.7 | 3.1 | | yes |
| Date Acquired: | August 02, 2023 | | | | | |
| **Client Sample Replicates** | **Units** | **Replicate 1** | **Replicate 2** | **% RSD Criteria** | **Absolute Criteria** | **Passed QC** |
| Sulfur | mg/L | 226 | 218 | 10 | 0.1 | yes |
| Date Acquired: | August 02, 2023 | | | | | |

### Routine Water

| Blanks | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Chloride | mg/L | 0.29 | -0.4 | 0.4 | yes |
| Calcium | mg/L | 0.0391602 | -0.2 | 0.2 | yes |
| Magnesium | mg/L | 0.00302589 | -0.1 | 0.1 | yes |
| Sodium | mg/L | -0.0316962 | -0.4 | 0.4 | yes |
| Potassium | mg/L | 0.0513618 | -0.4 | 0.4 | yes |
| Iron | mg/L | 0.00401366 | -0.01 | 0.01 | yes |
| Manganese | mg/L | 0.000583468 | -0.004 | 0.004 | yes |
| Nitrate - N | mg/L | 0.00404881 | -0.01 | 0.01 | yes |
| Nitrite - N | mg/L | 0 | -0.005 | 0.005 | yes |
| Date Acquired: | August 02, 2023 | | | | |
| **Control Sample** | **Units** | **Measured** | **Lower Limit** | **Upper Limit** | **Passed QC** |
| Chloride | mg/L | 1960 | 1847.4 | 2256.0 | yes |
| Date Acquired: | August 02, 2023 | | | | |
| Electrical Conductivity | dS/m | 32.3 | 27.200 | 36.800 | yes |
| Date Acquired: | August 02, 2023 | | | | |
| pH | | 9.15 | 8.90 | 9.44 | yes |
| Temperature of observed | °C | 20.0 | 15.5 | 24.5 | yes |
| Electrical Conductivity | dS/m | 2.76 | 2.631 | 2.829 | yes |
| P-Alkalinity | mg/L | 524 | 442 | 584 | yes |
| T-Alkalinity | mg/L | 1000 | 958 | 1059 | yes |
| Calcium | mg/L | 251 | 230.0 | 260.0 | yes |
| Magnesium | mg/L | 100 | 92.6 | 104.6 | yes |
| Sodium | mg/L | 256 | 234.6 | 259.2 | yes |
| Potassium | mg/L | 254 | 229.0 | 259.0 | yes |
| Iron | mg/L | 9.98 | 9.38 | 10.16 | yes |
| Manganese | mg/L | 2.46 | 2.320 | 2.560 | yes |
| Nitrate - N | mg/L | 10.2 | 9.03 | 11.13 | yes |
| Nitrite - N | mg/L | 9.97 | 9.010 | 10.990 | yes |

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## Quality Control

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Drew MacPhail & Darcy Meyers
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1668914**
Control Number:
Date Received: Jul 31, 2023
Date Reported: Aug 4, 2023
Report Number: 2899340

### Routine Water - Continued

| Control Sample | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Nitrate and Nitrite - N | mg/L | 20.1 | 19.10 | 20.90 | yes |
| Date Acquired: August 02, 2023 | | | | | |
| Chloride | mg/L | 80.0 | 74.9 | 86.9 | yes |
| pH | | 6.87 | 6.79 | 6.97 | yes |
| Temperature of observed | °C | 19.7 | 15.5 | 24.5 | yes |
| Electrical Conductivity | dS/m | 0.080 | 0.069 | 0.085 | yes |
| P-Alkalinity | mg/L | 59 | 28 | 72 | yes |
| T-Alkalinity | mg/L | 127 | 114 | 140 | yes |
| Calcium | mg/L | 50.8 | 44.9 | 56.9 | yes |
| Magnesium | mg/L | 20.0 | 17.9 | 22.0 | yes |
| Sodium | mg/L | 49.9 | 47.3 | 52.7 | yes |
| Potassium | mg/L | 49.6 | 45.8 | 55.8 | yes |
| Iron | mg/L | 2.01 | 1.90 | 2.08 | yes |
| Manganese | mg/L | 0.500 | 0.468 | 0.552 | yes |
| Nitrate - N | mg/L | 4.88 | 4.37 | 5.33 | yes |
| Nitrite - N | mg/L | 4.89 | 4.370 | 5.330 | yes |
| Nitrate and Nitrite - N | mg/L | 9.77 | 8.80 | 10.60 | yes |
| Date Acquired: August 02, 2023 | | | | | |
| Chloride | mg/L | 15.5 | 13.3 | 16.5 | yes |
| Calcium | mg/L | 5.1 | 4.7 | 5.4 | yes |
| Magnesium | mg/L | 2.0 | 1.9 | 2.2 | yes |
| Sodium | mg/L | 4.9 | 4.7 | 5.7 | yes |
| Potassium | mg/L | 4.9 | 4.6 | 5.6 | yes |
| Iron | mg/L | 0.20 | 0.18 | 0.22 | yes |
| Manganese | mg/L | 0.049 | 0.046 | 0.057 | yes |
| Nitrate - N | mg/L | 0.52 | 0.42 | 0.57 | yes |
| Nitrite - N | mg/L | 0.510 | 0.455 | 0.557 | yes |
| Nitrate and Nitrite - N | mg/L | 1.03 | 0.85 | 1.15 | yes |
| Date Acquired: August 02, 2023 | | | | | |

| Client Sample Replicates | Units | Replicate 1 | Replicate 2 | % RSD Criteria | Absolute Criteria | Passed QC |
|---|---|---|---|---|---|---|
| Chloride | mg/L | 12.8 | 11.8 | 10 | 0.5 | yes |
| pH | | 7.39 | 7.38 | 0 | 0.10 | yes |
| Electrical Conductivity | dS/m | 0.001 | 0.001 | 10 | 0.002 | yes |
| Hydroxide | mg/L | <5 | <5 | 10 | | yes |
| Carbonate | mg/L | <6 | <6 | 10 | 6 | yes |
| Bicarbonate | mg/L | <5 | <5 | 10 | 6 | yes |
| P-Alkalinity | mg/L | <5 | <5 | 10 | 5 | yes |
| T-Alkalinity | mg/L | <5 | <5 | 10 | 5 | yes |
| Calcium | mg/L | 225 | 234 | 10 | 0.6 | yes |
| Magnesium | mg/L | 128 | 132 | 10 | 0.7 | yes |
| Sodium | mg/L | 111 | 116 | 10 | 1.2 | yes |
| Potassium | mg/L | 4.5 | 4.7 | 10 | 1.2 | yes |
| Iron | mg/L | 0.11 | 0.11 | 10 | 0.05 | yes |
| Manganese | mg/L | 0.110 | 0.113 | 10 | 0.010 | yes |

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## Quality Control

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1668914** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Jul 31, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Aug 4, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2899340 |
| Sampled By: | Drew MacPhail & Darcy Meyers | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

## Routine Water - Continued

| Client Sample Replicates | Units | Replicate 1 | Replicate 2 | % RSD Criteria | Absolute Criteria | Passed QC |
|---|---|---|---|---|---|---|
| Nitrate - N | mg/L | 0.08 | 0.08 | 10 | 0.01 | yes |
| Nitrite - N | mg/L | <0.005 | <0.005 | 10 | 0.010 | yes |

Date Acquired: August 02, 2023

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## Methodology and Notes

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1668914** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Jul 31, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Aug 4, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2899340 |
| Sampled By: | Drew MacPhail & Darcy Meyers | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

## Method of Analysis

| Method Name | Reference | | Method | Date Analysis Started | Location |
|---|---|---|---|---|---|
| Alkalinity, pH, and EC in water | APHA | * | Alkalinity - Titration Method, 2320 B | Aug 2, 2023 | Element Edmonton - Roper Road |
| Alkalinity, pH, and EC in water | APHA | * | Conductivity, 2510 B | Aug 2, 2023 | Element Edmonton - Roper Road |
| Alkalinity, pH, and EC in water | APHA | * | pH - Electrometric Method, 4500-H+ B | Aug 2, 2023 | Element Edmonton - Roper Road |
| Anions (Routine) by Ion Chromatography | APHA | * | Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B | Aug 2, 2023 | Element Edmonton - Roper Road |
| Approval-Edmonton | APHA | | Checking Correctness of Analyses, 1030 E | Aug 3, 2023 | Element Edmonton - Roper Road |
| Chloride in Water | APHA | * | Automated Ferricyanide Method, 4500-Cl- E | Aug 2, 2023 | Element Edmonton - Roper Road |
| Metals Trace (Dissolved) in water | APHA | | Hardness by Calculation, 2340 B | Aug 2, 2023 | Element Edmonton - Roper Road |
| Metals Trace (Dissolved) in water | APHA | * | Inductively Coupled Plasma (ICP) Method, 3120 B | Aug 2, 2023 | Element Edmonton - Roper Road |

** Reference Method Modified*

## References

| | |
|---|---|
| APHA | Standard Methods for the Examination of Water and Wastewater |

## Comments:

- Jul 31, 2023 - Proj ID: 21-00365-07
  Proj Name: Pointed Mountain
  Client: Paramount Resources Ltd
  Consultant: Millenium EMS Solutions Ltd
- Aug 04, 2023 - The ionic balance for samples 22 and 23 could not be calculated due to a lack of dissolved ions.

Please direct any inquiries regarding this report to our Client Services group.
Results relate only to samples as submitted.
The test report shall not be reproduced except in full, without the written approval of the laboratory.

