Ammonia and pH Related Toxicity in Alkaline Mine-mill Effluent: The influence of atmospheric carbon dioxide on pH and non-ionized ammonia

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ABSTRACT

At INCO Ltd., Copper Cliff, Ontario, effluents from ore processing and tailings disposal sites are generally treated to precipitate nickel and other metals by adding calcium hydroxide (target pH 10.5). As of August 1997, Ontario began restricting the pH of such effluents to 6.0-9.5, and survival must be ≥50% in single concentration static acute toxicity tests with both *Daphnia magna* Straus and rainbow trout (*Oncorhynchus Mykiss* Walbaum). Without modifications, undiluted effluent from the Copper Cliff Waste Water Treatment Plant (CCWWTP) would have exhibited pH >10.0, 5-10 mg/L total ammonia/ium, and toxicity test failures. As the primary stressor was apparently un-ionized ammonia, it was hypothesized that lowering effluent pH would control toxicity by favouring ammonium ions. While previous Toxicity Identification/Evaluations generally supported the hypothesis, uncertainty remained because high survival rates often occurred on occasions when un-ionized ammonia was expected to cause high mortality.

Variability in toxicity was hypothesized to be attributable to spontaneous pH declines that occurred during the course of toxicity testing, and consequent variability in pH among effluent samples that were supposed to be identical. By marginally reducing pH of effluent samples using sulfuric acid, it was possible to eliminate toxicity test failures (mortality >50%) for both *Daphnia magna* and rainbow trout. Analysis of the influence of pH on mortality, and on the concentration of ammonia, was not straight forward since effluent pH began to decline from the very onset of investigations. The variability of pH as measured during toxicity testing was markedly lowered through efforts to ensure consistent atmospheric exposure. This included the aerations employed to achieve the required 80-100% oxygen saturation range for satisfactory bioassay testing. By focusing on sample pH from the critical periods during testing, i.e. prior to the time of death, I confirmed that the high toxicities observed exclusively in alkaline non adjusted effluents were associated with elevated pH (pH >9.5 for trout and >9.0 for *D. magna*) and high concentrations of ammonia (> 3.0 mg/L for trout and >2.5 mg/L for *D. magna.*). It was also confirmed that spontaneous pH declines followed from samples allowed to equilibrate with atmospheric carbon dioxide. (*continued*)

By the removal of carbon dioxide from the air supply, it was possible to acrate samples and still maintain effluent pH at initial recorded values of pH >10.0. Samples which were subjected to regular atmospheric aeration exhibited a prominent pH decline to approximately pH 7.8 by 24 h, and subsequent pH stability for the 96 h test duration.

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1.0 INTRODUCTION

1.1 Background

In conjunction with INCO Ltd., a series of studies were conducted from late fall 1995 and early spring 1997 on the toxicity of effluents from the Copper Cliff Waste Water Treatment Plant (CCWWTP) to rainbow trout (*Oncorhynchus mykiss* Walbaum) and the fresh water zooplankton *Daphnia magna* Straus. Previous studies had determined that toxic effluents were frequently highly alkaline (pH >10.0) and contained total ammonia in the range of 5-10 mg/L (B.A.R. Environmental Inc. 1993; Holtze *et al* .1989). Effluent toxicity was concluded to be mainly a result of non-ionized ammonia, the chemical species which is associated with alkaline pH and considered to be much more toxic than ammonium ions (Emerson *et al* . 1975; Haywood 1983). It was noted, however, that calculated concentrations of non-ionized ammonia often failed to predict observed mortality rates in toxicity tests on rainbow trout and *D. magna.* Trace metals were considered an additional factor influencing effluent toxicity but not well supported by available data (Aquatic Sciences 1995; B.A.R. Environmental Inc. 1993; Holtze *et al* . 1989).

Municipal Industrial Strategy for Abatement (MISA) regulations becoming effective by 1997 required that effluent pH be <9.5 and that mortality rates in trout and *Daphnia* acute single concentration toxicity tests be ≤50% (EPA 1997). The present investigation was undertaken to provide a more complete understanding of effluent toxicity, and to suggest practical modifications to effluent treatment methods that would consistently reduce its toxicity to acceptable levels.

1.2 Theory

Addition of alkaline materials to effluent, such as slaked lime ($Ca(OH)_2$), has been a common environmental measure to neutralize low pH (Snucins *et al* . 1995; Winterhalder 1995; Yan *et al* . 1995). Adding a strong base to acid mine drainage to reduce its acidity can minimize the leaching of dissolved trace metals into receiving waters (Buffle *et al.* 1994).

The treatment of effluents at the CCWWTP includes adding slaked lime which increases the pH of the effluent, favouring the process by which dissolved metals form insoluble hydroxides and subsequently precipitate from treated waters (Heale 1995). For example, a pH of at least 10.5 is required for efficient precipitation of Ni (Lanouette 1980). Precipitation of trace metals can markedly reduce the overall potential toxic metal burden in the effluent and the receiving waters (Yan and Dillon 1984).

Strong hydroxide bases such as slaked lime ($Ca(OH)_2$) added to effluent systems often increase the pH of the treatment waters to highly alkaline levels (pH >10.0). Thus, the pH of treated effluent would frequently exceed the maximum recommended pH of 9.5 established for 1997 by the Municipal Industrial Strategy for Abatement (MISA) legislation (EPA 1997). In addition to exhibiting MISA pH exceedance, highly alkaline effluent can have toxic effects on aquatic organisms. These toxic effects are often attributable to ammonia/ium which can be found in high concentrations in many effluents due to the presence of excess nitrogenous based products found in various industrial processes , i.e. sewage treatment, fertilizers for agricultural practices, and blasting agents in mining (Brezonik 1972; Geadah 1985; McNeely *et al* . 1979; Pommen 1983). Ontario's guideline for the protection of aquatic life is a concentration of ≤0.02 mg/L non-ionized ammonia (OMOEE 1984).

High effluent concentrations of total ammonia, high pH, and elevated temperatures favour the shift of ionized ammonia (NH_4^+) to the highly toxic non-ionized ammonia (NH_3) species (Emerson *et al* . 1975). Emerson *et al.* (1975) determined that with analytical data on three parameters, pH, temperature, and total ammonia, one can calculate the concentration of toxic non-ionized ammonia. Clearly, if one or several of these three factors were modified in a given effluent, a different concentration of non-ionized ammonia would be produced. By adjusting effluent samples to promote the transformation of ammonia (NH_3 to NH_4^+), one would be able to assess the importance of non-ionized ammonia with respect to toxicity.

Lowering pH in effluent samples should achieve a reduction in toxic ammonia concentrations and would be an experimentally simple alteration since pH can be readily adjusted to a specific target value by the careful addition of an acid (i.e. sulfuric acid) to lower pH. Because bioassay procedures attempt to control temperature at levels optimal to test organisms (i.e. 15°C for trout and 20°C for *D. magna*) and since total ammonia/ium concentration can be determined in effluent samples through analytical methods, these variables are conveniently obtained for use in the calculation of non-ionized ammonia.

The frequent, spontaneous declines in effluent pH previously observed during toxicity tests were of considerable interest, and they had not been examined in depth in previous Toxicity Identification/Evaluation studies (Aquatic Sciences 1995; B.A.R. Environmental Inc. 1993; Holtze *et al*. 1989). Since highly toxic non-ionized ammonia shifts to the less toxic ammonium ion as pH declines, it was apparent that test organisms exposed to ammonia rich alkaline effluent would have a reduced exposure to non-ionized ammonia. Thus, it seemed necessary to monitor temporal changes in pH very carefully, and to determine the time at which pH would be most critical for mortality. In this manner, a uniform technique of examining the contribution of ammonia and high pH to toxicity would be established.

Thiosalts and other partially oxidized sulfur compounds are known to generate acid, lowering pH as they are oxidized, and they are also typically present in iron sulfide based mining tailings (Bolger 1980). However, thiosalts are considered to be persistent in alkaline waters (Goldhaber 1983), and thiosalt generation has been noted to be mediated by bacteria such as *Thiobacillus* spp. which specifically require a pH range of 2-8 and temperatures of 20-43°C for optimal growth (Staley *et al.* 1989). For this reason, it was hypothesized that an alternative process was responsible for the spontaneous decline in pH typically observed in the alkaline effluents.

Through exploratory experimentation in 1995, it was observed that the spontaneous decline in pH of alkaline effluents could be eliminated by isolating effluent samples from atmospheric carbon dioxide.

The spontaneous declines in pH were hypothesized to have resulted primarily from limed effluents taking up carbon dioxide during aeration, as carbon dioxide equilibrium was being re-established between the effluent and the atmosphere.

Reactions expected in non-equilibrated alkaline effluent exposed to the atmosphere:

- reaction (1) supplies the carbonic acid required for reaction (2).

$$CO_2 \text{ (atmospheric)} + H_2O \text{ (effluent)} \longleftrightarrow H^+ + HCO_3^- \qquad (1)$$

$$Ca^{++} + 2OH^- + H^+ + HCO_3^- \longleftrightarrow Ca^{++} + CO_3^{--} + 2H_2O \qquad (2)$$

Base thus begins to be neutralized because of the substitution of the strong base OH^- by CO_3^{--}. The CO_3^{--} ion predominates while pH is high (>9.5), but as neutralization proceeds, HCO_3^{--} replaces CO_3^{--} (Butler 1991)

$$Ca^{++} + CO_3^{--} + H^+ + HCO_3^{--} \longleftrightarrow Ca^{++} + 2HCO_3^- \qquad (3)$$

and $$Ca^{++} + 2OH^- + 2H^+ + 2HCO_3^- \longleftrightarrow Ca^{++} + 2HCO_3^- + 2H_2O \qquad (4)$$

HCO_3^- ions predominate over both CO_3^{--} and OH^- at circumneutral pH (Bulter 1991).

The effluent equilibrium pH level would be expected to vary depending on the concentration of added calcium hydroxide, as a result of the added calcium ions (Ca^{++}) from the slaked lime being balanced by the bicarbonate ions (HCO_3^-) (Butler 1991).

If the substitution of hydroxide by atmospheric carbon dioxide (HCO_3^- or CO_3^{--}) was responsible for the pH declines observed, then several fundamental observations should be expected in the alkaline effluent during testing:

1) The pH of the alkaline effluent should decline over time and eventually stabilize at a level close to neutral.

2) Differences in the degree of effluent exposure to ambient air should control the rate or degree of pH decline observed before or during toxicity testing. Therefore, if effluent samples are subjected to similar and consistent exposure to the atmosphere, then we should observe similar patterns in pH decline among replicate tests, and these replicates should have low variability.

3) By isolating effluent from atmospheric carbon dioxide we should observe alkaline effluent pH to be stable at initial values.

1.3 Objectives

1) To determine changes in toxicity to rainbow trout and *Daphnia magna* after using sulfuric acid to adjust the pH of alkaline effluents from the Copper Cliff Waste Water Treatment Plant (CCWWTP) to levels <9.5, with toxicity being assessed from government approved (Environment Canada 1990a; 1990b) single concentration static acute toxicity bioassays.

2) To confirm or replicate the primary role of carbon dioxide uptake in the reduction of alkaline effluent pH during bioassay tests.

In order to meet these objectives it was necessary:

i) To examine the importance of chemical variation among samples collected at weekly intervals, and from two different seasonal periods.

ii) To compare effluent toxicity between *Daphnia magna* and rainbow trout.

iii) To examine the effects of specific pH reductions on effluent toxicity and subsequent spontaneous changes in pH.

iv) To determine whether effluent toxicity was influenced by filtration.

v) To confirm that among replicate variability in pH could be minimized through uniform handling and experimental protocols with respect to sample aeration.

vi) To determine the particular pH and non-ionized ammonia concentrations experienced by test organisms at critical times during static toxicity testing (i.e. prior to typical times of observed stress and mortality).

vii) To confirm by laboratory experiments:

- that pH declines would not occur in the absence of effluent exposure to carbon dioxide.
- that low temperature would not retard spontaneous pH declines in the presence of carbon dioxide, and therefore confirm that pH declines were not likely dependent on biological activity, such as thiosalt oxidation by bacteria.
- that the addition of an aqueous source of carbon dioxide, such as sodium bicarbonate to alkaline effluents would mimic a spontaneous decline in pH.

1.4 The use of Rainbow Trout and *Daphnia magna* in Toxicity Testing

Both rainbow trout and the cladoceran, represented by *Daphnia magna*, are commonly found in waters of North America as well as other continents (Environment Canada 1990a 1990b; Gulati 1978). Rainbow trout has been introduced from North America to a large geographic portion of the world due to its importance as a highly sought after sport fish and for table fare (MacCrimmon *et al.* 1972). While trout and *D. magna* represent different trophic levels in the aquatic environment both organisms are considered to have an important role. Cladocerans, such as *D. magna* , are primary consumers in the planktonic community, and are an important food source for both invertebrate and vertebrate predators (Hebert 1978). *D. magna* is considered to be representative of other zooplankton species in regards to feeding habits, physiology, and behaviour (OECD 1984). Of the daphnid species, *D. magna* is determined to be one of the easiest to handle (ten Berge 1978). As a result of its short life span, and its small size, culturing for the use of toxicity testing is rather inexpensive and convenient when compared to larger organisms (Environment Canada 1990b).

Because of its popularity, rainbow trout have been raised in hatcheries for stocking purposes and for commercial aquaculture (Environment Canada 1990a; Letritz *et al.* 1980). Rainbow trout are widely distributed in the world, therefore are an integral part of many freshwater ecosystems and can be the dominant predator in the food chain (Gulati 1978).

Both *D. magna* and rainbow trout have been studied to a great extent with regards to physiology and toxicological sensitivity (Adema 1978; Alabaster and Lloyd 1980; Ball 1967). While either organism can be used to determine environmental toxicity, the route by which the potential toxicant is bioavailable to these organisms may be different. As a result of smaller organism size, and hence the size of food particles ingested, *D. magna* may be in direct contact with particulate matter in effluent, unlike trout. Trout would not be expected to ingest large quantities of small particulate matter relative to their body mass, but since *D. magna* are known to be indiscriminent filter feeders (Lampert 1987), these organisms could be collecting and ingesting small particulates. Thus, the digestive system could be an additional or alternate route for a potential toxicant to effect the zooplankton.

Because of concerns about using single species tests to represent an entire ecosystem, both test organism are typically utilized to assess sensitivity to a particular toxicant (Taylor 1981a). Under the Environmental Protection Act (1997), industry is required by law to determine organism sensitivity to effluents by subjecting them to routine bioassays using both rainbow trout and *Daphnia* . A scientific data base of great size is available for both *D. magna* and rainbow trout, and both organisms have been accepted as international standards for use in effluent toxicity testing (Baudo 1987 ; Environment Canada 1990a 1990b).

2.0 METHODS

2.1 Phase I pH Adjustment Experiments

2.1.1 Effluent samples

Three replicate bulk samples of treated effluent (≈ 400 L) were obtained directly from the CCWWTP at the beginning of each of three weeks during late autumn in 1995. These samples, employed in Trials 1 -3, were carried out on the mornings of November 13, December 4, and December 11. Effluent was siphoned through a clean plastic hose from the top of Clarifier #1 into two 200 L vessels at ground level, that had been fitted with clean polyethylene plastic liners. The bulk samples were transported immediately to a work space provided at INCO's Central Processing Technology building, and promptly divided in random sequence among 15 plastic-lined containers (26 L) of the type routinely used for toxicity test samples. Temperature, pH, and dissolved oxygen were recorded for each sample prior to any experimental manipulations.

Trial samples were divided into these 15 portions so that sets of essentially identical samples would be available for testing all combinations of two classes of experimental manipulations. One class of manipulations included five levels of pH adjustment, while the other included three physical treatments that will be termed experiments (A, B, and C). Treatment combinations and the routine procedures associated with them are detailed below, and summarized in Figures. 1 - 2.

2.1.2 Five pH adjustments in combination with experiment A

Four of the 15 effluent samples selected at random were pH adjusted to approximate the targets of pH 9.3, 8.8, 8.3, and 7.8, by adding 10% (1:10 dilution) sulphuric acid dropwise through a burette while stirring gently to minimize aeration. The volumes of acid added were recorded in each case. While these pH adjustments were proceeding, pH was monitored in a fifth sample of effluent, which was also gently stirred, but not pH adjusted. When the pH of each 26 L sample was stabilized close to the desired target, and the pH and dissolved oxygen levels had been recorded, a 2 L subsample was extracted, sealed, and reserved for subsequent extensive chemical analyses (see Chemical Analyses below, section 2.4).

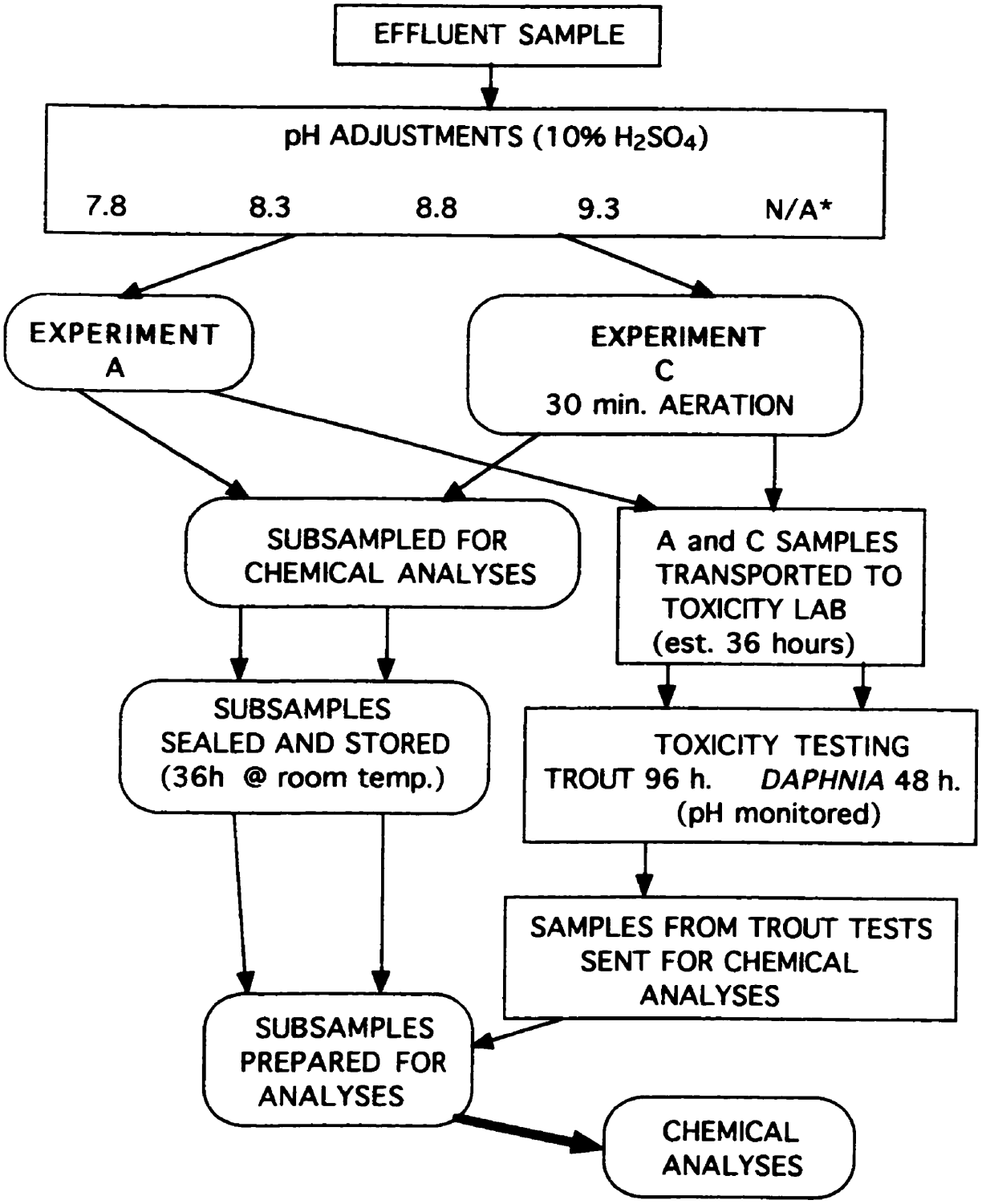


Figure 1: Manipulations of CCWWTP effluent samples for experiments A and C, trials 1-3, 1995.
* indicates raw unadjusted effluent

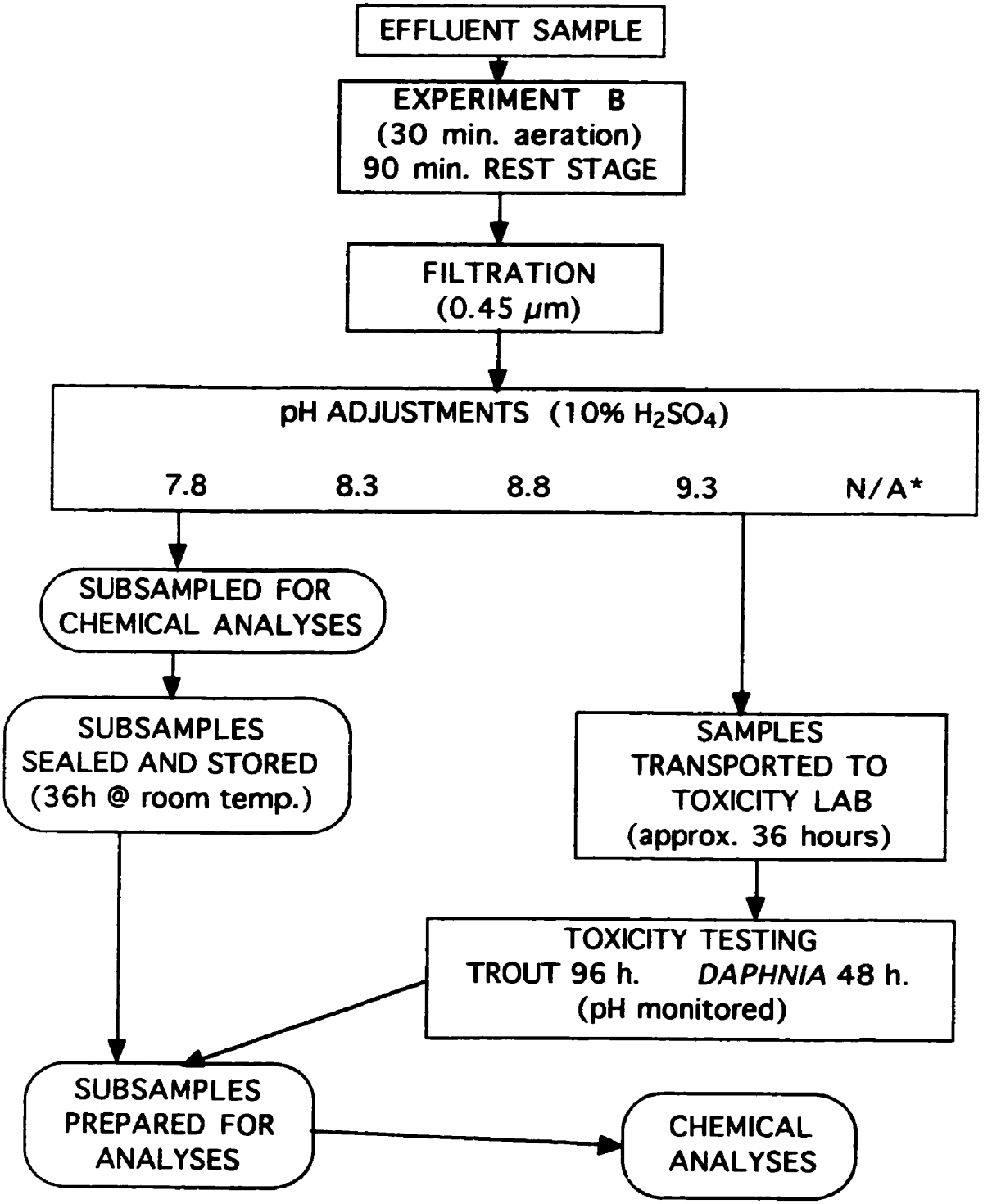


Figure 2: Manipulations of CCWWTP effluent samples for experiment B, trials 1-3, 1995.
* indicates raw unadjusted effluent

The remaining 24 L of each experimental sample was immediately sealed, minimizing headspace, labelled, and shipped as soon as possible by courier to Aquatic Sciences Inc. (St. Catharines, Ontario) for toxicity tests on rainbow trout and *Daphnia magna* (see Toxicity Tests below, section 2.3). The typical time elapsed from the preparation and sealing of the samples to the time of opening for toxicity testing was estimated to be approximately 36h.

2.1.3 Five pH adjustments in combination with experiment B.

On each effluent sampling date, five randomly selected 26 L samples were vigorously aerated for 30 minutes to ensure oxygen availability, and then allowed to stand for another 90 minutes. Each of the samples were separately passed through a high capacity pressure filter (393mm dia. Supor®, 0.45 μm pores) utilizing nitrogen gas at about 1.5 Bar as the propellant. After all five effluent samples had been filtered, four of the samples were randomly pH adjusted to pH targets 9.3, 8.8, 8.3, and 7.8. While gently stirring each sample, 10% (1:10 dilution) sulphuric acid was added dropwise from a burette, and the volumes of acid added were recorded. During the adjustment period, the fifth sample of filtered effluent was gently stirred and monitored for pH, but not pH adjusted. When the pH of each 26 L sample was stabilized close to the desired target, and the pH and dissolved oxygen levels had been recorded, a 2 L subsample was extracted, sealed, and reserved for the subsequent extensive chemical analyses we required (see Chemical Analyses below, section 2.4). The remaining 24 L of each experimental sample was immediately sealed, minimizing headspace, labelled, and shipped as soon as possible by courier to Aquatic Sciences Inc. (St. Catharines, Ontario) for toxicity tests on rainbow trout and *Daphnia magna* (see Toxicity Tests below, section 2.3). The typical time elapsed from the preparation and sealing of the samples to the time of opening for toxicity testing was estimated to be approximately 36h.

2.1.4 Five pH adjustments in combination with experiment C.

Four of the remaining five effluent samples were pH adjusted to approximate targets of pH 9.3, 8.8, 8.3, and 7.8, by adding 10% (1:10 dilution) sulphuric acid dropwise through a burette while stirring gently to minimize aeration. The volumes of acid added were recorded in each case. While these pH adjustments were proceeding, pH was monitored in the fifth sample of effluent, which was also gently stirred, but not pH adjusted. When the pH of each 26 L sample was stabilized close to the desired target, all five samples were vigorously aerated for 30 minutes. Following this aeration, pH and dissolved oxygen were measured, and a 2 L subsample was extracted from each sample, sealed, and reserved for subsequent chemical analyses (see Chemical Analyses below, section 2.4). The remaining 24 L of each experimental sample was immediately sealed, minimizing headspace, labelled, and shipped as soon as possible by courier to Aquatic Sciences Inc. for toxicity tests on rainbow trout and *Daphnia magna* (see Toxicity Tests below, section 2.3). The typical time elapsed from the preparation and sealing of the samples to the time of opening for toxicity testing was estimated to be approximately 36h.

2.2 Phase II pH Adjustment Experiments

2.2.1 Effluent sampling protocol

Three bulk samples of treated effluent (approx. 600L) were obtained directly from the Copper Cliff Waste Water Treatment Plant at the beginning of each of three weeks during the early spring/late winter of 1997. These samples, referred to as Trials 4-6, were collected on the mornings of April 28, May 5, and May 12. Each bulk sample was collected through a plastic hose attached to a line tapped into Clarifier #1, and each sample was received into three 200L vessels which had been fitted with clean polyethylene liners. These vessels were immediately transported to a work area provided at INCO's Central Processing and Technology building, and they were then divided among 32 smaller plastic lined containers of the type commonly used for transporting toxicity test samples.

Eight samples were extracted from the above vessels for chemical analysis; four (8L in volume) were passed through a high pressure filter apparatus (1.5 Bar, 0.45μm pore size, Supor® membrane) using nitrogen gas as the propellant, and four samples were not filtered. Four replicate filter residues, four 1.5L volumes of filtrant, and four 1.5L volumes of unfiltered effluent were immediately stored at 4°C (+/- 2) until they could be accepted for chemical analysis (see section 2.4). Temperature and pH were recorded for each sample prior to experimental manipulations.

Trial samples were divided into four replicates in such a manner that similar samples would be available for replicate experimental testing. One set of manipulations included physical treatments referred to as experiments (E and F), while the other included four levels of pH adjustment, using sulfuric acid obtained from INCO's acid plant. The pH adjustments and differences between experiments are discussed in the following sections, and are summarized in Figures. 3, 4, and 5.

2.2.2 Four pH adjustments, unfiltered samples (experiment E)

On each Trial date, sixteen effluent samples (approx. 25 L) were randomly distributed into four replicate groups. Three of the four samples in a replicate group were adjusted to predetermined pH targets of 9.1, 8.7, and 7.6. Adjustment of pH was completed using a 5% (1:20 dilution) of sulfuric acid added drop wise through a burette while the sample was mechanically stirred under moderate agitation. The fourth sample was monitored for pH during this period, while being stirred, but it was not pH adjusted.

Once the desired pH targets were achieved, the 25L samples were labelled, sealed, minimizing headspace, and shipped via courier to Aquatic Sciences Inc. for acute static toxicity testing with rainbow trout and *Daphnia magna* (section 2.3). The typical time elapsed from the preparation and sealing of the samples to the time of opening for toxicity testing was estimated to be approximately 36h.

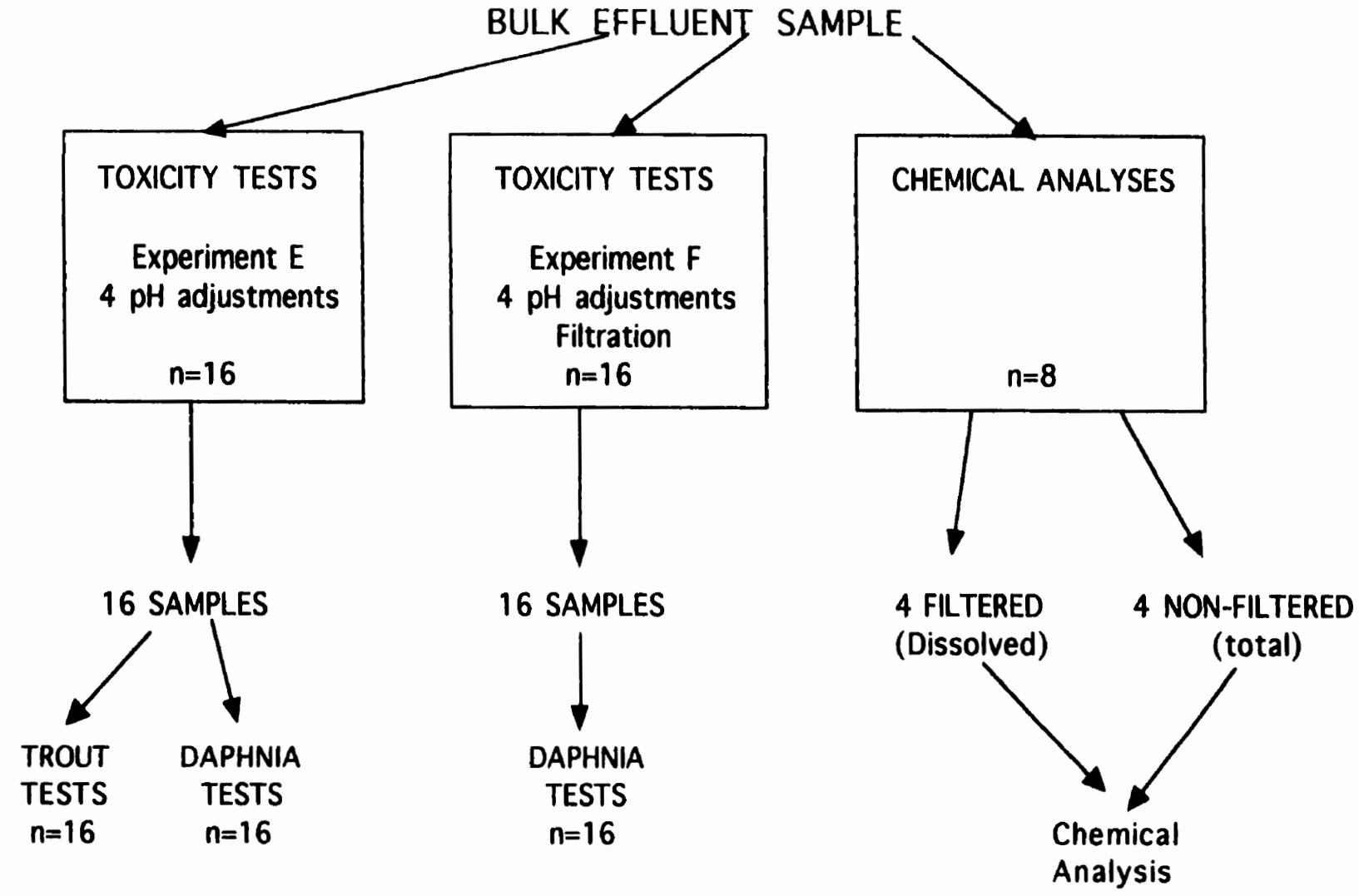


Figure 3: Divisions of bulk effluent through to acute toxicity testing. Effluent experiments were performed on three bulk samples, trials 4-6 from the Copper Cliff Waste Water Treatment Plant from early spring 1997.

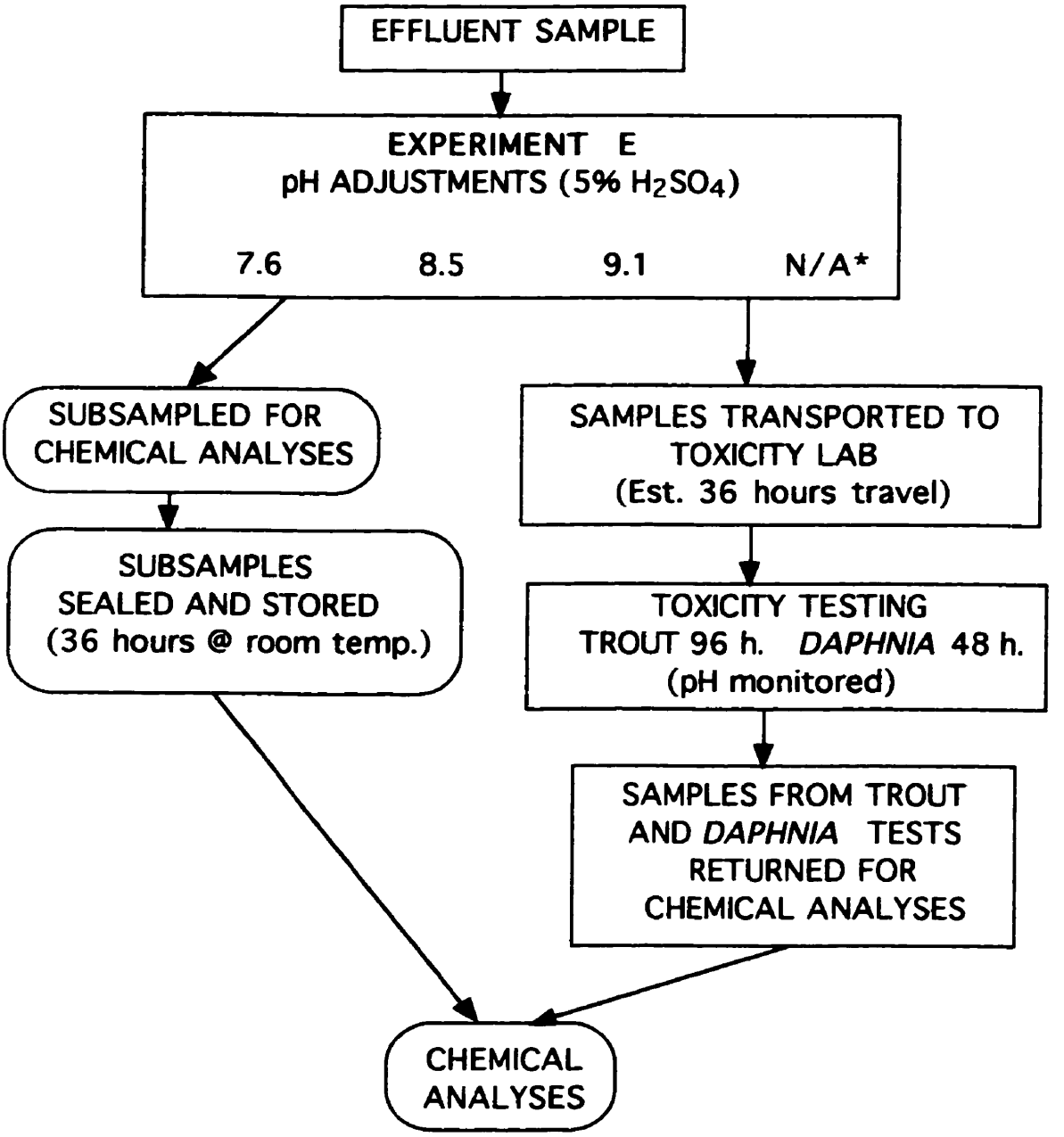


Figure 4: Manipulations of CCWWTP effluent samples for experiment E,trials 4-6, 1997.
* indicates raw unadjusted efflent

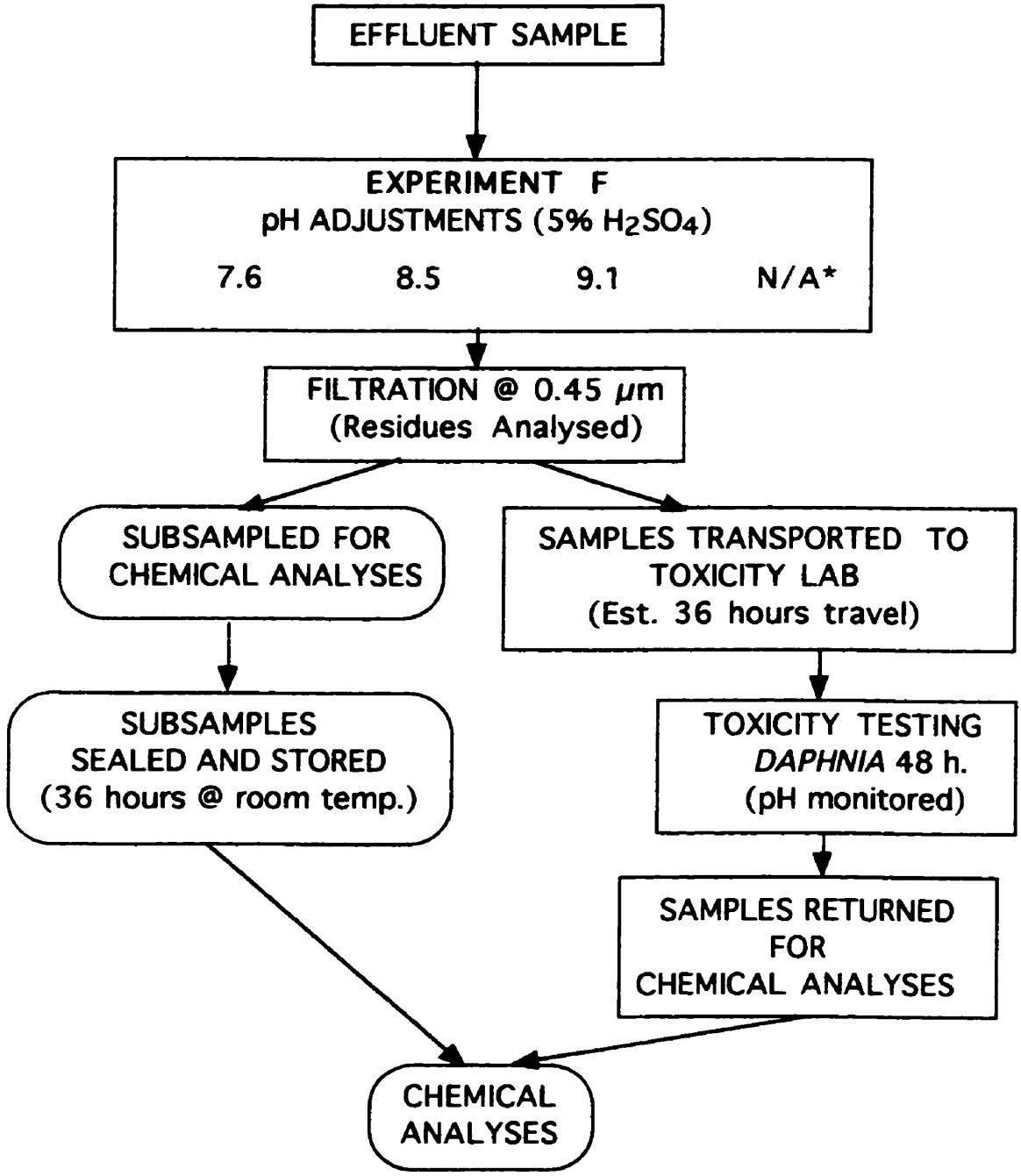


Figure 5: Manipulations of CCWWTP effluent samples for experiment F, trials 4-6, 1997.
* indicates raw unajusted effluent.

2.2.3 Four pH adjustments, samples filtered (experiment F)

On each trial date, sixteen effluent samples (approx. 10L) were taken from the bulk effluent collected, and randomly distributed into four replicate groups. Three of the four samples in each replicate group were modified to predetermined pH targets of 9.1, 8.7, and 7.6. Adjustment of pH was completed as described above, using a 5% (1:20 dilution) of sulfuric acid added drop wise through a burette while the sample was mechanically stirred under moderate agitation. The fourth sample was monitored for pH while being stirred during the experimental period, but not pH adjusted. Once the desired pH levels had been achieved, 8 L of each sample was passed through a high volume pressure filter apparatus (0.45μm pore size, Supor® membrane) using nitrogen gas as the propellant. Filters and residues were stored at room temperature until preparation for further chemical analysis (section 2.4). Upon completion of the above preparations, the filtered effluent samples were labelled, sealed, minimizing headspace, and shipped via courier to Aquatic Sciences for acute static toxicity testing with *Daphnia magna* (section 2.3). The typical time elapsed from the preparation and sealing of the samples to the time of opening for toxicity testing was estimated to be approximately 36h.

2.3 Toxicity Test Procedures

2.3.1 Rainbow trout and *D. magna* protocol for toxicity testing

Rainbow trout and *D. magna* toxicity tests were conducted by Aquatic Sciences Inc. in St. Catharines, Ontario essentially according to the standard Canadian protocols for acute static tests (Environment Canada 1990a; 1990b). In both cases undiluted effluent failed the test whenever total mortality was ≥ 50% of the exposed animals.

The 96-hour static rainbow trout tests were conducted by placing 10 specimens (0.3g-5.0g) into a sufficient volume of the test solution to ensure a loading density of < 0.5g/L. Samples were continually aerated during testing, and temperature was maintained at 15°C (+/-1). Mortalities were recorded after elapsed times of 24h, 48h, 72h, 96h, and 15h, 24h, 48h, 72h, and 96h for phase I and phase II studies respectively. Observations of stress were recorded throughout the test period.

Mortalities were determined by the absence of opercular movement and no response to subsequent gentle prodding. Symptoms of stress included failure to maintain balance, gasping at the water surface, and lethargic or sporadic swimming activities (Environment Canada 1990a).

For the 48-hour *D. magna* tests, three groups of 10 neonates (< 24h of age) were placed in three separate vessels containing 200mL replicate subsamples of the effluent at a temperature of 20°C (+/-1). Immobile specimens and any other indications of stress were recorded after elapsed times of 24h and 48h for both studies. Mortalities were determined by visual microscopic inspection of the organisms upon completion of each test (48h). Mortality was determined by the lack of appendage movement and absence of a heart beat. Symptoms of stress included immobility; defined as the inability to sustain free suspended swimming characteristics due to absence of antennae movement, or by the presence of organisms trapped in the water surface tension (Environment Canada 1990b).

2.3.2 Phase I study; additional procedures

When a bulk sample was received, three 200 mL subsamples were removed for *D. magna* tests, and the rest of the sample was reserved for a single rainbow trout test. At my request, each sample was aerated for a minimum of 30 minutes before toxicity testing began. Also, in accordance with the standard protocol, any sample exhibiting either a low or supersaturated concentration of dissolved oxygen was aerated further until dissolved oxygen levels fell between 80%-100% saturation (Environment Canada 1990a; 1990b).

2.3.3 Phase II study; additional procedures

Upon reception of the samples submitted for Experiment E, a subsample was extracted from each for *D. magna* testing. The parent samples, used subsequently for trout tests, and the *D. magna* test subsamples, were immediately sealed and held at 4°C (+/-2) until testing.

Upon request, the following variance from the usual protocol was added. All samples being prepared for trout testing were aerated for 90 minutes, partly to eliminate the possibility of over- or under- saturation of dissolved oxygen during the test, but especially to ensure each sample of effluent had a very similar pre-test exposure to atmospheric carbon dioxide. Without this modification in methodology, only samples over- or under-saturated with oxygen would have been pre-aerated. The samples to be used for *Daphnia* testing were consistently pre-aerated for 30 minutes for the same reasons; the aeration time was reduced from 90 minutes because *D. magna* tests employed a much smaller effluent sample volume than trout tests.

2.3.4 Chemical analyses at toxicity test laboratory

Prior to testing effluent samples, Aquatic Sciences Inc. raised stored effluent samples to temperature required for toxicity testing [i.e. 15 ^{o}C (+/-1) for trout and 20 ^{o}C (+/-1) for *Daphnia*](Environment Canada 1990a; 1990b), recorded dissolved oxygen, pH, temperature, conductivity, hardness, physical state of sample, clarity, colour, presence of precipitate, and odour. Temperature, pH, dissolved oxygen, and conductivity were monitored at intervals during the toxicity tests. In detail, pH was monitored in rainbow trout tests at the time intervals of 0h, 24h, 48h, 72h, 96h and 0h, 15h, 24h, 48h, 72h, and 96h for phase I and phase II studies respectively. Temperature, dissolved oxygen, and specific conductivity were recorded at the same time frames, but excluding 15h for the phase II study. In *D. magna* tests, pH was monitored at elapsed times of 0h and 48h and 0h, 24h, and 48h for phase I and phase II studies respectively. The other parameters listed above were monitored at 0h and 48h.

2.3.5 Post-bioassay chemical analysis

i) Phase I study

Upon completion of each rainbow trout toxicity test at Aquatic Sciences Inc., a 2 L effluent subsample from the test vessel was returned to INCO's Central Processing Technology laboratories at Copper Cliff. These samples were stored and transported at 4 ^{o}C (+/-2), and sample containers were kept closed. Upon sample arrival at the Copper Cliff laboratory, five aliquots from each sample were processed for the routine series of chemical analyses, as described in section 2.4.

ii) Phase II study

Upon completion of each trout and *Daphnia* toxicity test at Aquatic Sciences Inc., a 250 mL sample was collected from each trout test vessel, and a 250 mL composite was collected from the three subsets of effluent subjected to *Daphnia* tests. All effluent samples were sealed, stored, and transported, at 4^{o}C (+/-2), to the Central Processing Technology building at INCO Ltd., Copper Cliff, Sudbury. Once the effluent samples had arrived, post-test pH was determined, and then the samples were acidified and stored. Total ammonia was later measured for each sample as described in section 2.4.

2.4 Chemical Analyses

2.4.1 Phase I and Phase II effluent studies

The aliquots of effluent samples from both pre-test and post-biassay samplings of the phase I and phase II study were prepared for the specified chemical analyses as summarized in Figure 6.

Aliquot 1) Preserved with 1:1 H_2SO_4 @ 3 drops per 200 ml of sample; for total ammonia/ium & chemical oxygen demand (COD) analyses.

Aliquot 2) No preservative added; used for suspended solids*.

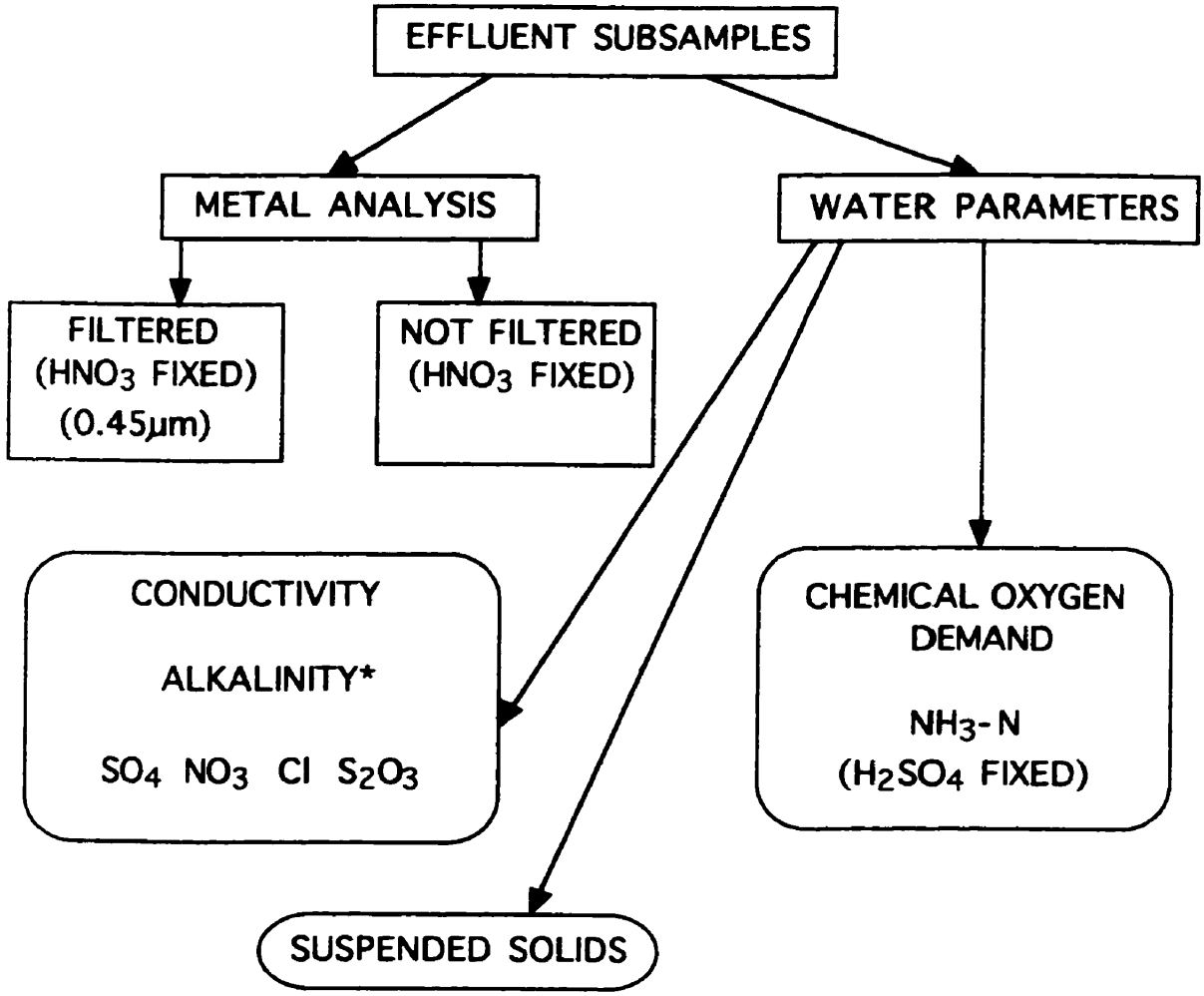


Figure 6: Treatment paths for chemical analyses of effluent subsamples, trials 1-6, from the CCWWTP studies of 1995 and 1997.

*includes total and phenolphthalein alkalinity.

Aliquot 3) No preservative added; used for analyses of sulfate, nitrate, chloride, thiosulfate, conductivity, phenolphthalein alkalinity**, and total alkalinity.

Aliquot 4) Filtered samples used for determination of "dissolved" elements. †

Aliquot 5) Non-filtered samples were used for "total" element analysis. †

* Suspended solids were completed only for the Phase I study.
** Phenolphthalein alkalinity was only measured in the Phase II study involving experiment E and F.
† Samples from aliquot 4 and 5 were preserved with a 1:1 dilution of nitric acid at 2 mL of acid per 50 mL of sample prior to being analysed for various elements (analyses included Ca, Na, Mg, K, Fe, Mn, Ni, Co, Cu, and Zn, among others).

2.4.2 Experiment F; filtered residues.

Filtered residues were liberated from the filters by placing them in 50mL of distilled water and then adding 5mL of concentrated HCl acid. The filters and solutions were subjected to an ultrasonic bath for approximately 20 minutes, and then fixed with 2 mL of nitric acid per 50 mL of solution. An aliquot of each sample was then analysed though inductively coupled plasma-atomic emission spectrophotometry (ICP-AES). The elements determined included Ca, Na, Mg, K, S, Fe, Mn, Al, Ni, Cu, Zn, Co, and several others. Unused filter material was also similarly analysed as blanks to allow for data correction where required. The total mass of each element retained on the filter was reported; this value was equivalent to the mass of the element in particulate form in 26 L and 8 L of effluent for experiments B and F respectively.

2.4.3 Analytical procedures for samples

Most chemical analyses were conducted by, or under the supervision of, staff chemists at INCO's Central Processing Technology laboratory facilities in Copper Cliff. Following the laboratory's normal protocol, total ammonia/ ammonium was analyzed by ion specific electrode. Chemical oxygen demand was determined by Hach® colorimetry and suspended solids were measured gravimetrically. The ions nitrate, chloride, sulfate, and thiosulfate were measured through ion chromatography. Phenolphthalein alkalinity, total alkalinity, and specific conductivity were measured using an automated Metohm® analyser. Element analysis was carried out by inductively coupled plasma-atomic emission spectrophotometry (ICP-AES).

2.5 Experiment D: Ambient Air Experiments

Procedures for studying the involvement of carbon dioxide in the decline of effluent pH are described in detail below and summarized in Figure 7.

2.5.1 Effluent Manipulations

Two effluent samples approximately 20L in volume were collected from the Copper Cliff Waste Water Treatment Plant Clarifiers in the morning on the specific dates of June 1/98 and July 6/98. These samples referred to as trials 10 and 11 were sampled from a outflow line from the clarifiers into a clean polycarbonate 20L container with no head space and sealed for immediate transport to Laurentian University. Upon arrival, the bulk samples for each trial were divided randomly into 28, 500 mL polyethylene containers (PETE ®) and sealed. Sixteen of these 500 ml subsamples, were immediately cooled in an ice bath in preparation for cold condition experiments, while the remaining 12 sealed subsamples were left to equilibrate to room temperature (24 ^{o}C (+/-1.5)) at a provided work space. After approximately one hour, samples in the ice bath were placed in a refrigerator to adjust to a temperature of 4^{o}C (+/-2.0) before test iniation.

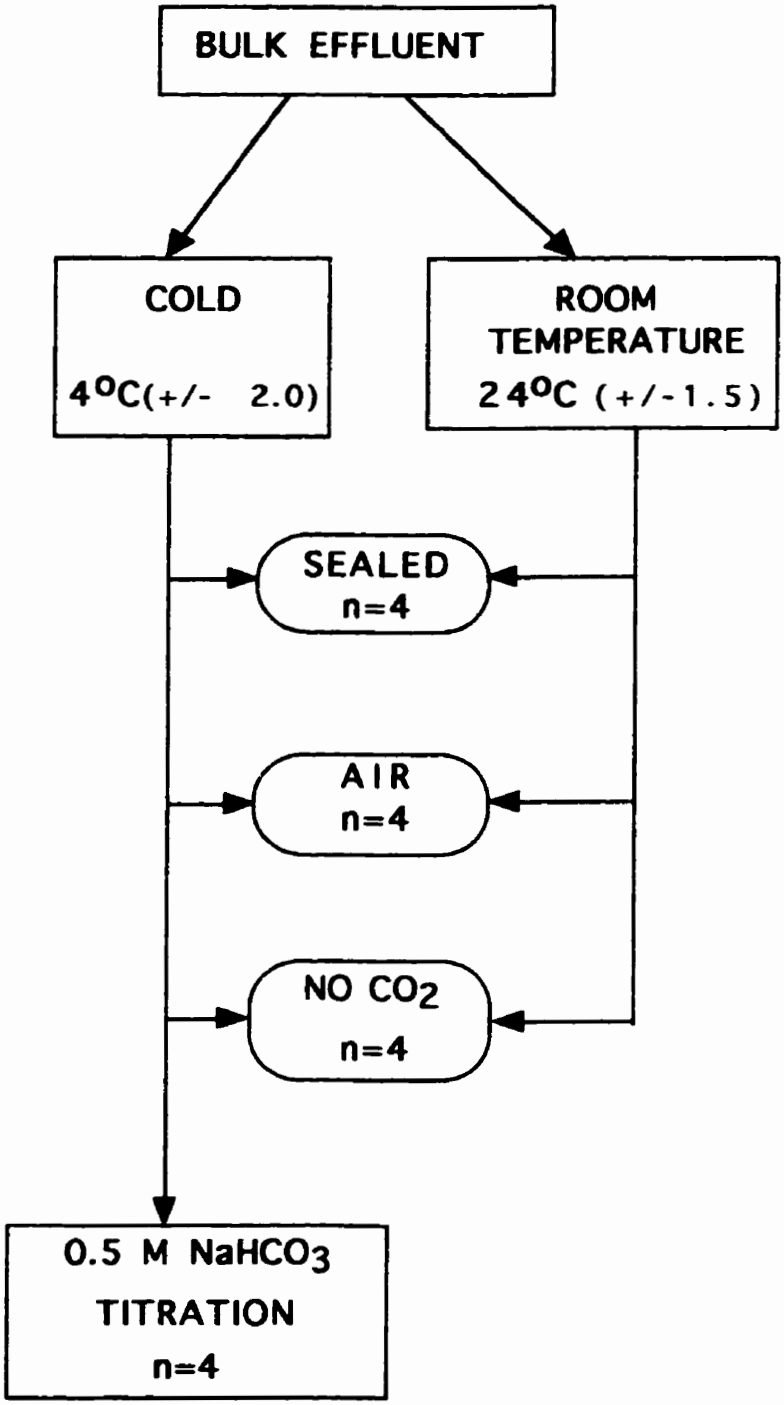


Figure 7: Manipulations of effluent subsamples from the CCWWTP for the ambient air studies of experiment D.

2.5.2 Procedures for air experiments

Trial samples were divided into four replicates for three physical manipulations of air for the two temperature conditions as previously described. For each temperature condition a set of four replicates were left sealed for the 96h duration of the experiments. Another set of replicates were subjected to glass wool filtered, atmospheric air bubbled into each sample. The final set of replicates was aerated using glass wool filtered air which was also passed through a column of Ascarite ® to remove carbon dioxide gas. At the start of the tests, each sample was opened briefly and measured for pH and temperature and immediately sealed with food grade plastic wrap. Each of the replicates were then subjected to experimental conditions as indicated above. To reduce potential mixing of effluent sample with ambient air outside the vessel, samples involving aeration were performed by piercing the plastic wrap covering to insert the aeration tube to allow for bubbling of samples. A second small perforation was made to avoid pressure build up in the vessel. Samples were only opened to monitor pH and temperature at specified time periods of 0, 2, 6, 15, 24, 48, 72, and 96h and promptly returned to conditions as described above.

2.5.3 Procedure for sodium bicarbonate study

The final set of four replicates that had been acclimated to cool temperatures, 4°C (+/-2.0) were removed and immediately subjected to a titration using 0.5 M sodium bicarbonate ($NaHCO_3$) within a 50 mL burette. 400mL of each replicate effluent sample was gently stirred as the 0.5 M $NaHCO_3$ solution was added dropwise and measured at random volumes while pH was recorded during the titration.

2.6 Chemical and Statistical Analyses and Integrity

Quality control and quality assurance of analytical processes were verified through routine analysis of spiked samples, certified standard reference materials, and blank samples for chemical parameters tested as demonstrated through INCO's analytical protocol. Most analytical work was completed by experienced professional chemists at the Central Processing and Technology building at INCO's Copper Cliff location. At Aquatic Sciences Inc., St. Catharines, On., parallel blank control bioassays to ensure the viability of both trout and *Daphnia*, utilizing dechlorinated tap water, were routinely run at the time bioassays were performed on tested effluent. Toxicity testing was considered void if blank controls exhibited mortality rates >10% (Environment Canada 1990a; 1990b). Sodium chloride was also used as a reference toxicant to ensure lethality to test organisms was well within documented values (Appendix B).

Statistical analyses were completed with the aid of two statistical software packages; one was SPSS statistical analyses on the VMS VAX mainframe computer, while the other was completed on a personal computer using the JMP statistics software (SAS).

3.0 RESULTS

3.1 Effluent Samples

3.1.1 Effluent variability

Initial chemical analyses of alkaline effluents indicated that the pre-test subsample variation within trials was low. Within the phase II study, for example, of the 21 chemical parameters analyzed, only six of these (phenolphthalein alkalinity, chemical oxygen demand, Co, Fe, Mn, and Ni) had coefficients of variation exceeding 5% (Table 1a, 1c). The coefficient of variation was only relatively high for the metals Fe, Mn, and Ni in trial 6, 15.1-18.1% , and for chemical oxygen demand and Co (10.5-23.5%) in trials 4 and 5 (Table 1a, 1c).

In contrast to within trial observations, most of the chemical parameters displayed significant variation among the six trials. Of particular interest was the fact that pH, alkalinity, and thiosulfate showed the highest levels in trial 5 (Table 1a, 1b). The base cations, Ca and Na showed the greatest concentrations in trial 1, as did sulfate and chloride ions (Table 1c). Total ammonia and Zn were most prominent in trial 2 (Table 1a, 1c). Trace metals Co, Al, Fe, Mn, Cu, and Ni tended to be the highest in trials 3 and 6 (Table 1c) .

3.1.2 Pre- and post-test comparisons

Data representing total trace metals (Co, Al, Fe, Mn, Cu, Ni, and Zn), cations (Ca, Na, K, and Mg) and anions (sulfate, chloride, and nitrate) concentrations for phase I rainbow trout tests are displayed in Table 1b and 1c. Examination of comparable post-test phase I chemical data (trials 1-3) did not indicate consistent temporal (pre-test/ post-test) trends (Appendix I and II; III and IV). Post-test total ammonia levels of trials 1-6 similarly did not reveal a consistently increasing, decreasing, or static pattern for the phase I (Appendix I and II) or the phase II studies (Appendix VI, VIII, and IX). Prior to toxicity testing, thiosulfate concentrations ranged from 10-22 mg/L in trials 1-3 (Appendix I). Samples analyzed for thiosulfate following the trout tests only in the first three trials indicated a reduction in concentration from pre-test analysis, most being < 5 mg/L (Appendix II).

Table 1a: Chemical characteristics of two trios of bulk effluent samples collected from the INCO - Copper Cliff Waste Water Treatment facility in late fall 1995 and early spring 1997. The ranges shown (bold face) for samples from 1995 are the values observed in experiments A and C non-adjusted unfiltered effluents. Data for the 1997 samples (bold face) are the means of four replicates of experiment E non-adjusted unfiltered effluents, and the associated coefficients of variation (%).

Sample	Date Collected	pH (-log [H+])	Total Alkalinity (mg/L)	Phenolphthalein Alkalinity (mg/L)	Total Ammonia (mg/L)	COD (mg/L)	Cond µS/cm
Trial 1(n=2)	**13/11/95**	**10.3-10.4**	**37-40**	**no data**	**5.7-6.0**	**23-28**	**2300**
Trial 2(n=2)	**4/12/95**	**10.2-10.2**	**35-36**	**no data**	**6.9-7.2**	**38-40**	**2300**
Trial 3(n=2)	**11/12/95**	**10.2-10.3**	**38-40**	**no data**	**6.6-6.8**	**18-25**	**2300-2400**
Trial 4(n=4)	4/28/97	10.4	47	26	5.5	55	2000
		0.6%	1.4%	4.1%	1.9%	11.9%	1.2%
Trial 5(n=4)	05/05/97	11.1	68	38	5.8	48	2300
		0.0%	2.0%	5.9%	0.0%	10.5%	0.2%
Trial 6(n=4)	5/12/97	10.2	52	26	6.3	52	2300
		0.0%	1.3%	5.6%	2.3%	4.1%	0.9%

Table 1b: Chemical characteristics of two trios of bulk effluent samples collected from the INCO - Copper Cliff Waste Water Treatment facility in late fall 1995 and early spring 1997. The ranges shown (bold face) for samples from 1995 are the values observed in experiments A and C non-adjusted unfiltered effluents. Data for the 1997 samples (bold face) are the means of four replicates of experiment E non-adjusted unfiltered effluents, and the associated coefficients of variation (%).

Sample	Date Collected	Calcium (mg/L)	Sodium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Nitrate (mg/L)	Thiosulfate (mg/L)
Trial 1(n=2)	13/11/95	**480-490**	**138-140**	**67-68**	**35-36**	**1700**	**91-95**	**4**	**10**
Trial 2(n=2)	4/12/95	**420-430**	**135-138**	**68-70**	**37-38**	**1700**	**72-84**	**4-5**	**14-15**
Trial 3(n=2)	11/12/95	**430-450**	**132-136**	**71-74**	**37-39**	**1700-1800**	**101-106**	**5**	**20-22**
Trial 4(n=4)	4/28/97	**320** 1.1%	**98** 0.5%	**66** 0.5%	**26** 1.1%	**1100** 2.4%	**70** 3.8%	**7** 1.2%	**34** 2.4%
Trial 5(n=4)	05/05/97	**340** 2.1%	**106** 2.4%	**57** 1.8%	**24** 3.4%	**1200** 0.7%	**80** 4.4%	**6** 1.0%	**35** 0.7%
Trial 6(n=4)	5/12/97	**390** 0.8%	**137** 0.8%	**81** 0.6%	**32** 0.8%	**1400** 2.0%	**88** 2.4%	**4** 3.1%	**33** 2.0%

Table 1c: Chemical characteristics of two trios of bulk effluent samples collected from the INCO - Copper Cliff Waste Water Treatment facility in late fall 1995 and early spring 1997. The ranges shown (bold face) for samples from 1995 are the values observed in experiments A and C non-adjusted unfiltered effluents. Data for the 1997 samples (bold face) are the means of four replicates of experiment E non-adjusted unfiltered effluents, and the associated coefficients of variation (%).

Sample	Date Collected	Cobalt (mg/L)	Aluminum (mg/L)	Iron (mg/L)	Manganese (mg/L)	Copper (mg/L)	Nickel (mg/L)	Zinc (mg/L)
Trial 1(n=2)	13/11/95	**0.010**	**0.120-0.179**	**0.125-0.513**	**0.023-0.062**	**0.023-0.080**	**0.275-0.749**	**0.010**
Trial 2(n=2)	4/12/95	**0.010-0.012**	**0.160-0.168**	**0.176-0.216**	**0.029-0.030**	**0.057-0.096**	**0.276-0.286**	**0.035-0.039**
Trial 3(n=2)	11/12/95	**0.013-0.013**	**0.210-0.261**	**0.216-0.557**	**0.034-0.077**	**0.046-0.101**	**0.356-0.783**	**0.010-0.013**
Trial 4(n=4)	4/28/97	**0.007** 23.5%	**0.193** 2.8%	**0.357** 8.4%	**0.018** 8.0%	**0.055** 3.9%	**0.244** 6.9%	**D.L.**
Trial 5(n=4)	05/05/97	**0.009** 13.3%	**0.162** 1.4%	**0.339** 8.8%	**0.020** 8.2%	**0.045** 4.9%	**0.200** 7.4%	**D.L.**
Trial 6(n=4)	5/12/97	**0.013** 3.6%	**0.206** 1.8%	**0.804** 18.1%	**0.058** 15.5%	**0.089** 4.1%	**0.526** 15.1%	**D.L.**

D.L. - < detection limit (0.005 mg/L).

3.1.3 Effluent particulates and metal concentrations

Trace metal concentrations were found to be low, and in some instances, close to detection limits of the analytical method (i.e. Zn, Table 1, Appendix VII). [The effectiveness of metal removal in the Copper Cliff treatment facility may be appreciated by comparing the analyses of treated effluents entering and leaving the treatment facility (Appendix XII)].

In order to better understand the biological availability of these metals contained in effluent samples studied, material retained from the filtering process in experiment F was analyzed for metals in question (Appendix X). In this fashion, metals accumulated on the filter disc could be concentrated by utilizing a larger volume of effluent. Thus, concentrated metals would allow for quantitative interpretation without the hindrance of low detection limits. It was also anticipated that as pH was lowered to specified pH targets, increased metal solubility would be reflected in decreased concentrations of trace metals captured on the filter discs.

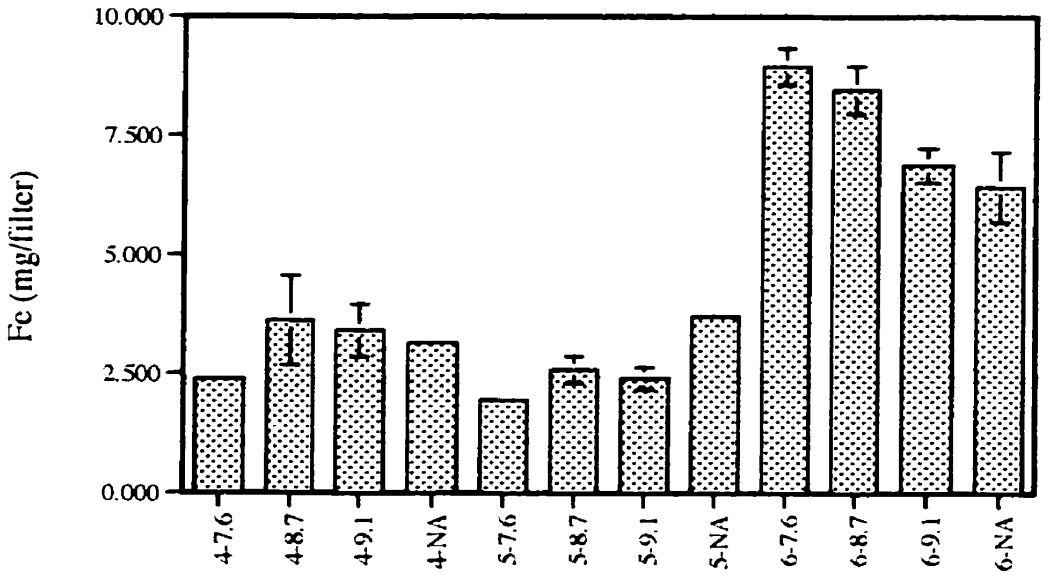
Chemical data for trials 4 and 5 suggested that metal solubility had generally increased as effluent samples were adjusted to pH 7.6 (Figure 8). In contrast, a reverse in solubility was apparent in trial 6 (Figure 8). In trial 6 the metals Fe, Cu, Al, and possibly Zn showed a greater solubility in the unadjusted alkaline samples, and the least solubility in circumneutral effluents. The solubilities of Mn, Ni, and Co were not significantly influenced by the pH adjustments in trial 6.

3.2 Toxicity Results

The results of effluent toxicity tests with rainbow trout indicated consistently high level of mortalities (100%) in all non adjusted alkaline effluents examined (Table 2). In contrast, all pH modified effluents indicated a high survival rate for rainbow trout. Only three instances in phase I, trials 1 and 2 indicated mortalities of $\geq$ 10% in pH targets of 8.8 and 7.8 and under no circumstances were mortalities $\geq$ 50% (Table 2). Filtered alkaline effluent samples tested in experiment B of the phase I study showed no differences in mortality with respect to experiments A and C.

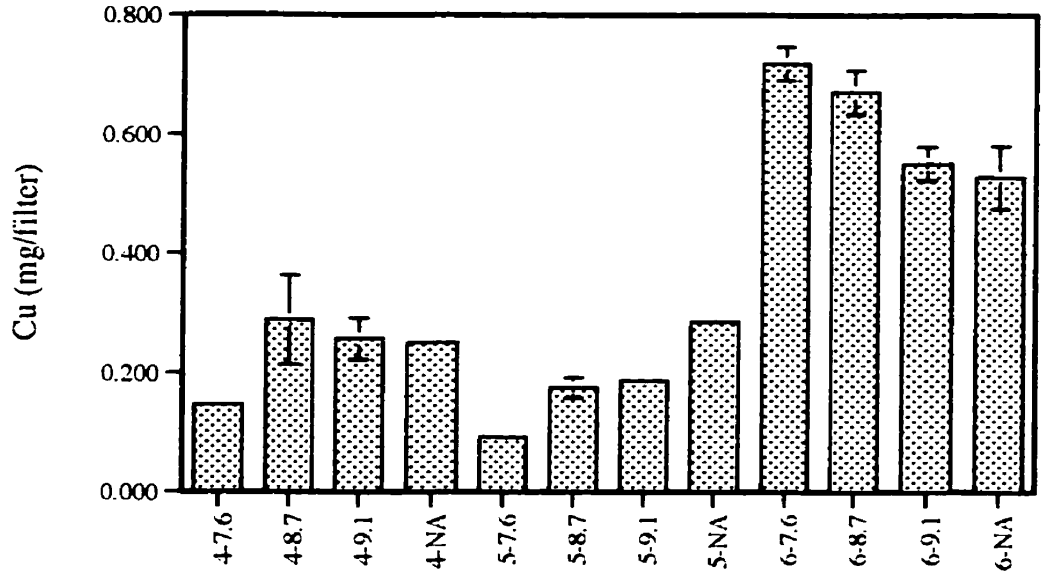
Figure 8. Mean total mass (mg) and standard errors (bars) observed for seven metals filtered (0.45μm) from quadruplicate, pH-adjusted 8L samples of three effluents (Expt. F; Trials 4-6 1997) from the INCO-Copper Cliff Waste Water Treatment Plant: a) Fe, b) Cu, c) Al, d) Zn, e) Mn, f) Ni, and g) Co.