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## Report Transmission Cover Page

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1664299**
Control Number:
Date Received: Jul 10, 2023
Date Reported: Jul 17, 2023
Report Number: 2892484

| Contact | Company | Address |
|---|---|---|
| **Accounts Payable** | **Millennium EMS Solutions** | #148, 2257 Premier Way<br>Sherwood Park, AB T8H 2M8<br>Phone: (780) 496-9048 Fax: (780) 496-9049<br>Email: acct@mems.ca |

| Delivery | Format | Deliverables |
|---|---|---|
| Email - Merge | PDF | COA / COC |
| Email - Merge | PDF | COC / Invoice |

| Contact | Company | Address |
|---|---|---|
| **Element Invoicing** | **Paramount Resources Ltd** | 7217 Roper Road<br>Edmonton, AB T6B 3J4<br>Phone: (780) 438-5522 Fax:<br>Email: invoicing.edmonton@element.com |

| Delivery | Format | Deliverables |
|---|---|---|
| Post | PDF | COC / Invoice |

| Contact | Company | Address |
|---|---|---|
| **Emma Stienne** | **Millennium EMS Solutions** | Nelson , BC<br>Phone: (000) 000-0000 Fax:<br>Email: estienne@mems.ca |

| Delivery | Format | Deliverables |
|---|---|---|
| Email | MEMS Custom Excel | Test Report |
| Email | PDF | COC / Test Report |
| Email | Standard Crosstab With Tabs | Test Report |
| Email | Standard Crosstab Without Tabs | Test Report |
| Email - Merge | PDF | COC / Invoice |

| Contact | Company | Address |
|---|---|---|
| **Guillermo Hernandez** | **Millennium EMS Solutions** | #148, 2257 Premier Way<br>Sherwood Park, AB T8H 2M8<br>Phone: (780) 391-2531 Fax: (780) 496-9049<br>Email: ghernandez@mems.ca |

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|---|---|---|
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| Email | Standard Crosstab With Tabs | Test Report |
| Email | Standard Crosstab Without Tabs | Test Report |
| Email - Merge | PDF | COC / Invoice |

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## Report Transmission Cover Page

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| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1664299** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Jul 10, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Jul 17, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2892484 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| Contact | Company | Address |
|---|---|---|
| **Jeff Belecky** | **Millennium EMS Solutions** | #148, 2257 Premier Way<br>Sherwood Park, AB T8H 2M8<br>Phone: (780) 496-9048 Fax: (780) 496-9049<br>Email: jbelecky@mems.ca |

| Delivery | Format | Deliverables |
|---|---|---|
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| Email | PDF | COC / Test Report |
| Email | Standard Crosstab With Tabs | Test Report |
| Email | Standard Crosstab Without Tabs | Test Report |
| Email - Merge | PDF | COC / Invoice |

| Contact | Company | Address |
|---|---|---|
| **Lab Data** | **Millennium EMS Solutions** | #148, 2257 Premier Way<br>Sherwood Park, AB T8H 2M8<br>Phone: (780) 496-9048 Fax: (780) 496-9049<br>Email: labdata@mems.ca |

| Delivery | Format | Deliverables |
|---|---|---|
| Email | MEMS Custom Excel | Test Report |
| Email | MEMS ESDAT Chemistry File | Test Report |
| Email | MEMS ESDAT Sample File | Test Report |
| Email | PDF | COC / Test Report |
| Email | Standard Crosstab With Tabs | Test Report |
| Email | Standard Crosstab Without Tabs | Test Report |
| Email - Merge | PDF | COA / COC |
| Email - Merge | PDF | COC / Invoice |

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## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1664299**
Control Number:
Date Received: Jul 10, 2023
Date Reported: Jul 17, 2023
Report Number: 2892484

| | | | |
|---|---|---|---|
| **Reference Number** | 1664299-1 | 1664299-4 | 1664299-6 |
| **Sample Date** | Jul 07, 2023 | Jul 07, 2023 | Jul 07, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-01 / 0.2 / m / 21.4°C | HA23-02 / 0.2 / m / 21.4°C | HA23-02 / 1.0 / m / 21.4°C |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 1.45 | 1.66 | 1.52 | 0.01 |
| SAR | Saturated Paste | | 1.1 | 1.6 | 1.7 | |
| % Saturation | | % | 193 | 174 | 108 | |
| Calcium | Saturated Paste | mg/kg | 284 | 287 | 162 | |
| Magnesium | Saturated Paste | mg/kg | 133 | 100 | 51.6 | |
| Sodium | Saturated Paste | mg/kg | 121 | 163 | 103 | |
| Potassium | Saturated Paste | mg/kg | 5 | 5 | 3 | |
| Chloride | Saturated Paste | mg/L | 27 | 135 | 26 | 3 |
| Chloride | Saturated Paste | mg/kg | 52 | 236 | 28 | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 1090 | 943 | 703 | |
| TGR | Saturated Paste | T/ac | <0.1 | <0.1 | <0.1 | |
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 8.6 | 8.5 | 7.9 | |

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Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1664299**
Control Number:
Date Received: Jul 10, 2023
Date Reported: Jul 17, 2023
Report Number: 2892484

| | | | | | | |
|---|---|---|---|---|---|---|
| | | **Reference Number** | 1664299-7 | 1664299-10 | 1664299-12 | |
| | | **Sample Date** | Jul 07, 2023 | Jul 08, 2023 | Jul 08, 2023 | |
| | | **Sample Time** | NA | NA | NA | |
| | | **Sample Location** | | | | |
| | | **Sample Description** | HA23-03 / 0.2 / m / 21.4°C | HA23-07 / 0.2 / m / 21.4°C | HA23-07 / 1.0 / m / 21.4°C | |
| | | **Matrix** | Soil | Soil | Soil | |
| **Analyte** | | **Units** | **Results** | **Results** | **Results** | Nominal Detection Limit |
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 0.81 | 1.01 | 0.85 | 0.01 |
| SAR | Saturated Paste | | 0.7 | 0.9 | 1.0 | |
| % Saturation | | % | 695 | 169 | 133 | |
| Calcium | Saturated Paste | mg/kg | 623 | 159 | 103 | |
| Magnesium | Saturated Paste | mg/kg | 196 | 72.3 | 43.5 | |
| Sodium | Saturated Paste | mg/kg | 198 | 73 | 53 | |
| Potassium | Saturated Paste | mg/kg | 30 | 8 | 3 | |
| Chloride | Saturated Paste | mg/L | 43 | 50 | 26 | 3 |
| Chloride | Saturated Paste | mg/kg | 301 | 84 | 34 | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 1730 | 596 | 391 | |
| TGR | Saturated Paste | T/ac | <0.1 | <0.1 | <0.1 | |
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 6.6 | 7.1 | 7.8 | |

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## Analytical Report

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Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1664299**
Control Number:
Date Received: Jul 10, 2023
Date Reported: Jul 17, 2023
Report Number: 2892484

| | | | | |
|---|---|---|---|---|
| **Reference Number** | | 1664299-13 | 1664299-15 | 1664299-16 |
| **Sample Date** | | Jul 08, 2023 | Jul 08, 2023 | Jul 08, 2023 |
| **Sample Time** | | NA | NA | NA |
| **Sample Location** | | | | |
| **Sample Description** | | HA23-08 / 0.2 / m / 21.4°C | HA23-08 / 1.0 / m / 21.4°C | HA23-09 / 0.2 / m / 21.4°C |
| **Matrix** | | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 1.76 | 1.56 | 1.88 | 0.01 |
| SAR | Saturated Paste | | 1.2 | 1.2 | 1.4 | |
| % Saturation | | % | 125 | 160 | 421 | |
| Calcium | Saturated Paste | mg/kg | 158 | 175 | 829 | |
| Magnesium | Saturated Paste | mg/kg | 113 | 141 | 342 | |
| Sodium | Saturated Paste | mg/kg | 89 | 107 | 379 | |
| Potassium | Saturated Paste | mg/kg | 4 | 6 | 26 | |
| Chloride | Saturated Paste | mg/L | 298 | 162 | 131 | 3 |
| Chloride | Saturated Paste | mg/kg | 373 | 260 | 553 | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 384 | 735 | 3090 | |
| TGR | Saturated Paste | T/ac | <0.1 | <0.1 | <0.1 | |
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 7.3 | 7.8 | 6.8 | |

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## Analytical Report

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T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1664299**
Control Number:
Date Received: Jul 10, 2023
Date Reported: Jul 17, 2023
Report Number: 2892484

| | |
|---|---|
| **Reference Number** | 1664299-19 |
| **Sample Date** | Jul 08, 2023 |
| **Sample Time** | NA |
| **Sample Location** | |
| **Sample Description** | HA23-10 / 0.2 / m / 21.4°C |
| **Matrix** | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 1.00 | | | 0.01 |
| SAR | Saturated Paste | | 0.5 | | | |
| % Saturation | | % | 148 | | | |
| Calcium | Saturated Paste | mg/kg | 150 | | | |
| Magnesium | Saturated Paste | mg/kg | 70.8 | | | |
| Sodium | Saturated Paste | mg/kg | 39 | | | |
| Potassium | Saturated Paste | mg/kg | 4 | | | |
| Chloride | Saturated Paste | mg/L | 49 | | | 3 |
| Chloride | Saturated Paste | mg/kg | 73 | | | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 529 | | | |
| TGR | Saturated Paste | T/ac | <0.1 | | | |
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 6.7 | | | |

Approved by:

Randy Neumann, BSc
Director

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
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## Quality Control

Bill To: Paramount Resources Ltd
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T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1664299**
Control Number:
Date Received: Jul 10, 2023
Date Reported: Jul 17, 2023
Report Number: 2892484

### Salinity

| Blanks | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Calcium | mg/L | 0.268745 | -2.0 | 2.0 | yes |
| Magnesium | mg/L | 0.0765649 | -0.3 | 0.3 | yes |
| Sodium | mg/L | 0.100663 | -1 | 1 | yes |
| Potassium | mg/L | 0.0781613 | -1.0 | 1.0 | yes |
| Chloride | mg/L | 2.0549 | -3 | 3 | yes |
| Sulfate-S | mg/L | 0.0760942 | -2 | 2 | yes |
| Boron | mg/L | -0.00689723 | -0.05 | 0.05 | yes |
| Date Acquired: July 11, 2023 | | | | | |

| Control Sample | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Electrical Conductivity | dS/m | 0.46 | 0.31 | 0.52 | yes |
| % Saturation | % | 58 | 47 | 80 | yes |
| Calcium | mg/L | 48.6 | 34.6 | 58.6 | yes |
| Magnesium | mg/L | 13.3 | 9.5 | 16.5 | yes |
| Sodium | mg/L | 12 | 9 | 15 | yes |
| Potassium | mg/L | 9.1 | 6.9 | 11.1 | yes |
| Chloride | mg/L | 27 | 16 | 34 | yes |
| Sulfate-S | mg/L | 16 | 11 | 22 | yes |
| Boron | mg/L | 0.16 | 0.15 | 0.29 | yes |
| Date Acquired: July 11, 2023 | | | | | |
| Electrical Conductivity | dS/m | 32.0 | 26.80 | 35.20 | yes |
| Calcium | mg/L | 247 | 226.9 | 261.1 | yes |
| Magnesium | mg/L | 99.4 | 91.0 | 104.8 | yes |
| Sodium | mg/L | 249 | 229 | 264 | yes |
| Potassium | mg/L | 254 | 230.7 | 265.5 | yes |
| Chloride | mg/L | 2000 | 1852 | 2229 | yes |
| Sulfate-S | mg/L | 149 | 142 | 157 | yes |
| Date Acquired: July 11, 2023 | | | | | |

### Soil Acidity

| Blanks | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| pH | pH | 6.85 | 5.2 | 7.0 | yes |
| Date Acquired: July 11, 2023 | | | | | |

| Control Sample | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| pH | pH | 7.0 | 6.5 | 7.1 | yes |
| Date Acquired: July 11, 2023 | | | | | |

| Client Sample Replicates | Units | Replicate 1 | Replicate 2 | % RSD Criteria | Absolute Criteria | Passed QC |
|---|---|---|---|---|---|---|
| pH | pH | 7.8 | 7.8 | 10 | 0.3 | yes |
| Date Acquired: July 11, 2023 | | | | | | |

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## Methodology and Notes

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1664299** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Jul 10, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Jul 17, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2892484 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

## Method of Analysis

| Method Name | Reference | | Method | Date Analysis Started | Location |
|---|---|---|---|---|---|
| pH by CaCl2 (1:2 ratio) in soil | McKeague | * | pH in 0.01M Calcium Chloride, 3.11 | Jul 11, 2023 | Element Edmonton - Roper Road |
| pH by CaCl2 (1:2 ratio) in soil | McKeague | * | pH in 0.01M Calcium Chloride, 3.11 | Jul 13, 2023 | Element Edmonton - Roper Road |
| Saturated Paste in General Soil | APHA | * | Automated Ferricyanide Method, 4500-Cl-E | Jul 11, 2023 | Element Edmonton - Roper Road |
| Saturated Paste in General Soil | Carter | * | Electrical Conductivity and Soluble Ions, Chapter 15 | Jul 11, 2023 | Element Edmonton - Roper Road |

** Reference Method Modified*

## References

| | |
|---|---|
| APHA | Standard Methods for the Examination of Water and Wastewater |
| Carter | Soil Sampling and Methods of Analysis. |
| McKeague | Manual on Soil Sampling and Methods of Analysis |

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Bill To: Paramount Resources Ltd
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Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| Contact | Company | Address |
|---|---|---|
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| Contact | Company | Address |
|---|---|---|
| **Emma Stienne** | **Millennium EMS Solutions** | Nelson , BC<br>Phone: (000) 000-0000 Fax:<br>Email: estienne@mems.ca |

| Delivery | Format | Deliverables |
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| Email | Standard Crosstab With Tabs | Test Report |
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| Email - Merge | PDF | COC / Invoice |

| Contact | Company | Address |
|---|---|---|
| **Jeff Belecky** | **Millennium EMS Solutions** | #148, 2257 Premier Way<br>Sherwood Park, AB T8H 2M8<br>Phone: (780) 496-9048 Fax: (780) 496-9049<br>Email: jbelecky@mems.ca |

| Delivery | Format | Deliverables |
|---|---|---|
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| Email | PDF | COC / Test Report |
| Email | Standard Crosstab With Tabs | Test Report |
| Email | Standard Crosstab Without Tabs | Test Report |
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|---|---|---|
| **Lab Data** | **Millennium EMS Solutions** | #148, 2257 Premier Way<br>Sherwood Park, AB T8H 2M8<br>Phone: (780) 496-9048 Fax: (780) 496-9049<br>Email: labdata@mems.ca |

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## Report Transmission Cover Page

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| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 |
| Attn: | Jeff Belecky |
| Sampled By: | Guillermo Hernandez |
| Company: | MEMS |

| | |
|---|---|
| Project ID: | 21-00365-07 |
| Project Name: | Pointed Mountain |
| Project Location: | West of Fort Liard, NWT |
| LSD: | 300/a-55-60-30-123-45/0 |
| P.O.: | 23SR0061 |
| Proj. Acct. code: | |
| OI Customer | PR210-Drilling and |

| | |
|---|---|
| Lot ID: | **1676280** |
| Control Number: | |
| Date Received: | Sep 1, 2023 |
| Date Reported: | Sep 15, 2023 |
| Report Number: | 2909874 |

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P.O.: 23SR0061
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OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-1 | 1676280-3 | 1676280-4 |
| **Sample Date** | Aug 25, 2023 | Aug 25, 2023 | Aug 25, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | Pond 1 / 1 / m | Pond 2 / 2.5 / m | Pond 3 / 0.5 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Metals Strong Acid Digestion** | | | | | | |
| Antimony | Strong Acid Extractable | mg/kg | 0.5 | 0.4 | 0.5 | 0.2 |
| Arsenic | Strong Acid Extractable | mg/kg | 12.4 | 10.4 | 9.7 | 0.2 |
| Barium | Strong Acid Extractable | mg/kg | 176 | 204 | 207 | 1 |
| Beryllium | Strong Acid Extractable | mg/kg | 0.6 | 0.6 | 0.7 | 0.1 |
| Cadmium | Strong Acid Extractable | mg/kg | 0.35 | 0.52 | 0.21 | 0.01 |
| Chromium | Strong Acid Extractable | mg/kg | 18.6 | 21.2 | 23.9 | 0.5 |
| Cobalt | Strong Acid Extractable | mg/kg | 10.2 | 13.2 | 10.5 | 0.1 |
| Copper | Strong Acid Extractable | mg/kg | 23.4 | 26.6 | 19.1 | 1 |
| Lead | Strong Acid Extractable | mg/kg | 12.3 | 12.8 | 13.0 | 0.1 |
| Mercury | Strong Acid Extractable | mg/kg | 0.07 | 0.06 | <0.05 | 0.05 |
| Molybdenum | Strong Acid Extractable | mg/kg | 2.8 | 2.4 | 2.1 | 1 |
| Nickel | Strong Acid Extractable | mg/kg | 30.3 | 35.7 | 28.7 | 0.5 |
| Selenium | Strong Acid Extractable | mg/kg | 0.65 | 1.05 | 0.65 | 0.3 |
| Silver | Strong Acid Extractable | mg/kg | 0.2 | 0.2 | 0.1 | 0.1 |
| Thallium | Strong Acid Extractable | mg/kg | 0.20 | 0.23 | 0.15 | 0.05 |
| Tin | Strong Acid Extractable | mg/kg | <1.0 | <1.0 | <1.0 | 1 |
| Uranium | Strong Acid Extractable | mg/kg | 1.8 | 2.0 | 1.3 | 0.5 |
| Vanadium | Strong Acid Extractable | mg/kg | 28.1 | 30.5 | 34.7 | 0.1 |
| Zinc | Strong Acid Extractable | mg/kg | 93 | 103 | 75 | 1 |
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 3.67 | 4.72 | 3.08 | 0.01 |
| SAR | Saturated Paste | | 0.8 | 1.8 | 1.0 | |
| % Saturation | | % | 76 | 76 | 76 | |
| Calcium | Saturated Paste | mg/kg | 411 | 392 | 341 | |
| Magnesium | Saturated Paste | mg/kg | 222 | 327 | 148 | |
| Sodium | Saturated Paste | mg/kg | 73 | 175 | 76 | |
| Potassium | Saturated Paste | mg/kg | <8 | 9 | <8 | |
| Chloride | Saturated Paste | mg/L | 20 | 84 | 122 | 3 |
| Chloride | Saturated Paste | mg/kg | 15 | 64 | 93 | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 1880 | 2400 | 1290 | |
| Boron | Saturated Paste | mg/L | <0.5 | <0.5 | <0.5 | 0.05 |
| TGR | Saturated Paste | T/ac | <0.1 | <0.1 | <0.1 | |
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 7.5 | 7.5 | 7.4 | |
| **Water Soluble Parameters** | | | | | | |
| Chromium (VI) | Dry Weight | mg/kg | <0.05 | <0.05 | 0.08 | 0.05 |
| **Mono-Aromatic Hydrocarbons - Soil** | | | | | | |
| Benzene | Dry Weight | mg/kg | <0.005 | <0.005 | <0.005 | 0.005 |
| Toluene | Dry Weight | mg/kg | <0.02 | <0.02 | <0.02 | 0.02 |

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## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | | |
|---|---|---|---|---|
| **Reference Number** | | 1676280-1 | 1676280-3 | 1676280-4 |
| **Sample Date** | | Aug 25, 2023 | Aug 25, 2023 | Aug 25, 2023 |
| **Sample Time** | | NA | NA | NA |
| **Sample Location** | | | | |
| **Sample Description** | | Pond 1 / 1 / m | Pond 2 / 2.5 / m | Pond 3 / 0.5 / m |
| **Matrix** | | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Mono-Aromatic Hydrocarbons - Soil - Continued** | | | | | | |
| Ethylbenzene | Dry Weight | mg/kg | <0.005 | <0.005 | <0.005 | 0.005 |
| Total Xylenes (m,p,o) | Dry Weight | mg/kg | <0.03 | <0.03 | <0.03 | 0.03 |
| Methanol Field Preservation | | | Yes | Yes | Yes | |
| **Volatile Petroleum Hydrocarbons - Soil** | | | | | | |
| F1 C6-C10 | Dry Weight | mg/kg | <10 | <10 | <10 | 10 |
| F1 -BTEX | Dry Weight | mg/kg | <10 | <10 | <10 | 10 |
| **Extractable Petroleum Hydrocarbons - Soil** | | | | | | |
| Extraction Date | Total Extractables | | 5-Sep-23 | 5-Sep-23 | 5-Sep-23 | |
| F2c C10-C16 | Dry Weight | mg/kg | <25 | <25 | <25 | 25 |
| F3c C16-C34 | Dry Weight | mg/kg | <50 | <50 | <50 | 50 |
| F4c C34-C50 | Dry Weight | mg/kg | <100 | <100 | <100 | 100 |
| F4HTGCc C34-C50+ | Dry Weight | mg/kg | <100 | <100 | <100 | 100 |
| % C50+ | | % | <5 | <5 | <5 | |
| **Silica Gel Cleanup** | | | | | | |
| Silica Gel Cleanup | | | Done | Done | Done | |
| **Soil % Moisture** | | | | | | |
| Moisture | Soil % Moisture | % by weight | 17.00 | 24.70 | 23.30 | |