8a



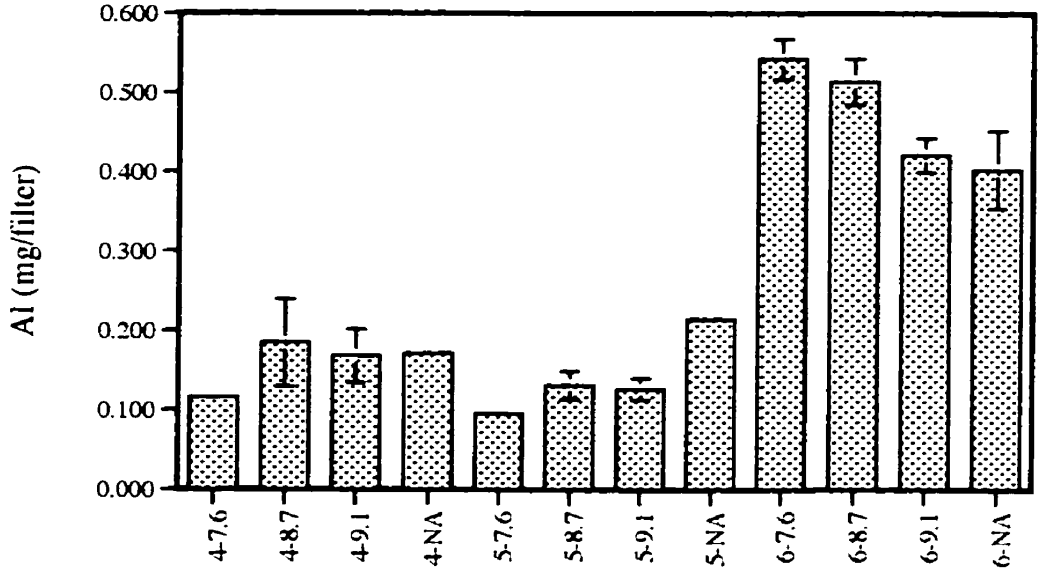
Target pH of Samples from Trials 4-6

8b



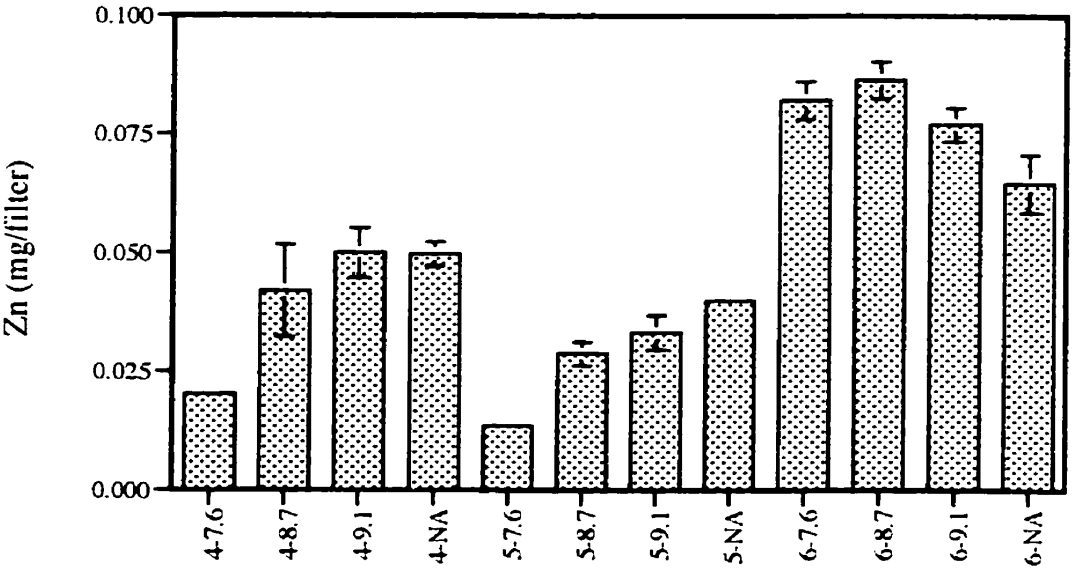
Target pH of Samples from Trials 4-6

8c



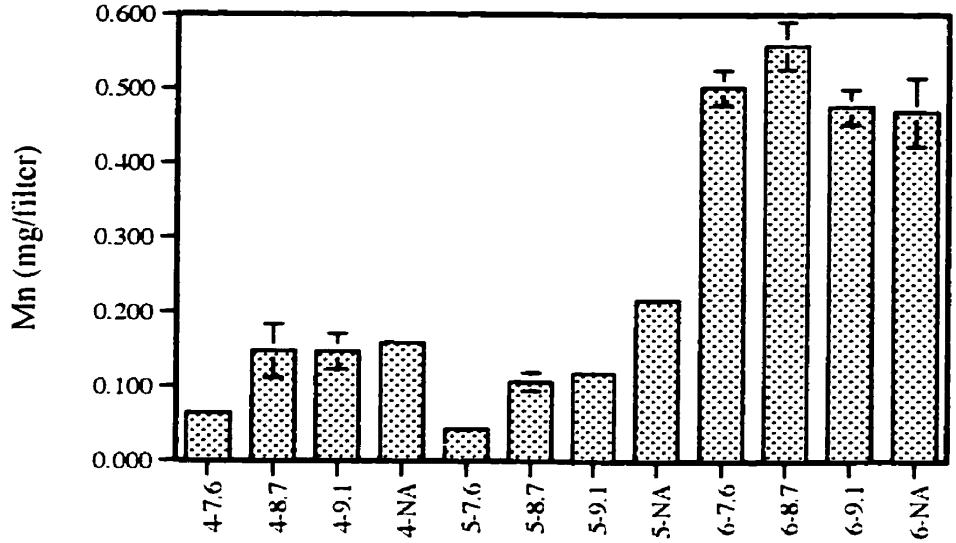
Target pH of Samples from Trials 4-6

8d



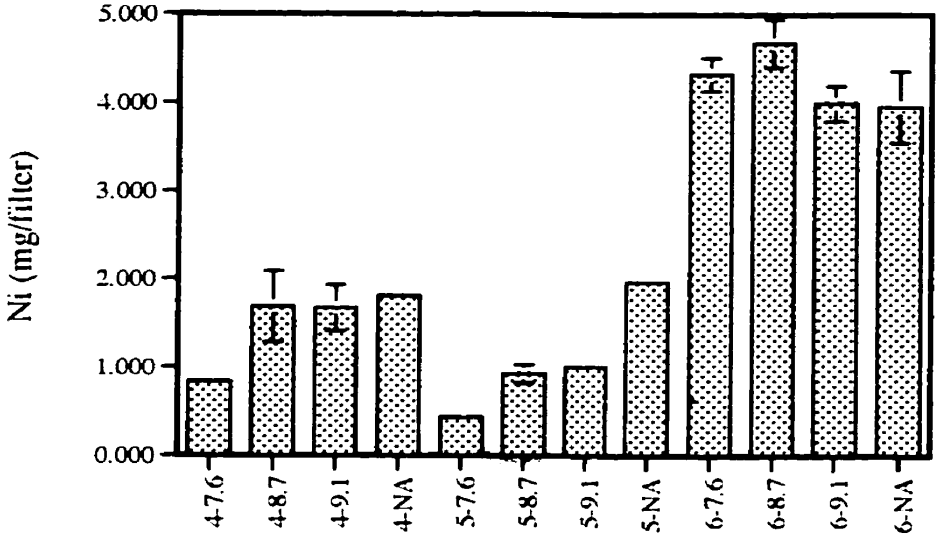
Target pH of Samples from Trials 4-6

8e



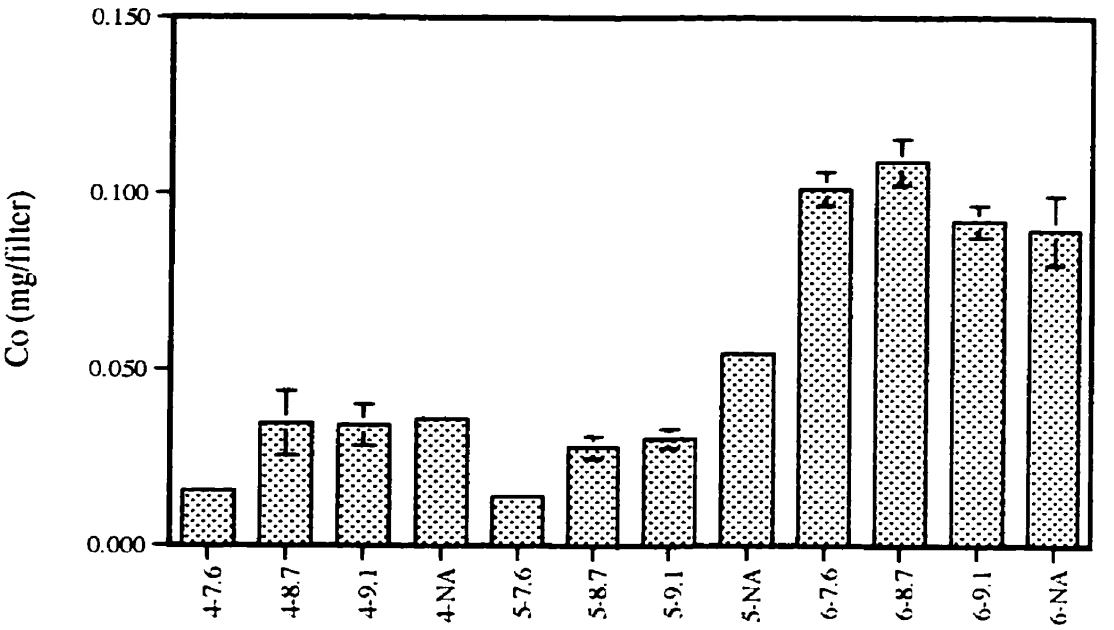
Target pH of Samples from Trials 4-6

8f



Target pH of Samples from Trials 4-6

8g



Target pH of Samples from Trials 4-6

Table 2. Percent mortality of rainbow trout in static, acute (96h) toxicity tests carried out in fall 1995 and spring 1997 on CCWWTP* effluents that were previously subjected to pH adjustments and aeration/ filtration procedures. Collection of effluent samples on six dates provided for six trials. Mortality rates ≥ 50% are in bold face. Mortality values displayed in trials 1-3 are based on single toxicity tests (n=1) while trials 4-6 are means of four replicate tests (n=4).

		PERCENT MORTALITY of RAINBOW TROUT				
	TRIAL No.	NOMINAL pH ADJUSTMENTS				
EXPERIMENT	(Sampling Date)	N/A†	9.3	8.8	8.3	7.8
A	1 (Nov. 13)	**100**	0	0	0	10
('95)	2 (Dec. 4)	**100**	0	10	0	20
	3 (Dec. 11)	**100**	0	0	0	0
B	1 (Nov. 13)	**100**	0	0	0	0
('95)	2 (Dec. 4)	**100**	0	0	0	0
	3 (Dec. 11)	**100**	0	0	0	0
C	1 (Nov. 13)	**100**	0	0	0	0
('95)	2 (Dec. 4)	**100**	0	0	0	0
	3 (Dec. 11)	**100**	0	0	0	0

EXPERIMENT	TRIAL No.	N/A†	9.1	8.7		7.6
E	4 (Apr.28)	**100**	0	0		0
('97)	5 (May 5)	**100**	2.5	0		0
	6 (May12)	**100**	0	0		0

* Copper Cliff Waste Water Treatment Plant.
† Non-adjusted effluent samples

Hence, for this reason and to eliminate unnecessary investigations in phase II experiments, trout toxicity testing involving filtered effluents was excluded from the latter study.

In *Daphnia* bioassays, mortalities greater than 50% were commonly observed in unadjusted alkaline effluent samples of the phase II study trials 4-6 and in the first trial of the phase I study of experiment A (Table 3). Even with the inclusion of immobile organisms (as a possible indicator of stress) with mortalities, no test exceeded the failure criterion of 50% for the pH adjusted effluents samples (Table 3). The pH modified effluent samples showed a high survival rate for organisms tested. With the exception of experiment A, at pH target of 7.8 of the phase I study, which produced a mortality rate of 27%, none of the pH adjusted effluents tested exceed a mortality rate of 10% (Table 3). Filtration of alkaline effluents prior to toxicity testing (experiments B and F) caused no apparent differences in *Daphnia* mortality in relation to non filtered effluents.

3.3 Sources of Toxicity

3.3.1 General effluent chemistry

Excluding pH, data collected from alkaline effluents displayed in Table 1 and Figure 8 , did not suggest a possible source of toxicity to trout or *D. magna*. Since mortalities were substantial in non-adjusted alkaline effluent, and the process of filtration had no apparent effect on mortalities, it was concluded that a soluble component was responsible for toxicity observed. None of the soluble cations Ca, Na, Mg, K, Co, Al, Fe, Mn, Cu, Ni, Zn, nor anions sulfate, chloride, nitrate, thiosulfate, and total ammonia demonstrated a relationship different from pH adjusted, low mortality effluents and high pH high mortality effluents.

3.3.2 pH decline

Adjustment of pH to the intended targets was difficult with the 10% dilution of sulfuric acid in 1995, and was not always accurate (Appendix V). In fact, as a result of malfunctioning pH equipment in trial 2 and 3, acid was added to samples using amounts previously determined from trial 1, to achieve desired pH targets.

Table 3. Percent mortality among neonate *Daphnia magna* , and percent immobile-plus-dead, in static, acute (48h) toxicity tests carried out in 1995 and 1997 on INCO-Copper Cliff Waste Water Treatment Plant effluents that were previously subjected to pH adjustments and aeration/filtration procedures. Collection of effluent samples on six dates provided for six trials. Mortality rates ≥ 50% are in bold face. Mortality values displayed in trials 1-3 are based on single toxicity tests (n=1) while trials 4-6 are means of four replicate tests (n=4).

		PERCENT MORTALITY of *Daphnia magna* (Percent Dead plus Immobile in Parentheses)				
	TRIAL No.		NOMINAL pH ADJUSTMENTS			
EXPERIMENT	(Sampling Dates)	N/A†	9.3	8.8	8.3	7.8
A	1 (Nov. 13)	**77**(87)	0(0)	0(7)	3(23)	27(44)
('95)	2 (Dec. 4)	0(0)	0(0)	3(10)	7(7)	3(7)
	3 (Dec. 11)	0(3)	0(0)	0(0)	0(0)	0(0)
B	1 (Nov. 13)	27(37)	0(20)	0(0)	0(0)	0(0)
('95)	2 (Dec. 4)	0(0)	0(0)	0(0)	0(0)	0(0)
	3 (Dec. 11)	0(0)	0(0)	0(0)	0(0)	0(0)
C	1 (Nov. 13)	0(27)	0(0)	3(3)	7(10)	3(3)
('95)	2 (Dec. 4)	17(57)	0(0)	0(0)	0(0)	0(0)
	3 (Dec. 11)	0(20)	3(3)	0(0)	0(0)	0(0)

EXPERIMENT	TRIAL No.	N/A†	9.1	8.7	7.6
E	4 (Apr. 28)	**80**(97)	0	0	0
('97)	5 (May 5)	**100**	0	0	0(19)
	6 (May 12)	**88**(98)	0(7)	0(1)	2(4)
F	4 (Apr. 28)	**96**(98)	0	0	0
('97)	5 (May 5)	**100**	1	0	3(5)
	6 (May 12)	**82**(95)	1(2)	0	0(1)

† Non-adjusted effluent samples

However, using a 5% dilution of acid in 1996, initial adjustments were within +/- 0.1 pH units of the intended targets of 9.1, 8.7, and 7.6 (Appendix XI).

In all effluent samples, regardless of any prior pH adjustment, pH levels at the start times of toxicity tests were lower than the pH levels recorded at completion of pH adjustment and other pre-bioassay treatments. By the conclusion of the 96h trout tests, again regardless of any prior pH adjustment, all but one test solution exhibited a pH close to neutral (Tables 4 and 5). The coefficients of variation for pH measurements taken at different elapsed times in the phase II study were less than 5% for both trout and *Daphnia* tests (Tables 5 and 6).

3.3.3 Determination of pH critical to mortality

Assessing the influence of pH on the toxicity of effluents was complicated by the fact that pH typically declined while each test was proceeding. Generally, however, mortalities were not scattered throughout the whole test period; rather, mortalities and stress almost always occurred within a few hours of test initiation. These observations indicated that water quality characteristics at the end or even mid-way through a test period could be quite irrelevant for identifying the conditions causing toxicity. Aquatic Sciences Inc. saw indications of very early mortality in some trout tests (2h in trial 5) and noted almost immediate signs of stress in all tests that failed (see toxicity test reports, Appendix B). Such observations suggested that effluent toxicity would be most strongly correlated with water quality data from test start times (t=0). Since data at 24h was not obtained for *Daphnia* tests in 1995, and apparent *Daphnia* mortalities were not confirmed until completion of 48h acute tests (Environment Canada 1990b), it seemed that data from the 0h or 48h time frames would be the most appropriate for assessing the possible role of pH in determining effluent toxicity.

Initial sample pH in trout tests typically differed significantly from initial sample pH in *Daphnia* tests performed on the same effluent (i.e. trial 1, target pH 8.7, Experiment E; t=0 pH=8.1 for Daphnia; t=0 pH=8.6 for trout,) (Tables 5 and 6). In addition, the duration of acute testing for trout (96h) exceeded the duration of *Daphnia* tests (48h).

Table 4: Ranges of temporal pH declines observed for Experiments A and C (n=2) during rainbow trout 96h acute, static, toxicity tests on a trio of pH adjusted, aerated, unfiltered effluent samples from the Copper Cliff Waste Water Treatment Plant, INCO Ltd. (1995). Ranges of pH reported for initial time 0h and concluding 96h are indicated by outlined text.

Sample	target pH	0h	24h	48h	72h	96h
Trial I '95	7.8	6.8-7.0	6.9-7.0	6.8-7.0	6.9-7.1	6.9-7.2
A&C	8.3	7.2-7.4	6.9-7.1	6.8-7.0	7.0-7.1	7.0-7.2
	8.8	7.4-8.1	7.2	7.0-7.2	7.0-7.3	7.1-7.3
	9.3	8.8-9.7	7.3-7.6	7.2-7.3	7.3-7.6	7.2-7.6
	N/A	9.8-10.0	9.0-9.4	8.4-9.0	8.8*	8.6*
Trial II '95	7.8	6.8-7.2	6.8-7.0	6.2-6.6	5.0-5.1	3.8-4.2
A&C	8.3	7.2-7.3	7.1	6.9	6.6-6.9	6.4-6.9
	8.8	7.5-8.2	7.2-7.4	7.1-7.2	7.1-7.2	7.0-7.2
	9.3	8.0-8.2	7.4-7.5	7.2	7.1-7.2	7.0-7.3
	N/A	9.7	9.3-9.4	8.8	7.9-8.1	7.4-7.7
Trial III '95	7.8	8.0-8.6	7.5-7.7	7.2-7.3	7.3-7.4	7.1-7.2
A&C	8.3	8.2-8.6	7.4-7.7	7.2-7.4	7.3-7.4	7.1-7.2
	8.8	8.7-8.9	7.9-8.2	7.3-7.4	7.4	7.0-7.3
	9.3	8.1-8.5	7.6-7.7	7.4-7.5	7.4	7.0-7.2
	N/A	9.5-9.7	8.7-8.9	7.6-8.0	7.2-7.6	7.2-7.6

* Experiment C toxicity test terminated at 48h, Experiment A data reported only.

Table 5. Mean values of pH and coefficient of variation (% below mean) for pH declines observed (n=4) during rainbow trout 96h acute, static, toxicity tests on three pH-adjusted, unfiltered, effluent samples from the INCO-Copper Cliff Waste Water Treatment Plant (Expt. E; Trials 4-6, 1997).

pH AT ELAPSED TIMES DURING TOXICITY TESTS

Sample	Target pH	0h	15h	24h	48h	72h	96h
TRIAL 4	**7.6**	**7.7** 3.5%	**7.3** 1.8%	**7.2** 2.2%	**7.2** 1.6%	**7.3** 2.1%	**7.2** 2.3%
	8.7	**8.6** 2.0%	**7.5** 0.9%	**7.3** 1.7%	**7.4** 1.1%	**7.4** 1.3%	**7.4** 1.5%
	9.1	**9.1** 0.5%	**7.8** 2.0%	**7.5** 1.1%	**7.5** 0.9%	**7.5** 1.3%	**7.5** 1.3%
	N/A	**10.1** 0.4%	**9.6** (tests terminated) 1.0%				
TRIAL 5	**7.6**	**7.4** 5.1%	**7.2** 1.9%	**7.2** 1.5%	**7.2** 1.8%	**7.3** 1.6%	**7.2** 1.2%
	8.7	**8.5** 0.6%	**7.3** 1.2%	**7.3** 1.0%	**7.3** 1.5%	**7.3** 1.5%	**7.2** 1.5%
	9.1	**8.9** 0.7%	**7.4** 0.6%	**7.4** 0.9%	**7.4** 1.0%	**7.4** 0.7%	**7.4** 0.8%
	N/A	**10.5** 0.6%	**9.6** (test terminated) 0.7%				
TRIAL 6	**7.6**	**7.7** 3.5%	**7.3** 1.8%	**7.2** 2.2%	**7.2** 1.6%	**7.3** 2.1%	**7.2** 2.3%
	8.7	**8.6** 2.0%	**7.5** 0.9%	**7.3** 1.7%	**7.4** 1.1%	**7.4** 1.3%	**7.4** 1.5%
	9.1	**9.1** 0.5%	**7.8** 2.0%	**7.5** 1.1%	**7.5** 0.9%	**7.5** 1.3%	**7.5** 1.3%
	N/A	**10.1** 0.4%	**9.6** (test terminated) 1.0%				

Table 6. Mean values of pH (n=4) and coefficient of variation (%) for pH declines observed in Expts. E and F during *Daphnia magna* 48h acute, static toxicity tests on three pH-adjusted effluent samples (Trials 4-6, April 4, and May 12, 1997) from the INCO-Copper Cliff Waste Water Treatment Plant.

pH AT ELAPSED TIMES DURING TOXICITY TESTS

		Daphnia Experiment E			*Daphnia* Experiment F		
Sample	**Target pH**	**0h**	**24h**	**48h**	**0h**	**24h**	**48h**
TRIAL 4	**7.6**	**7.4** 1.8%	**7.3** 0.7%	**7.2** 0.4%	**7.2** 1.4%	**7.2** 0.4%	**7.1** 0.6%
	8.7	**8.1** 1.8%	**7.8** 1.7%	**7.5** 1.2%	**7.9** 0.6%	**7.7** 1.5%	**7.4** 1.5%
	9.1	**8.7** 0.8%	**8.5** 1.6%	**8.0** 2.5%	**8.6** 1.3%	**8.4** 1.4%	**7.9** 1.5%
	N/A	**9.8** 0.5%	**9.5** 1.6%	**9.1** 2.2%	**9.7** 0.5%	**9.6** 1.1%	**9.2** 1.4%
TRIAL 5	**7.6**	**7.4** 4.4%	**7.3** 4.1%	**7.1** 3.4%	**7.0** 2.3%	**6.9** 1.6%	**6.9** 1.5%
	8.7	**8.3** 1.4%	**8.1** 1.0%	**7.7** 1.6%	**8.2** 1.8%	**7.9** 1.5%	**7.5** 1.3%
	9.1	**8.8** 0.5%	**8.5** 1.2%	**8.2** 3.4%	**9.0** 1.7%	**8.6** 1.3%	**8.3** 1.4%
	N/A	**10.3** 0.3%	**10.1** 1.1%	**9.8** 2.0%	**10.3** 0.9%	**10.1** 1.2%	**10.0** 2.0%
TRIAL 6	**7.6**	**7.5** 2.7%	**7.3** 2.3%	**7.2** 0.9%	**7.2** 1.6%	**7.1** 0.9%	**7.2** 0.7%
	8.7	**8.4** 1.2%	**7.9** 1.0%	**7.5** 1.6%	**8.0** 2.5%	**7.7** 1.4%	**7.5** 9.5%
	9.1	**8.9** 0.9%	**8.5** 1.6%	**8.2** 2.0%	**8.6** 1.0%	**8.3** 1.6%	**7.9** 1.7%
	N/A	**9.9** 0.9%	**9.5** 1.6%	**9.2** 1.9%	**9.6** 0.9%	**9.4** 1.3%	**9.2** 0.2%

Thus, it was apparent that interpretation of mortalities in the two test organisms should be examined separately.

3.3.4 Mortality and pH

Since pH declines usually occurred during the progress of a toxicity test, and mortalities confirmed were determined at widely separated time intervals during each test, any observed association of pH with mortality rates could not be highly accurate. Nevertheless, for rainbow trout, the data indicated that 50% or greater mortality would be observed whenever pH at t=0 was approximately 9.5 or higher (Figure 9). For *Daphnia* tests, the possible relationship between pH and mortality was examined using the median pH for the selected time frame of 0h - 48h. Thus, it was interpolated that a pH of approximately 9.0 or higher would be associated with *Daphnia* mortality rates of 50% or greater in both filtered and non-filtered effluents (Figure 10).

3.3.5 Ammonia and toxicity

Non-ionized ammonia was not determined by direct chemical analysis, but by indirect calculations that requires data on temperature, pH, and total ammonia/ium (Emerson *et al* 1975). These particular parameters were routinely recorded throughout each bioassay, hence the Emerson equation could be applied to all circumstances and the expected concentration of free ammonia was calculated for each individual trout and *Daphnia* test.

Sample temperature (+/- 1.0 ^{o}C, Appendix B) did not differ significantly throughout the toxicity tests. Therefore, temperatures of 15 ^{o}C for trout and 20 ^{o}C for *Daphnia* were used in the Emerson equation. As expected, total ammonia/ium varied significantly from trial to trial. Also comparisons of pre-test with post-test data on total ammonia/ium suggested that total ammonia/ium concentrations changed little if any during the bioassays (Appendix I, II, VII, and IX). Thus, it seemed most suitable to use the means obtained from initial ammonia/ium data based on total concentrations for each separate trial to calculate non-ionized ammonia (Table 1a).

Figure 9. Scattergram of results from 96h rainbow trout static toxicity tests on CCWWTP effluents (fall 1995 and spring 1997), showing the relationship between mean mortality rate and mean effluent pH at elapsed time of 0h. Data on pH is plotted for experiments A, B, and C (n=1, '95) and E (n=4, '97).

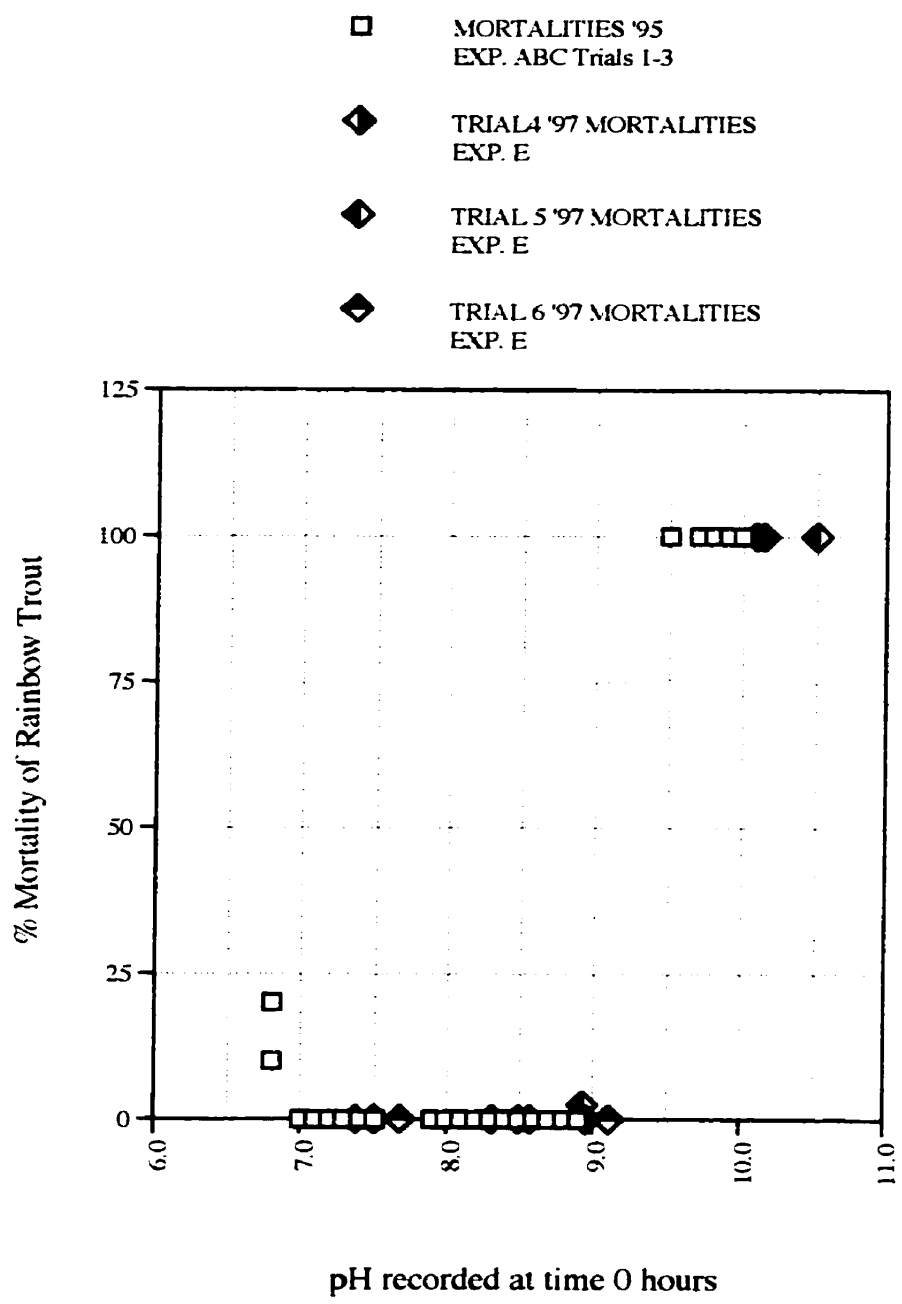
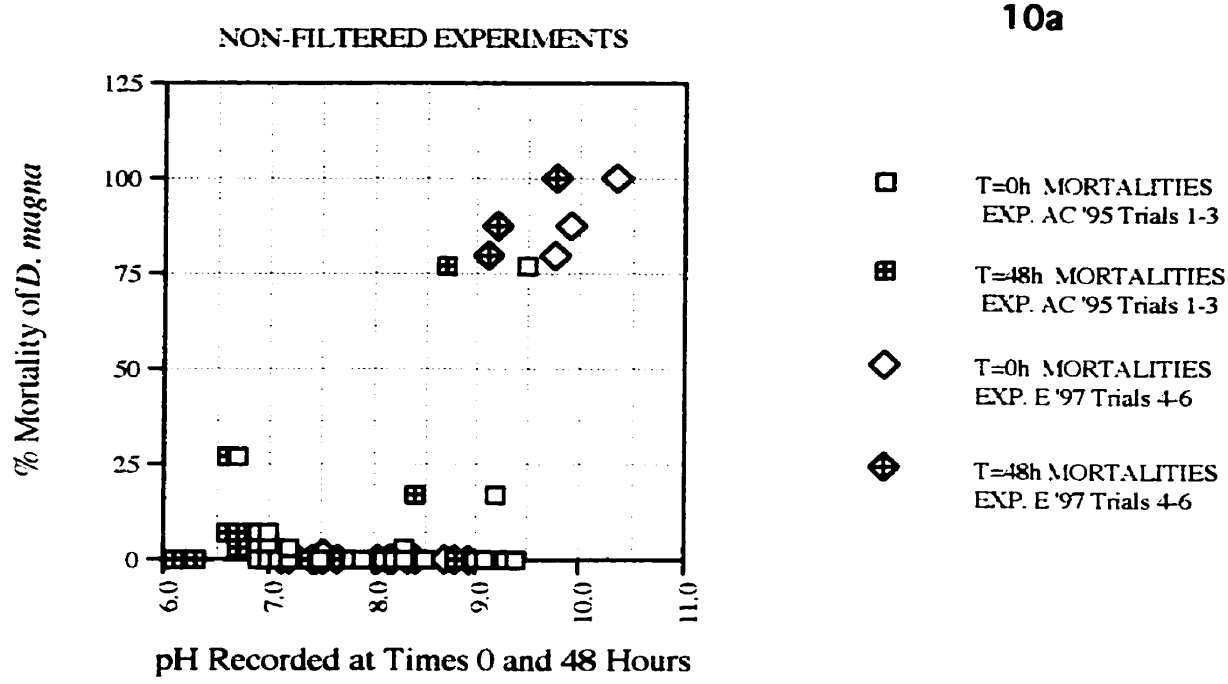
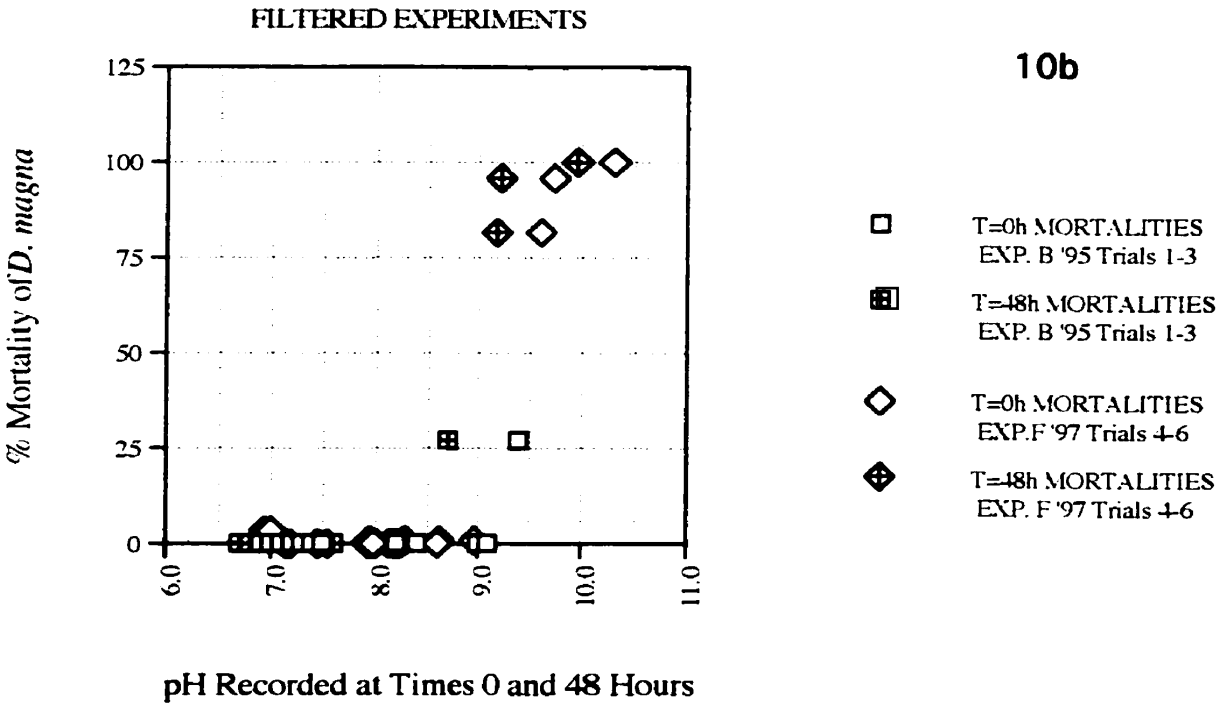

MORTALITIES '95
EXP. ABC Trials 1-3
TRIAL4 '97 MORTALITIES
EXP. E
TRIAL 5 '97 MORTALITIES
EXP. E
TRIAL 6 '97 MORTALITIES
EXP. E
% Mortality of Rainbow Trout
125
100
75
50
25
0
6.0
7.0
8.0
9.0
10.0
11.0
pH recorded at time 0 hours

Figure 10. Scattergram of results from 48h *D. magna* static toxicity tests on CCWWTP effluents (fall 1995 and spring 1997), showing the relationship between mean mortality rate and mean effluent pH at elapsed times of 0h and 48h. Data is plotted for both non filtered [experiments A and C (n=1, '95) and E (n=4, '97)] and filtered (0.45 μm) effluent samples [experiments B (n=1, '95) and F (n=4, '97)].

10a


NON-FILTERED EXPERIMENTS
% Mortality of D. magna
125
100
75
50
25
0
6.0
7.0
8.0
9.0
10.0
11.0
pH Recorded at Times 0 and 48 Hours
T=0h MORTALITIES EXP. AC '95 Trials 1-3
T=48h MORTALITIES EXP. AC '95 Trials 1-3
T=0h MORTALITIES EXP. E '97 Trials 4-6
T=48h MORTALITIES EXP. E '97 Trials 4-6

10b


FILTERED EXPERIMENTS
% Mortality of D. magna
125
100
75
50
25
0
6.0
7.0
8.0
9.0
10.0
11.0
pH Recorded at Times 0 and 48 Hours
T=0h MORTALITIES EXP. B '95 Trials 1-3
T=48h MORTALITIES EXP. B '95 Trials 1-3
T=0h MORTALITIES EXP.F '97 Trials 4-6
T=48h MORTALITIES EXP. F '97 Trials 4-6

Values of pH representing the periods critical to mortality and stress (0h for trout; 0h and 48h for *Daphnia*) were used to calculate ammonia exposure concentrations. Based on calculations, elevated levels of ammonia were associated with high mortality rates in alkaline effluents for both trout and *Daphnia* bioassays. More specifically, 50% or higher mortality was observed in trout tests where non-ionized ammonia levels had been at or above approximately 3.0 mg/L (Figure 11). *Daphnia* toxicity showed a similar relationship between elevated ammonia in alkaline effluents and high mortality. As a result of utilizing the time frames of 0h and 48h, the median concentration of ammonia calculated was used as the predictor of toxicity. It was determined that an approximate concentration of 2.5 mg/L or higher ammonia had been associated with 50% or greater mortality in all *Daphnia* tests examined (Figure 12).

3.4 Experiment D: Aeration and Carbonate Studies

3.4.1 Quality assurance

Bulk samples taken from the Copper Cliff Waste Water Treatment facility for each trial date were determined to have an initial pH > 10.0. Trial 11 bulk effluent sample was higher in pH (11.1 @ 24 ^{o}C) than trial 10 (10.8 @ 24 ^{o}C) (Appendix XIII). Although it was not intended to ensure absolute consistency within warm and cold temperature treatments during the course of the 96 h testing period for both warm and cold adjusted samples, the temperature variation were determined to be relatively low. In fact, warm temperature samples were found to have a mean temperature of 24.0 ^{o}C (+/- 1.5 ^{o}C, n=64) for both trials 10 and 11, and cold acclimated samples had a mean temperature of 4.0 ^{o}C (+/- 2.0 ^{o}C, n=64).

Measurements of pH over the 96 h time frame for each set of replicated effluent tests (n=4) indicated highly consistent results. Other than two instances observed in cold adjusted samples which were subjected to regular air (standard error 0.13 and 0.16 pH units), the standard error for pH was determined to be < 0.1 pH units (n=4) in all other time frames for the two temperature modified treatments.

Figure 11. Scattergram of results from 96h rainbow trout static toxicity tests on CCWWTP effluents (fall 1995 and spring 1997), showing the relationship between mean mortality rate and the calculated mean concentration of non-ionized ammonia at elapsed time of 0h. Data on non-ionized ammonia is plotted for experiments A, B, and C (n=1, '95) and E (n=4, '97).

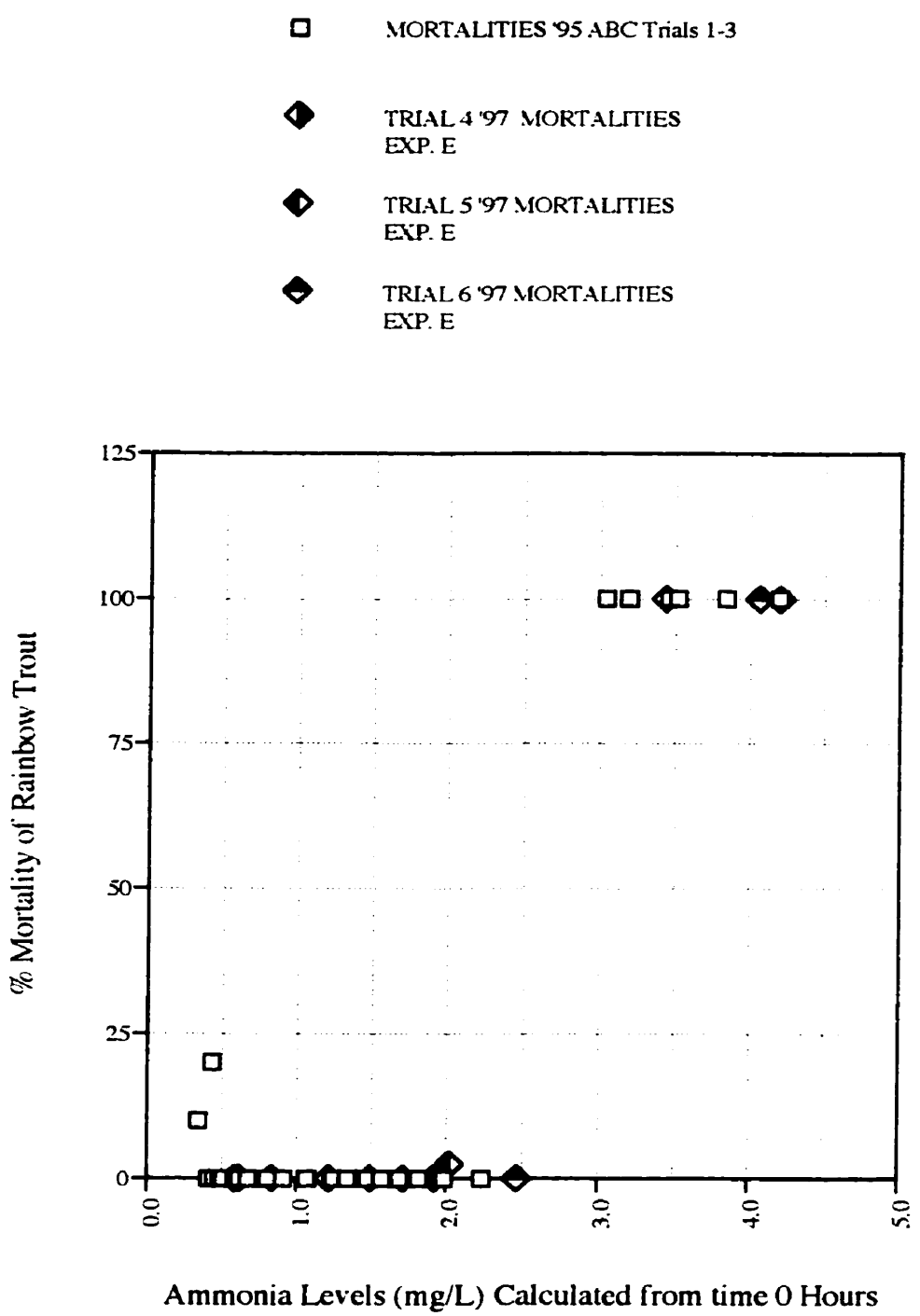
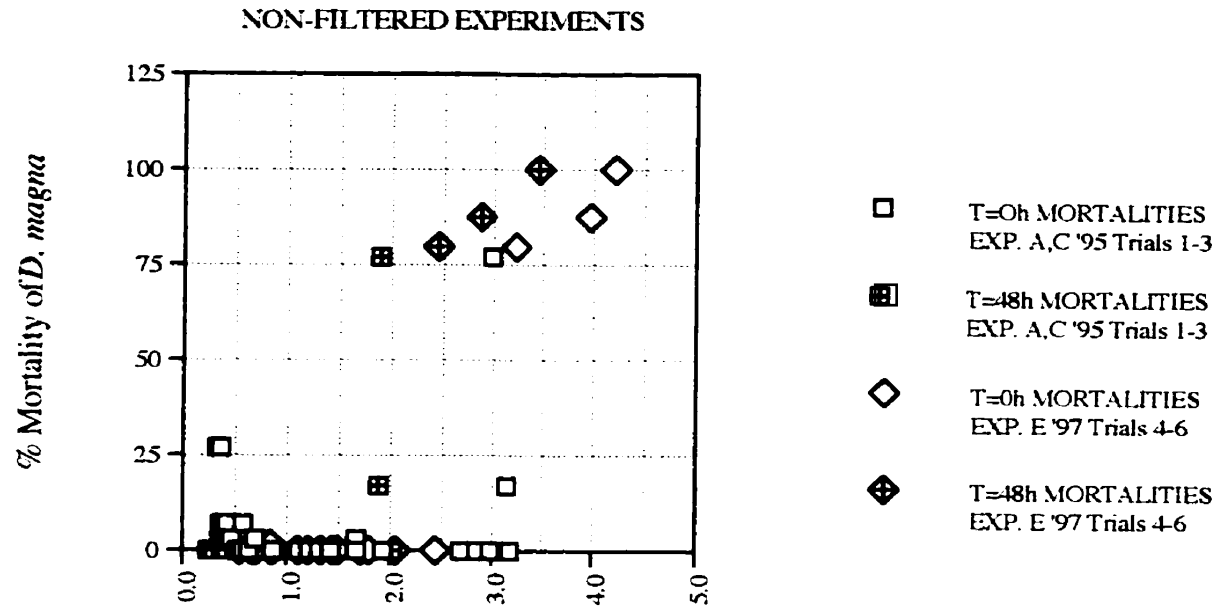

MORTALITIES '95 ABC Trials 1-3
TRIAL 4 '97 MORTALITIES EXP. E
TRIAL 5 '97 MORTALITIES EXP. E
TRIAL 6 '97 MORTALITIES EXP. E
% Mortality of Rainbow Trout
125
100
75
50
25
0
0.0
1.0
2.0
3.0
4.0
5.0
Ammonia Levels (mg/L) Calculated from time 0 Hours

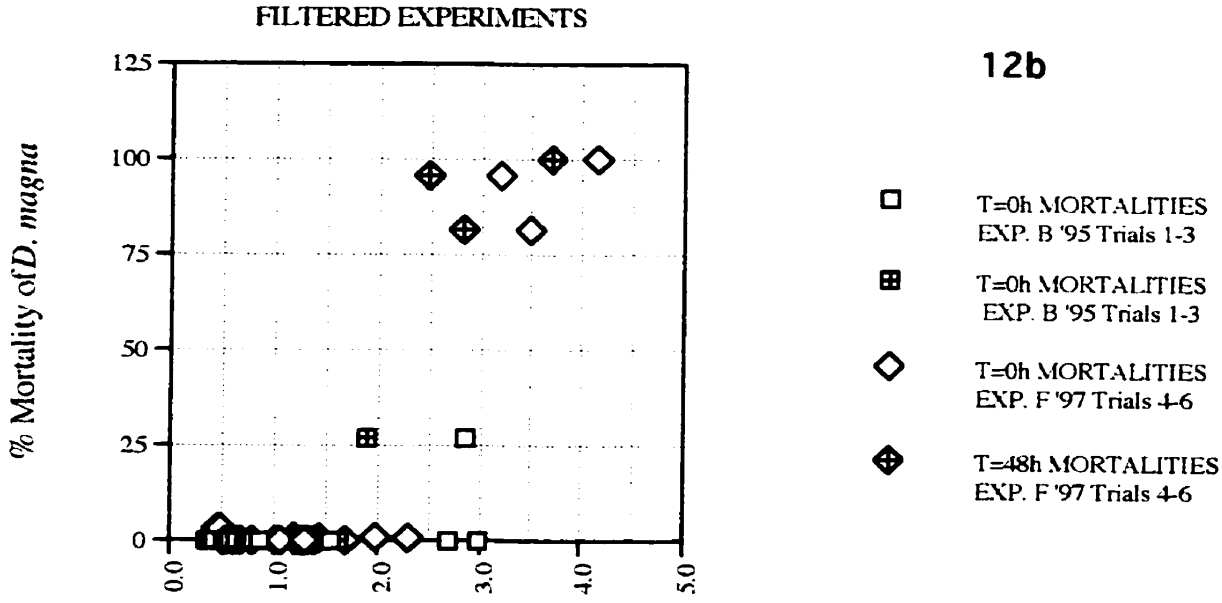
Figure 12. Scattergram of results from 48h, static, *D. magna* toxicity tests on CCWWTP effluents (fall 1995 and spring 1997), showing the relationship between mean mortality rates and calculated mean concentrations of non-ionized ammonia at elapsed times of 0h and 48h. Data is plotted for both filtered [experiments A and C, (n=1, '95) and E, (n=4, '97)] and filtered (0.45 μm) effluent samples [experiments B, (n=1, '95) and F, (n=4, '97)].

12a



Ammonia Levels (mg/L) Calculated from Times 0 and 48 Hours

12b



Ammonia Levels (mg/L) Calculated from Times 0 and 48 Hours

3.4.2 Examination of aerated effluents

At initiation of each aeration test for warm and cold adjusted conditions, it was noted that samples at 4°C were typically 0.5 pH units higher than the warm sample counterparts (24 °C) (Figure 13). Sealed samples and those subjected to air passed through the acscarite® column showed negligible deviation in pH regardless of temperature conditions over the course 96 h for both trials. However, samples subjected to regular aeration in both temperature conditions, showed a significant decline in pH over time for the first 24 h of testing. Measurements of pH taken from 48 h onward were essentially stable at circumneutral pH levels (Figure 13).

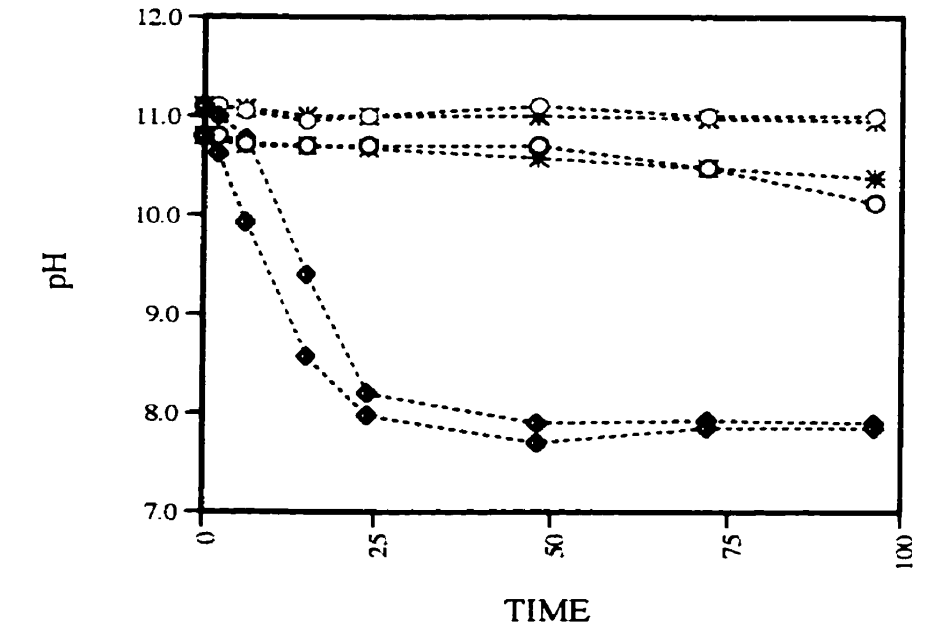
3.4.3 Examination of Carbonate titrations

Titration of alkaline effluents with 0.5 M sodium bicarbonate revealed an initial decline in pH as the amount of bicarbonate increased. As the titrations progressed, pH showed stability at circumneutral level regardless of several further additions of 0.5 M sodium carbonate to the effluent samples (Appendix XIV). A scattergram of the $\log_{10}$ concentration of bicarbonate added to effluent samples indicated a high correlation with a decease in pH for all samples investigated. The correlation coefficient value (r^2) for the relationship was determined to be 0.995 (Figure 14).

Figure 13. Measurements of pH over 96 hours for effluent samples collected from the Copper Cliff Waste Water Treatment Plant in 1998. Effluent samples were divided into replicated samples (n=4) and subjected to sealed, aerated, and carbon dioxide absent aerated samples under room temperature (24^{o}C +/-1.5) and cold acclimated (4 ^{o}C +/-2.0) conditions. Standard error bars were <0.16 pH units.

ROOM TEMPERATURE

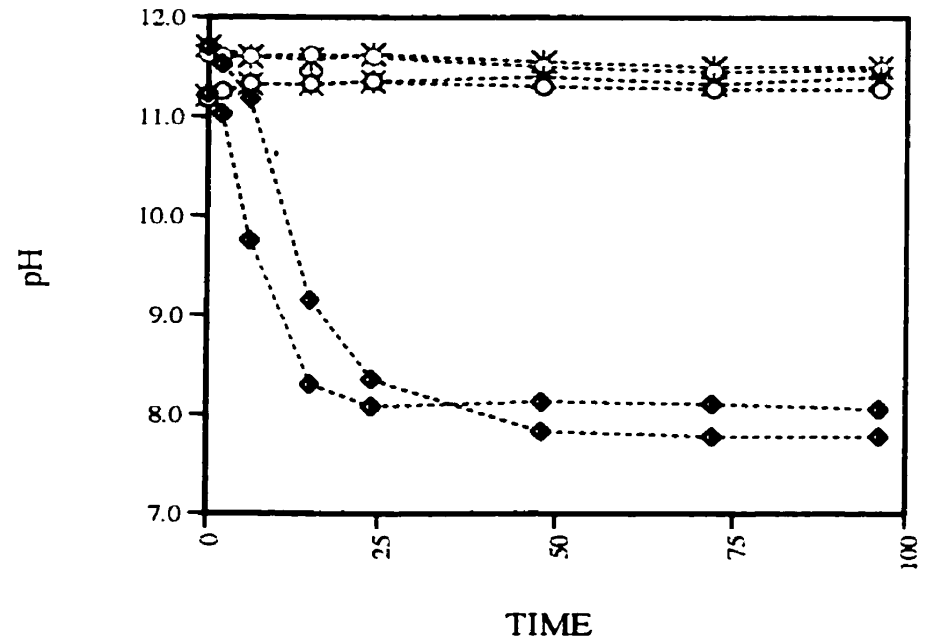
13a



AIR Trials 10&11 NO CO_2 Trials 10&11 SEALED Trials 10&11

COLD CHAMBER

13b



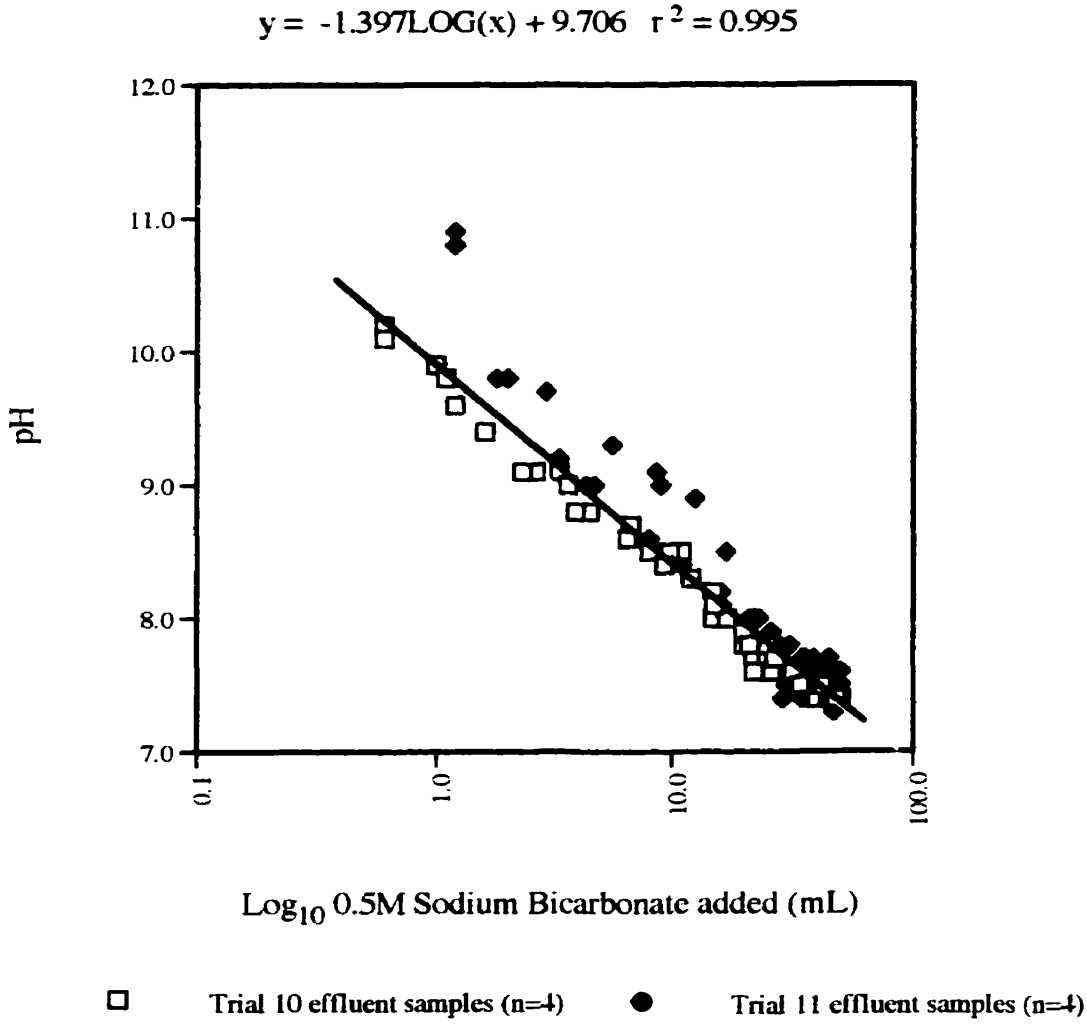


Figure 14. Scattergram of pH measured in each 400 mL effluent sample from the CCWWTP, as 0.5M sodium bicarbonate (mL, Log_{10}) was titrated via a 50 mL burette. Replicate effluent samples (n=4) were for each of trial 10 and 11 for the dates of June 1 and July 6, 1998 respectively . Correlation coefficient r^2=0.995

4.0 DISCUSSION

4.1 Quality Control of Study

4.1.1 Design

INCO was interested in utilizing sulfuric acid from its local recovery systems to lower effluent pH in the most efficient manner possible, such that no toxicity test failures would occur in undiluted effluent. Past research on effluent toxicity mainly examined the toxicity in the alkaline effluents, and contrasted the results with those from pH modified effluents at neutral pH or lower (Aquatic Sciences 1995; B.A.R. Environmental Inc. 1993; Holtze *et al.* 1989). In these studies, however, chemical data on the experimentally altered effluents were frequently unavailable. Thus, the data recorded in previous studies, did not allow for the thorough investigation of the agents and circumstances of toxicity.

This project was designed to employ the routine procedures involved in producing data for INCO's regulatory and monitoring needs. In this manner, it was ensured the conclusions derived from this study would be relevant for understanding previous experiences with effluent toxicity. This approach was also based on the judgment that INCO's routine procedures would provide highly satisfactory data.

4.1.2 Chemical and toxicity test variability

Even though high quality data were expected from INCO's analytical laboratory and from Aquatic Sciences Inc., it was necessary to assess the quality of the data with great care, especially with regard to the magnitude of any bias in chemical and analytical observations. Through the routine use of certified reference standards, spiked, and blank samples, by the analytical staff, excellent quality assurance and control was achieved. Precision of the data was verified to be of high quality as demonstrated though low variation (< 5.0%) found by replication of effluent sample analysis (see section 3.1).

With the exception of pH and alkalinity, variation of chemistry in pH modified effluents from the same trial was found to be negligible (Appendix I and II). Confidences were increased in pre-test chemical data due to high reproducibility among replicate samples (see section 3.1). Thus, as the quality of analytical data was not in question, it was concluded that differences observed in chemical data examined among the six trials were a product of real effluent variation. Though variation was observed in pre-test to post-test comparisons for most chemical data, chemical changes were not considered relevant in understanding the causes of observed toxicity.

Assurance of quality of rainbow trout and *Daphnia magna* in bioassays were demonstrated through complete survival of test organisms in dechlorinated tap water bioassays (Appendix B). Standard reference toxicity tests using sodium chloride indicated no bias in the viability of trout and *Daphnia* used for bioassay testing. The predominance of toxicity test results that were either high (100 %) or nil (0%) in both trout and *Daphnia* tests, indicated that testing was excellent in terms of reproducibility and the lack of ambiguity in the responses (see section 3.2).

4.2 Effluent Toxicity

4.2.1 Trace heavy metals

By filtering effluent samples prior to toxicity testing, it was possible to separate soluble components in the effluent from insoluble filterable particulates. By separating particulate matter from effluent solution, it was feasible to assess possible relationships between both particulate and dissolved matter to effluent toxicity.

Most trace metal data were at or near detection limits in effluent samples and low variation among treatment pH adjustments was observed. As a result, the relationship of trace metal concentrations with mortality rates in effluent samples was difficult to assess. This difficulty was addressed in part by calculating effluent trace metal concentrations from data on metal concentrations in the filter residues extracted from larger volumes of effluent (Appendix X). Dissolved trace metals were eliminated as possible agents of toxicity because the relatively small quantities recorded were mostly found to be present in particulates (Appendix III and IV). In cases where lowered pH appeared to increase trace metal solubility no consistent tendency to increased toxicity was evident (see section 3.1.3). That is, trace metals captured in filter particulates were also eliminated as variables causing toxicity. Filtered and non-filtered alkaline effluents indicated no differences in mortality of test organisms (see section 3.2). This provided direction to examine the dissolved components in alkaline effluents, excluding dissolved trace metals, for the source(s) of toxicity

4.2.2 pH variability

By using sulfuric acid to marginally reduce the pH of alkaline effluents below the MISA maximum of 9.5, it was possible to sharply reduce toxicity of CCWWTP effluents to both rainbow trout and *Daphnia magna*. In contrast, without pH adjustments, the alkaline effluents consistently imposed a high level of toxicity on both organisms (see section 3.2). Unexplained differences in mortality rates among similar treated effluents, as observed in results of the preliminary study (Table 3, trial 1, experiments A and C, *Daphnia*) and past research [both trout and *Daphnia* (Aquatic Sciences 1995; B.A.R. Environmental Inc. 1993; Holtze *et al.* 1989)] were eliminated in the phase II study ,

apparently through consistent sample handling methodology. Previous inconsistencies in mortality rates, appeared to be attributable to variability in the spontaneous declines in pH that were persistent during the time following initial pH adjustment. Through consistent sample handling methodology, major variability in the pH decline rate was eliminated among replicated toxicity tests (Tables 5 and 6). Consistent methodology, however, did not halt the spontaneous decline of pH following initial pH measurements. Because pH was not constant, it was necessary to consider which of the available pH data were most pertinent to explain toxicity (see below).

4.2.3 pH and critical periods of mortality and stress

A specific series of facts allowed for the logical selection of pH observation times most appropriate for interpreting toxicity results. In summary: i) sample pH was typically lower at initiation of toxicity tests than periods of examination prior to bioassay initiation, ii) sample pH was usually higher early in test periods than upon test termination, and iii) as a result of requested additional monitoring of both pH and the behaviour of test organisms, it was reported that the viability of both trout and *Daphnia* was being compromised at early stages of acute testing. Thus, the pH level at or immediately prior to the period most critical to organism mortality and stress was pH at t=0h for trout and pH at t=0h and 24h for *Daphnia*.. Focusing on test conditions in these time periods provided a uniform method of examining effluent related toxicity.

4.2.4 Ammonia and pH related mortality

It was concluded that pH and ammonia were highly associated with effluent toxicity, and that slight lowering of effluent pH also lowered the concentration of non-ionized ammonia to concentrations which would not be expected to cause toxicity test failures [highest reported LC_{50} value=0.697 mg/L for trout; highest reported LC_{50} value=2.77 mg/L for *Daphnia*] (Alabaster and Lloyd 1980; Haywood 1983; Thurston *et al.* 1981a; U.S. EPA 1983). Ammonia being highly soluble (Gordon *et al.* 1972), neither total ammonia/ium nor pH should be influenced by filtration. Thus, the above conclusion was consistent with no differences being observed between mortality rates in filtered and non-filtered effluents, for either *Daphnia* or trout bioassays.

It was assumed that if ammonia was the primary agent of toxicity, species differences in mortality would be observed at specific concentrations of pH or ammonia/ium because rainbow trout and *D. magna* have different sensitivities to ammonia (Alabaster and Lloyd 1980; Haywood 1983; Thurston *et al.* 1981a; U. S. EPA 1983). It was not anticipated, however, that observed critical values of calculated ammonia [3.0 mg/L for trout and 2.5 mg/L for *Daphnia*] would be typically higher than the LC_{50} values reported in the literature (Alabaster and Lloyd 1980; Haywood 1983; Thurston *et al.* 1981a; U.S. EPA 1983). These discrepancies between established incipient lethal concentrations of ammonia and values observed in the present study, are believed to be the result of several factors. Although literature articles on ammonia toxicity to rainbow trout could confirm previous findings from similar studies (Alabaster and Lloyd 1980; Haywood 1983; Thurston *et al.* 1981a), only one reference could be found for reported ammonia toxicity values for *D. magna* (U. S. EPA 1983).

Thus, the reported LC_{50} toxic concentrations of non-ionized ammonia for the single *D. magna* article could not be supported by other work.

Recall that the equation used in this study to calculate the concentration of non-ionized ammonia was based on temperature, pH, and total ammonia/ium (Emerson *et al* 1975). Temperatures measured in toxicity test were deemed sufficiently accurate and precise for use in the equation, and varied little within or among tests. Ammonia degassing during testing was apparently insignificant, since no specific pre-test to post-test trend in total ammonia/ium could be identified, and since degassing was not expected. The solubility of ammonia in water (322 mg/L at 25 °C, Gordon *et al*. 1972) is higher than any ammonia concentrations observed in this study. Hence, as neither temperature nor total ammonia/ium data were considered problematic, but pH was unstable, it was likely that only pH instability could have contributed a bias to ammonia calculations. The equation for calculating non-ionized ammonia was derived exclusively for samples in which all independent variables were stable (Emerson *et al.* 1975). Therefore, while the estimations of relevant sample pH had a logical objective basis, it was uncertain how the use of pH data from samples with unstable pH would compromise the validity of the equation.

Published data on ammonia toxicity to various organisms was generally collected from experiments performed in solutions chemically similar to those of natural surface waters (Haywood 1983). Effluent examined from the CCWWTP, on the other hand, was quite unique in its composition and chemistry. Therefore, it is also possible that elevated tolerance of organisms to ammonia could be attributable in some unknown way to the unique chemistry of the effluent. Ammonia is well known to form complexes with other chemicals and elements, including the various heavy metals present in the Copper Cliff Treatment Plant effluent (Bjerrum 1957).

Such complexes may have low acute toxicity, but the ammonia could be freed during sample analysis. This would increase the recorded total ammonia/ium concentrations and increase the apparent tolerance of trout and *Daphnia* to ammonia.

4.3 The Influence of Carbon dioxide on pH Stability

Through a series of controlled experiments, it was demonstrated that spontaneous pH declines in alkaline effluents from the CCWWTP could be halted by isolating samples from carbon dioxide, in particular, by preventing prolonged atmospheric exposure, or by the removal of carbon dioxide from aeration air. Also, the high level of similarity in data between tests conducted at near freezing and at room temperature (see section 3.4.2) suggested that biological activity was not responsible for the observed decline in pH. For example, biological oxidation of thiosalts was rejected as a factor in the declining effluent pH during toxicity testing. Further to this conclusion, background chemistry on the second trial studied (trial 11) indicated a concentration of thiosalts below the analytical detection limits (< 5mg/L) (Appendix XII). This indicated that in at least trial 11 experiments, virtually no thiosulfate was present, nor available for oxidation to sulfuric acid.

It appeared that carbon dioxide availability had a definitive influence on pH stability in highly alkaline effluents, and this influence could be rendered consistent and reproducible through ensuring uniform exposure of effluents to the atmosphere. Although not quantitatively examined, the hypothesized role of carbon dioxide availability in controlling the stability of effluent pH was supported by the absence of pH reduction in the absence of carbon dioxide. It was further supported by the occurrence of pH declines by the addition of an aqueous ion source (sodium bicarbonate) (see section 3.4.3).

4.4 Summary

It was concluded that toxicity of the Copper Cliff Waste Water Treatment Plant alkaline effluent was primarily a function of excessive non-ionized ammonia and high pH. The wide range of chemical parameters analysed made it possible to consider, and generally reject, many effluent constituents (cations, anions, and trace metals), both total and dissolved as the possible source(s) of toxicity. The findings of this study further indicated that alkaline effluents from the Copper Cliff Waste Water Treatment facility could be rendered consistently non-toxic to both rainbow trout and *Daphnia magna* by marginally adjusting effluent pH to about pH 9.0, using sulfuric acid. Low variation in chemical concentrations among replicated experimental toxicity samples clearly demonstrated that previously reported discrepancies in testing, and consequent difficulties in bioassay interpretation, could be eliminated through improved methodology in respect to aeration protocols. The present study also provided quality information to interpret and confirm the source of toxicity, and to identify the times for sample analysis that were most pertinent to organism stress.

The isolation of effluent from carbon dioxide during aeration indicated that indeed differences in pH as measured over time were due to a carbon dioxide imbalance with the atmosphere that occurred because the effluents had been highly limed for a short time (2h) prior to collection. Periodic variability and inconsistency of pH data, as observed in the preliminary study, could be eliminated by handling and aerating all replicated samples in similar fashion. Because differences in toxicity results were demonstrated to be partially attributable to pH instability, it was apparent that consideration should be given to carbon dioxide equilibrium in all bioassays on recently limed alkaline effluents.

Unless they are known to be in equilibrium with atmospheric carbon dioxide, effluents of alkaline nature should be handled to ensure consistent exposure to atmospheric carbon dioxide in order to produce consistent results in toxicity investigations. This aspect of good practise for acute static bioassay tests has not been adequately discussed in the published literature to date.

4.5 Applications to INCO

From test results, it was concluded that by adjusting alkaline effluents from the Copper Cliff Waste Water Treatment Plant, to a pH < 9.0 [lower than the lethal level for one of the most pH sensitive organisms (*Daphnia*)], INCO would be in compliance with MISA regulations (EPA 1997). This would also ensure that ammonia concentrations are below the estimated level of toxicity [2.5 mg/L for the most sensitive organism (*Daphnia*)]. Adjustment of alkaline effluent using sulfuric acid was determined to be an effective method to modify pH. If alkaline effluent is modified according to these conclusions, future toxicity should be eliminated providing that effluent chemistry is similar to what was observed in this study.

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Toxicity testing of the effluent, conducted by Aquatic Sciences Inc., St. Catharines, Ontario, was organized by Kim Groombridge (Project Manager). Static 96 hour rainbow trout tests and 48 hour *Daphnia magna* tests were overseen by Gillian Shriner (Laboratory Supervisor).

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7.0 APPENDIX A

(CHEMICAL ANALYSES)

Appendix I. Chemical characteristics of experimental effluent samples from the Copper Cliff Waste Water Treatment Plant prior to toxicity testing. Sample Codes indicate Trials (1-3), Experiments (A, B, C), and pH Adjustments (NA/non-adjusted, 9.3, 8.8, 8.3, 7.8). Trials 1-3 refer to sampling dates Oct. 30, Nov. 6, Nov. 13, Dec. 4, and Dec. 11, 1995. Experiment B samples were aerated and filtered (0.45μm) prior to pH adjustment, Experiment C samples were aerated following pH adjustment but not pre-filtered, and Experiment A samples were neither pre-filtered nor aerated. Part of each sample was filtered (0.45μm) at analysis (dissolved/Dslvd), and part was analysed without filtration (Total). Alk. refers to total alkalinity, Cond. refers to specific conductivity, NHx refers to total ammonia/ium, and COD refers to chemical oxygen demand.