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## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-6 | 1676280-8 | 1676280-9 |
| **Sample Date** | Aug 25, 2023 | Aug 25, 2023 | Aug 25, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | Pond 4 / 1.5 / m | HA23-33 / 0.1 / m | HA23-33 / 0.5 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 1.61 | | | 0.01 |
| SAR | Saturated Paste | | 0.7 | | | |
| % Saturation | | % | 75 | 113 | 94 | |
| Calcium | Saturated Paste | mg/kg | 144 | | | |
| Magnesium | Saturated Paste | mg/kg | 70.9 | | | |
| Sodium | Saturated Paste | mg/kg | 37 | | | |
| Potassium | Saturated Paste | mg/kg | 3 | | | |
| Chloride | Saturated Paste | mg/L | 14 | | | 3 |
| Chloride | Saturated Paste | mg/kg | 11 | | | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 600 | | | |
| Boron | Saturated Paste | mg/L | 0.09 | 0.05 | 0.08 | 0.05 |
| TGR | Saturated Paste | T/ac | <0.1 | | | |

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## Analytical Report

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1676280** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Sep 15, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-6 | 1676280-51 | 1676280-52 |
| **Sample Date** | Aug 25, 2023 | Aug 27, 2023 | Aug 27, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | Pond 4 / 1.5 / m | HA23-47 / 0.5 / m | HA23-47 / 1 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 7.7 | 6.6 | 7.2 | |

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## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-6 | 1676280-53 | 1676280-55 |
| **Sample Date** | Aug 25, 2023 | Aug 27, 2023 | Aug 27, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | Pond 4 / 1.5 / m | Tank Area SS23-01 / 0.1 / m | Tank Area SS23-03 / 0.1 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Metals Strong Acid Digestion** | | | | | | |
| Antimony | Strong Acid Extractable | mg/kg | 0.5 | 0.4 | 0.5 | 0.2 |
| Arsenic | Strong Acid Extractable | mg/kg | 12.5 | 9.9 | 11.5 | 0.2 |
| Barium | Strong Acid Extractable | mg/kg | 245 | 145 | 231 | 1 |
| Beryllium | Strong Acid Extractable | mg/kg | 0.7 | 0.6 | 0.8 | 0.1 |
| Cadmium | Strong Acid Extractable | mg/kg | 0.16 | 0.12 | 0.15 | 0.01 |
| Chromium | Strong Acid Extractable | mg/kg | 25.6 | 22.3 | 33.5 | 0.5 |
| Cobalt | Strong Acid Extractable | mg/kg | 11.6 | 9.6 | 12.1 | 0.1 |
| Copper | Strong Acid Extractable | mg/kg | 22.0 | 10.5 | 18.2 | 1 |
| Lead | Strong Acid Extractable | mg/kg | 13.9 | 13.1 | 14.5 | 0.1 |
| Mercury | Strong Acid Extractable | mg/kg | <0.05 | <0.05 | <0.05 | 0.05 |
| Molybdenum | Strong Acid Extractable | mg/kg | 1.8 | 1.3 | 2.2 | 1 |
| Nickel | Strong Acid Extractable | mg/kg | 38.0 | 21.1 | 34.7 | 0.5 |
| Selenium | Strong Acid Extractable | mg/kg | 0.84 | 0.47 | 0.59 | 0.3 |
| Silver | Strong Acid Extractable | mg/kg | 0.1 | 0.10 | 0.2 | 0.1 |
| Thallium | Strong Acid Extractable | mg/kg | 0.15 | 0.11 | 0.15 | 0.05 |
| Tin | Strong Acid Extractable | mg/kg | <1.0 | <1.0 | <1.0 | 1 |
| Uranium | Strong Acid Extractable | mg/kg | 2.4 | 0.9 | 1.3 | 0.5 |
| Vanadium | Strong Acid Extractable | mg/kg | 38.3 | 36.2 | 43.2 | 0.1 |
| Zinc | Strong Acid Extractable | mg/kg | 82 | 64 | 83 | 1 |
| **Water Soluble Parameters** | | | | | | |
| Chromium (VI) | Dry Weight | mg/kg | <0.05 | 0.06 | 0.05 | 0.05 |
| **Mono-Aromatic Hydrocarbons - Soil** | | | | | | |
| Benzene | Dry Weight | mg/kg | <0.005 | <0.005 | <0.005 | 0.005 |
| Toluene | Dry Weight | mg/kg | <0.02 | <0.02 | <0.02 | 0.02 |
| Ethylbenzene | Dry Weight | mg/kg | <0.005 | <0.005 | <0.005 | 0.005 |
| Total Xylenes (m,p,o) | Dry Weight | mg/kg | <0.03 | <0.03 | <0.03 | 0.03 |
| Methanol Field Preservation | | | Yes | Yes | Yes | |
| **Volatile Petroleum Hydrocarbons - Soil** | | | | | | |
| F1 C6-C10 | Dry Weight | mg/kg | <10 | <10 | <10 | 10 |
| F1 -BTEX | Dry Weight | mg/kg | <10 | <10 | <10 | 10 |
| **Extractable Petroleum Hydrocarbons - Soil** | | | | | | |
| Extraction Date | Total Extractables | | 5-Sep-23 | 5-Sep-23 | 5-Sep-23 | |
| F2c C10-C16 | Dry Weight | mg/kg | <25 | <25 | <25 | 25 |
| F3c C16-C34 | Dry Weight | mg/kg | <50 | <50 | <50 | 50 |
| F4c C34-C50 | Dry Weight | mg/kg | <100 | <100 | <100 | 100 |
| F4HTGCc C34-C50+ | Dry Weight | mg/kg | <100 | <100 | <100 | 100 |
| % C50+ | | % | <5 | <5 | <5 | |

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## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | | |
|---|---|---|---|---|
| | **Reference Number** | 1676280-6 | 1676280-53 | 1676280-55 |
| | **Sample Date** | Aug 25, 2023 | Aug 27, 2023 | Aug 27, 2023 |
| | **Sample Time** | NA | NA | NA |
| | **Sample Location** | | | |
| | **Sample Description** | Pond 4 / 1.5 / m | Tank Area SS23-01 / 0.1 / m | Tank Area SS23-03 / 0.1 / m |
| | **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Silica Gel Cleanup** | | | | | | |
| Silica Gel Cleanup | | | Done | Done | Done | |
| **Soil % Moisture** | | | | | | |
| Moisture | Soil % Moisture | % by weight | 21.90 | 16.50 | 18.70 | |

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## Analytical Report

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1676280** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Sep 15, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-8 | 1676280-9 | 1676280-11 |
| **Sample Date** | Aug 25, 2023 | Aug 25, 2023 | Aug 26, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-33 / 0.1 / m | HA23-33 / 0.5 / m | HA23-34 / 0.1 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Hot Water Soluble** | | | | | | |
| Boron | Hot Water Soluble | mg/kg | 0.99 | 1.2 | 0.82 | 0.2 |

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## Analytical Report

Bill To: Paramount Resources Ltd
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Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | | | | |
|---|---|---|---|---|---|---|
| | | **Reference Number** | 1676280-11 | 1676280-12 | 1676280-14 | |
| | | **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 | |
| | | **Sample Time** | NA | NA | NA | |
| | | **Sample Location** | | | | |
| | | **Sample Description** | HA23-34 / 0.1 / m | HA23-34 / 0.5 / m | HA23-35 / 0.1 / m | |
| | | **Matrix** | Soil | Soil | Soil | |
| **Analyte** | | **Units** | **Results** | **Results** | **Results** | Nominal Detection Limit |
| **Salinity** | | | | | | |
| % Saturation | | % | 99 | 82 | 94 | |
| Boron | Saturated Paste | mg/L | <0.05 | 0.06 | 0.05 | 0.05 |

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## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-12 | 1676280-14 | 1676280-15 |
| **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-34 / 0.5 / m | HA23-35 / 0.1 / m | HA23-35 / 0.5 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Hot Water Soluble** | | | | | | |
| Boron | Hot Water Soluble | mg/kg | 1.1 | 0.87 | 0.49 | 0.2 |

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T8H 2M8
Attn: Jeff Belecky
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Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | | | | |
|---|---|---|---|---|---|---|
| | | **Reference Number** | 1676280-15 | 1676280-17 | 1676280-18 | |
| | | **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 | |
| | | **Sample Time** | NA | NA | NA | |
| | | **Sample Location** | | | | |
| | | **Sample Description** | HA23-35 / 0.5 / m | HA23-36 / 0.1 / m | HA23-36 / 0.5 / m | |
| | | **Matrix** | Soil | Soil | Soil | |
| **Analyte** | | **Units** | **Results** | **Results** | **Results** | Nominal Detection Limit |
| **Salinity** | | | | | | |
| % Saturation | | % | 88 | 101 | 71 | |
| Boron | Saturated Paste | mg/L | <0.05 | <0.05 | <0.05 | 0.05 |

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## Analytical Report

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Attn: Jeff Belecky
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Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | | |
|---|---|---|---|---|
| **Reference Number** | | 1676280-17 | 1676280-18 | 1676280-20 |
| **Sample Date** | | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 |
| **Sample Time** | | NA | NA | NA |
| **Sample Location** | | | | |
| **Sample Description** | | HA23-36 / 0.1 / m | HA23-36 / 0.5 / m | HA23-37 / 0.1 / m |
| **Matrix** | | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Hot Water Soluble** | | | | | | |
| Boron | Hot Water Soluble | mg/kg | 1.2 | 0.75 | 1.0 | 0.2 |

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## Analytical Report

Bill To: Paramount Resources Ltd
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T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | | | | |
|---|---|---|---|---|---|---|
| | | **Reference Number** | 1676280-20 | 1676280-21 | 1676280-23 | |
| | | **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 | |
| | | **Sample Time** | NA | NA | NA | |
| | | **Sample Location** | | | | |
| | | **Sample Description** | HA23-37 / 0.1 / m | HA23-37 / 0.5 / m | HA23-38 / 0.1 / m | |
| | | **Matrix** | Soil | Soil | Soil | |
| **Analyte** | | **Units** | **Results** | **Results** | **Results** | Nominal Detection Limit |
| **Salinity** | | | | | | |
| % Saturation | | % | 90 | 103 | 93 | |
| Boron | Saturated Paste | mg/L | <0.05 | 0.09 | <0.05 | 0.05 |

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## Analytical Report

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T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-21 | 1676280-23 | 1676280-24 |
| **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-37 / 0.5 / m | HA23-38 / 0.1 / m | HA23-38 / 0.5 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Hot Water Soluble** | | | | | | |
| Boron | Hot Water Soluble | mg/kg | 1.5 | 0.77 | 0.54 | 0.2 |

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## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | | | | |
|---|---|---|---|---|---|---|
| | | **Reference Number** | 1676280-24 | 1676280-26 | 1676280-27 | |
| | | **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 | |
| | | **Sample Time** | NA | NA | NA | |
| | | **Sample Location** | | | | |
| | | **Sample Description** | HA23-38 / 0.5 / m | HA23-39 / 0.1 / m | HA23-39 / 0.5 / m | |
| | | **Matrix** | Soil | Soil | Soil | |
| **Analyte** | | **Units** | **Results** | **Results** | **Results** | Nominal Detection Limit |
| **Salinity** | | | | | | |
| % Saturation | | % | 94 | 84 | 77 | |
| Boron | Saturated Paste | mg/L | <0.05 | 0.08 | <0.05 | 0.05 |

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## Analytical Report

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|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1676280** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Sep 15, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-26 | 1676280-27 | 1676280-29 |
| **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-39 / 0.1 / m | HA23-39 / 0.5 / m | HA23-40 / 0.1 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Hot Water Soluble** | | | | | | |
| Boron | Hot Water Soluble | mg/kg | 0.87 | 0.26 | 1.2 | 0.2 |

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## Analytical Report

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T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | | | | |
|---|---|---|---|---|---|---|
| | | **Reference Number** | 1676280-29 | 1676280-30 | 1676280-32 | |
| | | **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 | |
| | | **Sample Time** | NA | NA | NA | |
| | | **Sample Location** | | | | |
| | | **Sample Description** | HA23-40 / 0.1 / m | HA23-40 / 0.5 / m | HA23-41 / 0.1 / m | |
| | | **Matrix** | Soil | Soil | Soil | |
| **Analyte** | | **Units** | **Results** | **Results** | **Results** | Nominal Detection Limit |
| **Salinity** | | | | | | |
| % Saturation | | % | 105 | 127 | 182 | |
| Boron | Saturated Paste | mg/L | 0.06 | 0.10 | 0.06 | 0.05 |

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## Analytical Report

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|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1676280** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Sep 15, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-30 | 1676280-32 | 1676280-35 |
| **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-40 / 0.5 / m | HA23-41 / 0.1 / m | HA23-42 / 0.1 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Hot Water Soluble** | | | | | | |
| Boron | Hot Water Soluble | mg/kg | 1.7 | 0.70 | 0.62 | 0.2 |

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Attn: Jeff Belecky
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Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
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P.O.: 23SR0061
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OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | | | | |
|---|---|---|---|---|---|---|
| | | **Reference Number** | 1676280-35 | 1676280-38 | 1676280-41 | |
| | | **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 | |
| | | **Sample Time** | NA | NA | NA | |
| | | **Sample Location** | | | | |
| | | **Sample Description** | HA23-42 / 0.1 / m | HA23-43 / 0.1 / m | HA23-44 / 0.1 / m | |
| | | **Matrix** | Soil | Soil | Soil | |
| **Analyte** | | **Units** | **Results** | **Results** | **Results** | Nominal Detection Limit |
| **Salinity** | | | | | | |
| % Saturation | | % | 77 | 106 | 79 | |
| Boron | Saturated Paste | mg/L | <0.05 | <0.05 | <0.05 | 0.05 |

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## Analytical Report

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|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1676280** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Sep 15, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-38 | 1676280-41 | 1676280-44 |
| **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 26, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-43 / 0.1 / m | HA23-44 / 0.1 / m | HA23-45 / 0.1 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Hot Water Soluble** | | | | | | |
| Boron | Hot Water Soluble | mg/kg | 0.47 | 0.65 | 1.4 | 0.2 |

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## Analytical Report

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Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
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OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-44 | 1676280-47 | 1676280-51 |
| **Sample Date** | Aug 26, 2023 | Aug 26, 2023 | Aug 27, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-45 / 0.1 / m | HA23-46 / 0.1 / m | HA23-47 / 0.5 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | | | 2.03 | 0.01 |
| SAR | Saturated Paste | | | | <0.1 | |
| % Saturation | | % | 103 | 80 | 390 | |
| Calcium | Saturated Paste | mg/kg | | | 1790 | |
| Magnesium | Saturated Paste | mg/kg | | | 160 | |
| Sodium | Saturated Paste | mg/kg | | | <39 | |
| Potassium | Saturated Paste | mg/kg | | | <39 | |
| Chloride | Saturated Paste | mg/L | | | 11 | 3 |
| Chloride | Saturated Paste | mg/kg | | | 42 | |
| Sulfate (SO4) | Saturated Paste | mg/kg | | | 4280 | |
| Boron | Saturated Paste | mg/L | 0.07 | <0.05 | | 0.05 |
| TGR | Saturated Paste | T/ac | | | <0.1 | |

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## Analytical Report

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1676280** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Sep 15, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | |
|---|---|
| **Reference Number** | 1676280-47 |
| **Sample Date** | Aug 26, 2023 |
| **Sample Time** | NA |
| **Sample Location** | |
| **Sample Description** | HA23-46 / 0.1 / m |
| **Matrix** | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Hot Water Soluble** | | | | | | |
| Boron | Hot Water Soluble | mg/kg | 0.56 | | | 0.2 |

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## Analytical Report

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T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-52 | 1676280-53 | 1676280-54 |
| **Sample Date** | Aug 27, 2023 | Aug 27, 2023 | Aug 27, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-47 / 1 / m | Tank Area SS23-01 / 0.1 / m | Tank Area SS23-02 / 0.1 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 1.82 | 1.15 | 0.92 | 0.01 |
| SAR | Saturated Paste | | <0.1 | 1.0 | 1.9 | |
| % Saturation | | % | 428 | 68 | 76 | |
| Calcium | Saturated Paste | mg/kg | 1680 | 77.8 | 57.6 | |
| Magnesium | Saturated Paste | mg/kg | 138 | 23.6 | 15.1 | |
| Sodium | Saturated Paste | mg/kg | 30 | 32 | 54 | |
| Potassium | Saturated Paste | mg/kg | 30 | 2 | 4 | |
| Chloride | Saturated Paste | mg/L | 18 | 243 | 175 | 3 |
| Chloride | Saturated Paste | mg/kg | 77 | 166 | 134 | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 4310 | 46.6 | 17 | |
| Boron | Saturated Paste | mg/L | | 0.05 | | 0.05 |
| TGR | Saturated Paste | T/ac | <0.1 | <0.1 | <0.1 | |

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## Analytical Report

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T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-53 | 1676280-54 | 1676280-55 |
| **Sample Date** | Aug 27, 2023 | Aug 27, 2023 | Aug 27, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | Tank Area SS23-01 / 0.1 / m | Tank Area SS23-02 / 0.1 / m | Tank Area SS23-03 / 0.1 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 7.7 | 7.4 | 7.4 | |

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Project Name: Pointed Mountain
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LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-55 | 1676280-56 | 1676280-57 |
| **Sample Date** | Aug 27, 2023 | Aug 27, 2023 | Aug 27, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | Tank Area SS23-03 / 0.1 / m | Tank Area SS23-04 / 0.1 / m | Tank Area SS23-05 / 0.1 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 1.25 | 0.31 | 1.09 | 0.01 |
| SAR | Saturated Paste | | 0.9 | 0.2 | 1.3 | |
| % Saturation | | % | 72 | 87 | 84 | |
| Calcium | Saturated Paste | mg/kg | 88.7 | 32.6 | 83.0 | |
| Magnesium | Saturated Paste | mg/kg | 26.4 | 9.2 | 23.4 | |
| Sodium | Saturated Paste | mg/kg | 32 | 5 | 48 | |
| Potassium | Saturated Paste | mg/kg | 2 | 2 | 4 | |
| Chloride | Saturated Paste | mg/L | 292 | 14 | 249 | 3 |
| Chloride | Saturated Paste | mg/kg | 212 | 12 | 210 | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 47.0 | 25 | 24 | |
| Boron | Saturated Paste | mg/L | 0.08 | | | 0.05 |
| TGR | Saturated Paste | T/ac | <0.1 | <0.1 | <0.1 | |

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Sampled By: Guillermo Hernandez
Company: MEMS

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Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
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Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-56 | 1676280-57 | 1676280-59 |
| **Sample Date** | Aug 27, 2023 | Aug 27, 2023 | Aug 29, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | Tank Area SS23-04 / 0.1 / m | Tank Area SS23-05 / 0.1 / m | HA23-48 / 0.7 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 7.5 | 7.5 | 6.3 | |

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## Analytical Report

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|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1676280** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Sep 15, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-59 | 1676280-61 | 1676280-63 |
| **Sample Date** | Aug 29, 2023 | Aug 29, 2023 | Aug 29, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-48 / 0.7 / m | HA23-48 / 1.5 / m | HA23-49 / 0.7 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 0.45 | 2.47 | 1.12 | 0.01 |
| SAR | Saturated Paste | | 0.8 | 1.4 | 0.7 | |
| % Saturation | | % | 80 | 84 | 89 | |
| Calcium | Saturated Paste | mg/kg | 28.9 | 181 | 110 | |
| Magnesium | Saturated Paste | mg/kg | 18.7 | 180 | 53.0 | |
| Sodium | Saturated Paste | mg/kg | 19 | 103 | 35 | |
| Potassium | Saturated Paste | mg/kg | 3 | <8 | 5 | |
| Chloride | Saturated Paste | mg/L | 16 | 18 | 18 | 3 |
| Chloride | Saturated Paste | mg/kg | 13 | 15 | 16 | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 97.1 | 1170 | 328 | |
| TGR | Saturated Paste | T/ac | <0.1 | <0.1 | <0.1 | |

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## Analytical Report

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|---|---|---|---|---|---|
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| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
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| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-61 | 1676280-63 | 1676280-65 |
| **Sample Date** | Aug 29, 2023 | Aug 29, 2023 | Aug 29, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-48 / 1.5 / m | HA23-49 / 0.7 / m | HA23-49 / 1.5 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 7.9 | 7.4 | 7.8 | |