Sample Code	Anal.	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Alk. mg/L	SO_4 mg/L	Cl mg/L	Cond. μS/cm	NO_3 mg/L	NH_x mg/L	COD mg/L	S_2O_3 mg/L
1	A-NA Total	481	67	138	35	42	1729	91	2296	4.1	6.0	28	10
1	A-9.3 Total	468	66	137	35	18	1750	93	2290	4.3	6.0	18	10
1	A-8.8 Total	489	69	143	37	14	1782	91	2286	4.1	5.7	20	10
1	A-8.3 Total	501	70	146	37	12	1821	88	2282	4.2	5.7	18	10
1	A-7.8 Total	475	67	138	35	9	1765	90	2278	4.2	5.7	20	10
1	B-NA Total	500	71	148	38	40	1734	92	2276	4.2	5.5	27	10
1	B-9.3 Total	472	66	137	35	22	1766	92	2280	4.2	5.7	22	10
1	B-8.8 Total	487	68	141	36	16	1767	92	2274	4.2	5.7	25	10
1	B-8.3 Total	488	69	142	36	15	1730	91	2272	4.3	5.5	25	10
1	B-7.8 Total	489	69	144	37	13	1769	95	2268	4.3	5.7	29	10
1	C-NA Total	489	68	140	36	37	1746	95	2266	4.1	5.5	23	10
1	C-9.3 Total	482	67	138	35	21	1810	95	2278	4.4	5.5	34	10
1	C-8.8 Total	484	68	140	36	14	1801	97	2276	4.2	5.7	29	10
1	C-8.3 Total	489	69	144	37	13	1811	95	2270	4.3	5.5	22	10
1	C-7.8 Total	491	69	142	37	12	1811	100	2266	4.5	5.5	20	10
2	A-NA Total	432	70	138	38	36	1715	84	2266	4.7	7.2	40	15
2	A-9.3 Total	399	64	127	35	22	1725	77	2292	5.0	7.2	31	12
2	A-8.8 Total	445	72	142	39	21	1654	75	2298	4.8	7.2	38	12
2	A-8.3 Total	418	68	133	37	16	1786	86	2302	4.6	7.2	40	5
2	A-7.8 Total	425	68	135	37	0	1755	75	2290	4.4	7.2	43	5
2	B-NA Total	438	70	138	38	40	1667	77	2346	3.9	7.0	38	15
2	B-9.3 Total	421	68	134	37	26	1679	77	2332	4.4	7.0	36	12
2	B-8.8 Total	452	73	146	40	21	1733	82	2314	4.1	7.0	40	12
2	B-8.3 Total	427	69	138	38	20	1754	84	2316	3.8	7.0	38	11
2	B-7.8 Total	453	73	144	40	17	1706	69	2316	3.9	7.2	38	10
2	C-NA Total	418	68	135	37	35	1704	77	2354	4.1	7.0	38	14
2	C-9.3 Total	432	70	136	37	22	1762	78	2336	4.5	7.0	38	11
2	C-8.8 Total	432	70	137	37	19	1858	81	2320	4.4	7.5	38	9
2	C-8.3 Total	423	68	132	36	10	1761	77	2316	4.1	7.5	40	5
2	C-7.8 Total	428	69	135	37	3	1886	83	2310	4.8	7.5	40	5

Sample Code	Anal.	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Alk. mg/L	SO_4 mg/L	Cl mg/L	Cond. µS/cm	NO_3 mg/L	NH_x mg/L	COD mg/L	S_2O_3 mg/L
3	A-NA Total	452	74	136	39	40	1805	106	2384	5.1	6.8	18	22
3	A-9.3 Total	461	75	139	39	36	1835	104	2448	4.5	6.8	13	21
3	A-8.8 Total	429	70	128	36	32	1750	102	2438	5.6	6.8	16	21
3	A-8.3 Total	442	72	133	38	29	1825	107	2446	4.7	6.8	20	19
3	A-7.8 Total	445	72	134	38	28	1780	104	2402	4.4	6.8	20	22
3	B-NA Total	435	71	131	37	42	1705	102	2380	4.3	6.6	25	21
3	B-9.3 Total	439	71	133	38	33	1695	99	2358	4.2	6.6	25	20
3	B-8.8 Total	414	67	124	35	26	1645	96	2339	4.2	6.3	22	19
3	B-8.3 Total	442	72	134	38	28	1755	102	2364	4.5	6.6	22	20
3	B-7.8 Total	439	71	133	38	26	1740	103	2424	5.4	6.6	25	20
3	C-NA Total	432	71	132	37	38	1720	101	2370	4.6	6.6	25	20
3	C-9.3 Total	442	72	133	37	34	1760	97	2444	4.2	6.6	25	19
3	C-8.8 Total	427	70	129	36	34	1730	103	2436	5.7	6.3	27	20
3	C-8.3 Total	450	73	135	38	31	1820	107	2444	4.6	6.3	25	20
3	C-7.8 Total	442	72	133	38	27	1845	106	2434	5.0	6.3	20	22

Sample Code	Anal.	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Alk. mg/L	SO_4 mg/L	Cl mg/L	Cond. µS/cm	NO_3 mg/L	NH_x mg/L	COD mg/L	S_2O_3 mg/L
1	A-NADslvd	489	68	142	36								
1	A-9.3Dslvd	479	68	140	36								
1	A-8.8Dslvd	484	68	140	36								
1	A-8.3Dslvd	495	69	142	36								
1	A-7.8Dslvd	471	67	138	35								
1	B-NADslvd	476	67	139	36								
1	B-9.3Dslvd	475	66	136	35								
1	B-8.8Dslvd	491	68	141	36								
1	B-8.3Dslvd	474	67	139	36								
1	B-7.8Dslvd	497	70	145	37								
1	C-NADslvd	487	68	140	36								
1	C-9.3Dslvd	479	66	136	35								
1	C-8.8Dslvd	488	69	142	37								
1	C-8.3Dslvd	479	68	140	36								
1	C-7.8Dslvd	491	68	140	36								
2	A-NADslvd	421	68	132	36								
2	A-9.3Dslvd	426	68	131	36								
2	A-8.8Dslvd	427	69	133	37								
2	A-8.3Dslvd	426	69	135	37								
2	A-7.8Dslvd	434	70	137	38								
2	B-NADslvd	432	70	136	37								
2	B-9.3Dslvd	423	68	131	36								
2	B-8.8Dslvd	445	72	140	38								
2	B-8.3Dslvd	419	68	131	36								
2	B-7.8Dslvd	420	68	130	36								
2	C-NADslvd	426	69	132	36								
2	C-9.3Dslvd	422	68	129	36								
2	C-8.8Dslvd	431	70	135	37								
2	C-8.3Dslvd	427	70	138	38								
2	C-7.8Dslvd	434	71	137	38								

Sample Code	Anal.	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Alk. mg/L	SO_4 mg/L	Cl mg/L	Cond. µS/cm	NO_3 mg/L	NH_x mg/L	COD mg/L	S_2O_3 mg/L
3 A-NA	Dslvd	431	71	132	37								
3 A-9.3	Dslvd	450	73	136	38								
3 A-8.8	Dslvd	432	70	131	37								
3 A-8.3	Dslvd	444	72	135	38								
3 A-7.8	Dslvd	427	70	129	36								
3 B-NA	Dslvd	422	69	130	37								
3 B-9.3	Dslvd	426	69	129	37								
3 B-8.8	Dslvd	404	66	123	35								
3 B-8.3	Dslvd	431	70	132	37								
3 B-7.8	Dslvd	433	71	131	37								
3 C-NA	Dslvd	448	74	138	39								
3 C-9.3	Dslvd	446	73	134	38								
3 C-8.8	Dslvd	438	72	133	37								
3 C-8.3	Dslvd	431	70	130	37								
3 C-7.8	Dslvd	432	70	130	37								

Appendix II. Chemical characteristics of experimental effluent samples from the Copper Cliff Waste Water Treatment Plant as analysed after trout toxicity testing. Sample Codes indicate Trials (1-3), Experiments (A, B, C), and pH Adjustments (NA/non-adjusted, 9.3, 8.8, 8.3, 7.8). Trials 1-3 refer to sampling dates Nov. 13, Dec. 4, and Dec. 11, 1995. Experiment B samples were aerated and filtered (0.45μm) prior to pH adjustment, Experiment C samples were aerated after pH adjustment but not pre-filtered, and Experiment A samples were neither aerated nor pre-filtered. Part of each sample was filtered (0.45μm) at analysis (dissolved/Dslvd), and part was analysed without filtration (Total). Alk. refers to total alkalinity, Cond. refers to specific conductivity, NHx refers to total ammonia/ium, and COD refers to chemical oxygen demand.

Sample Code	Anal.	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Alk. mg/L	SO_4 mg/L	Cl mg/L	Cond. μS/cm	NO_3 mg/L	NH_x mg/L	COD mg/L	S_2O_3 mg/L
1A-NA	Total	501	70	146	38	34	1829	83	2418	5.0	5.5	20	5
1A-9.3	Total	498	70	145	37	14	1788	115	2368	4.0	6.7	15	5
1A-8.8	Total	480	67	141	36	9	1870	102	2366	4.0	6.7	15	5
1A-8.3	Total	492	69	145	37	10	1845	124	2410	9.0	6.5	13	5
1A-7.8	Total	501	70	146	38	6	1917	123	2472	5.0	6.5	15	5
1B-NA	Total	482	68	141	36	33	1880	124	2402	4.0	6.2	13	5
1B-9.3	Total	508	71	149	38	18	1843	98	2396	7.0	6.5	20	5
1B-8.8	Total	483	68	141	36	14	1894	101	2394	3.0	6.5	15	5
1B-8.3	Total	492	69	144	37	12	1892	139	2402	1.0	6.5	22	5
1B-7.8	Total	496	70	146	37	9	1908	119	2400	1.0	6.5	20	5
1C-NA	Total	492	69	144	37	33	1918	132	2408	5.0	5.7	11	5
1C-9.3	Total	486	68	142	36	16	1916	104	2402	4.0	6.5	11	5
1C-8.8	Total	480	68	142	36	15	1862	94	2410	5.0	6.7	17	5
1C-8.3	Total	490	69	144	37	13	1910	120	2400	1.0	6.7	9	5
1C-7.8	Total	477	67	141	36	10	1903	134	2394	4.0	6.7	11	5
2A-NA	Total	438	72	140	39	23	1820	102	2394	4.0	6.3	11	5
2A-9.3	Total	423	69	134	37	15	1760	97	1184	3.6	6.8	13	6
2A-8.8	Total	425	70	136	37	18	1795	102	2404	3.7	6.8	13	5
2A-8.3	Total	419	69	134	37	12	1780	97	2400	3.6	6.8	13	5
2A-7.8	Total	423	70	135	37	0	1725	93	2418	3.7	6.8	11	5
2B-NA	Total	419	69	133	36	20	1775	100	2386	3.6	5.8	13	5
2B-9.3	Total	430	71	138	38	25	1720	95	2350	3.9	6.6	20	13
2B-8.8	Total	431	71	137	37	22	1730	94	2404	3.4	6.8	18	13
2B-8.3	Total	431	71	138	38	17	1735	99	2360	3.4	6.8	28	8
2B-7.8	Total	418	68	132	36	14	1765	99	2402	3.8	6.8	18	5
2C-NA	Total	420	69	135	37	16	1670	96	2338	3.7	6.1	18	5
2C-9.3	Total	423	69	134	37	18	1715	97	2402	3.9	6.6	13	5
2C-8.8	Total	426	70	136	37	23	1805	101	2404	3.9	6.6	25	5

Sample Code	Anal.	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Alk. mg/L	SO_4 mg/L	Cl mg/L	Cond. µS/cm	NO_3 mg/L	NH_x mg/L	COD mg/L	S_2O_3 mg/L
2C-8.3	Total	435	72	139	38	5	1740	97	2326	3.6	6.6	16	5
2C-7.8	Total	409	68	131	36	0	1800	101	2342	3.9	6.6	18	5
3A-NA	Total	428	71	131	37	18	1706	83	2474	4.4	6.7	30	5
3A-9.3	Total	446	73	135	39	7	1602	76	2526	4.5	7.3	28	5
3A-8.8	Total	438	72	133	38	5	1567	90	2532	4.5	7.3	20	5
3A-8.3	Total	449	74	138	39	3	1547	92	2550	4.5	7.3	25	5
3A-7.8	Total	443	73	136	39	7	1567	79	2532	4.8	7.3	30	5
3B-NA	Total	439	73	136	39	4	1642	82	2496	4.1	6.0	27	5
3B-9.3	Total	436	72	134	38	6	1524	72	2490	4.3	7.0	24	5
3B-8.8	Total	428	71	131	38	4	1497	83	2428	4.2	7.0	31	5
3B-8.3	Total	437	72	135	38	10	1566	82	2508	4.4	7.3	32	5
3B-7.8	Total	450	75	140	40	4	1596	82	2522	4.4	7.3	19	5
3C-NA	Total	444	74	138	39	22	1563	80	2520	4.5	6.7	25	5
3C-9.3	Total	436	72	135	38	7	1594	87	2530	4.4	7.0	21	5
3C-8.8	Total	453	75	141	40	7	1582	77	2520	4.1	6.7	32	5
3C-8.3	Total	452	75	140	40	2	1580	84	2548	4.3	7.0	28	5
3C-7.8	Total	437	73	136	39	7	1602	77	2532	4.5	7.0	27	5

Sample Code	Anal.	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Alk. mg/L	SO_4 mg/L	Cl mg/L	Cond. µS/cm	NO_3 mg/L	NH_x mg/L	COD mg/L	S_2O_3 mg/L
1A-NA	Dslvd	479	67	142	36								
1A-9.3	Dslvd	479	68	142	36								
1A-8.8	Dslvd	484	69	143	36								
1A-8.3	Dslvd	480	68	143	36								
1A-7.8	Dslvd	492	70	145	37								
1B-NA	Dslvd	494	70	146	37								
1B-9.3	Dslvd	478	68	142	36								
1B-8.8	Dslvd	479	68	142	36								
1B-8.3	Dslvd	508	72	151	39								
1B-7.8	Dslvd	487	69	144	37								
1C-NA	Dslvd	500	71	149	38								
1C-9.3	Dslvd	476	67	142	36								
1C-8.8	Dslvd	482	68	144	36								
1C-8.3	Dslvd	470	67	140	36								
1C-7.8	Dslvd	484	69	144	37								
2A-NA	Dslvd	411	68	133	37								
2A-9.3	Dslvd	419	69	134	37								
2A-8.8	Dslvd	427	70	137	37								
2A-8.3	Dslvd	421	69	135	37								
2A-7.8	Dslvd	425	70	135	37								
2B-NA	Dslvd	434	69	133	37								
2B-9.3	Dslvd	434	69	133	36								
2B-8.8	Dslvd	439	70	135	37								
2B-8.3	Dslvd	437	69	135	37								
2B-7.8	Dslvd	436	69	134	36								
2C-NA	Dslvd	434	69	135	37								
2C-9.3	Dslvd	442	70	136	37								
2C-8.8	Dslvd	438	70	135	37								
2C-8.3	Dslvd	429	68	132	36								
2C-7.8	Dslvd	450	72	140	38								

Sample Code	Anal.	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Alk. mg/L	SO_4 mg/L	Cl mg/L	Cond. µS/cm	NO_3 mg/L	NH_x mg/L	COD mg/L	S_2O_3 mg/L
3A-NA	Dslvd	444	74	138	40								
3A-9.3	Dslvd	445	74	138	39								
3A-8.8	Dslvd	454	75	141	40								
3A-8.3	Dslvd	438	73	136	39								
3A-7.8	Dslvd	430	71	134	38								
3B-NA	Dslvd	420	70	131	37								
3B-9.3	Dslvd	430	72	135	39								
3B-8.8	Dslvd	416	70	130	37								
3B-8.3	Dslvd	433	72	136	39								
3B-7.8	Dslvd	431	72	135	38								
3C-NA	Dslvd	428	72	134	38								
3C-9.3	Dslvd	431	72	134	38								
3C-8.8	Dslvd	429	72	134	38								
3C-8.3	Dslvd	420	70	132	38								
3C-7.8	Dslvd	442	74	139	40								

Appendix III. Trace metal concentrations in experimental effluent samples from the Copper Cliff Waste Water Treatment Plant prior to toxicity testing. Sample Codes indicate Trials (1 - 3), Experiments (A, B, C), and pH Adjustments (NA/non-adjusted, 9.3, 8.8, 8.3, 7.8). Trials 1-3 refer to sampling dates Nov. 13, Dec. 4, and Dec. 11, 1995. Experiment B samples were aerated and filtered (0.45μm) prior to pH adjustment, Experiment C samples were aerated after pH adjustment but not pre-filtered, and Experiment A samples were neither pre-filtered nor aerated. Part of each sample was filtered (0.45μm) at analysis (dissolved/Dslvd), and part was analysed without filtration (Total).

Sample Code		Anal.	Fe mg/L	Mn mg/L	Al mg/L	Ni mg/L	Cu mg/L	Zn mg/L	Co mg/L
	Blank	Total	0.007	0.000	0.008	0.009	0.084	0.005	0.005
1	A-NA	Total	0.125	0.023	0.120	0.275	0.023	0.010	0.010
1	A-9.3	Total	0.166	0.030	0.122	0.379	0.029	0.010	0.010
1	A-8.8	Total	0.149	0.032	0.119	0.393	0.026	0.010	0.010
1	A-8.3	Total	0.134	0.038	0.112	0.462	0.023	0.010	0.010
1	A-7.8	Total	0.139	0.042	0.111	0.523	0.028	0.010	0.010
1	B-NA	Total	0.013	0.001	0.097	0.057	0.002	0.010	0.010
1	B-9.3	Total	0.013	0.001	0.096	0.061	0.002	0.010	0.010
1	B-8.8	Total	0.013	0.001	0.088	0.057	0.002	0.010	0.010
1	B-8.3	Total	0.013	0.001	0.100	0.059	0.002	0.010	0.010
1	B-7.8	Total	0.013	0.001	0.107	0.059	0.002	0.010	0.010
1	C-NA	Total	0.513	0.062	0.179	0.749	0.080	0.010	0.010
1	C-9.3	Total	0.418	0.057	0.157	0.700	0.072	0.010	0.010
1	C-8.8	Total	0.160	0.035	0.128	0.429	0.026	0.010	0.010
1	C-8.3	Total	0.351	0.051	0.157	0.628	0.061	0.010	0.010
1	C-7.8	Total	0.145	0.036	0.123	0.465	0.025	0.010	0.010
	Blank	Total	0.020	0.000	0.008	0.009	0.005	0.007	0.005
2	A-NA	Total	0.216	0.030	0.168	0.276	0.057	0.035	0.012
2	A-9.3	Total	0.555	0.055	0.189	0.532	0.084	0.042	0.013
2	A-8.8	Total	0.316	0.048	0.182	0.433	0.070	0.036	0.011
2	A-8.3	Total	0.208	0.045	0.170	0.397	0.061	0.035	0.011
2	A-7.8	Total	0.309	0.054	0.177	0.486	0.073	0.040	0.015
2	B-NA	Total	0.023	0.007	0.153	0.134	0.034	0.046	0.010
2	B-9.3	Total	0.013	0.005	0.140	0.104	0.027	0.030	0.010
2	B-8.8	Total	0.013	0.007	0.145	0.124	0.032	0.032	0.010
2	B-8.3	Total	0.013	0.007	0.150	0.115	0.033	0.034	0.011
2	B-7.8	Total	0.013	0.007	0.158	0.127	0.035	0.039	0.010
2	C-NA	Total	0.176	0.029	0.160	0.286	0.096	0.039	0.010
2	C-9.3	Total	0.295	0.047	0.181	0.433	0.071	0.038	0.010
2	C-8.8	Total	0.374	0.051	0.177	0.479	0.075	0.037	0.014
2	C-8.3	Total	0.342	0.048	0.196	0.453	0.072	0.036	0.015
2	C-7.8	Total	0.284	0.048	0.188	0.445	0.070	0.037	0.012

Sample Code		Anal.	Fe mg/L	Mn mg/L	Al mg/L	Ni mg/L	Cu mg/L	Zn mg/L	Co mg/L
	Blank	Total	0.007	0.000	0.008	0.009	0.001	0.005	0.005
3	A-NA	Total	0.557	0.077	0.261	0.783	0.101	0.013	0.013
3	A-9.3	Total	0.797	0.097	0.285	0.986	0.120	0.014	0.017
3	A-8.8	Total	0.458	0.067	0.239	0.682	0.081	0.010	0.012
3	A-8.3	Total	0.380	0.060	0.228	0.595	0.071	0.010	0.010
3	A-7.8	Total	0.206	0.048	0.216	0.465	0.052	0.010	0.010
3	B-NA	Total	0.013	0.003	0.208	0.135	0.018	0.010	0.010
3	B-9.3	Total	0.013	0.003	0.200	0.129	0.019	0.010	0.010
3	B-8.8	Total	0.013	0.003	0.189	0.122	0.016	0.010	0.010
3	B-8.3	Total	0.054	0.004	0.202	0.136	0.020	0.050	0.010
3	B-7.8	Total	0.013	0.003	0.198	0.129	0.019	0.010	0.010
3	C-NA	Total	0.216	0.034	0.210	0.356	0.046	0.010	0.013
3	C-9.3	Total	0.418	0.062	0.234	0.643	0.075	0.010	0.010
3	C-8.8	Total	0.394	0.060	0.260	0.614	0.072	0.010	0.015
3	C-8.3	Total	0.467	0.062	0.232	0.620	0.074	0.010	0.013
3	C-7.8	Total	0.460	0.067	0.232	0.693	0.083	0.010	0.010
	Blank	Dslvd	0.007	0.000	0.008	0.009	0.042	0.005	0.005
1	A-NA	Dslvd	0.013	0.001	0.135	0.019	0.002	0.010	0.010
1	A-9.3	Dslvd	0.013	0.007	0.125	0.131	0.002	0.010	0.010
1	A-8.8	Dslvd	0.013	0.014	0.114	0.211	0.002	0.010	0.010
1	A-8.3	Dslvd	0.013	0.025	0.106	0.330	0.002	0.010	0.010
1	A-7.8	Dslvd	0.013	0.037	0.113	0.437	0.012	0.010	0.010
1	B-NA	Dslvd	0.013	0.001	0.110	0.055	0.002	0.010	0.010
1	B-9.3	Dslvd	0.013	0.001	0.105	0.063	0.002	0.010	0.010
1	B-8.8	Dslvd	0.013	0.001	0.115	0.065	0.002	0.010	0.010
1	B-8.3	Dslvd	0.013	0.001	0.101	0.056	0.002	0.010	0.010
1	B-7.8	Dslvd	0.013	0.001	0.106	0.138	0.017	0.010	0.010
1	C-NA	Dslvd	0.013	0.001	0.104	0.040	0.002	0.010	0.010
1	C-9.3	Dslvd	0.013	0.006	0.101	0.135	0.002	0.010	0.010
1	C-8.8	Dslvd	0.013	0.020	0.112	0.274	0.002	0.010	0.010
1	C-8.3	Dslvd	0.013	0.025	0.105	0.328	0.002	0.010	0.010
1	C-7.8	Dslvd	0.013	0.025	0.110	0.342	0.002	0.010	0.010

Sample Code		Anal.	Fe mg/L	Mn mg/L	Al mg/L	Ni mg/L	Cu mg/L	Zn mg/L	Co mg/L
	Blank	Dslvd	0.007	0.000	0.008	0.011	0.041	0.028	0.005
2	A-NA	Dslvd	0.013	0.001	0.163	0.052	0.034	0.034	0.011
2	A-9.3	Dslvd	0.013	0.027	0.174	0.219	0.036	0.033	0.013
2	A-8.8	Dslvd	0.013	0.029	0.175	0.236	0.038	0.047	0.013
2	A-8.3	Dslvd	0.013	0.038	0.170	0.325	0.047	0.036	0.012
2	A-7.8	Dslvd	0.018	0.052	0.176	0.459	0.070	0.049	0.015
2	B-NA	Dslvd	0.013	0.007	0.174	0.125	0.032	0.036	0.010
2	B-9.3	Dslvd	0.013	0.006	0.172	0.114	0.032	0.036	0.014
2	B-8.8	Dslvd	0.013	0.008	0.174	0.129	0.035	0.039	0.012
2	B-8.3	Dslvd	0.013	0.007	0.181	0.122	0.035	0.037	0.010
2	B-7.8	Dslvd	0.013	0.007	0.185	0.126	0.038	0.034	0.012
2	C-NA	Dslvd	0.058	0.002	0.184	0.053	0.029	0.034	0.010
2	C-9.3	Dslvd	0.013	0.026	0.188	0.234	0.036	0.036	0.014
2	C-8.8	Dslvd	0.013	0.033	0.178	0.274	0.040	0.036	0.016
2	C-8.3	Dslvd	0.013	0.038	0.156	0.331	0.045	0.036	0.010
2	C-7.8	Dslvd	0.013	0.042	0.177	0.371	0.052	0.035	0.014
	Blank	Dslvd	0.007	0.000	0.008	0.009	0.010	0.005	0.005
3	A-NA	Dslvd	0.013	0.001	0.194	0.037	0.013	0.010	0.010
3	A-9.3	Dslvd	0.013	0.012	0.229	0.146	0.015	0.010	0.010
3	A-8.8	Dslvd	0.013	0.015	0.198	0.171	0.015	0.010	0.010
3	A-8.3	Dslvd	0.015	0.020	0.199	0.204	0.016	0.010	0.010
3	A-7.8	Dslvd	0.013	0.024	0.191	0.233	0.018	0.010	0.012
3	B-NA	Dslvd	0.013	0.003	0.194	0.134	0.016	0.010	0.010
3	B-9.3	Dslvd	0.013	0.003	0.199	0.132	0.017	0.010	0.010
3	B-8.8	Dslvd	0.013	0.003	0.180	0.113	0.014	0.010	0.010
3	B-8.3	Dslvd	0.104	0.004	0.206	0.205	0.020	0.010	0.051
3	B-7.8	Dslvd	0.013	0.002	0.199	0.130	0.019	0.010	0.010
3	C-NA	Dslvd	0.013	0.001	0.205	0.064	0.012	0.010	0.010
3	C-9.3	Dslvd	0.013	0.015	0.198	0.182	0.016	0.010	0.010
3	C-8.8	Dslvd	0.013	0.015	0.190	0.173	0.014	0.010	0.010
3	C-8.3	Dslvd	0.013	0.018	0.196	0.212	0.016	0.010	0.010
3	C-7.8	Dslvd	1.174	0.037	0.219	1.776	0.050	0.010	0.898

Appendix IV. Trace metal concentrations in experimental effluent samples from the Copper Cliff Waste Water Treatment Plant as analysed after trout toxicity testing. Sample Codes indicate Trials (1 - 3), Experiments (A, B, C), and pH Adjustments (NA/non-adjusted, 9.3, 8.8, 8.3, 7.8). Trials 1-3 refer to sampling dates Nov. 13, Dec. 4, and Dec. 11, 1995. Experiment B samples were aerated and filtered (0.45μm) prior to pH adjustment, Experiment C samples were aerated following pH adjustment but not pre-filtered, and Experiment A samples were neither pre-filtered nor aerated. Part of each sample was filtered (0.45μm) at analysis (dissolved/Dslvd), and part was analysed without filtration (Total).

Sample Code		Anal.	Fe mg/L	Mn mg/L	Al mg/L	Ni mg/L	Cu mg/L	Zn mg/L	Co mg/L
	Blank	Total	0.007	0.000	0.008	0.009	0.001	0.005	0.005
1	A-NA	Total	0.026	0.006	0.173	0.082	0.018	0.011	0.010
1	A-9.3	Total	0.026	0.022	0.178	0.292	0.018	0.010	0.010
1	A-8.8	Total	0.025	0.029	0.170	0.357	0.021	0.010	0.010
1	A-8.3	Total	0.020	0.035	0.169	0.426	0.021	0.011	0.010
1	A-7.8	Total	0.043	0.046	0.187	0.529	0.039	0.010	0.010
1	B-NA	Total	0.013	0.001	0.164	0.060	0.008	0.010	0.010
1	B-9.3	Total	0.013	0.001	0.172	0.072	0.010	0.010	0.010
1	B-8.8	Total	0.013	0.001	0.161	0.060	0.009	0.010	0.010
1	B-8.3	Total	0.013	0.001	0.168	0.063	0.011	0.010	0.010
1	B-7.8	Total	0.031	0.002	0.170	0.077	0.009	0.010	0.010
1	C-NA	Total	0.013	0.010	0.169	0.148	0.012	0.010	0.010
1	C-9.3	Total	0.024	0.020	0.171	0.273	0.017	0.010	0.010
1	C-8.8	Total	0.063	0.027	0.169	0.349	0.017	0.010	0.010
1	C-8.3	Total	0.075	0.031	0.170	0.391	0.020	0.023	0.010
1	C-7.8	Total	0.023	0.031	0.168	0.394	0.021	0.010	0.010
	Blank	Total	0.007	0.000	0.008	0.009	0.064	0.039	0.005
2	A-NA	Total	0.040	0.016	0.192	0.149	0.044	0.020	0.010
2	A-9.3	Total	0.028	0.038	0.189	0.308	0.025	0.010	0.015
2	A-8.8	Total	0.018	0.038	0.182	0.306	0.023	0.010	0.010
2	A-8.3	Total	0.034	0.047	0.202	0.410	0.040	0.012	0.011
2	A-7.8	Total	0.148	0.058	0.236	0.529	0.073	0.040	0.011
2	B-NA	Total	0.013	0.008	0.200	0.113	0.021	0.010	0.010
2	B-9.3	Total	0.048	0.006	0.197	0.101	0.021	0.013	0.010
2	B-8.8	Total	0.013	0.007	0.204	0.113	0.021	0.010	0.010
2	B-8.3	Total	0.013	0.007	0.191	0.112	0.022	0.010	0.010
2	B-7.8	Total	0.013	0.007	0.198	0.112	0.022	0.010	0.010
2	C-NA	Total	0.024	0.013	0.198	0.115	0.020	0.010	0.010
2	C-9.3	Total	0.019	0.036	0.191	0.312	0.024	0.010	0.010
2	C-8.8	Total	0.036	0.041	0.190	0.349	0.029	0.013	0.012
2	C-8.3	Total	0.025	0.051	0.215	0.452	0.051	0.010	0.012
2	C-7.8	Total	0.071	0.051	0.225	0.458	0.063	0.010	0.016

Sample Code		Anal.	Fe mg/L	Mn mg/L	Al mg/L	Ni mg/L	Cu mg/L	Zn mg/L	Co mg/L
	Blank	Total	0.040	0.001	0.015	0.018	0.111	0.052	0.010
3	A-NA	Total	0.021	0.016	0.215	0.172	0.020	0.010	0.010
3	A-9.3	Total	0.027	0.037	0.222	0.368	0.028	0.010	0.010
3	A-8.8	Total	0.024	0.032	0.220	0.331	0.028	0.010	0.010
3	A-8.3	Total	0.019	0.044	0.216	0.423	0.028	0.010	0.010
3	A-7.8	Total	0.016	0.037	0.221	0.386	0.027	0.010	0.010
3	B-NA	Total	0.013	0.004	0.212	0.149	0.020	0.010	0.010
3	B-9.3	Total	0.013	0.003	0.207	0.150	0.013	0.010	0.010
3	B-8.8	Total	0.013	0.003	0.210	0.140	0.017	0.010	0.010
3	B-8.3	Total	0.013	0.004	0.213	0.148	0.023	0.010	0.010
3	B-7.8	Total	0.013	0.003	0.220	0.152	0.025	0.010	0.010
3	C-NA	Total	0.013	0.020	0.213	0.225	0.021	0.010	0.010
3	C-9.3	Total	0.024	0.034	0.214	0.357	0.021	0.010	0.010
3	C-8.8	Total	0.014	0.032	0.214	0.334	0.023	0.010	0.010
3	C-8.3	Total	0.027	0.043	0.226	0.420	0.030	0.010	0.010
3	C-7.8	Total	0.014	0.042	0.214	0.422	0.030	0.010	0.010
	Blank	Dslvd	0.007	0.000	0.008	0.009	0.019	0.005	0.005
1	A-NA	Dslvd	0.013	0.002	0.166	0.061	0.021	0.020	0.010
1	A-9.3	Dslvd	0.013	0.020	0.165	0.279	0.014	0.014	0.010
1	A-8.8	Dslvd	0.013	0.028	0.174	0.416	0.022	0.015	0.010
1	A-8.3	Dslvd	0.013	0.034	0.167	0.449	0.023	0.016	0.010
1	A-7.8	Dslvd	0.040	0.045	0.175	0.542	0.039	0.014	0.010
1	B-NA	Dslvd	0.014	0.001	0.168	0.060	0.008	0.010	0.010
1	B-9.3	Dslvd	0.013	0.001	0.161	0.059	0.008	0.010	0.010
1	B-8.8	Dslvd	0.013	0.001	0.159	0.056	0.009	0.012	0.010
1	B-8.3	Dslvd	0.013	0.001	0.172	0.065	0.010	0.010	0.010
1	B-7.8	Dslvd	0.013	0.001	0.174	0.059	0.009	0.010	0.010
1	C-NA	Dslvd	0.022	0.009	0.168	0.146	0.010	0.010	0.010
1	C-9.3	Dslvd	0.013	0.018	0.165	0.253	0.013	0.010	0.010
1	C-8.8	Dslvd	0.013	0.026	0.165	0.333	0.015	0.010	0.010
1	C-8.3	Dslvd	0.013	0.028	0.158	0.367	0.021	0.016	0.010
1	C-7.8	Dslvd	0.013	0.031	0.172	0.411	0.023	0.018	0.010
	Blank	Dslvd	0.007	0.000	0.008	0.009	0.010	0.008	0.005
2	A-NA	Dslvd	0.035	0.013	0.193	0.120	0.031	0.014	0.010
2	A-9.3	Dslvd	0.013	0.037	0.201	0.303	0.025	0.010	0.010
2	A-8.8	Dslvd	0.013	0.037	0.209	0.314	0.023	0.010	0.012
2	A-8.3	Dslvd	0.013	0.047	0.206	0.409	0.041	0.013	0.010
2	A-7.8	Dslvd	0.142	0.059	0.310	0.540	0.078	0.018	0.013
2	B-NA	Dslvd	0.013	0.009	0.232	0.114	0.030	0.010	0.011
2	B-9.3	Dslvd	0.013	0.006	0.198	0.102	0.029	0.010	0.010
2	B-8.8	Dslvd	0.013	0.007	0.201	0.114	0.028	0.010	0.010
2	B-8.3	Dslvd	0.013	0.007	0.202	0.113	0.029	0.010	0.010
2	B-7.8	Dslvd	0.013	0.006	0.199	0.108	0.035	0.010	0.010

Sample Code		Anal.	Fe mg/L	Mn mg/L	Al mg/L	Ni mg/L	Cu mg/L	Zn mg/L	Co mg/L
2	C-NA	Dslvd	0.013	0.010	0.518	0.100	0.024	0.010	0.010
2	C-9.3	Dslvd	0.013	0.037	0.202	0.306	0.031	0.010	0.010
2	C-8.8	Dslvd	0.013	0.040	0.199	0.331	0.033	0.014	0.011
2	C-8.3	Dslvd	0.013	0.048	0.211	0.428	0.054	0.010	0.011
2	C-7.8	Dslvd	0.068	0.055	0.256	0.491	0.080	0.010	0.010
	Blank	Dslvd	0.013	0.001	0.015	0.018	0.002	0.010	0.010
3	A-NA	Dslvd	0.016	0.016	0.222	0.181	0.047	0.017	0.010
3	A-9.3	Dslvd	0.019	0.037	0.223	0.368	0.021	0.010	0.010
3	A-8.8	Dslvd	0.023	0.033	0.221	0.341	0.026	0.010	0.010
3	A-8.3	Dslvd	0.017	0.043	0.217	0.412	0.028	0.010	0.010
3	A-7.8	Dslvd	0.025	0.038	0.252	0.383	0.029	0.010	0.010
3	B-NA	Dslvd	0.013	0.004	0.216	0.138	0.018	0.010	0.010
3	B-9.3	Dslvd	0.014	0.003	0.229	0.143	0.010	0.010	0.010
3	B-8.8	Dslvd	0.013	0.003	0.228	0.131	0.024	0.010	0.010
3	B-8.3	Dslvd	0.013	0.003	0.210	0.151	0.026	0.010	0.010
3	B-7.8	Dslvd	0.013	0.003	0.210	0.143	0.022	0.010	0.010
3	C-NA	Dslvd	0.013	0.019	0.211	0.207	0.018	0.010	0.010
3	C-9.3	Dslvd	0.013	0.034	0.209	0.361	0.019	0.010	0.010
3	C-8.8	Dslvd	0.021	0.030	0.208	0.321	0.019	0.010	0.010
3	C-8.3	Dslvd	0.040	0.040	0.213	0.387	0.029	0.010	0.010
3	C-7.8	Dslvd	0.013	0.043	0.222	0.434	0.026	0.010	0.010

Appendix V. Amount of 10% dilution of sulfuric acid added in mLs for samples that were adjusted to a pH target of 9.3, 8.8, 8.3, 7.8, and not adjusted (NA) for experiments A, B, and C. Values of pH were recorded upon initial pH adjustment, 36 h after pH adjustments at Copper Cliff, and upon return of samples after completion of bioassay tests (post). Trials 1-3 effluents were collected on Nov. 13, Dec. 4, and Dec. 11 of 1995 respectively. X in data set indicates missing values.

Trial& Expt.	Target pH	Dilute Acid Added (mL)	pH	pH (36 h)	pH (post)
1 A	NA	0.0	10.4	9.9	7.6
1 A	9.3	3.6	9.3	8.8	6.6
1 A	8.8	4.2	8.8	8.2	6.4
1 A	8.3	4.2	8.3	7.1	6.4
1 A	7.8	4.8	7.0	6.8	7.6
1 B	NA	0.0	10.4	9.8	7.1
1 B	9.3	2.6	9.2	8.9	6.9
1 B	8.8	3.6	8.7	8.3	6.5
1 B	8.3	3.7	8.3	7.7	6.5
1 B	7.8	4.0	7.3	7.1	6.4
1 C	NA	0.0	10.4	9.8	7.3
1 C	9.3	3.3	9.3	8.8	6.7
1 C	8.8	4.2	8.7	7.8	6.9
1 C	8.3	4.4	8.0	7.3	6.8
1 C	7.8	4.3	7.0	7.3	6.6
2 A	NA	0.0	X	9.7	6.9
2 A	9.3	3.5	X	8.3	6.7
2 A	8.8	4.0	X	8.3	6.8
2 A	8.3	4.2	X	7.5	6.5
2 A	7.8	4.7	X	6.7	3.9
2 B	NA	0.0	10.0	9.6	6.8
2 B	9.3	3.0	9.2	8.7	7.1
2 B	8.8	3.7	8.1	7.6	7.2
2 B	8.3	4.0	7.5	7.4	7.1
2 B	7.8	4.4	7.6	7.0	6.9
2 C	NA	0.0	X	9.6	7.1
2 C	9.3	3.5	X	8.2	6.7

Trial& Expt.	Target pH	Dilute Acid Added (mL)	pH	pH (36 h)	pH (post)
2 C	8.8	4.0	X	7.7	6.9
2 C	8.3	4.2	X	7.3	5.8
2 C	7.8	4.6	X	7.3	4.2
3 A	NA	0.0	X	9.8	6.0
3 A	9.3	3.0	X	9.1	5.3
3 A	8.8	3.5	X	8.9	5.5
3 A	8.3	3.8	X	8.7	5.4
3 A	7.8	4.3	X	8.5	5.8
3 B	NA	0.0	X	9.7	5.4
3 B	9.3	2.8	X	8.9	5.3
3 B	8.8	3.2	X	8.2	4.9
3 B	8.3	3.6	X	8.4	5.8
3 B	7.8	4.0	X	8.2	5.0
3 C	NA	0.0	X	9.6	6.4
3 C	9.3	3.0	X	8.9	5.3
3 C	8.8	3.5	X	8.9	5.5
3 C	8.3	3.8	X	8.6	4.6
3 C	7.8	4.2	X	8.3	5.6

trial 1 initial temperature 1.0°C
trial 2 initial temperature 1.0°C
trial 3 initial temperature 0.5°C

trial 1 initial dissolved oxygen not available
trial 2 initial dissolved oxygen 10.2 mg/L
trial 3 initial dissolved oxygen 12.0 mg/L

Appendix VI. Chemical characteristics of effluent samples (Trials 4-6) collected from the Copper Cliff Waste Water Treatment Plant on April 28, May 5, and May 12, 1997, as determined prior to toxicity testing.
Analyses are identified by Trial, replicate number, and subsample code number. Data classified as "diss" (dissolved) were filtered at 0.45μm prior to analyses and "total" samples were not filtered. COD refers to chemical oxygen demand, pH Lab denotes pH when analyses were started, and Cond. indicates specific conductivity. Total alkalinity is denoted by Alk.(t), and phenolphthalein alkalinity by Alk.(p). NHx indicates total ammonia /ammonium concentrations.