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## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-65 | 1676280-67 | 1676280-69 |
| **Sample Date** | Aug 29, 2023 | Aug 29, 2023 | Aug 29, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-49 / 1.5 / m | HA23-50 / 0.7 / m | HA23-50 / 1.5 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 1.21 | 1.66 | 1.28 | 0.01 |
| SAR | Saturated Paste | | 0.7 | 1.4 | 1.7 | |
| % Saturation | | % | 137 | 103 | 130 | |
| Calcium | Saturated Paste | mg/kg | 175 | 171 | 133 | |
| Magnesium | Saturated Paste | mg/kg | 93.3 | 89.4 | 80.9 | |
| Sodium | Saturated Paste | mg/kg | 58 | 93 | 114 | |
| Potassium | Saturated Paste | mg/kg | 6 | 4 | 8 | |
| Chloride | Saturated Paste | mg/L | 17 | 93 | 39 | 3 |
| Chloride | Saturated Paste | mg/kg | 23 | 96 | 51 | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 718 | 702 | 672 | |
| TGR | Saturated Paste | T/ac | <0.1 | <0.1 | <0.1 | |

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## Analytical Report

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#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | | |
|---|---|---|---|---|
| | | **Reference Number** | 1676280-67 | 1676280-69 | 1676280-71 |
| | | **Sample Date** | Aug 29, 2023 | Aug 29, 2023 | Aug 29, 2023 |
| | | **Sample Time** | NA | NA | NA |
| | | **Sample Location** | | | |
| | | **Sample Description** | HA23-50 / 0.7 / m | HA23-50 / 1.5 / m | HA23-51 / 0.7 / m |
| | | **Matrix** | Soil | Soil | Soil |
| **Analyte** | | **Units** | **Results** | **Results** | **Results** | Nominal Detection Limit |
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 7.7 | 7.7 | 7.6 | |

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## Analytical Report

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T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-71 | 1676280-73 | 1676280-75 |
| **Sample Date** | Aug 29, 2023 | Aug 29, 2023 | Aug 29, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-51 / 0.7 / m | HA23-51 / 1.5 / m | HA23-52 / 0.7 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 0.88 | 1.97 | 0.82 | 0.01 |
| SAR | Saturated Paste | | 0.7 | 1.6 | 0.6 | |
| % Saturation | | % | 142 | 114 | 172 | |
| Calcium | Saturated Paste | mg/kg | 119 | 210 | 135 | |
| Magnesium | Saturated Paste | mg/kg | 65.7 | 135 | 77.5 | |
| Sodium | Saturated Paste | mg/kg | 47 | 129 | 45 | |
| Potassium | Saturated Paste | mg/kg | 3 | 8 | 5 | |
| Chloride | Saturated Paste | mg/L | 15 | 12 | 12 | 3 |
| Chloride | Saturated Paste | mg/kg | 21 | 13 | 20 | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 468 | 1190 | 441 | |
| TGR | Saturated Paste | T/ac | <0.1 | <0.1 | <0.1 | |

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## Analytical Report

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | | |
|---|---|---|---|---|
| **Reference Number** | | 1676280-73 | 1676280-75 | 1676280-77 |
| **Sample Date** | | Aug 29, 2023 | Aug 29, 2023 | Aug 29, 2023 |
| **Sample Time** | | NA | NA | NA |
| **Sample Location** | | | | |
| **Sample Description** | | HA23-51 / 1.5 / m | HA23-52 / 0.7 / m | HA23-52 / 1.5 / m |
| **Matrix** | | Soil | Soil | Soil |
| **Analyte** | **Units** | **Results** | **Results** | **Results** | Nominal Detection Limit |
| **Soil Acidity** | | | | | |
| pH 1:2 Soil:CaCl2 sol. | pH | 7.9 | 7.9 | 7.9 | |

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## Analytical Report

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Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-77 | 1676280-79 | 1676280-81 |
| **Sample Date** | Aug 29, 2023 | Aug 29, 2023 | Aug 29, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-52 / 1.5 / m | HA23-53 / 0.7 / m | HA23-53 / 1.5 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 1.60 | 1.91 | 3.98 | 0.01 |
| SAR | Saturated Paste | | 0.6 | 1.2 | 1.1 | |
| % Saturation | | % | 93 | 110 | 75 | |
| Calcium | Saturated Paste | mg/kg | 170 | 244 | 493 | |
| Magnesium | Saturated Paste | mg/kg | 89.4 | 76.7 | 164 | |
| Sodium | Saturated Paste | mg/kg | 39 | 89 | 97 | |
| Potassium | Saturated Paste | mg/kg | 5 | 3 | 8 | |
| Chloride | Saturated Paste | mg/L | 28 | 256 | 342 | 3 |
| Chloride | Saturated Paste | mg/kg | 26 | 283 | 257 | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 713 | 581 | 1490 | |
| TGR | Saturated Paste | T/ac | <0.1 | <0.1 | <0.1 | |

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## Analytical Report

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1676280** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Sep 15, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | | | |
|---|---|---|---|
| **Reference Number** | 1676280-79 | 1676280-81 | 1676280-83 |
| **Sample Date** | Aug 29, 2023 | Aug 29, 2023 | Aug 29, 2023 |
| **Sample Time** | NA | NA | NA |
| **Sample Location** | | | |
| **Sample Description** | HA23-53 / 0.7 / m | HA23-53 / 1.5 / m | HA23-54 / 0.7 / m |
| **Matrix** | Soil | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 7.8 | 7.6 | 7.7 | |

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T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

| | | |
|---|---|---|
| **Reference Number** | 1676280-83 | 1676280-84 |
| **Sample Date** | Aug 29, 2023 | Aug 29, 2023 |
| **Sample Time** | NA | NA |
| **Sample Location** | | |
| **Sample Description** | HA23-54 / 0.7 / m | HA23-54 / 1 / m |
| **Matrix** | Soil | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Salinity** | | | | | | |
| Electrical Conductivity | Saturated Paste | dS/m | 0.51 | 0.89 | | 0.01 |
| SAR | Saturated Paste | | <0.1 | 0.4 | | |
| % Saturation | | % | 149 | 72 | | |
| Calcium | Saturated Paste | mg/kg | 114 | 89.9 | | |
| Magnesium | Saturated Paste | mg/kg | 23.3 | 20.0 | | |
| Sodium | Saturated Paste | mg/kg | 5 | 13 | | |
| Potassium | Saturated Paste | mg/kg | 4 | 2 | | |
| Chloride | Saturated Paste | mg/L | 18 | 128 | | 3 |
| Chloride | Saturated Paste | mg/kg | 27 | 91 | | |
| Sulfate (SO4) | Saturated Paste | mg/kg | 106 | 72.9 | | |
| TGR | Saturated Paste | T/ac | <0.1 | <0.1 | | |

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## Analytical Report

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1676280** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Sep 15, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

| | |
|---|---|
| **Reference Number** | 1676280-84 |
| **Sample Date** | Aug 29, 2023 |
| **Sample Time** | NA |
| **Sample Location** | |
| **Sample Description** | HA23-54 / 1 / m |
| **Matrix** | Soil |

| Analyte | | Units | Results | Results | Results | Nominal Detection Limit |
|---|---|---|---|---|---|---|
| **Soil Acidity** | | | | | | |
| pH | 1:2 Soil:CaCl2 sol. | pH | 7.6 | | | |

Approved by:

Anthony Neumann, MSc
General Manager

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

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## Quality Control

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Attn: Jeff Belecky
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Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

### Extractable Petroleum Hydrocarbons - Soil

| Blanks | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| F2c C10-C16 | µg/mL | 0 | -10 | 10 | yes |
| F3c C16-C34 | µg/mL | 0 | -30 | 30 | yes |
| F4c C34-C50 | µg/mL | 0 | -20 | 20 | yes |
| F4HTGCc C34-C50+ | µg/mL | 0 | -20 | 20 | yes |
| Date Acquired: | September 05, 2023 | | | | |

| Calibration Check | Units | % Recovery | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| F2c C10-C16 | µg/mL | 98.42 | 80 | 120 | yes |
| F3c C16-C34 | µg/mL | 101.22 | 80 | 120 | yes |
| F4c C34-C50 | µg/mL | 102.59 | 80 | 120 | yes |
| F4HTGCc C34-C50+ | µg/mL | 102.59 | 80 | 120 | yes |
| Date Acquired: | September 05, 2023 | | | | |

### Hot Water Soluble

| Control Sample | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Boron | mg/kg | 1.9 | 1.27 | 2.17 | yes |
| Date Acquired: | September 11, 2023 | | | | |
| Boron | mg/kg | <0.1 | -0.20 | 0.20 | yes |
| Date Acquired: | September 11, 2023 | | | | |
| Boron | mg/kg | 0.11 | 0.09 | 0.11 | yes |
| Date Acquired: | September 11, 2023 | | | | |

| Client Sample Replicates | Units | Replicate 1 | Replicate 2 | % RSD Criteria | Absolute Criteria | Passed QC |
|---|---|---|---|---|---|---|
| Boron | mg/kg | 1.9 | 2.03 | 10 | 0.10 | yes |
| Date Acquired: | September 11, 2023 | | | | | |

### Metals Strong Acid Digestion

| Blanks | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Antimony | µg/L | 0.00445136 | -0.2 | 0.2 | yes |
| Arsenic | µg/L | 0.00796448 | -0.2 | 0.2 | yes |
| Barium | µg/L | 0.20999 | -1 | 1 | yes |
| Beryllium | µg/L | -1.8913e-005 | -0.1 | 0.1 | yes |
| Boron | µg/L | 0.948933 | -1 | 1 | yes |
| Cadmium | µg/L | 0.000751373 | -0.01 | 0.01 | yes |
| Chromium | µg/L | 0.0912986 | -0.5 | 0.5 | yes |
| Cobalt | µg/L | -5.59565e-005 | -0.1 | 0.1 | yes |
| Copper | µg/L | 0.0565559 | -0.6 | 1.2 | yes |
| Lead | µg/L | 0.0400338 | -5.0 | 5.0 | yes |
| Mercury | µg/L | 0.00910272 | -0.04 | 0.04 | yes |
| Molybdenum | µg/L | 0.00252725 | -1.0 | 1.0 | yes |
| Nickel | µg/L | 0.262987 | -0.4 | 0.7 | yes |
| Selenium | µg/L | 0.00172944 | -0.30 | 0.30 | yes |
| Silver | µg/L | 0.0002933 | -0.09 | 0.14 | yes |
| Thallium | µg/L | 0.0105753 | -0.04 | 0.04 | yes |
| Tin | µg/L | -0.00516491 | -0.4 | 0.4 | yes |