Trial Repl. Code		Ca mg/L	Na mg/L	Mg mg/L	K mg/L	NO3 mg/L	Cl mg/L	SO4 mg/L	S2O3 mg/L	COD mg/L	pH Lab mg/L	cond uS/cm	Alk. (p) mg/L	Alk. (t) mg/L	NHx mg/L
4.1-1	total	328	98	67	26	7	67	1201	33	52	9.7	1984	27	48	5.6
4.2-2	total	322	98	66	26	7	73	1080	34	62	9.7	2032	26	48	5.4
4.3-3	total	322	97	66	26	7	70	1070	35	60	9.6	2034	25	47	5.4
4.4-4	total	321	98	66	26	7	69	1070	34	48	9.6	2030	25	47	5.4
4.1-5	diss	322	97	66	25	7	73	1070	35	52	9.6	2028	27	52	5.2
4.2-6	diss	299	91	62	23	7	69	1025	34	50	9.6	2028	27	52	5.4
4.3-7	diss	327	99	67	26	7	79	1035	35	55	9.6	2032	26	52	5.2
4.4-8	diss	317	97	66	25	7	71	1033	34	55	9.6	2026	25	51	5.2
5-9	total	347	108	58	25	6	84	1169	35	50	10.1	2314	40	69	5.8
5-10	total	337	104	56	23	6	76	1170	35	47	10.1	2322	40	69	5.8
5-11	total	330	103	56	23	6	81	1165	35	54	10.0	2310	36	67	5.8
5-12	total	337	107	57	24	6	77	1163	35	42	9.9	2312	36	68	5.8
5-13	diss	340	105	57	24	6	85	1168	35	50	10.0	2322	39	73	5.8
5-14	diss	306	115	57	26	6	80	1168	36	54	9.9	2320	37	71	5.8
5-15	diss	336	106	56	24	6	99	1161	36	52	9.9	2312	37	71	5.8
5-16	diss	344	108	58	25	6	88	1168	36	45	9.9	2324	36	71	5.8

Trial Code	Anal.	Ca mg/L	Na mg/L	Mg mg/L	K mg/L	NO3 mg/L	Cl mg/L	SO4 mg/L	S2O3 mg/L	COD mg/L	pH Lab mg/L	cond us/cm	Alk. (p) mg/L	Alk. (t) mg/L	NHx mg/L
6-17	total	390	136	81	32	4	88	1377	33	53	9.7	2314	28	53	6.5
6-18	total	394	137	82	32	4	91	1359	34	53	9.6	2346	26	52	6.5
6-19	total	387	138	82	32	4	88	1363	33	49	9.6	2314	24	51	6.2
6-20	total	388	138	82	32	4	86	1368	33	53	9.6	2352	26	53	6.2
6-21	diss	392	140	82	32	4	95	1417	34	53	9.6	2336	27	56	6.2
6-22	diss	390	140	81	32	4	94	1416	33	49	9.6	2330	28	58	6.2
6-23	diss	386	137	80	32	4	94	1420	33	48	9.6	2322	27	56	6.0
6-24	diss	388	139	81	32	4	95	1427	33	49	9.6	2328	26	55	6.0

Appendix VII. Trace metal concentrations prior to toxicity testing for effluent samples (Trials 4-6) from the Copper Cliff Waste Water Treatment Plant on April 28, May 5, and May 12, 1997. Effluent samples that were filtered (0.45μm) at the time of analysis are referred to as "diss" (dissolved) and as "total" were not filtered. Detection limits were 0.0070 mg/L for Fe, 0.0003 mg/L for Mn, 0.0090 mg/L for Ni, and 0.0050 mg/L for Co and Zn.

Trial Code	Anal	Fe mg/L	Mn mg/L	Al mg/L	Ni mg/L	Zn mg/L	Cu mg/L	Co mg/L
4-1	total	0.3740	0.0189	0.1899	0.2509	0.0049	0.0560	0.0080
4-2	total	0.3709	0.0189	0.1889	0.2479	0.0049	0.0549	0.0080
4-3	total	0.3120	0.0160	0.1940	0.2189	0.0049	0.0520	0.0089
4-4	total	0.3720	0.0189	0.2010	0.2569	0.0049	0.0570	0.0049
4-5	diss	0.0065	0.0003	0.1599	0.0320	0.0049	0.0260	0.0048
4-6	diss	0.0065	0.0003	0.1609	0.0320	0.0049	0.0250	0.0049
4-7	diss	0.0065	0.0003	0.1739	0.0260	0.0049	0.0280	0.0048
4-8	diss	0.0065	0.0003	0.1679	0.0299	0.0049	0.0280	0.0048
5-9	total	0.3709	0.0219	0.1599	0.2179	0.0260	0.0480	0.0099
5-10	total	0.3339	0.0199	0.1630	0.2000	0.0049	0.0439	0.0080
5-11	total	0.3129	0.0179	0.1609	0.1819	0.0049	0.0430	0.0089
5-12	total	0.3379	0.0199	0.1650	0.1990	0.0049	0.0460	0.0109
5-13	diss	0.0130	0.0003	0.1500	0.0280	0.0049	0.0230	0.0048
5-14	diss	0.0065	0.0003	0.0549	0.0092	0.0049	0.0070	0.0048
5-15	diss	0.0065	0.0003	0.1439	0.0209	0.0049	0.0179	0.0048
5-16	diss	0.0065	0.0003	0.1459	0.0199	0.0049	0.0199	0.0048
6-17	total	0.5970	0.0450	0.2109	0.4120	0.0049	0.0850	0.0130
6-18	total	0.8360	0.0599	0.2020	0.5500	0.0049	0.0890	0.0140
6-19	total	0.9390	0.0659	0.2049	0.5960	0.0049	0.0939	0.0140
6-20	total	0.8450	0.0599	0.2049	0.5479	0.0049	0.0890	0.0140
6-21	diss	0.0109	0.0003	0.1469	0.0350	0.0049	0.0230	0.0048
6-22	diss	0.0120	0.0003	0.1529	0.0309	0.0049	0.0240	0.0048
6-23	diss	0.0080	0.0003	0.1490	0.0329	0.0049	0.0219	0.0048
6-24	diss	0.0080	0.0003	0.1379	0.0309	0.0049	0.0209	0.0048

Appendix VIII. Total ammonia/ammonium (NHx) and pH as measured in samples collected at 96h time frame of trout toxicity tests.
Values represent three trial samples from early spring 1997. Missing data for pH and ammonia/ammonium are indicated as an X.

Trial	Target pH	pH	NHx
4	NA	X	X
4	9.1	X	4.4
4	8.7	X	4.2
4	7.6	X	4.6
4	NA	X	X
4	9.1	X	4.6
4	8.7	X	5.4
4	7.6	X	5.4
4	NA	X	X
4	9.1	X	5.2
4	8.7	X	5.2
4	7.6	X	5.2
4	NA	X	X
4	9.1	X	5.0
4	8.7	X	5.0
4	7.6	X	5.0
5	NA	X	X
5	9.1	6.4	6.4
5	8.7	6.3	6.4
5	7.6	6.4	6.2
5	NA	X	X
5	9.1	6.1	6.2
5	8.7	5.8	6.4
5	7.6	5.9	6.2
5	NA	X	X
5	9.1	5.8	5.9
5	8.7	5.9	5.9
5	7.6	6.2	5.9

Trial	Target pH	pH	NHx
5	NA	X	X
5	9.1	6.3	5.9
5	8.7	5.9	6.2
5	7.6	6.2	6.2
6	NA	X	X
6	9.1	6.3	6.6
6	8.7	6.2	6.6
6	7.6	5.6	6.6
6	NA	X	X
6	9.1	6.3	6.6
6	8.7	6.0	6.9
6	7.6	5.9	6.6
6	NA	X	X
6	9.1	6.2	6.6
6	8.7	6.3	6.6
6	7.6	6.3	6.6
6	NA	X	X
6	9.1	6.4	6.4
6	8.7	6.3	6.6
6	7.6	6.4	6.6

Appendix IX. Total ammonia/ammonium (NHx) and pH as measured in samples collected at 48h elapsed time of *Daphnia magna* toxicity tests, Experiments E (not filtered) and F (filtered 0.45 μm). Values represent three trials from early spring 1997. Missing data for pH are indicated as as an X.

		Experiment E		Experiment F	
Trial	Target pH	pH	NHx	pH	NHx
4	NA	X	4.6	X	4.2
4	9.1	X	4.6	X	4.0
4	8.7	X	4.6	X	4.2
4	7.6	X	4.6	X	3.9
4	NA	X	4.4	X	4.2
4	9.1	X	4.4	X	3.9
4	8.7	X	4.4	X	4.2
4	7.6	X	4.4	X	3.9
4	NA	X	4.2	X	3.9
4	9.1	X	4.4	X	3.7
4	8.7	X	4.2	X	3.9
4	7.6	X	4.4	X	3.9
4	NA	X	4.4	X	3.7
4	9.1	X	4.4	X	3.7
4	8.7	X	4.4	X	3.9
4	7.6	X	4.2	X	3.5
5	NA	9.2	5.5	9.7	6.0
5	9.1	7.4	5.2	7.7	6.0
5	8.7	6.9	5.7	7.2	6.0
5	7.6	6.7	5.5	6.6	5.6
5	NA	9.4	5.5	9.7	5.8
5	9.1	7.1	5.5	7.9	6.0
5	8.7	6.7	5.5	7.2	5.6
5	7.6	6.5	5.5	6.9	6.0
5	NA	9.4	5.8	9.6	6.0
5	9.1	7.5	6.3	7.8	6.3
5	8.7	7.0	6.3	7.2	6.3
5	7.6	6.8	6.3	6.9	6.3

Trial	Target pH	Experiment E pH	Experiment E NHx	Experiment F pH	Experiment F NHx
5	NA	9.4	6.3	9.4	6.3
5	9.1	7.7	6.0	8.1	6.0
5	8.7	6.8	6.0	7.2	6.0
5	7.6	6.6	6.0	6.7	6.3
6	NA	8.8	5.9	8.8	5.0
6	9.1	6.5	5.9	7.1	5.5
6	8.7	6.0	6.2	6.9	5.5
6	7.6	6.3	6.2	6.8	5.5
6	NA	8.8	5.9	9.0	5.2
6	9.1	6.7	5.9	7.6	5.5
6	8.7	6.2	5.9	7.1	5.2
6	7.6	6.3	5.9	6.8	5.5
6	NA	8.9	5.7	9.0	5.0
6	9.1	6.6	5.9	7.4	5.2
6	8.7	6.3	5.7	7.1	5.5
6	7.6	6.3	5.7	6.9	5.2
6	NA	8.8	5.5	8.9	5.0
6	9.1	6.7	5.7	7.6	5.2
6	8.7	6.0	5.7	7.0	5.2
6	7.6	6.5	5.7	6.9	5.2

Appendix X. Total mass of each of 11 elements found in the effluent particulates collected by filtering (0.45μm) 8L effluent samples after pH adjustment (Experiment F). Sample codes indicate Trials 4-6 and identification numbers. Trials 4-6 are samples from April 28, May 5, and May 12, 1997. Target pH is adjustment to 7.6, 8.7, 9.1, or not adjusted.

Sample Code	Target pH	Ca (mg)	Mg (mg)	Na (mg)	K (mg)	Fe (mg)	Mn (mg)	Al (mg)	Ni (mg)	Cu (mg)	Zn (mg)	Co (mg)
4-SC117	N/A	2.025	2.893	0.344	0.123	3.513	0.176	0.190	2.006	0.271	0.055	0.040
4-SC118	9.1	2.555	1.972	0.221	0.082	2.792	0.122	0.131	1.401	0.241	0.044	0.028
4-SC119	8.7	8.444	5.043	0.371	0.126	6.425	0.255	0.348	2.891	0.509	0.071	0.062
4-SC120	7.6	2.230	1.190	0.218	0.080	2.470	0.076	0.122	0.966	0.164	0.021	0.018
4-SC121	N/A	2.013	2.704	0.320	0.108	3.213	0.162	0.176	1.845	0.254	0.052	0.037
4-SC122	9.1	2.891	2.018	0.273	0.094	2.820	0.119	0.131	1.373	0.205	0.042	0.028
4-SC123	8.7	2.867	2.058	0.270	0.092	2.897	0.115	0.141	1.322	0.203	0.035	0.027
4-SC124	7.6	2.282	1.087	0.292	0.097	2.206	0.065	0.109	0.831	0.142	0.020	0.015
4-SC125	N/A	1.745	2.298	0.284	0.097	2.718	0.139	0.148	1.580	0.222	0.043	0.031
4-SC126	9.1	3.414	2.186	0.316	0.108	2.935	0.128	0.142	1.463	0.223	0.049	0.029
4-SC127	8.7	2.466	1.854	0.259	0.091	2.561	0.111	0.126	1.274	0.251	0.032	0.025
4-SC128	7.6	2.577	1.067	0.313	0.110	2.416	0.062	0.117	0.809	0.145	0.023	0.015
4-SC129	N/A	2.092	2.680	0.342	0.119	3.122	0.158	0.171	1.807	0.253	0.049	0.036
4-SC130	9.1	6.543	4.408	0.390	0.129	5.063	0.218	0.269	2.450	0.360	0.065	0.052
4-SC131	8.7	2.585	1.795	0.217	0.079	2.572	0.109	0.123	1.259	0.191	0.030	0.025
4-SC132	7.6	2.315	0.902	0.296	0.123	2.445	0.052	0.117	0.721	0.137	0.018	0.014
5-SC217	N/A	2.518	5.634	0.228	0.074	3.759	0.218	0.219	1.987	0.310	0.038	0.055
5-SC218	9.1	2.315	2.612	0.247	0.079	3.049	0.143	0.165	1.256	0.213	0.044	0.038
5-SC219	8.7	1.411	1.202	0.222	0.073	2.119	0.081	0.100	0.726	0.132	0.024	0.022
5-SC220	7.6	1.277	0.374	0.305	0.097	1.737	0.031	0.079	0.341	0.096	0.012	0.011

Sample Code	Target pH	Ca (mg)	Mg (mg)	Na (mg)	K (mg)	Fe (mg)	Mn (mg)	Al (mg)	Ni (mg)	Cu (mg)	Zn (mg)	Co (mg)
5-SC221	N/A	3.119	5.953	0.362	0.115	3.900	0.226	0.227	2.065	0.291	0.042	0.057
5-SC222	9.1	1.782	2.025	0.206	0.070	2.244	0.114	0.117	0.962	0.190	0.031	0.029
5-SC223	8.7	1.513	1.378	0.245	0.082	2.074	0.089	0.101	0.759	0.165	0.025	0.023
5-SC224	7.6	1.185	0.527	0.221	0.073	2.062	0.049	0.103	0.491	0.099	0.015	0.016
5-SC225	N/A	2.673	5.647	0.245	0.083	3.720	0.218	0.215	1.988	0.285	0.042	0.055
5-SC226	9.1	2.019	2.082	0.232	0.073	2.348	0.118	0.123	0.998	0.176	0.031	0.030
5-SC227	8.7	2.094	2.029	0.215	0.074	3.068	0.124	0.162	1.085	0.199	0.032	0.033
5-SC228	7.6	0.985	0.410	0.163	0.058	1.854	0.039	0.093	0.397	0.078	0.011	0.013
5-SC229	N/A	2.801	5.274	0.312	0.097	3.425	0.200	0.198	1.829	0.257	0.038	0.051
5-SC230	9.1	1.675	1.720	0.176	0.065	1.962	0.097	0.100	0.825	0.170	0.027	0.025
5-SC231	8.7	2.154	2.121	0.213	0.071	3.051	0.130	0.162	1.133	0.207	0.034	0.034
5-SC232	7.6	1.131	0.526	0.180	0.061	2.115	0.05	0.107	0.500	0.096	0.016	0.016
6-SC317	N/A	8.263	7.955	0.000	0.118	6.107	0.448	0.383	3.781	0.505	0.059	0.085
6-SC318	9.1	11.840	7.889	0.000	0.151	6.871	0.472	0.418	3.977	0.546	0.073	0.091
6-SC319	8.7	13.770	9.679	0.000	0.132	9.190	0.613	0.552	5.135	0.734	0.090	0.119
6-SC320	7.6	10.270	6.707	0.000	0.118	8.287	0.457	0.496	3.964	0.674	0.073	0.092

Sample Code	Target pH	Ca (mg)	Mg (mg)	Na (mg)	K (mg)	Fe (mg)	Mn (mg)	Al (mg)	Ni (mg)	Cu (mg)	Zn (mg)	Co (mg)
6-SC321	N/A	10.830	10.360	0.000	0.129	7.779	0.555	0.492	4.708	0.634	0.075	0.107
6-SC322	9.1	13.380	9.133	0.000	0.137	7.756	0.532	0.476	4.479	0.620	0.085	0.103
6-SC323	8.7	15.110	10.000	0.000	0.192	9.413	0.615	0.572	5.154	0.737	0.095	0.121
6-SC324	7.6	11.320	7.285	0.000	0.124	8.992	0.495	0.540	4.288	0.713	0.083	0.100
6-SC325	N/A	10.720	9.747	0.000	0.168	7.325	0.523	0.463	4.43	0.582	0.074	0.101
6-SC326	9.1	10.880	7.026	0.000	0.129	5.985	0.419	0.370	3.513	0.483	0.069	0.081
6-SC327	8.7	11.650	7.731	0.000	0.115	7.455	0.494	0.456	4.123	0.603	0.077	0.096
6-SC328	7.6	11.010	7.211	0.000	0.124	8.507	0.490	0.519	4.185	0.687	0.081	0.098
6-SC329	N/A	6.874	5.883	0.000	0.145	4.476	0.350	0.272	2.898	0.392	0.050	0.064
6-SC330	9.1	12.500	7.968	0.000	0.122	6.898	0.480	0.420	4.015	0.554	0.080	0.092
6-SC331	8.7	12.490	8.128	0.000	0.126	7.764	0.513	0.474	4.279	0.611	0.083	0.100
6-SC332	7.6	13.390	8.559	0.000	0.152	10.000	0.567	0.612	4.854	0.801	0.092	0.115

Appendix XI. The final adjusted pH of CCWWTP effluents (Trials 4-6. 1997), and the volume of dilute (5%) sulfuric acid added, for samples that were firstly adjusted to a pH target of 7.6, 8.7, 9.1, or not adjusted (na), and subsequently either not filtered (Experiment E) or filtered (0.45μm; Experiment F). Trials 4-6 effluents were collected on April 28, May 5, and May 12, respectively. Code refers to sample identification number.

Experiment	Trial	Code	Initial pH Target	Dilute Acid Added (mL)	Final Adjusted pH
E	4	101	na	0.0	10.3
E	4	102	9.1	6.5	9.1
E	4	103	8.7	7.8	8.6
E	4	104	7.6	8.6	7.6
E	4	105	na	0.0	10.4
E	4	106	9.1	6.7	9.1
E	4	107	8.7	7.5	8.7
E	4	108	7.6	8.7	7.6
E	4	109	na	0.0	10.4
E	4	110	9.1	6.5	9.1
E	4	111	8.7	7.6	8.6
E	4	112	7.6	8.8	7.6
E	4	113	na	0.0	10.3
E	4	114	9.1	6.5	9.1
E	4	115	8.7	7.5	8.7
E	4	116	7.6	8.6	7.6
F	4	117	na	0.0	10.4
F	4	118	9.1	3.8	9.1
F	4	119	8.7	3.8	8.6
F	4	120	7.6	5.0	7.6
F	4	121	na	0.0	10.4
F	4	122	9.1	3.8	9.1
F	4	123	8.7	3.6	8.7
F	4	124	7.6	4.6	7.5
F	4	125	na	0.0	10.4
F	4	126	9.1	3.8	9.0
F	4	127	8.7	3.4	8.7
F	4	128	7.6	4.4	7.5
F	4	129	na	0.0	10.4
F	4	130	9.1	3.1	9.1
F	4	131	8.7	3.5	8.7
F	4	132	7.6	4.2	7.5

Experiment	Trial	Code	Initial pH Target	Dilute Acid Added (mL)	Final Adjusted pH
E	5	201	na	0.0	11.1
E	5	202	9.1	9.4	9.1
E	5	203	8.7	10.0	8.7
E	5	204	7.6	13.0	7.6
E	5	205	na	0.0	11.1
E	5	206	9.1	9.4	9.1
E	5	207	8.7	10.2	8.7
E	5	208	7.6	12.3	7.6
E	5	209	na	0.0	11.1
E	5	210	9.1	9.5	9.1
E	5	211	8.7	10.5	8.7
E	5	212	7.6	12.7	7.6
E	5	213	na	0.0	11.1
E	5	214	9.1	9.4	9.1
E	5	215	8.7	10.7	8.7
E	5	216	7.6	12.3	7.5
F	5	217	na	0.0	11.1
F	5	218	9.1	5.2	9.1
F	5	219	8.7	6.3	8.6
F	5	220	7.6	6.8	7.6
F	5	221	na	0.0	11.1
F	5	222	9.1	4.4	9.1
F	5	223	8.7	5.0	8.7
F	5	224	7.6	6.2	7.6
F	5	225	na	0.0	11.1
F	5	226	9.1	4.4	9.1
F	5	227	8.7	5.3	8.6
F	5	228	7.6	6.4	7.6
F	5	229	na	0.0	11.1
F	5	230	9.1	4.3	9.1
F	5	231	8.7	5.1	8.7
F	5	232	7.6	6.0	7.6
E	6	310	na	0.0	10.2
E	6	301	9.1	6.5	9.2
E	6	303	8.7	7.8	8.7
E	6	304	7.6	10.0	7.6
E	6	305	na	0.0	10.2
E	6	306	9.1	6.4	9.1
E	6	307	8.7	8.0	8.7
E	6	308	7.6	9.0	7.6

Experiment	Trial	Code	Initial pH Target	Dilute Acid Added (mL)	Final Adjusted pH
E	6	309	na	0.0	10.2
E	6	310	9.1	6.7	9.1
E	6	311	8.7	7.6	8.8
E	6	312	7.6	9.0	7.5
E	6	313	na	0.0	10.2
E	6	314	9.1	6.8	9.1
E	6	315	8.7	8.0	8.7
E	6	316	7.6	9.2	7.5
F	6	317	na	0.0	10.2
F	6	318	9.1	4.9	9.1
F	6	319	8.7	4.6	8.7
F	6	320	7.6	5.9	7.6
F	6	321	na	0.0	10.2
F	6	322	9.1	3.1	9.1
F	6	323	8.7	4.1	8.7
F	6	324	7.6	4.7	7.6
F	6	325	na	0.0	10.2
F	6	326	9.1	3.0	9.1
F	6	327	8.7	3.9	8.6
F	6	328	7.6	4.8	7.6
F	6	329	na	0.0	10.2
F	6	330	9.1	4.3	9.1
F	6	331	8.7	3.9	8.7
F	6	332	7.6	4.7	7.5

Appendix XII. Chemical analyses of INCO/Copper Cliff Creek effluents prior to entering the Copper Cliff Waste Water Treatment Plant, and effluent sample (CCC4) exiting the treatment facility. Effluent samples, identified by the code CCC and date collected, were analysed to show both total (unfiltered) and dissolved (0.45 μm filtered) compositions. Values following "<" were below detection limits.

Sample	Date Collected	Calcium (mg/L)	Sodium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Cobalt (mg/L)	Aluminium (mg/L)
CCC2 total	05/05/97	304	119	101.0	28.0	0.383	2.535
CCC2 dissolved	05/05/97	304	120	103.0	28.0	0.313	0.259
CCC3 total	05/12/97	260	90	79.0	28.0	0.227	1.403
CCC3 dissolved	05/12/97	250	85	78.0	27.0	0.198	0.259
CCC4 total	06/07/98	656	117	4.3	34.3	0.003	<0.005

Sample	Date Collected	Iron (mg/L)	Manganese (mg/L)	Copper (mg/L)	Nickel (mg/L)	Sulfur (mg/L)	Zinc (mg/L)	S2O3 (mg/L)
CCC2 total	05/05/97	32.87	1.303	1.574	13.67	485	0.228	
CCC2 dissolved	05/05/97	5.74	1.256	0.966	11.36	486	0.134	
CCC3 total	05/12/97	17.92	1.016	0.608	8.791	471	0.010	
CCC3 dissolved	05/12/97	6.36	0.972	0.523	7.710	454	0.060	
CCC4 total	06/07/97	0.22	0.008	0.038	0.095	552	0.009	<10.0

Appendix XIII. Measurements of pH and temperature over the duration of 96 h for Experiment D bulk effluent samples from the CCWWTP trials 10 and 11 from June 1 and July 6, 1998 respectively. Each trial was divided into three quadruplicate treatment groups for two temperature conditions, room temperature [24°C (+/-1.5)] and refrigerated [4°C (+/-2.0)]. Each treatment group refers to NOCO (carbon dioxide absent aerated samples), AIR (aerated samples), and SEALED samples. Additional pH data were collected post 96h for a temperature switch test (i.e. cold condition samples were room temperature acclimated and visa versa, trial 10) and for observations of pH in trial 11 samples several days afterwards (July 15**). Four temperature measurements were randomly selected from among similar temperature acclimated treatment groups and are indicated at the appropriate time frames directly below pH data from the specific treatment groups. Missing values are represented as an X in the data set.

Trial	Exp	Time interval 0-96 hours and Temperature (°C)								
		0	2	6	15	24	48	72	96	temp. switch
10	NOCO	10.8	10.8	10.7	10.7	10.7	10.7	10.6	10.3	10.4
10	NOCO	10.8	10.8	10.7	10.7	10.7	10.7	10.4	10.0	10.1
10	NOCO	10.8	10.8	10.7	10.7	10.7	10.7	10.5	10.2	10.3
10	NOCO	10.8	10.8	10.7	10.7	10.7	10.7	10.4	10.0	10.1
10	AIR	10.8	10.6	9.7	9.7	7.7	7.7	7.8	7.8	8.2
10	AIR	10.8	10.6	10.0	10.0	7.7	7.7	7.9	7.8	8.1
10	AIR	10.8	10.7	10.0	10.0	7.7	7.7	7.9	7.9	8.3
10	AIR	10.8	10.6	10.0	10.0	7.7	7.7	7.8	7.9	8.1
10	SEALED	10.8	X	10.7	10.7	10.6	10.6	10.5	10.4	10.3
10	SEALED	10.8	X	10.7	10.7	10.7	10.6	10.5	10.4	10.4
10	SEALED	10.8	X	10.7	10.7	10.7	10.6	10.5	10.4	10.4
10	SEALED	10.8	X	10.7	10.7	10.7	10.6	10.4	10.3	10.4
		Temperature (°C)								
		20	22	24	24	24	25	25	25	5
		20	22	24	24	24	25	25	25	5
		20	22	24	24	24	25	25	25	5
		20	22	24	24	24	25	25	25	5

Trial	Exp	Time interval 0-96 hours and Temperature (°C)								
		0	2	6	15	24	48	72	96	temp. switch
10	NOCO	11.1	11.2	11.3	11.3	11.3	11.3	11.2	11.3	10.6
10	NOCO	11.2	11.3	11.3	11.3	11.3	11.3	11.3	11.3	10.6
10	NOCO	11.2	11.2	11.4	11.3	11.4	11.3	11.3	11.2	10.6
10	NOCO	11.2	11.3	11.3	11.4	11.4	11.3	11.3	11.3	10.6
10	AIR	11.2	11.1	9.7	8.4	8.1	8.1	8.2	8.1	7.8
10	AIR	11.3	11.1	10.1	8.4	8.1	8.1	8.1	8.0	7.8
10	AIR	11.2	11.1	9.7	8.3	8.0	8.1	8.1	8.0	7.8
10	AIR	11.2	10.8	9.5	8.1	8.1	8.2	8.0	8.1	7.9
10	SEALED	11.2	X	11.3	11.3	11.3	11.4	11.3	11.4	11.3
10	SEALED	11.2	X	11.3	11.3	11.3	11.4	11.3	11.4	11.3
10	SEALED	11.2	X	11.4	11.3	11.4	11.4	11.3	11.4	11.3
10	SEALED	11.2	X	11.3	11.4	11.4	11.4	11.4	11.4	11.3
		Temperature (°C)								
		2	4	4	3	3	4	2	2	24
		2	4	4	3	3	4	2	2	24
		2	4	4	3	2	4	2	2	24
		2	4	4	3	2	3	2	2	24
										July 15**
11	NOCO	11.1	11.1	11.0	10.9	11.0	11.1	11.0	11.0	10.9
11	NOCO	11.1	11.1	11.0	11.0	11.0	11.1	11.0	11.0	10.9
11	NOCO	11.1	11.1	11.1	10.9	11.0	11.1	11.0	11.0	10.8
11	NOCO	11.1	11.1	11.1	11.0	11.0	11.1	11.0	11.0	10.9
11	AIR	11.1	11.0	10.8	9.4	8.3	7.9	7.9	7.9	7.7
11	AIR	11.1	11.0	10.7	9.2	8.2	7.9	7.9	7.9	7.7
11	AIR	11.1	11.0	10.8	9.5	8.2	7.9	7.9	7.9	7.7
11	AIR	11.1	11.0	10.8	9.5	8.1	7.9	8.0	7.9	7.7
11	SEALED	11.1	X	11.1	11.0	11.0	11.0	10.9	10.9	10.5
11	SEALED	11.1	X	11.1	11.0	11.0	11.0	11.0	10.9	10.6
11	SEALED	11.1	X	11.1	11.0	11.0	11.0	11.0	11.0	10.8
11	SEALED	11.1	X	11.1	11.0	11.0	11.0	11.0	11.0	10.8
		Temperature (°C)								
		23	25	25	26	26	26	26	24	25
		23	24	25	26	26	26	26	24	25
		23	25	25	25	26	26	26	24	25
		23	25	25	26	26	26	26	24	25

Trial	Exp	Time interval 0-96 hours and Temperature (°C)								
		0	2	6	15	24	48	72	96	July 15**
11	NOCO	11.6	11.6	11.6	11.6	11.6	11.5	11.5	11.5	11.2
11	NOCO	11.6	11.6	11.6	11.6	11.6	11.5	11.5	11.5	11.2
11	NOCO	11.6	11.6	11.6	11.6	11.6	11.5	11.4	11.4	11.2
11	NOCO	11.7	11.6	11.6	11.7	11.6	11.5	11.4	11.5	11.2
11	AIR	11.7	11.5	11.1	9.5	8.4	7.8	7.8	7.7	7.6
11	AIR	11.7	11.5	11.1	9.0	8.4	7.8	7.8	7.7	7.6
11	AIR	11.7	11.6	11.2	8.8	8.3	7.8	7.8	7.9	7.6
11	AIR	11.7	11.5	11.3	9.3	8.3	7.8	7.7	7.8	7.6
11	SEALED	11.7	X	11.6	11.5	11.6	11.5	11.5	11.5	11.2
11	SEALED	11.7	X	11.6	11.6	11.6	11.5	11.5	11.5	11.1
11	SEALED	11.7	X	11.6	11.6	11.6	11.5	11.5	11.5	11.0
11	SEALED	11.7	X	11.6	11.7	11.7	11.5	11.5	11.5	11.1
				Temperature (°C)						
		5	8	8	6	5	6	5	4	4
		6	8	8	6	5	6	5	4	4
		5	8	8	6	5	6	5	4	4
		6	8	8	6	5	6	5	4	4

Appendix XIV. Measurements of pH and 0.5 M sodium bicarbonate (mLs) as sodium bicarbonate was titrated into a 400 mL sample of bulk effluent from the CCWWTP. Bulk samples were collected on June 1 and July 6, 1998. Sodium bicarbonate (carb.) and pH (pH) were measured for quadruplicate samples 1-4 and 5-8 for the two bulk effluent sampling sessions respectively.

pH1	carb1 mLs	pH2	carb 2 mLs	pH3	carb3 mLs	pH4	carb4 mLs
11.3	0.0	11.2	0.0	11.2	0.0	11.2	0.0
10.1	0.6	9.8	1.1	10.2	0.6	9.9	1.0
9.6	1.2	9.1	2.6	9.4	1.6	9.1	3.3
9.1	2.3	8.8	4.5	9.0	3.6	8.5	10.9
8.8	3.9	8.5	8.0	8.7	6.7	8.0	14.9
8.6	6.5	8.3	12.0	8.5	9.8	7.8	20.0
8.4	9.3	8.0	17.0	8.2	14.8	7.7	22.0
8.1	15.0	7.6	22.0	7.9	20.0	7.7	25.0
7.8	21.1	7.6	26.0	7.8	25.0	7.6	30.1
7.7	27.0	7.6	32.0	7.6	30.0	7.5	33.0
7.5	34.0	7.5	37.0	7.5	38.0	7.5	37.0
7.5	42.0	7.5	42.0	7.4	46.0	7.4	40.0
7.4	48.0	7.4	49.0	7.4	49.0	7.4	45.0
						7.4	50.0

pH5	carb5 mLs	pH6	carb 6 mLs	pH7	carb7 mLs	pH8	carb8 mLs
11.6	0.0	11.6	0.0	11.6	0.0	11.6	0.0
10.9	1.2	9.8	1.8	9.8	2.0	10.8	1.2
9.7	2.9	9.0	4.3	9.0	4.7	9.2	3.3
9.3	5.6	9.1	8.6	8.6	8.0	8.6	7.0
9.0	9.0	8.4	11.0	8.4	11.0	8.4	10.0
8.9	12.5	8.2	15.0	8.2	16.0	8.1	16.1
8.5	16.8	7.9	19.9	8.0	21.0	8.0	22.0
8.0	23.0	7.7	24.0	7.9	26.0	7.8	28.0
7.4	29.0	7.5	30.0	7.8	31.0	7.7	35.0
7.4	34.9	7.4	35.0	7.7	36.0	7.6	40.0
7.4	43.0	7.4	40.0	7.7	39.0	7.6	43.0
7.4	49.0	7.3	47.0	7.7	45.0	7.5	48.0
				7.6	50.0	7.5	50.0

8.0 APPENDIX B

(TOXICITY REPORTS)

AQUATIC SCIENCES INC.

48 HOUR STATIC DAPHNIA MAGNA TEST

Client:	Inco Ltd.	Project Number:	L9224
	Copper Cliff	Sample Number:	131 - 145
Sample Type:	Grab	Test Number:	D270 - D284
Sample State:	Liquid		

QUALITY ASSURANCE INFORMATION

Reference Toxicant Data

Chemical Used:	Sodium Chloride
Date of Test:	November 14/95
48-hour LC50:	6305 mg/L
Warning Limits:	5911 - 7039 mg/L

Test Protocol

Biological Test Methods: Reference Methods for Determining
Acute Lethality of Effluents to Daphnia magna
Environment Canada
July 1990

Test Conditions

Test Organism:	Daphnia magna
Test Type:	Static
Test Temperature:	20+/-1C
Test Volume:	200mL
Loading Density:	20mL/neonate
Photoperiod:	16 hours light/8 hours dark
Dilution Water:	Dechlorinated Tap
Organism Age:	<24 hours
Stock Source:	in house cultures
Time of First Brood:	7 days
Average Brood Size:	25 neonates
Ephippia Frequency:	0

Comments

The reference toxicant results show that test reproducibility and organism are within acceptable limits.
All data is scrutinized for errors.
Instruments used to monitor parameters are calibrated daily and continuously maintained.