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## Quality Control

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

## Metals Strong Acid Digestion - Continued

| Blanks | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Uranium | µg/L | 0.00162376 | -0.5 | 0.5 | yes |
| Vanadium | µg/L | -0.0191429 | -0.1 | 0.1 | yes |
| Zinc | µg/L | 0.79728 | -1 | 1 | yes |
| Date Acquired: | September 06, 2023 | | | | |
| **Control Sample** | **Units** | **Measured** | **Lower Limit** | **Upper Limit** | **Passed QC** |
| Antimony | mg/kg | 40.5 | 36.1 | 43.9 | yes |
| Arsenic | mg/kg | 41.5 | 36.3 | 43.9 | yes |
| Barium | mg/kg | 205 | 180 | 220 | yes |
| Beryllium | mg/kg | 20.1 | 17.4 | 22.2 | yes |
| Boron | mg/kg | 402 | 344 | 438 | yes |
| Cadmium | mg/kg | 2.11 | 1.88 | 2.28 | yes |
| Chromium | mg/kg | 102 | 93.2 | 107.0 | yes |
| Cobalt | mg/kg | 20.3 | 18.3 | 21.5 | yes |
| Copper | mg/kg | 203 | 183.5 | 213.5 | yes |
| Lead | mg/kg | 20.3 | 18.3 | 21.3 | yes |
| Mercury | mg/kg | 2.89 | 2.64 | 3.36 | yes |
| Molybdenum | mg/kg | 204 | 185.1 | 222.3 | yes |
| Nickel | mg/kg | 102 | 92.4 | 106.2 | yes |
| Selenium | mg/kg | 40.6 | 35.20 | 44.20 | yes |
| Silver | mg/kg | 20.2 | 18.30 | 21.30 | yes |
| Thallium | mg/kg | 10.3 | 8.87 | 11.03 | yes |
| Tin | mg/kg | 203 | 183.1 | 223.3 | yes |
| Uranium | mg/kg | 104 | 86.0 | 116.0 | yes |
| Vanadium | mg/kg | 20.4 | 18.0 | 21.6 | yes |
| Zinc | mg/kg | 203 | 186 | 212 | yes |
| Date Acquired: | September 06, 2023 | | | | |
| Antimony | mg/kg | 3.6 | 2.9 | 4.7 | yes |
| Arsenic | mg/kg | 3.6 | 2.9 | 5.4 | yes |
| Barium | mg/kg | 98 | 76 | 126 | yes |
| Beryllium | mg/kg | 0.4 | 0.2 | 0.4 | yes |
| Boron | mg/kg | 8 | 5 | 9 | yes |
| Cadmium | mg/kg | 0.89 | 0.68 | 1.16 | yes |
| Chromium | mg/kg | 77.7 | 58.2 | 97.2 | yes |
| Cobalt | mg/kg | 6.3 | 4.7 | 7.9 | yes |
| Copper | mg/kg | 114 | 97.2 | 151.2 | yes |
| Lead | mg/kg | 264 | 185.9 | 333.5 | yes |
| Mercury | mg/kg | 0.07 | 0.05 | 0.09 | yes |
| Molybdenum | mg/kg | 1.1 | 0.7 | 1.5 | yes |
| Nickel | mg/kg | 25.3 | 20.7 | 30.9 | yes |
| Selenium | mg/kg | <0.29 | 0.23 | 0.35 | yes |
| Silver | mg/kg | 3.2 | 2.30 | 5.30 | yes |
| Thallium | mg/kg | 0.07 | 0.05 | 0.10 | yes |
| Tin | mg/kg | 9.6 | 7.6 | 12.4 | yes |
| Uranium | mg/kg | <0.5 | 0.4 | 0.6 | yes |

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## Quality Control

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T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

### Metals Strong Acid Digestion - Continued

| Control Sample | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Vanadium | mg/kg | 27.8 | 20.4 | 34.2 | yes |
| Zinc | mg/kg | 314 | 244 | 408 | yes |

Date Acquired: September 06, 2023

| Client Sample Replicates | Units | Replicate 1 | Replicate 2 | % RSD Criteria | Absolute Criteria | Passed QC |
|---|---|---|---|---|---|---|
| Antimony | mg/kg | 0.7 | 0.8 | 20 | 0.4 | yes |
| Arsenic | mg/kg | 3.0 | 3.1 | 20 | 0.4 | yes |
| Barium | mg/kg | 106 | 109 | 20 | 2 | yes |
| Beryllium | mg/kg | 0.9 | 0.9 | 20 | 0.2 | yes |
| Cadmium | mg/kg | 0.44 | 0.44 | 20 | 0.02 | yes |
| Chromium | mg/kg | 27.5 | 28.5 | 20 | 1.1 | yes |
| Cobalt | mg/kg | 13.3 | 14.1 | 20 | 0.2 | yes |
| Copper | mg/kg | 47.3 | 50.7 | 20 | 2.2 | yes |
| Lead | mg/kg | 16.2 | 17.3 | 20 | 0.2 | yes |
| Mercury | mg/kg | 0.15 | 0.16 | 20 | 0.05 | yes |
| Molybdenum | mg/kg | <1.0 | <1.0 | 20 | 2.2 | yes |
| Nickel | mg/kg | 38.3 | 41.1 | 20 | 1.1 | yes |
| Selenium | mg/kg | 0.54 | 0.56 | 20 | 0.66 | yes |
| Silver | mg/kg | 0.2 | 0.2 | 20 | 0.22 | yes |
| Thallium | mg/kg | 0.20 | 0.21 | 20 | 0.11 | yes |
| Tin | mg/kg | <1.0 | <1.0 | 20 | 2.2 | yes |
| Uranium | mg/kg | 1.1 | 1.2 | 20 | 1.1 | yes |
| Vanadium | mg/kg | 34.0 | 36.2 | 20 | 0.2 | yes |
| Zinc | mg/kg | 127 | 135 | 20 | 2 | yes |
| Boron | mg/kg | 5 | 7 | 20 | 4 | yes |

Date Acquired: September 06, 2023

### Mono-Aromatic Hydrocarbons - Soil

| Blanks | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Benzene | ng | 0 | -0.005 | 0.005 | yes |
| Toluene | ng | 0 | -0.06 | 0.06 | yes |
| Ethylbenzene | ng | 0 | -0.030 | 0.030 | yes |
| Total Xylenes (m,p,o) | ng | 0 | -0.09 | 0.09 | yes |
| Styrene | ng | 0 | -0.030 | 0.030 | yes |

Date Acquired: September 05, 2023

| Calibration Check | Units | % Recovery | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Benzene | ng | 83.27 | 80 | 120 | yes |
| Toluene | ng | 88.47 | 80 | 120 | yes |
| Ethylbenzene | ng | 91.62 | 80 | 120 | yes |
| m,p-Xylene | ng | 92.37 | 80 | 120 | yes |
| Total Xylenes (m,p,o) | ng | 92.24 | 80 | 120 | yes |
| Styrene | ng | 88.48 | 80 | 120 | yes |

Date Acquired: September 05, 2023

### Salinity

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## Quality Control

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

## Salinity

| Blanks | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Calcium | mg/L | 0.132855 | -2.0 | 2.0 | yes |
| Magnesium | mg/L | 0.0363952 | -0.3 | 0.3 | yes |
| Sodium | mg/L | 0.0776901 | -1 | 1 | yes |
| Potassium | mg/L | 0.0627103 | -1.0 | 1.0 | yes |
| Chloride | mg/L | 2.3002 | -3 | 3 | yes |
| Sulfate-S | mg/L | 0.0503389 | -2 | 2 | yes |
| Boron | mg/L | 0.0102308 | -0.05 | 0.05 | yes |
| Date Acquired: | September 05, 2023 | | | | |

| Control Sample | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| Electrical Conductivity | dS/m | 0.47 | 0.31 | 0.52 | yes |
| % Saturation | % | 65 | 47 | 80 | yes |
| Calcium | mg/L | 54.2 | 33.5 | 60.5 | yes |
| Magnesium | mg/L | 14.7 | 9.5 | 16.5 | yes |
| Sodium | mg/L | 14 | 9 | 16 | yes |
| Potassium | mg/L | 10.3 | 6.9 | 11.1 | yes |
| Chloride | mg/L | 26 | 16 | 34 | yes |
| Sulfate-S | mg/L | 17 | 11 | 22 | yes |
| Boron | mg/L | 0.21 | 0.15 | 0.29 | yes |
| Date Acquired: | September 05, 2023 | | | | |
| Electrical Conductivity | dS/m | 31.5 | 26.80 | 35.20 | yes |
| Calcium | mg/L | 252 | 226.9 | 261.1 | yes |
| Magnesium | mg/L | 99.7 | 91.0 | 104.8 | yes |
| Sodium | mg/L | 250 | 229 | 264 | yes |
| Potassium | mg/L | 252 | 230.7 | 265.5 | yes |
| Chloride | mg/L | 2090 | 1852 | 2229 | yes |
| Sulfate-S | mg/L | 148 | 142 | 157 | yes |
| Date Acquired: | September 05, 2023 | | | | |

| Client Sample Replicates | Units | Replicate 1 | Replicate 2 | % RSD Criteria | Absolute Criteria | Passed QC |
|---|---|---|---|---|---|---|
| Electrical Conductivity | dS/m | 1.41 | 1.37 | 10 | 0.03 | yes |
| Calcium | mg/L | 104 | 101 | 15 | | yes |
| Magnesium | mg/L | 46.5 | 45.6 | 15 | 0.6 | yes |
| Sodium | mg/L | 119 | 121 | 15 | 1 | yes |
| Potassium | mg/kg | 15 | 15 | 20 | 1 | yes |
| Chloride | mg/kg | 11 | 10 | 15 | 3 | yes |
| Sulfate-S | mg/L | 188 | 187 | 15 | 1 | yes |
| Date Acquired: | September 05, 2023 | | | | | |

## Soil Acidity

| Blanks | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| pH | pH | 6.38 | 5.2 | 7.0 | yes |
| Date Acquired: | September 05, 2023 | | | | |

| Control Sample | Units | Measured | Lower Limit | Upper Limit | Passed QC |
|---|---|---|---|---|---|
| pH | pH | 6.9 | 6.5 | 7.1 | yes |
| Date Acquired: | September 05, 2023 | | | | |

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## Quality Control

Bill To: Paramount Resources Ltd
#148, 2257 Premier Way
Sherwood Park, AB, Canada
T8H 2M8
Attn: Jeff Belecky
Sampled By: Guillermo Hernandez
Company: MEMS

Project ID: 21-00365-07
Project Name: Pointed Mountain
Project Location: West of Fort Liard, NWT
LSD: 300/a-55-60-30-123-45/0
P.O.: 23SR0061
Proj. Acct. code:
OI Customer PR210-Drilling and

Lot ID: **1676280**
Control Number:
Date Received: Sep 1, 2023
Date Reported: Sep 15, 2023
Report Number: 2909874

### Soil Acidity - Continued

| Client Sample Replicates | Units | Replicate 1 | Replicate 2 | % RSD Criteria | Absolute Criteria | Passed QC |
|---|---|---|---|---|---|---|
| pH | pH | 7.6 | 7.5 | 10 | 0.3 | yes |
| Date Acquired: | September 05, 2023 | | | | | |

### Volatile Petroleum Hydrocarbons - Soil

| Blanks | Units | Measured | Lower Limit | Upper Limit | | Passed QC |
|---|---|---|---|---|---|---|
| F1 C6-C10 | ng | 0 | -10 | 10 | | yes |
| Date Acquired: | September 05, 2023 | | | | | |

### Water Soluble Parameters

| Blanks | Units | Measured | Lower Limit | Upper Limit | | Passed QC |
|---|---|---|---|---|---|---|
| Chromium (VI) | mg/L | 0 | -0.10 | 0.10 | | yes |
| Date Acquired: | September 05, 2023 | | | | | |

| Client Sample Replicates | Units | Replicate 1 | Replicate 2 | % RSD Criteria | Absolute Criteria | Passed QC |
|---|---|---|---|---|---|---|
| Chromium (VI) | mg/kg | <0.05 | <0.05 | 10 | 0.01 | yes |
| Date Acquired: | September 05, 2023 | | | | | |

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## Methodology and Notes

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1676280** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Sep 15, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

## Method of Analysis

| Method Name | Reference | | Method | Date Analysis Started | Location |
|---|---|---|---|---|---|
| 1:5 Water Soluble Extraction | APHA | * | Colorimetric Method, 3500-Cr B | Sep 5, 2023 | Element Edmonton - Roper Road |
| 1:5 Water Soluble Extraction | McKeague | * | Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23 | Sep 5, 2023 | Element Edmonton - Roper Road |
| Boron in general soil | BCELM | * | Hot Water Soluble Boron, HWS-Boron | Sep 11, 2023 | Element Edmonton - Roper Road |
| BTEX-CCME - Soil | CCME | * | Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1 | Sep 5, 2023 | Element Calgary |
| BTEX-CCME - Soil | US EPA | * | Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis/Gas Chromatography Mass Spectrometry, 5021/8260 | Sep 5, 2023 | Element Calgary |
| Metals ICP (Hot Block) in soil | EPA | * | Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, October 1999, 200.2 | Sep 6, 2023 | Element Edmonton - Roper Road |
| Metals ICP (Hot Block) in soil | US EPA | * | Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8 | Sep 6, 2023 | Element Edmonton - Roper Road |
| pH by CaCl2 (1:2 ratio) in soil | McKeague | * | pH in 0.01M Calcium Chloride, 3.11 | Sep 5, 2023 | Element Edmonton - Roper Road |
| Saturated Paste in General Soil | APHA | * | Automated Ferricyanide Method, 4500-Cl-E | Sep 5, 2023 | Element Edmonton - Roper Road |
| Saturated Paste in General Soil | Carter | * | Electrical Conductivity and Soluble Ions, Chapter 15 | Sep 5, 2023 | Element Edmonton - Roper Road |
| Saturated Paste in General Soil | Carter | * | Electrical Conductivity and Soluble Ions, Chapter 15 | Sep 9, 2023 | Element Edmonton - Roper Road |
| Saturated Paste in General Soil | Carter | * | Electrical Conductivity and Soluble Ions, Chapter 15 | Sep 12, 2023 | Element Edmonton - Roper Road |
| TEH-CCME-Soil (Shake) | CCME | * | Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1 | Sep 5, 2023 | Element Calgary |

** Reference Method Modified*

## References

| | |
|---|---|
| APHA | Standard Methods for the Examination of Water and Wastewater |
| BCELM | B.C. Environmental Laboratory Manual |
| Carter | Soil Sampling and Methods of Analysis. |
| CCME | Canadian Council of Ministers of the Environment |
| EPA | Environmental Protection Agency Test Methods - US |
| McKeague | Manual on Soil Sampling and Methods of Analysis |
| US EPA | US Environmental Protection Agency Test Methods |

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## Methodology and Notes

| | | | | | |
|---|---|---|---|---|---|
| Bill To: | Paramount Resources Ltd<br>#148, 2257 Premier Way<br>Sherwood Park, AB, Canada<br>T8H 2M8 | Project ID: | 21-00365-07 | Lot ID: | **1676280** |
| | | Project Name: | Pointed Mountain | Control Number: | |
| | | Project Location: | West of Fort Liard, NWT | Date Received: | Sep 1, 2023 |
| | | LSD: | 300/a-55-60-30-123-45/0 | Date Reported: | Sep 15, 2023 |
| Attn: | Jeff Belecky | P.O.: | 23SR0061 | Report Number: | 2909874 |
| Sampled By: | Guillermo Hernandez | Proj. Acct. code: | | | |
| Company: | MEMS | OI Customer | PR210-Drilling and | | |

Please direct any inquiries regarding this report to our Client Services group.
Results relate only to samples as submitted.
The test report shall not be reproduced except in full, without the written approval of the laboratory.

# Quality Control Measures

Internal laboratory quality control (QC) measures consisted of the following:

- Method blank - a clean sample is processed simultaneously with and under the same conditions as the samples being analyzed to confirm whether the instrument, reagents and solvents used are contaminant free.
- Laboratory duplicates - two samples from the same container are analyzed and used to evaluate laboratory precision.
- Matrix spike samples - a known mass of target analyte is added to a matrix sample with known concentrations and is used to evaluate the influence of the matrix on the method's recovery efficiency.
- Surrogate spike samples - a known mass of compound not found in nature *(e.g.,* deuterated compounds such as toluene-d8) but that has similar characteristics to the analyzed compounds is added to a sample at a known concentration and is used to assess the recovery efficiency.
- Use of standard reference materials - a reference material where the concentration has been established to a very high level of certainty is used to assess accuracy.
- Evaluation of relative percent difference calculations for laboratory duplicate samples and of surrogate recoveries for the method blank and matrix spike.

Additionally, MEMS performed QC checks to verify the quality of the data reported. The following were reviewed for each lab submission:

- All requested analyses on the Chain of Custody (COC) were completed.
- Extractions and analyses were completed within acceptable hold times.
- No sample integrity issues were identified by the laboratory.
- No internal laboratory QC failures were noted except for pH. The pH levels measured in the field and trip blank surface water samples were reported to be below the guideline specified for Canadian Drinking Water in 2022. The laboratory has confirmed that low pH results are expected due to the deionized water used for the blank samples.
- All parameters reported as non-detect were below applied guidelines.
- QC checks for standard tables created by MEMS met acceptable criteria (10-15%) values checked against COA; sample names and dates match between export and COC.

All QC checks listed in Appendix F passed.

# APPENDIX G: MILLENNIUM EMS SOLUTIONS LTD. THIRD PARTY RELIANCE AGREEMENT

#148, 2257 Premier Way
Sherwood Park, AB T8H 2M8
tel: 780.496.9048
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**Suite 202, 701 64 Avenue SE**
**Calgary, AB T2H 2C3**
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Grande Prairie, AB T8V 8H4
tel: 780.357.5500
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Suite 218, 852 Fort Street
Victoria, BC V8W 1H8
tel: 1.888.722.2563

#105, 116 Research Drive
Saskatoon, SK S7N 3R3
tel: 306.518.2442

303 Vernon Street
Nelson, BC V1L 4E3
tel: 1.888.722.2563

**toll free: 888.722.2563**
**www.mems.ca**

[Name of recipient]

[Date]
**DELIVERED VIA E-MAIL**

Dear [name],

**RE: RELIANCE LETTER PERTAINING TO 2023 WETLAND DATA COLLECTION POINTED MOUNTAIN GAS PLANT**

Paramount Resources Ltd. ("Client") retained Millennium EMS Solutions Ltd. ("Millennium") to prepare a "2023 Wetland Data Collection Pointed Mountain Gas Plant" ("Report") for the Pointed Mountain Gas Field, Northwest Territories.

We understand that you wish to rely on the information presented in the Report. Millennium has agreed to allow you to rely on the contents of the Report based on the terms and conditions below:

1) The limitations and assumptions stated in the Report in association with any closure statement continue to apply to your use of the Report.
2) You may have an interest in the Report that conflicts with the interest of Client. Millennium takes no responsibility for claims, liabilities, damages or expenses that arise because of such conflict.
3) Millennium expressly disclaims any and all warranties in connection with the Report. This disclaimer of warranties includes, without limitation, any warranty that the Report and any associated site investigation work has uncovered all potential environmental liabilities associated with the property that is the subject of the Report. Millennium disclaims any warranty of the completeness or accuracy of information supplied to Millennium that was relied upon in the preparation of the Report. You will waive any claim against Millennium, its officers, employees, agents, assignees and successors as a result of use of the Report.
4) You agree to defend, indemnify, protect and hold harmless Millennium and its officers, employees, agents, assignees and successors from any and all claims, liabilities, damages or expenses, including but not limited to delay of project commencement or completion, reduction of property value, fear of or actual exposure to or release of toxic or hazardous substances, or conflicts of interest, whether foreseeable or unforeseeable, which may arise directly or indirectly, to any party, as a result of your use of the Report.
5) Millennium's and its officers, employees, agents, assignees, and successors liability arising out of or relating to the use of the Report is limited to one thousand Canadian dollars (CAD$1,000.00). We will not be liable for consequential, incidental or indirect damages as a result of your use of the Report.
6) Use of the Report, including all information and recommendations prepared or issued by Millennium within the Report or pertaining to the Report, is for your exclusive use. No other use is authorized, including distribution to any other party without our prior written consent, which may be arbitrarily withheld. You will release us from liability and agrees to defend, indemnify, protect and hold harmless Millennium and its officers, employees, agents, assignees and successors from any and all claims, liabilities, damages or expenses arising, in whole or in part, from such unauthorized distribution.

Please sign in the space provided below to indicate your acceptance to the above conditions.

Regards,

MILLENNIUM EMS SOLUTIONS LTD.

By: _____
MEMS Representative
Title
Date

Agreed to this ____ day of •, _____.
[THIRD PARTY]

By: _____
Name:
Title
Date