Reviewers

Technical Review

Final Review

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	131
Client:	Inco Ltd	Test Number:	D270
	Copper Cliff, Ontario	Sample Date/Time:	11/13/95 //-:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0453	Test Date:	11/14/95// 18:00 hrs
		Technician:	K Groombridge

		Concentration %V/V					
	Sample ID:					SC3-A10Y	
	Sample #:					131	
TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C
	Dissolved Oxygen	8.8	8.8	8.8	9.5	9.5	9.5
	pH	7.78	7.78	7.78	9.53	9.53	9.53
0 HOURS	Temperature(C)	20.3	20.3	20.3	19.5	19.5	19.5
	Conductivity(uS)	301	301	301	2970	2970	2970
	# Immobile (10 exposed)	0	0	0	0	0	0
	Temperature(C)	20.6	20.6	20.6	20.6	20.6	20.6
24 HOURS	# Immobile	0	0	0	3	5	6
	# Dead (10 exposed)	0	0	0	0	0	0
	Dissolved Oxygen	8.3	8.3	8.2	8.5	8.5	8.5
	pH	7.59	7.61	7.58	8.71	8.72	8.72
48 HOURS	Temperature (C)	20.4	20.4	20.4	20.3	20.3	20.3
	Conductivity	302	304	303	2930	2930	2940
	# Immobile	0	0	0	0	2	1
	# Dead (10 exposed)	0	0	0	9	5	9
TOTAL MORTALITY (10 EXPOSED)		0	0	0	9	5	9
MEAN PERCENT MORTALITY		0%			77%		

RESULTS

48-HOUR RESULT:	SC3-A10Y - FAIL (77% mortality)
Brood Culture:	101695
Time to First Brood:	7 days
Average Brood Size:	24 neonates

Comments:
- effluent sub-sample numbers 131 - 145 were preaerated for 120 minutes since D.O. > 100% of saturation

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	132 - 133
Client:	Inco Ltd	Test Number:	D271 - D272
	Copper Cliff, Ontario	Sample Date/Time:	11/13/95 //-:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0453	Test Date:	11/14/95// 18:00 hrs
		Technician:	K Groombridge

		Concentrations %V/V					
	Sample ID:		SC3-A93Y			SC3-A88Y	
	Sample #:		132			133	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
	Dissolved Oxygen	9.6	9.6	9.6	9.5	9.5	9.5
	pH	8.15	8.15	8.15	7.15	7.15	7.15
0 HOURS	Temperature(C)	19.4	19.4	19.4	19.4	19.4	19.4
	Conductivity(uS)	3010	3010	3010	3020	3020	3020
	# Immobile (10 exposed)	0	0	0	0	0	0
	Temperature(C)	20.6	20.6	20.6	20.6	20.6	20.6
24 HOURS	# Immobile	1	1	2	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
	Dissolved Oxygen	8.4	8.3	8.3	8.4	8.3	8.3
	pH	7.31	7.26	7.27	6.94	6.91	6.92
48 HOURS	Temperature (C)	20.4	20.4	20.4	20.4	20.4	20.4
	Conductivity	2950	2950	2960	2960	2960	2950
	# Immobile	0	0	0	0	1	0
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT: SC3-A93Y - PASS (0% mortality)
SC3-A88Y - PASS (0% mortality)

Comments:
- 23% of daphnids floating at SC3-A93Y effluent surface

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	134 - 135
Client:	Inco Ltd	Test Number:	D273 - D274
	Copper Cliff, Ontario	Sample Date/Time:	11/13/95 //:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0453	Test Date:	11/14/95// 18:00 hrs
		Technician:	K Groombridge

		Concentrations %V/V					
	Sample ID:		SC3-A83Y			SC3-A78Y	
	Sample #:		134			135	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
	Dissolved Oxygen	9.4	9.4	9.4	9.4	9.4	9.4
	pH	6.91	6.91	6.91	6.73	6.73	6.73
0 HOURS	Temperature(C)	19.4	19.4	19.4	19.4	19.4	19.4
	Conductivity(uS)	3020	3020	3020	3020	3020	3020
	# Immobile (10 exposed)	0	0	0	0	0	0
	Temperature(C)	20.6	20.6	20.6	20.6	20.6	20.6
24 HOURS	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
	Dissolved Oxygen	8.4	8.4	8.4	8.4	8.4	8.4
	pH	6.65	6.70	6.72	6.57	6.57	6.56
48 HOURS	Temperature (C)	21.5	21.7	21.0	22.1	22.3	22.3
	Conductivity	2950	2960	2960	2950	2960	2900
	# Immobile	1	2	3	3	2	1
	# Dead (10 exposed)	0	1	0	4	3	1
TOTAL MORTALITY (10 EXPOSED)		0	1	0	4	3	1
MEAN PERCENT MORTALITY		3%			27%		

RESULTS

48-HOUR RESULT: SC3-A83Y - PASS (3% mortality)
SC3-A78Y - PASS (27% mortality)

Comments:

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	136 - 137
Client:	Inco Ltd	Test Number:	D275 - D276
	Copper Cliff, Ontario	Sample Date/Time:	11/13/95 //-:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0453	Test Date:	11/14/95// 18:00 hrs
		Technician:	K Groombridge

		Concentrations %V/V					
	Sample ID:	SC3-B10Y			SC3-B93Y		
	Sample #:	136			137		
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
	Dissolved Oxygen	9.5	9.5	9.5	9.6	9.6	9.6
	pH	9.37	9.37	9.37	8.43	8.43	8.43
0 HOURS	Temperature(C)	19.5	19.5	19.5	19.4	19.4	19.4
	Conductivity(uS)	2990	2990	2990	3010	3010	3010
	# Immobile (10 exposed)	0	0	0	0	0	0
	Temperature(C)	20.6	20.6	20.6	20.6	20.6	20.6
24 HOURS	# Immobile	1	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
	Dissolved Oxygen	8.6	8.6	8.5	8.4	8.4	8.3
	pH	8.73	8.69	8.63	7.61	7.64	7.60
48 HOURS	Temperature (C)	20.9	20.8	20.7	20.8	20.7	20.7
	Conductivity	2920	2940	2920	2940	2940	2950
	# Immobile	1	0	2	1	3	2
	# Dead (10 exposed)	2	4	2	0	0	0
TOTAL MORTALITY (10 EXPOSED)		2	4	2	0	0	0
MEAN PERCENT MORTALITY		27%			0%		

RESULTS

48-HOUR RESULT: SC3-B10Y - PASS (27% mortality)
SC3-B93Y - PASS (0% mortality)

Comments:

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	138 - 139
Client:	Inco Ltd	Test Number:	D277 - D278
	Copper Cliff, Ontario	Sample Date/Time:	11/13/95 //-:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0453	Test Date:	11/14/95// 18:00 hrs
		Technician:	K Groombridge

			Concentrations %V/V					
		Sample ID:		SC3-B88Y			SC3-B83Y	
		Sample #:		138			139	
TIME	PARAMETER		100-A	100-B	100-C	100-A	100-B	100-C
	Dissolved Oxygen		9.5	9.5	9.5	9.6	9.6	9.6
	pH		7.18	7.18	7.18	7.06	7.06	7.06
0 HOURS	Temperature(C)		19.5	19.5	19.5	19.5	19.5	19.5
	Conductivity(uS)		3020	3020	3020	3020	3020	3020
	# Immobile (10 exposed)		0	0	0	0	0	0
	Temperature(C)		20.6	20.6	20.6	20.6	20.6	20.6
24 HOURS	# Immobile		0	0	0	0	0	0
	# Dead (10 exposed)		0	0	0	0	0	0
	Dissolved Oxygen		8.3	8.1	8.3	8.3	7.9	8.3
	pH		6.90	6.88	6.92	6.78	5.44	6.78
48 HOURS	Temperature (C)		20.7	20.7	20.7	20.8	20.7	20.7
	Conductivity		2970	2960	2970	2960	2970	2960
	# Immobile		0	0	0	0	0	0
	# Dead (10 exposed)		0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)			0	0	0	0	0	0
MEAN PERCENT MORTALITY			0%			0%		

RESULTS

48-HOUR RESULT: SC3-B88Y - PASS (0% mortality)
SC3-B83Y - PASS (0% mortality)

Comments:

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	140 - 141
Client:	Inco Ltd	Test Number:	D279 - D280
	Copper Cliff, Ontario	Sample Date/Time:	11/13/95 //-:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0453 & 0454	Test Date:	11/14/95// 18:00 hrs
		Technician:	K Groombridge

		Concentrations %V/V					
	Sample ID:		SC3-B78Y			SC3-C10Y	
	Sample #:		140			141	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
	Dissolved Oxygen	9.2	9.2	9.2	9.6	9.6	9.6
	pH	6.86	6.86	6.86	9.42	9.42	9.42
0 HOURS	Temperature(C)	19.6	19.6	19.6	19.5	19.5	19.5
	Conductivity(uS)	3020	3020	3020	2990	2990	2990
	# Immobile (10 exposed)	0	0	0	0	0	0
	Temperature(C)	20.6	20.6	20.6	20.6	20.6	20.6
24 HOURS	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
	Dissolved Oxygen	8.1	8.1	8.1	8.6	8.6	8.6
	pH	6.69	6.70	6.71	8.78	8.73	8.75
48 HOURS	Temperature (C)	20.9	20.7	20.6	20.9	20.9	21.0
	Conductivity	2950	2960	2970	2930	2940	2930
	# Immobile	0	0	0	3	3	2
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT: SC3-B78Y - PASS (0% mortality)
SC3-C10Y - PASS (0% mortality)

Comments:

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	142 - 143
Client:	Inco Ltd	Test Number:	D281 - D282
	Copper Cliff, Ontario	Sample Date/Time:	11/13/95 //-:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0454	Test Date:	11/14/95// 18:00 hrs
		Technician:	K Groombridge

		Concentration %V/V					
	Sample ID:	SC3-C93Y			SC3-C88Y		
	Sample #:	142			143		
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
	Dissolved Oxygen	9.7	9.7	9.7	9.3	9.3	9.3
	pH	8.34	8.34	8.34	6.96	6.96	6.96
0 HOURS	Temperature(C)	19.5	19.5	19.5	19.6	19.6	19.6
	Conductivity(uS)	3020	3020	3020	3020	3020	3020
	# Immobile (10 exposed)	0	0	0	0	0	0
	Temperature(C)	20.6	20.6	20.6	20.6	20.6	20.6
24 HOURS	# Immobile	0	0	0	0	1	0
	# Dead (10 exposed)	0	0	0	0	0	0
	Dissolved Oxygen	8.5	8.6	8.2	8.3	8.4	8.3
	pH	7.80	7.66	7.40	6.89	6.88	6.84
48 HOURS	Temperature (C)	20.7	20.7	20.8	20.9	20.8	20.8
	Conductivity	2940	2950	2970	2960	2960	2960
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	1
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	1
MEAN PERCENT MORTALITY		0%			3%		

RESULTS

48-HOUR RESULT:	SC3-C93Y - PASS (0% mortality)
	SC3-C88Y - PASS (3% mortality)

Comments:

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	144 - 145
Client:	Inco Ltd	Test Number:	D283 - D284
	Copper Cliff, Ontario	Sample Date/Time:	11/13/95 //:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0454	Test Date:	11/14/95// 18:00 hrs
		Technician:	K Groombridge

			Concentration %V/V				
		Sample ID:	SC3-C83Y			SC3-C78Y	
		Sample #:	144			145	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
0 HOURS	Dissolved Oxygen	9.4	9.4	9.4	9.4	9.4	9.4
	pH	6.86	6.86	6.86	6.86	6.86	6.86
	Temperature(C)	19.6	19.6	19.6	19.6	19.6	19.6
	Conductivity(uS)	3020	3020	3020	3030	3030	3030
	# Immobile (10 exposed)	0	0	0	0	0	0
24 HOURS	Temperature(C)	20.6	20.6	20.6	20.6	20.6	20.6
	# Immobile	0	0	0	0	1	0
	# Dead (10 exposed)	0	0	0	0	0	0
48 HOURS	Dissolved Oxygen	8.3	8.4	8.2	8.4	8.4	8.3
	pH	6.74	6.77	6.73	6.75	6.76	6.77
	Temperature (C)	21.0	20.9	21.0	21.1	21.1	21.0
	Conductivity	2960	2970	2960	2960	2950	2950
	# Immobile	1	0	0	0	0	0
	# Dead (10 exposed)	0	1	1	0	1	0
TOTAL MORTALITY (10 EXPOSED)		0	1	1	0	1	0
MEAN PERCENT MORTALITY		7%			3%		

RESULTS

48-HOUR RESULT: SC3-C83Y - PASS (7% mortality)
SC3-C78Y - PASS (3% mortality)

Comments:

AQUATIC SCIENCES INC.

96 HOUR STATIC RAINBOW TROUT TEST

Client:	Inco Ltd.	Project Number:	L9224
	Copper Cliff	Sample Number:	131 - 145
Sample Type:	Grab	Test Number:	T269 - T283
Sample State:	Liquid		

QUALITY ASSURANCE INFORMATION

Reference Toxicant Data

Chemical Used:	Sodium Chloride
Date of Test:	October 31/95
96-hour LC50:	14890 mg/L
Warning Limits:	13459 - 15806 mg/L

Test Protocol

Biological Test Methods: Reference Methods for Determining
Acute Lethality of Effluents to Rainbow Trout
Environment Canada
July 1990

Test Conditions

Test Organism:	Rainbow Trout
Test Type:	Static
Test Temperature:	15+/-1C
Test Volume:	16 litres
Photoperiod:	16 hours light/8 hours dark
Dilution Water:	Dechlorinated Tap
Organism Age:	Fingerlings
Stock Source:	Rainbow Springs Hatchery
Mean Weight:	0.13 +/- 0.02g

Comments

The reference toxicant results show that test reproducibility and organism are within acceptable limits.
All data is scrutinized for errors.
Instruments used to monitor parameters are calibrated daily and continuously maintained.

Reviewers

Technical Review

Final Review

AQUATIC SCIENCES INC.

96-HOUR STATIC RAINBOW TROUT TEST

Project Number:	L8224	Sample Number:	131 - 137
Client:	Inco Ltd.	Test Number:	T269 - T275
	Copper Cliff, Ontario	Sample Date/Time:	11/13/95 // -- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Tech:	Unknown
Chain of Custody #:	0453	Test Date:	11/13/95//15:30 hrs
		Technician:	K Groom[illegible]

TIME	PARAMETER	Sample ID: CONTROL	SC3-A10Y	SC3-A93Y	SC3-A88Y	SC3-A83Y	SC3-A78Y	SC3-B10Y	SC3-B93Y
	Sample #:		131	132	133	134	135	136	137
	[illegible]	0	100	100	100	100	100	100	100
0 HOURS	Dissolved Oxygen	8.7	9.0	9.3	9.0	9.3	9.4	9.2	9.3
	pH	7.72	10.03	8.74	8.07	7.42	6.88	9.73	8.70
	Temperature(C)	15.5	14.5	14.8	15.0	15.4	15.8	15.0	14.8
	Conductivity(uS)	286	3080	3080	3100	3080	3100	3080	3110
	# Immobile (10 exposed)	0	0	0	0	0	0	0	0
24 HOURS	Dissolved Oxygen	9.2	9.4	9.3	9.2	9.3	9.3	9.5	9.3
	pH	7.77	9.41	7.30	7.22	7.11	6.81	8.57	7.48
	Temperature (C)	15.7	15.5	15.7	15.7	15.7	15.7	15.2	15.2
	Conductivity	287	2980	3030	3030	3030	3040	3020	3030
	# Immobile	0	-	0	0	0	0	-	0
	# Dead (10 exposed)	0	10	0	0	0	0	10	0
48 HOURS	Dissolved Oxygen	9.8	9.7	9.5	9.6	9.6	9.5	9.8	9.8
	pH	7.83	9.03	7.23	7.05	6.98	6.79	7.88	7.31
	Temperature (C)	15.8	15.8	15.8	15.7	15.7	15.6	15.1	15.2
	Conductivity	288	2980	3020	3020	3030	3030	3010	3020
	# Immobile	0	-	0	0	0	0	-	0
	# Dead (10 exposed)	0	-	0	0	0	0	-	0
72 HOURS	Dissolved Oxygen	9.4	9.6	9.5	9.5	9.6	9.4	9.7	9.3
	pH	7.75	8.79	7.29	7.05	7.00	6.87	7.50	7.29
	Temperature (C)	15.8	15.9	16.0	15.9	15.9	15.8	15.4	15.5
	Conductivity	286	2980	3020	3030	3040	3040	3020	3020
	# Immobile	0	-	0	0	0	0	-	0
	# Dead (10 exposed)	0	-	0	0	0	0	-	0
96 HOURS	Dissolved Oxygen	9.7	9.6	9.4	9.4	9.5	9.7	9.7	9.7
	pH	7.73	8.58	7.28	7.07	7.02	6.89	7.83	7.48
	Temperature (C)	15.9	16.0	16.1	16.0	16.0	15.9	15.5	15.5
	Conductivity	289	3010	3030	3030	3050	3080	3020	3030
	# Immobile	0	-	0	0	0	0	-	0
	# Dead (10 exposed)	0	-	0	0	0	1	-	0
TOTAL MORTALITY (10 EXPOSED)		0	10	0	0	0	1	10	0

RESULTS

96-HOUR RESULT:

SC3-A10Y - FAIL (100% mortality)
SC3-A93Y - PASS (0% mortality)
SC3-A88Y - PASS (0% mortality)
SC3-A83Y - PASS (0% mortality)
SC3-A78Y - PASS (10% mortality)
SC3-B10Y - FAIL (100% mortality)
SC3-B93Y - PASS (0% mortality)

Mean Weight: 0.34 +/- 0.10 g

Loading Density: 0.21 g fish/L

Comments:

- [illegible] evident in samples 131, 141, 136 in <30 minutes

INITIAL PARAMETERS: (upon reception by lab)

	SC3-A10Y	SC3-A93Y	SC3-A88Y	SC3-A83Y	SC3-A78Y	SC3-B10Y	SC3-B93Y
Dissolved Oxygen (ppm):	11.2	11.1	10.8	11.0	10.8	11.8	11.2
pH:	10.3	9.16	8.82	7.81	6.89	10.13	9.13
Temperature (C):	6.9	6.9	6.6	7.0	6.7	6.8	7.9
Conductivity (uS/cm):	2970	3020	3030	3030	3030	2980	3020
Hardness (mg/L):	1815	1815	1815	1815	1815	1488	1488
Physical State:	liquid	liquid	liquid	liquid	liquid	liquid	liquid
Clarity:	clear	clear	clear	clear	clear	clear	clear
Colour:	yellow	yellow	yellow	yellow	yellow	colourless	colourless
Precipitate:	yes	yes	yes	yes	yes	no	no
Odour:	none	none	none	none	none	none	none
Pre-aeration Time (minutes):	60	60	60	60	60	60	60

AQUATIC SCIENCES INC.

96-HOUR STATIC RAINBOW TROUT TEST

Project Number:	L9224	Sample Number:	138 - 145
Client:	Inco Ltd.	Test Number:	T278 - T283
	Copper Cliff, Ontario	Sample Date/Time:	11/13/88 // - - hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Tech:	unknown
Chain of Custody #:	0453 - 0464	Test Date:	11/15/88//15.30 hrs
		Technician:	K Groomendge

		Sample ID:	SC3-B88Y	SC3-B83Y	SC3-B78Y	SC3-C10Y	SC3-C83Y	SC3-C88Y	SC3-C83Y	SC3-C78Y
		Sample #:	138	139	140	141	142	143	144	145
TIME	PARAMETER		100	100	100	100	100	100	100	100
	Dissolved Oxygen		9.4	9.4	9.9	9.4	9.5	9.9	9.5	9.8
	pH		7.88	7.39	7.08	9.79	8.82	7.37	7.29	7.04
0 HOURS	Temperature(C)		14.6	14.7	15.2	15.0	14.4	14.2	14.2	14.5
	Conductivity(uS)		3120	3100	3110	3070	3100	3100	3100	3130
	# Immobile (10 exposed)		0	0	0	0	0	0	0	0
	Dissolved Oxygen		9.3	9.3	9.2	9.2	9.4	9.4	9.4	9.4
	pH		7.21	7.17	7.08	9.05	7.80	7.23	6.94	6.96
	Temperature (C)		15.2	15.2	15.4	15.2	15.1	14.8	14.7	14.7
24 HOURS	Conductivity		3030	2880	3030	3010	3030	3030	3030	3030
	# Immobile		0	0	0	-	0	0	0	0
	# Dead (10 exposed)		0	0	0	10	0	0	0	0
	Dissolved Oxygen		9.7	9.8	9.8	9.7	9.8	9.5	9.8	9.4
	pH		7.17	7.13	7.07	8.46	7.30	7.16	6.84	6.86
48 HOURS	Temperature (C)		15.3	15.2	15.4	15.2	15.1	14.9	14.8	14.7
	Conductivity		3020	3020	3020	3010	3020	3020	3020	3020
	# Immobile		0	0	0	-	0	0	0	0
	# Dead (10 exposed)		0	0	0	-	0	0	0	0
	Dissolved Oxygen		9.8	9.8	9.8	-	9.8	9.4	9.5	9.3
	pH		7.30	7.21	7.11	-	7.62	7.30	7.13	7.08
72 HOURS	Temperature (C)		15.6	15.5	15.7	-	15.4	15.3	15.0	15.0
	Conductivity		3020	3030	3010	-	3030	3030	3030	3030
	# Immobile		0	0	0	-	0	0	0	0
	# Dead (10 exposed)		0	0	0	-	0	0	0	0
	Dissolved Oxygen		8.7	9.6	9.6	-	9.6	9.4	9.5	9.7
	pH		7.88	7.20	7.18	-	7.57	7.88	7.21	7.18
96 HOURS	Temperature (C)		15.8	15.5	15.7	-	15.5	15.3	15.2	15.0
	Conductivity		3030	3040	3030	-	3030	3030	3040	3030
	# Immobile		0	0	0	-	0	0	0	0
	# Dead (10 exposed)		0	0	0	-	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)			0	0	0	10	0	0	0	0

RESULTS

96-HOUR RESULT:	SC3-B88Y - PASS (0% mortality)	SC3-C83Y - PASS (0% mortality)
	SC3-B83Y - PASS (0% mortality)	SC3-C88Y - PASS (0% mortality)
	SC3-B78Y - PASS (0% mortality)	SC3-C83Y - PASS (0% mortality)
	SC3-C10Y - FAIL (100% mortality)	SC3-C78Y - PASS (0% mortality)
Mean Weight:	0.34 +/- 0.10 g	
Loading Density:	0.21 g fish/L	

Comments:

INITIAL PARAMETERS: (upon reception by lab)

	SC3-B88Y	SC3-B83Y	SC3-B78Y	SC3-C10Y	SC3-C83Y	SC3-C88Y	SC3-C83Y	SC3-C78Y
Dissolved Oxygen (ppm):	11.4	11.8	11.4	11.2	11.2	11.2	11.8	11.0
pH:	8.57	7.91	7.87	10.19	8.11	7.88	7.42	7.33
Temperature (C):	7.1	7.6	7.1	7.3	7.5	7.5	7.2	7.9
Conductivity (uS/cm):	3030	3030	3030	2880	3020	3030	3030	3040
Hardness (mg/L):	1466	1466	1466	1446	1446	1446	1446	1446
Physical State:	liquid	liquid	liquid	liquid	liquid	liquid	liquid	liquid
Clarity:	clear	clear	clear	clear	clear	clear	clear	clear
Colour:	colourless	colourless	colourless	yellow	yellow	yellow	yellow	yellow
Precipitate:	no	no	no	yes	yes	yes	yes	yes
Odour:	none	none	none	none	none	none	none	none
Pre-aeration Time (mn):	60	60	60	60	60	60	60	60

AQUATIC SCIENCES INC.

48 HOUR STATIC DAPHNIA MAGNA TEST

Client:	Inco Ltd.	Project Number:	9224
	Copper Cliff	Sample Number:	156-17C
Sample Type:	Grab	Test Number:	D296-D309
Sample State:	Liquid		

QUALITY ASSURANCE INFORMATION

Reference Toxicant Data

Chemical Used:	Sodium Chloride
Date of Test:	November 20/95
48-hour LC50:	6558 mg/L
Warning Limits:	4967 - 7987 mg/L

Test Protocol

Biological Test Methods: Reference Methods for Determining
Acute Lethality of Effluents to Daphnia magna
Environment Canada
July 1990

Test Conditions

Test Organism:	Daphnia magna
Test Type:	Static
Test Temperature:	20+/-1C
Test Volume:	200mL
Loading Density:	20mL/neonate
Photoperiod:	16 hours light/8 hours dark
Dilution Water:	Dechlorinated Tap
Organism Age:	<24 hours
Stock Source:	in house cultures
Time of First Brood:	7 days
Average Brood Size:	28 neonates
Ephippia Frequency:	0

Comments

The reference toxicant results show that test reproducibility and organism are within acceptable limits.
All data is scrutinized for errors.
Instruments used to monitor parameters are calibrated daily and continuously maintained.

Reviewers

Technical Review

Final Review

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number	156
Client:	Inco Ltd	Test Number:	D295
	Copper Cliff, Ontario	Sample Date/Time:	12/04/95 //-:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0452	Test Date:	12/06/95// 14:45 hrs
		Technician.	K Groombridge/C Huras

		Sample ID:				SC4-A1CY	
		Sample #:				156	
TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C
0 HOURS	Dissolved Oxygen	8.9	8.9	8.9	9.1	9.1	9.1
	pH	7.85	7.85	7.85	8.11	8.11	9.11
	Temperature(C)	20.5	20.5	20.5	20.4	20.4	20.4
	Conductivity(uS)	299	299	299	2780	2780	2780
	# Immobile (10 exposed)	0	0	0	0	0	0
24 HOURS	Temperature(C)	20.0	20.0	20.0	20.0	20.0	20.0
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
48 HOURS	Dissolved Oxygen	8.3	8.2	8.2	7.9	7.9	8.0
	pH	8.30	8.35	8.27	8.18	7.94	8.02
	Temperature (C)	2.7	20.7	20.7	20.8	20.8	20.8
	Conductivity	323	318	322	2780	2790	2780
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT:	SC4-A1CY - PASS (0% mortality)
Brood Culture:	110695
Time to First Brood:	7
Average Brood Size:	30

Comments:
- sample 156 was preaerated for 88 minutes since D.O. >100% of saturation

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	157 - 158
Client:	Inco Ltd	Test Number:	D296 - D297
	Copper Cliff, Ontario	Sample Date/Time:	12/4/95 //:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0452	Test Date:	12/06/95// 15:30 hrs
		Technician:	K Groombridge/C Huras

		Sample ID:		SC4-A93Y			SC4-A88Y	
		Sample #:		157			158	
TIME	PARAMETER		100-A	100-B	100-C	100-A	100-B	100-C
0 HOURS	Dissolved Oxygen		8.9	8.9	8.9	9.1	9.1	9.1
	pH		7.08	7.08	7.06	7.18	7.18	7.18
	Temperature(C)		20.2	20.2	20.2	20.5	20.5	20.5
	Conductivity(uS)		2810	2810	2810	2810	2810	2810
	# Immobile (10 exposed)		0	0	0	0	0	0
24 HOURS	Temperature(C)		20.0	20.0	20.0	20.0	20.0	20.0
	# Immobile		0	0	0	0	0	1
	# Dead (10 exposed)		0	0	0	0	0	0
48 HOURS	Dissolved Oxygen		7.2	7.7	7.8	7.4	7.9	7.9
	pH		6.97	6.90	6.99	6.19	6.86	6.94
	Temperature (C)		20.8	20.8	20.8	20.9	20.9	20.9
	Conductivity		2810	2820	2810	2800	2810	2800
	# Immobile		0	0	0	0	0	0
	# Dead (10 exposed)		0	0	0	0	1	0
TOTAL MORTALITY (10 EXPOSED)			0	0	0	0	1	0
MEAN PERCENT MORTALITY			0%			3.3%		

RESULTS

48-HOUR RESULT: SC4-A93Y - PASS (0% mortality)
SC4-A88Y - PASS (3.3% mortality)

Comments:
- Sample 157 preaerated 120 minutes since D.O. > 100% air saturaion.
- Sample 158 preaerated 86 minutes since D.O. > 100% air saturaion.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	159 - 160
Client:	Inco Ltd	Test Number:	D298 - D299
	Copper Cliff, Ontario	Sample Date/Time:	12/04/95 //:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0452	Test Date:	12/06/95// 15:30 hrs
		Technician:	K Groombridge/C Huras

		Sample ID:		SC4-A83Y			SC4-A78Y	
		Sample #:		159			160	
TIME	PARAMETER		100-A	100-B	100-C	100-A	100-B	100-C
0 HOURS	Dissolved Oxygen		9.1	9.1	9.1	9.2	9.2	9.2
	pH		6.99	6.99	6.99	6.76	6.76	6.76
	Temperature(C)		20.3	20.3	20.3	20.3	20.3	20.3
	Conductivity(uS)		2820	2820	2820	2810	2810	2810
	# Immobile (10 exposed)		0	0	0	0	0	0
24 HOURS	Temperature(C)		20.0	20.0	20.0	20.0	20.0	20.0
	# Immobile		0	1	0	0	0	0
	# Dead (10 exposed)		0	0	0	0	0	0
48 HOURS	Dissolved Oxygen		7.0	7.5	7.1	3.7	4.6	4.4
	pH		6.62	6.66	6.62	4.38	4.35	4.18
	Temperature (C)		20.8	20.8	20.8	20.8	20.8	20.8
	Conductivity		2790	2800	2760	2780	2810	2810
	# Immobile		0	0	0	0	0	0
	# Dead (10 exposed)		1	1	0	1	0	0
TOTAL MORTALITY (10 EXPOSED)			1	1	0	1	0	0
MEAN PERCENT MORTALITY			6.7%			3.3%		

RESULTS

48-HOUR RESULT: SC4-A83Y - PASS (6.7% mortality)
SC4-A78Y - PASS (3.3% mortality)

Comments: - Samples 159, 160 presserated 120 minutes since D.O. > 100% of air saturation.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	161 - 162
Client:	Inco Ltd	Test Number:	D300 - D301
	Copper Cliff, Ontario	Sample Date/Time:	12/04/95 //:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0452	Test Date:	12/06/95// 14:45 hrs
		Technician:	K Groombridge/C Huras

		Sample ID:	SC4-B10Y			SC4-B93Y	
		Sample #:	161			162	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
0 HOURS	Dissolved Oxygen	9.0	9.0	9.0	9.0	9.0	9.0
	pH	9.10	9.10	9.10	7.30	7.30	7.30
	Temperature(C)	20.4	20.4	20.4	20.5	20.5	20.5
	Conductivity(uS)	2790	2790	2790	2810	2810	2810
	# Immobile (10 exposed)	0	0	0	0	0	0
24 HOURS	Temperature(C)	20.0	20.0	20.0	20.0	20.0	20.0
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
48 HOURS	Dissolved Oxygen	7.7	8.0	8.0	8.0	7.9	8.1
	pH	8.30	8.25	8.20	7.07	7.08	7.12
	Temperature (C)	20.8	20.8	20.8	20.8	20.8	20.8
	Conductivity	2780	2800	2790	2790	2790	2800
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT: SC4-B10Y - PASS (0% mortality)
SC4-B93Y - PASS (0% mortality)

Comments: - Samples 161, 162 presparated 85 minutes since D.O.>100% of air saturation.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	163 - 164
Client:	Inco Ltd	Test Number:	D302 - D303
	Copper Cliff, Ontario	Sample Date/Time:	12/04/95 //-:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0452	Test Date:	12/06/95// 14:45 hrs
		Technician:	K Groombridge/C Huras

TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
	Sample ID:		SC4-B88Y			SC4-B83Y	
	Sample #:		163			164	
0 HOURS	Dissolved Oxygen	9.1	9.1	9.1	9.1	9.1	9.1
	pH	7.11	7.11	7.11	7.05	7.05	7.05
	Temperature(C)	20.4	20.4	20.4	20.5	20.5	20.5
	Conductivity(uS)	2810	2810	2810	2810	2810	2810
	# Immobile (10 exposed)	0	0	0	0	0	0
24 HOURS	Temperature(C)	20.0	20.0	20.0	20.0	20.0	20.0
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
48 HOURS	Dissolved Oxygen	7.9	8.1	8.0	7.7	7.7	7.9
	pH	7.05	7.09	6.99	6.92	6.96	7.01
	Temperature (C)	20.7	20.7	20.7	20.8	20.8	20.8
	Conductivity	2790	2790	2780	2790	2780	2780
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT: SC4-B88Y - PASS (0% mortality)
SC4-B83Y - PASS (0% mortality)

Comments: - Samples 163, 164 preaerated 85 minutes since D.O >100% of air saturation.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	165 - 166
Client:	Inco Ltd	Test Number:	D304 - D305
	Copper Cliff, Ontario	Sample Date/Time:	12/04/95 //-:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0452, 0451	Test Date:	12/06/95// 15:30 hrs
		Technician:	K Groombridge/C Huras

		Sample ID:	SC4-B78Y			SC4-C10Y	
		Sample #:	165			166	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
0 HOURS	Dissolved Oxygen	9.3	9.3	9.3	9.0	9.0	9.0
	pH	6.86	6.86	6.86	9.16	9.16	9.16
	Temperature(C)	20.2	20.2	20.2	20.7	20.7	20.7
	Conductivity(uS)	2820	2820	2820	2760	2760	2760
	# Immobile (10 exposed)	0	0	0	0	0	0
24 HOURS	Temperature(C)	20.0	20.0	20.0	20.0	20.0	20.0
	# Immobile	0	0	0	2	6	0
	# Dead (10 exposed)	0	0	0	0	0	0
48 HOURS	Dissolved Oxygen	7.9	8.1	8.0	8.1	8.1	8.1
	pH	6.88	6.87	6.85	8.15	8.55	8.44
	Temperature (C)	20.8	20.8	20.8	21.6	21.6	21.1
	Conductivity	2800	2810	2810	2780	2750	2790
	# Immobile	0	0	0	8	5	4
	# Dead (10 exposed)	0	0	0	0	4	1
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	4	1
MEAN PERCENT MORTALITY		0%			16.7%		

RESULTS

48-HOUR RESULT:	SC4-B78Y - PASS (0% mortality)
	SC4-C10Y - PASS (16.7% mortality)

Comments: - Samples 165, 166 were preaerated for 120 minutes since D.O. > 100% of air saturation.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	167 - 168
Client:	Inco Ltd	Test Number:	D306 - D307
	Copper Cliff, Ontario	Sample Date/Time:	12/04/95 //:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0451	Test Date:	12/06/95// 15:30 hrs
		Technician:	K Groombridge/C Huras

		Sample ID:	SC4-C93Y			SC4-C95Y	
		Sample #:	167			168	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
0 HOURS	Dissolved Oxygen	9.0	9.0	9.0	9.2	9.2	9.2
	pH	7.14	7.14	7.14	7.12	7.12	7.12
	Temperature(C)	20.3	20.3	20.3	20.3	20.3	20.3
	Conductivity(uS)	2810	2810	2810	2810	2810	2810
	# Immobile (10 exposed)	0	0	0	0	0	0
24 HOURS	Temperature(C)	20.0	20.0	20.0	20.0	20.0	20.0
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
48 HOURS	Dissolved Oxygen	7.9	7.6	7.8	7.9	8.1	8.0
	pH	6.93	6.86	6.88	6.91	6.94	6.91
	Temperature (C)	20.9	20.9	20.9	20.9	20.9	20.9
	Conductivity	2800	2810	2840	2800	2840	2830
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT: SC4-C93Y - PASS (0% mortality)
SC4-C95Y - PASS (0% mortality)

Comments: - Samples 167, 168 were preaerated for 120 minutes since D.O.>100% of air saturation.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	169 - 170
Client:	Inco Ltd	Test Number:	D308 - D309
	Copper Cliff, Ontario	Sample Date/Time:	12/04/95 //:- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	unknown
Chain of Custody #:	0451	Test Date:	12/05/95// 15:30 hrs
		Technician:	K Groombridge/C Huras

		Sample ID:	SC4-C83Y			SC4-C78Y	
		Sample #:	169			170	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
0 HOURS	Dissolved Oxygen	9.0	9.0	9.0	9.3	9.3	9.3
	pH	6.95	6.95	6.95	6.92	6.92	6.92
	Temperature(C)	20.2	20.2	20.2	20.5	20.5	20.5
	Conductivity(uS)	2820	2820	2820	2810	2810	2810
	# Immobile (10 exposed)	0	0	0	0	0	0
24 HOURS	Temperature(C)	20.0	20.0	20.0	20.0	20.0	20.0
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
48 HOURS	Dissolved Oxygen	7.1	6.8	6.5	6.0	6.0	6.3
	pH	6.39	6.33	6.27	6.02	6.10	6.14
	Temperature (C)	20.8	20.8	20.8	20.8	20.8	20.8
	Conductivity	2790	2830	2800	2810	2830	2830
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT: SC4-C83Y - PASS (0% mortality)
SC4-C78Y - PASS (0% mortality)

Comments: - Samples 169, 170 preserated 120 minutes since D.O.>100% of air saturation.

AQUATIC SCIENCES INC.

96 HOUR STATIC RAINBOW TROUT TEST

Client:	Inco Ltd.	Project Number:	L9224
	Copper Cliff	Sample Number:	156 - 170
Sample Type:	Grab	Test Number:	T291 - T305
Sample State:	Liquid		

QUALITY ASSURANCE INFORMATION

Reference Toxicant Data

Chemical Used:	Sodium Chloride
Date of Test:	November 20/95
96-hour LC50:	15232 mg/L
Warning Limits:	11365 - 19846 mg/L

Test Protocol

Biological Test Methods: Reference Methods for Determining
Acute Lethality of Effluents to Rainbow Trout
Environment Canada
July 1990

Test Conditions

Test Organism:	Rainbow Trout
Test Type:	Static
Test Temperature:	15+/-1C
Test Volume:	16 litres
Photoperiod:	16 hours light/8 hours dark
Dilution Water:	Dechlorinated Tap
Organism Age:	Fingerlings
Stock Source:	Rainbow Springs Hatchery
Mean Weight:	0.17 +/-0.01g

Comments

The reference toxicant results show that test reproducibility
and organism are within acceptable limits.
All data is scrutinized for errors.
Instruments used to monitor parameters are calibrated daily
and continuously maintained.

Reviewers

Technical Review

Final Review

AQUATIC SCIENCES INC

96-HOUR STATIC RAINBOW TROUT TEST

Project Number:	L9224	Sample Number:	1[illegible] - 192
Client:	Inco Ltd.	Test Number:	T[illegible]1 - T[illegible]7
	Copper Cliff, Ontario	Sample Date/Time:	12/04/[illegible] // -- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Tech:	Unknown
Chain of Custody #:	0462	Test Date:	12/[illegible]/[illegible]/11:[illegible] hrs
		Technician:	C [illegible]

TIME	PARAMETER	CONTROL	SC4-A10Y	SC4-A[illegible]Y	SC4-A[illegible]Y	SC4-A[illegible]Y	SC4-A7[illegible]Y	SC4-B10Y	SC4-B[illegible]Y
	Sample #:		18[illegible]	187	18[illegible]	1[illegible]	1[illegible]	1[illegible]1	192
		0	100	100	100	100	100	100	100
0 HOURS	Dissolved Oxygen	9.[illegible]	10.0	10.0	10.0	10.1	10.0	10.0	10.1
	pH	7.77	[illegible].72	[illegible].[illegible]1	[illegible].10	7.[illegible]	[illegible]	[illegible]	[illegible]
	Temperature(C)	16.0	15.2	15.1	15.[illegible]	15.0	15.4	15.1	15.1
	Conductivity(uS)	[illegible]	[illegible]	2[illegible]70	[illegible]	2[illegible]70	2[illegible]70	[illegible]	[illegible]
	# Immobile (10 exposed)	0	0	0	0	0	0	0	0
24 HOURS	Dissolved Oxygen	9.1	9.[illegible]	[illegible].7	[illegible]	[illegible]	[illegible]	[illegible].1	[illegible].1
	pH	7.55	[illegible].41	7.[illegible]	7.40	7.12	[illegible]	[illegible]	7.[illegible]1
	Temperature (C)	14.[illegible]	14.5	14.4	14.6	14.2	14.[illegible]	1[illegible].[illegible]	13.[illegible]
	Conductivity	304	[illegible]	2[illegible]70	2[illegible]70	2[illegible]70	[illegible]	[illegible]	[illegible]
	# Immobile	0	0	0	0	0	0	0	0
	# Dead (10 exposed)	0	10	0	0	0	0	10	0
48 HOURS	Dissolved Oxygen	[illegible].2	[illegible].4	[illegible].5	[illegible].4	[illegible].4	7.[illegible]	[illegible]	[illegible].7
	pH	7.[illegible]	[illegible].[illegible]1	7.17	7.11	[illegible]	[illegible].17	[illegible]	7.32
	Temperature (C)	14.[illegible]	14.[illegible]	14.4	14.3	14.2	1[illegible].[illegible]	1[illegible].[illegible]	1[illegible].[illegible]
	Conductivity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	# Immobile	0	-	0	0	0	1	-	0
	# Dead (10 exposed)	0	-	0	0	0	0	-	0
72 HOURS	Dissolved Oxygen	[illegible].0	7.[illegible]	7.7	[illegible].0	[illegible].0	7.[illegible]	7.0	[illegible].0
	pH	7.70	7.[illegible]	7.[illegible]	7.17	[illegible]	4.[illegible]	7.[illegible]	7.[illegible]
	Temperature (C)	15.0	14.[illegible]	14.6	14.7	14.7	14.[illegible]	14.5	14.5
	Conductivity	307	2[illegible]70	2[illegible]70	[illegible]	[illegible]	[illegible]	2[illegible]70	[illegible]
	# Immobile	0	-	0	0	0	0	-	0
	# Dead (10 exposed)	0	-	0	0	0	1	-	0
96 HOURS	Dissolved Oxygen	7.5	[illegible].[illegible]	7.7	7.[illegible]	7.[illegible]	7.[illegible]	[illegible].[illegible]	7.[illegible]
	pH	7.74	7.41	7.[illegible]	7.[illegible]	[illegible]	[illegible]	7.[illegible]	7.1[illegible]
	Temperature (C)	15.2	15.1	15.0	14.[illegible]	14.[illegible]	14.[illegible]	14.[illegible]	14.[illegible]
	Conductivity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	# Immobile	0	-	0	0	0	0	-	0
	# Dead (10 exposed)	0	-	0	1	0	1	-	0
TOTAL MORTALITY (10 EXPOSED)		0	10	0	1	0	[illegible]	10	0

RESULTS

96-HOUR RESULT:

- SC4-A10Y - FAIL (100% mortality)
- SC4-A[illegible]Y - PASS (0% mortality)
- SC4-A[illegible]Y - PASS (10% mortality)
- SC4-A[illegible]Y - PASS (0% mortality)
- SC4-A7[illegible]Y - PASS ([illegible]% mortality)
- SC4-B10Y - FAIL (100% mortality)
- SC4-B[illegible]Y - PASS (0% mortality)

Mean Weight: 0.3[illegible] +/- 0.11 g

Loading Density: 0.[illegible]1 g fish/L

Comments:

- [illegible] in samples [illegible], [illegible], [illegible] after 1 hour

INITIAL PARAMETERS: [illegible]

	SC4-A1[illegible]Y	SC4-A[illegible]Y	SC4-A[illegible]Y	SC4-A[illegible]Y	SC4-A7[illegible]Y	SC4-B1[illegible]Y	SC4-B[illegible]Y
Dissolved Oxygen (ppm):	10.2	10.2	[illegible].[illegible]	10.4	10.2	1[illegible].[illegible]	10.4
pH:	[illegible].11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Temperature (C):	10.4	10.7	12.[illegible]	10.4	11.[illegible]	11.1	10.1
Conductivity (uS/cm):	2[illegible]40	[illegible]	2[illegible]70	[illegible]	[illegible]	[illegible]	[illegible]
Hardness (mg/L):	1071	1071	1071	1071	1071	113[illegible]	113[illegible]
Physical State:	liquid	liquid	liquid	liquid	liquid	liquid	liquid
Clarity:	clear	clear	clear	clear	clear	clear	clear
Colour:	yellow	yellow	yellow	yellow	yellow	colourless	colourless
Precipitate:	yes	yes	yes	yes	yes	[illegible]	yes
Odour:	none	none	none	none	none	none	none
Pre-aeration Time (minutes):	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AQUATIC SCIENCES INC.

96-HOUR STATIC RAINBOW TROUT TEST

Project Number:	L9234	Sample Number:	163 - 170
Client:	Inco Ltd.	Test Number:	T396 - T305
	Copper Cliff, Ontario	Sample Date/Time:	12/04/95 // -- hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Tech:	unknown
Chain of Custody #:	9451 - 9462	Test Date:	12/08/95//1200 hrs
		Technician:	C Hurse

TIME	PARAMETER	Sample ID:	SC4-B88Y	SC4-B83Y	SC4-B78Y	SC4-C10Y	SC4-C83Y	SC4-C88Y	SC4-C83Y	SC4-C78Y
		Sample #:	163	164	165	166	167	168	169	170
			100	100	100	100	100	100	100	100
0 HOURS	Dissolved Oxygen		10.1	10.0	10.0	10.0	9.8	10.1	10.0	10.1
	pH		7.53	7.18	6.99	6.79	6.62	7.58	7.18	7.22
	Temperature(C)		14.9	15.0	15.2	15.3	13.2	14.8	15.2	14.9
	Conductivity(uS)		2870	2870	2870	2830	2870	2870	2870	2880
	# Immobile (10 exposed)		0	0	0	0	0	0	0	0
24 HOURS	Dissolved Oxygen		8.0	8.9	8.8	8.3	9.0	8.0	8.0	8.8
	pH		7.35	7.27	7.11	6.31	7.28	7.18	7.14	6.85
	Temperature (C)		14.9	14.1	14.1	14.0	13.8	13.8	13.7	13.7
	Conductivity		2880	2880	2870	2840	2880	2880	2880	2880
	# Immobile		0	0	0	0	0	0	0	0
	# Dead (10 exposed)		0	0	0	10	0	0	0	0
48 HOURS	Dissolved Oxygen		8.8	8.3	8.4	8.8	8.7	8.8	8.5	7.8
	pH		7.22	7.05	6.97	6.77	7.25	7.22	6.84	6.92
	Temperature (C)		14.8	14.2	14.0	13.9	13.8	13.7	13.7	13.8
	Conductivity		2880	2880	2880	2880	2880	2880	2880	2880
	# Immobile		0	0	0	-	0	0	0	0
	# Dead (10 exposed)		0	0	0	-	0	0	0	0
72 HOURS	Dissolved Oxygen		7.7	8.0	8.0	7.8	7.7	7.8	7.7	7.8
	pH		7.18	7.07	6.80	6.10	7.11	7.08	6.86	5.11
	Temperature (C)		14.5	14.4	14.5	14.3	14.4	14.4	14.3	14.3
	Conductivity		2880	2880	2880	2870	2880	2880	2880	2880
	# Immobile		0	0	0	-	0	0	0	0
	# Dead (10 exposed)		0	0	0	-	0	0	0	0
96 HOURS	Dissolved Oxygen		7.6	7.5	7.5	7.3	7.8	7.8	7.8	7.7
	pH		7.14	7.06	6.89	7.72	7.09	7.05	6.97	4.16
	Temperature (C)		14.6	14.6	14.7	14.7	14.6	14.6	14.5	14.4
	Conductivity		2880	2880	2880	2880	2880	2880	2880	2880
	# Immobile		0	0	0	-	0	0	0	0
	# Dead (10 exposed)		0	0	0	-	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)			0	0	0	10	0	0	0	0

RESULTS

96-HOUR RESULT:

SC4-B88Y - PASS (0% mortality)
SC4-B83Y - PASS (0% mortality)
SC4-B78Y - PASS (0% mortality)
SC4-C10Y - FAIL (100% mortality)
SC4-C83Y - PASS (0% mortality)
SC4-C88Y - PASS (0% mortality)
SC4-C83Y - PASS (0% mortality)
SC4-C78Y - PASS (0% mortality)

Mean Weight: 0.35 +/- 0.11 g

Loading Density: 0.21 g fish/L

Comments:

INITIAL PARAMETERS: (upon reception by lab)

	SC4-B88Y	SC4-B83Y	SC4-B78Y	SC4-C10Y	SC4-C83Y	SC4-C88Y	SC4-C83Y	SC4-C78Y
Dissolved Oxygen (ppm):	10.2	10.0	10.4	9.8	10.0	10.4	10.4	10.4
pH:	7.80	7.33	6.84	10.13	6.62	7.82	7.44	7.20
Temperature (C):	10.4	9.7	9.0	11.5	11.5	9.2	10.5	9.7
Conductivity (uS/cm):	2880	2880	2880	2840	2880	2880	2880	2880
Hardness (mg/L):	1130	1130	1130	1130	1130	1130	1130	1130
Physical State:	liquid	liquid	liquid	liquid	liquid	liquid	liquid	liquid
Clarity:	clear	clear	clear	clear	clear	clear	clear	clear
Colour:	colourless	colourless	colourless	yellow	yellow	yellow	yellow	yellow
Precipitate:	no	no	no	yes	yes	yes	yes	yes
Odour:	none	none	none	none	none	none	none	none
Pre-aeration Time (min):	60	60	60	60	60	60	60	60

AQUATIC SCIENCES INC.

48 HOUR STATIC DAPHNIA MAGNA TEST

Client:	Inco Ltd.	Project Number:	L9224
	Copper Cliff	Sample Number:	171-185
Sample Type:	Grab	Test Number:	D310-D324
Sample State:	Liquid		

QUALITY ASSURANCE INFORMATION

Reference Toxicant Data

Chemical Used:	Sodium Chloride
Date of Test:	December 15/95
48-hour LC50:	6272 mg/L
Warning Limits:	4981 - 7962 mg/L

Test Protocol

Biological Test Methods: Reference Methods for Determining
Acute Lethality of Effluents to Daphnia magna
Environment Canada
July 1990

Test Conditions

Test Organism:	Daphnia magna
Test Type:	Static
Test Temperature:	20+/-1C
Test Volume:	200mL
Loading Density:	20mL/neonate
Photoperiod:	16 hours light/8 hours dark
Dilution Water:	Dechlorinated Tap
Organism Age:	<24 hours
Stock Source:	in house cultures
Time of First Brood:	6 days
Average Brood Size:	28 neonates
Ephippia Frequency:	0

Comments

The reference toxicant results show that test reproducibility and organism are within acceptable limits.
All data is scrutinized for errors.
Instruments used to monitor parameters are calibrated daily and continuously maintained.

Reviewers

Technical Review

Final Review

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	171
Client:	Inco Ltd	Test Number:	D310
	Copper Cliff, Ontario	Sample Date/Time:	12/11/95 //14:30 hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	S Clark
Chain of Custody #:	0449	Test Date:	12/15/95// 13:00 hrs
		Technician:	S Hilliker / K Groombridge

		Concentration 2%					
	Sample ID:					SC5-A10Y	
	Sample #:					171	
TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C
	Dissolved Oxygen	8.8	8.8	8.8	8.9	8.9	8.9
	pH	7.95	7.95	7.95	9.30	9.30	9.30
0 HOURS	Temperature(C)	19.5	19.5	19.5	19.5	19.5	19.5
	Conductivity(uS)	307	307	307	2900	2900	2900
	# Immobile (10 exposed)	0	0	0	0	0	0
	Temperature(C)	20.2	20.2	20.2	20.2	20.2	20.2
24 HOURS	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
	Dissolved Oxygen	8.9	8.9	8.9	8.0	8.1	8.1
	pH	7.74	7.70	7.70	8.27	8.26	8.32
48 HOURS	Temperature (C)	21.0	21.0	21.0	20.6	20.6	20.6
	Conductivity	309	310	309	2890	2920	2920
	# Immobile	0	0	0	0	1	0
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT:	SC5-A10Y - PASS (0% mortality)
Brood Culture:	110695
Time to First Brood:	6
Average Brood Size:	28 neonates

Comments:
- sample 171 was preaerated for 120 minutes since D.O. >100% air saturation

AQUATIC SC ENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	172 - 173
Client:	Inco Ltd	Test Number:	D311 - D312
	Copper Cliff, Ontario	Sample Date/Time:	12/11/95//14:30 hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	S Clark
Chain of Custody #:	0449	Test Date:	12/15/95// 13:20 hrs
		Technician:	S Hilliker / K Groombridge

			Concentrations %V/V					
		Sample ID:		SC5-A93Y			SC5-A88Y	
		Sample #:		172			173	
TIME	PARAMETER		100-A	100-B	100-C	100-A	100-B	100-C
0 HOURS	Dissolved Oxygen		8.9	8.9	8.9	8.9	8.9	8.9
	pH		8.47	8.47	8.47	8.11	8.11	8.11
	Temperature(C)		19.4	19.4	19.4	19.4	19.4	19.4
	Conductivity(uS)		2910	2910	2910	2920	2920	2920
	# Immobile (10 exposed)		0	0	0	0	0	0
24 HOURS	Temperature(C)		20.2	20.2	20.2	20.2	20.2	20.2
	# Immobile		0	0	0	0	0	0
	# Dead (10 exposed)		0	0	0	0	0	0
48 HOURS	Dissolved Oxygen		5.6	5.8	5.7	6.6	5.6	5.8
	pH		6.98	6.98	7.03	7.07	7.06	6.99
	Temperature (C)		20.7	20.5	20.5	20.8	20.5	20.6
	Conductivity		2920	2980	2930	2930	2990	2930
	# Immobile		0	0	0	0	0	0
	# Dead (10 exposed)		0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)			0	0	0	0	0	0
MEAN PERCENT MORTALITY			0%			0%		

RESULTS

48-HOUR RESULT: SC5-A93Y - PASS (0% mortality)
SC5-A88Y - PASS (0% mortality)

Comments:
- Samples 172 & 173 preaerated 120 minutes since D.O. > 100% air saturaion.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	174 - 175
Client:	Inco Ltd	Test Number:	D313 - D314
	Copper Cliff, Ontario	Sample Date/Time:	12/11/95 //14:30 hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	S Clark
Chain of Custody #:	0449	Test Date:	12/15/95// 13:20 hrs
		Technician:	S Hilliker / K Groombridge

		Concentrations %V/V					
	Sample ID:		SC5-A83Y			SC5-A78Y	
	Sample #:		174			175	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
	Dissolved Oxygen	8.9	8.9	8.9	9.1	9.1	9.1
	pH	7.86	7.86	7.86	7.90	7.90	7.90
0 HOURS	Temperature(C)	19.5	19.5	19.5	19.5	19.5	19.5
	Conductivity(uS)	2900	2900	2900	2900	2900	2900
	# Immobile (10 exposed)	0	0	0	0	0	0
	Temperature(C)	20.2	20.2	20.2	20.2	20.2	20.2
24 HOURS	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
	Dissolved Oxygen	6.9	7.1	7.0	7.6	7.7	7.9
	pH	7.02	7.05	7.06	7.16	7.17	7.21
48 HOURS	Temperature (C)	20.8	20.6	20.6	21.0	20.6	20.7
	Conductivity	2990	2940	2980	2910	2970	2920
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT: SC5-A83Y - PASS (0% mortality)
SC5-A78Y - PASS (0% mortality)

Comments: - Samples 174, 175 preaerated 120 minutes since D.O. > 100% of air saturation.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	176 - 177
Client:	Inco Ltd	Test Number:	D315 - D316
	Copper Cliff, Ontario	Sample Date/Time:	12/11/95 //14:30 hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	S Clark
Chain of Custody #:	0449	Test Date:	12/15/95// 13:25 hrs
		Technician:	S Hilliker / K Groombridge

			Concentrations %V/V				
	Sample ID:		SC5-B10Y			SC5-B93Y	
	Sample #:		176			177	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
	Dissolved Oxygen	8.9	8.9	8.9	8.9	8.9	8.9
	pH	8.99	8.99	8.99	8.18	8.18	8.18
0 HOURS	Temperature(C)	19.4	19.4	19.4	19.5	19.5	19.5
	Conductivity(uS)	2850	2850	2850	2850	2850	2850
	# Immobile (10 exposed)	0	0	0	0	0	.0
	Temperature(C)	20.2	20.2	20.2	20.2	20.2	20.2
24 HOURS	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
	Dissolved Oxygen	6.4	5.6	6.1	8.0	8.1	8.1
	pH	7.24	7.20	7.19	7.47	7.47	7.51
48 HOURS	Temperature (C)	20.8	20.9	20.6	20.7	20.7	20.8
	Conductivity	2990	2920	2900	2880	2870	2880
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT: SC5-B10Y - PASS (0% mortality)
SC5-B93Y - PASS (0% mortality)

Comments: - Samples 176, 177 preaerated 120 minutes since D.O.>100% of air saturation.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	178 - 179
Client:	Inco Ltd	Test Number:	D317 - D318
	Copper Cliff, Ontario	Sample Date/Time:	12/11/95 //14:30 hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	S Clark
Chain of Custody #:	0449	Test Date:	12/15/95// 13:25 hrs
		Technician:	S Hilliker / K Groombridge

		Concentrations %V/V					
	Sample ID:		SC5-B88Y			SC5-B83Y	
	Sample #:		178			179	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
	Dissolved Oxygen	8.9	8.9	8.9	8.9	8.9	8.9
	pH	7.42	7.42	7.42	7.46	7.46	7.46
0 HOURS	Temperature(C)	19.6	19.6	19.6	19.6	19.6	19.6
	Conductivity(uS)	2730	2730	2730	2880	2880	2880
	# Immobile (10 exposed)	0	0	0	0	0	0
	Temperature(C)	20.2	20.2	20.2	20.2	20.2	20.2
24 HOURS	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
	Dissolved Oxygen	7.4	7.6	7.6	8.0	8.1	8.2
	pH	6.74	6.80	6.82	7.11	7.15	7.22
48 HOURS	Temperature (C)	20.7	20.8	20.7	20.6	20.6	20.6
	Conductivity	2810	2750	2740	2880	2900	2890
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT:	SC5-B88Y - PASS (0% mortality)
	SC5-B83Y - PASS (0% mortality)

Comments: - Samples 178, 179 preaerated 120 minutes since D.O.>100% of air saturation.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	180 - 181
Client:	Inco Ltd	Test Number:	D319 - D320
	Copper Cliff, Ontario	Sample Date/Time:	12/11/95 //14:30 hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	S Clark
Chain of Custody #:	0449, 0448	Test Date:	12/15/95// 15:15 hrs
		Technician:	K Groombridge/C Huras

		Concentrations %V/V					
	Sample ID:		SC5-B78Y			SC5-C10Y	
	Sample #:		180			181	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
0 HOURS	Dissolved Oxygen	8.9	8.9	8.9	8.8	8.8	8.8
	pH	7.27	7.27	7.27	8.96	8.96	8.96
	Temperature(C)	19.8	19.8	19.8	19.8	19.8	19.8
	Conductivity(uS)	2800	2800	2800	2850	2850	2850
	# Immobile (10 exposed)	0	0	0	0	0	0
24 HOURS	Temperature(C)	20.2	20.2	20.2	20.2	20.2	20.2
	# Immobile	0	0	0	0	1	1
	# Dead (10 exposed)	0	0	0	0	0	0
48 HOURS	Dissolved Oxygen	8.1	8.2	8.2	4.8	4.3	4.7
	pH	7.17	7.16	7.19	7.25	7.11	7.19
	Temperature (C)	20.6	20.5	20.5	20.7	20.8	20.7
	Conductivity	2870	2820	2850	2880	2920	2880
	# Immobile	0	0	0	6	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT:	SC5-B78Y - PASS (0% mortality)
	SC5-C10Y - PASS (0% mortality)

Comments: - Samples 180, 181 were preaerated for 95 minutes since D.O. > 100% of air saturation.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/PM/14

Project Number:	L9224	Sample Number:	182 - 183
Client:	Inco Ltd	Test Number:	D321 - D322
	Copper Cliff, Ontario	Sample Date/Time:	12/11/95 //14:30 hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	S Clark
Chain of Custody #:	448	Test Date:	12/15/95// 15:15 hrs
		Technician:	K Groombridge/C Huras

		Concentrations %V/V					
	Sample ID:		SC5-C93Y			SC5-C88Y	
	Sample #:		182			183	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
	Dissolved Oxygen	8.9	8.9	8.9	8.9	8.9	8.9
	pH	8.29	8.29	8.29	8.29	8.29	8.29
0 HOURS	Temperature(C)	19.7	19.7	19.7	19.7	19.7	19.7
	Conductivity(uS)	2880	2880	2880	2890	2890	2890
	# Immobile (10 exposed)	0	0	0	0	0	0
	Temperature(C)	20.2	20.2	20.2	20.2	20.2	20.2
24 HOURS	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
	Dissolved Oxygen	6.1	6.5	6.6	7.2	7.3	7.6
	pH	7.13	7.10	7.15	7.36	7.40	7.43
48 HOURS	Temperature (C)	20.7	20.7	20.7	20.6	20.6	20.6
	Conductivity	2920	2910	2880	2920	2910	2920
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	1	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	1	0	0	0
MEAN PERCENT MORTALITY		3%			0%		

RESULTS

48-HOUR RESULT: SC5-C93Y - PASS (3% mortality)
SC5-C88Y - PASS (0% mortality)

Comments: - Samples 182, 183 were preaerated for 95 minutes since D.O.> 100% of air saturation.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST
EPS 1/RM/14

Project Number:	L9224	Sample Number:	184 - 185
Client:	Inco Ltd	Test Number:	D323 - D324
	Copper Cliff, Ontario	Sample Date/Time:	12/11/95 //14:30 hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Technician:	S Clark
Chain of Custody #:	0448	Test Date:	12/15/95// 15:15 hrs
		Technician:	K Groombridge/C Huras

		Concentrations %V/V					
	Sample ID:		SC5-C83Y			SC5-C78Y	
	Sample #:		184			185	
TIME	PARAMETER	100-A	100-B	100-C	100-A	100-B	100-C
0 HOURS	Dissolved Oxygen	9.0	9.0	9.0	9.0	9.0	9.0
	pH	7.85	7.85	7.85	7.47	7.47	7.47
	Temperature(C)	19.7	19.7	19.7	19.7	19.7	19.7
	Conductivity(uS)	2920	2920	2920	2900	2900	2900
	# Immobile (10 exposed)	0	0	0	0	0	0
24 HOURS	Temperature(C)	20.2	20.2	20.2	20.2	20.2	20.2
	# Immobile	0	0	0	0	0	0
	# Dead (10 exposed)	0	0	0	0	0	0
48 HOURS	Dissolved Oxygen	8.1	8.0	8.0	7.6	7.6	7.7
	pH	7.28	7.21	7.18	7.10	7.08	7.05
	Temperature (C)	20.5	20.6	20.6	20.6	20.6	20.7
	Conductivity	2930	2970	2950	2900	3000	2900
	# Immobile	0	0	0	0	0	1
	# Dead (10 exposed)	0	0	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)		0	0	0	0	0	0
MEAN PERCENT MORTALITY		0%			0%		

RESULTS

48-HOUR RESULT:	SC5-C83Y - PASS (0% mortality)
	SC5-C78Y - PASS (0% mortality)

Comments: - Samples 184, 185 preaerated 95 minutes since D.O.>100% of air saturation.

AQUATIC SCIENCES INC.

96 HOUR STATIC RAINBOW TROUT TEST

Client:	Inco Ltd.	Project Number:	L9224
	Copper Cliff	Sample Number:	171 - 185
Sample Type:	Grab	Test Number:	T306 - T320
Sample State:	Liquid		

QUALITY ASSURANCE INFORMATION

Reference Toxicant Data

Chemical Used:	Sodium Chloride
Date of Test:	December 15/95
96-hour LC50:	17020 mg/L
Warning Limits:	11509 - 19770 mg/L

Test Protocol

Biological Test Methods: Reference Methods for Determining Acute Lethality of Effluents to Rainbow Trout
Environment Canada
July 1990

Test Conditions

Test Organism:	Rainbow Trout
Test Type:	Static
Test Temperature:	15+/-1C
Test Volume:	16 litres
Photoperiod:	16 hours light/8 hours dark
Dilution Water:	Dechlorinated Tap
Organism Age:	Fingerlings
Stock Source:	Rainbow Springs Hatchery
Mean Weight:	0.23 +/- 0.03g

Comments

The reference toxicant results show that test reproducibility and organism are within acceptable limits.
All data is scrutinized for errors.
Instruments used to monitor parameters are calibrated daily and continuously maintained.

Reviewers

Craig Hurs
Technical Review

Final Review

AQUATIC SCIENCES INC.

96-HOUR STATIC RAINBOW TROUT TEST

Project Number:	L9224	Sample Number:	171 - 177
Client:	Inco Ltd.	Test Number:	T308 - T312
	Copper Cliff, Ontario	Sample Date/Time:	12/11/95 // 14:30 hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Tech:	S Clark
Chain of Custody #:	0449	Test Date/Time:	12/15/95//10:45 hrs
		Technician:	C Hurss

		Sample ID:	CONTROL	SCS-A10Y	SCS-A83Y	SCS-A88Y	SCS-A83Y	SCS-A78Y	SCS-B10Y	SCS-B83Y
		Sample #:		171	172	173	174	175	176	177
TIME	PARAMETER		0	100	100	100	100	100	100	100
0 HOURS	Dissolved Oxygen		9.6	9.6	9.6	10.6	10.4	10.6	10.4	10.4
	pH		8.04	9.70	8.13	8.91	8.62	8.55	9.54	8.74
	Temperature(C)		14.3	14.8	14.5	14.2	13.9	13.9	14.1	13.9
	Conductivity(uS)		314	2680	2920	2930	3120	2930	2870	2880
	# Immobile (10 exposed)		0	0	0	0	0	0	0	0
24 HOURS	Dissolved Oxygen		9.4	9.6	9.5	9.3	9.7	9.3	9.5	9.2
	pH		8.19	8.68	7.70	8.20	7.58	7.86	8.98	7.82
	Temperature (C)		14.6	14.3	14.1	14.0	13.8	13.8	13.8	13.8
	Conductivity		313	2910	2950	2940	2950	2950	2880	2840
	# Immobile		0	-	0	0	0	0	-	0
	# Dead (10 exposed)		0	10	0	0	0	0	10	0
48 HOURS	Dissolved Oxygen		9.8	10.1	10.0	9.8	10.1	9.9	9.1	9.0
	pH		7.89	7.56	7.38	7.39	7.35	7.26	7.15	7.28
	Temperature (C)		14.7	15.2	15.0	14.9	14.8	14.7	14.7	14.8
	Conductivity		318	2980	3030	3010	3070	2990	3030	2940
	# Immobile		0	-	0	0	0	0	-	0
	# Dead (10 exposed)		0	-	0	0	0	0	-	0
72 HOURS	Dissolved Oxygen		9.3	9.0	9.1	8.7	9.7	9.0	8.9	9.2
	pH		7.87	7.56	7.43	7.45	7.43	7.37	7.45	7.38
	Temperature (C)		14.5	15.1	14.9	14.8	14.8	14.8	14.7	14.5
	Conductivity		319	2950	2970	2970	2970	2980	2900	2820
	# Immobile		0	-	0	0	0	0	-	0
	# Dead (10 exposed)		0	-	0	0	0	0	-	0
96 HOURS	Dissolved Oxygen		9.8	9.0	9.0	9.1	8.9	9.5	9.0	9.3
	pH		7.88	6.94	6.97	7.03	7.08	7.14	7.10	7.27
	Temperature (C)		14.3	14.9	14.7	14.6	14.6	14.5	14.5	14.4
	Conductivity		320	3010	2980	3000	3010	3020	2990	2980
	# Immobile		0	-	0	0	0	0	-	0
	# Dead (10 exposed)		0	-	0	0	0	0	-	0
TOTAL MORTALITY (10 EXPOSED)			0	10	0	0	0	0	10	0

RESULTS

96-HOUR RESULT:	SCS-A10Y - FAIL (100% mortality)	SCS-A78Y - PASS (0% mortality)
	SCS-A83Y - PASS (0% mortality)	SCS-B10Y - FAIL (100% mortality)
	SCS-A88Y - PASS (0% mortality)	SCS-B83Y - PASS (0% mortality)
	SCS-A83Y - PASS (0% mortality)	
Mean Weight:	0.23 +/- 0.03 g	
Loading Density:	0.14 g fish/L	

Comments:

AQUATIC SCIENCES INC.

96-HOUR STATIC RAINBOW TROUT TEST

Project Number:	L9224	Sample Number:	178 - 185
Client:	Inco Ltd.	Test Number:	T313 - T320
	Copper Cliff, Ontario	Sample Date/Time:	12/11/95 //14:30 hrs
Sample Name/ID:	Copper Cliff Wastewater Treatment Plant	Sample Tech:	S Clark
Chain of Custody #:	0449 - 0446	Test Date:	12/15/95//10:45 hrs
		Technician:	C Huras

					Concentration 100%				
		Sample ID:	SCS-B88Y	SCS-B83Y	SCS-B78Y	SCS-C10Y	SCS-C93Y	SCS-C88Y	SCS-C83Y	SCS-C78Y
		Sample #:	178	179	180	181	182	183	184	185
TIME	PARAMETER		100	100	100	100	100	100	100	100
	Dissolved Oxygen		10.6	10.2	11.0	10.2	10.2	10.2	10.0	10.2
	pH		8.17	8.18	8.15	9.47	8.49	8.72	8.19	7.99
0 HOURS	Temperature(C)		13.7	13.9	13.6	14.1	13.8	14.3	13.8	14.4
	Conductivity(uS)		2770	2910	2920	2870	2930	2920	2950	2920
	# Immobile (10 exposed)		0	0	0	0	0	0	0	0
	Dissolved Oxygen		9.6	9.3	9.1	9.5	9.5	9.4	9.6	9.4
	pH		7.38	7.33	7.31	8.66	7.52	7.92	7.99	7.46
	Temperature (C)		13.8	13.9	13.8	14.0	14.0	14.0	13.7	14.0
24 HOURS	Conductivity		2900	2920	2930	2990	2970	2930	2950	2930
	# Immobile		0	0	0	-	0	0	0	0
	# Dead (10 exposed)		0	0	0	10	0	0	0	0
	Dissolved Oxygen		10.1	10.0	10.2	9.6	10.0	9.7	9.6	9.7
	pH		7.29	7.17	7.26	8.01	7.47	7.31	7.23	7.18
48 HOURS	Temperature (C)		14.7	14.9	14.8	15.0	14.8	15.0	14.8	15.0
	Conductivity		2990	2970	3270	2980	3100	3090	3210	3000
	# Immobile		0	0	0	-	0	0	0	0
	# Dead (10 exposed)		0	0	0	-	0	0	0	0
	Dissolved Oxygen		8.9	9.0	8.9	8.3	9.1	9.2	8.6	9.1
	pH		7.37	7.34	7.32	7.15	7.36	7.41	7.30	7.32
72 HOURS	Temperature (C)		14.6	14.8	14.6	14.9	14.6	14.8	14.5	14.8
	Conductivity		2940	2930	2940	2930	2980	2940	2970	2950
	# Immobile		0	0	0	-	0	0	0	0
	# Dead (10 exposed)		0	0	0	-	0	0	0	0
	Dissolved Oxygen		8.8	9.2	9.1	9.6	9.1	9.7	8.5	9.4
	pH		7.09	7.12	7.15	7.18	7.19	7.28	7.18	7.16
96 HOURS	Temperature (C)		14.3	14.3	14.3	14.3	14.3	14.3	14.2	14.3
	Conductivity		2950	2940	2970	2990	2970	2990	2990	2990
	# Immobile		0	0	0	-	0	0	0	0
	# Dead (10 exposed)		0	0	0	-	0	0	0	0
TOTAL MORTALITY (10 EXPOSED)			0	0	0	10	0	0	0	0

RESULTS

96-HOUR RESULT:

SCS-B88Y - PASS (0% mortality)
SCS-B83Y - PASS (0% mortality)
SCS-B78Y - PASS (0% mortality)
SCS-C10Y - FAIL (100% mortality)
SCS-C93Y - PASS (0% mortality)
SCS-C88Y - PASS (0% mortality)
SCS-C83Y - PASS (0% mortality)
SCS-C78Y - PASS (0% mortality)

Mean Weight: 0.23 +/- 0.03 g

Loading Density: 0.14 g fish/L

Comments:

INITIAL PARAMETERS (upon reception by lab)

	SCS-A10Y	SCS-A93Y	SCS-A88Y	SCS-A83Y	SCS-A78Y	SCS-B10Y	SCS-B93Y
Dissolved Oxygen (ppm)	10.6	10.0	10.4	10.2	10.2	10.0	10.2
pH	10.02	9.11	9.09	8.91	8.75	9.78	8.95
Temperature (C)	13.4	14.1	10.8	10.7	10.2	13.2	12.8
Conductivity (uS/cm)	2740	2920	2440	2700	2550	2870	2880
Hardness (mg/L)	not available						
Physical State:	part frozen	part frozen	part frozen	part frozen	part frozen	part frozen	part frozen
Clarity:	clear	clear	clear	clear	clear	clear	clear
Colour:	yellow	yellow	yellow	yellow	yellow	colourless	colourless
Precipitate:	yes	yes	yes	yes	yes	no	no
Odour:	none	none	none	none	none	none	none
Pre-aeration Time (minutes):	30	30	90	90	90	90	90

INITIAL PARAMETERS: (upon reception by lab)

	SCS-B88Y	SCS-B83Y	SCS-B78Y	SCS-C10Y	SCS-C93Y	SCS-C88Y	SCS-C83Y	SCS-C78Y
Dissolved Oxygen (ppm):	10.4	9.8	10.2	9.6	10.3	9.6	9.6	9.5
pH:	8.44	8.93	8.40	9.71	9.00	8.94	8.66	8.34
Temperature (C):	9.9	12.8	9.7	13.3	11.4	13.6	13.8	13.6
Conductivity (uS/cm):	2550	2920	2420	2880	2840	2920	2930	2920
Hardness (mg/L):	not available							
Physical State:	part. frozen	part. frozen	part. frozen	part. frozen	part. frozen	part. frozen	part. frozen	part. frozen
Clarity:	clear	clear	clear	clear	clear	clear	clear	clear
Colour:	colourless	colourless	colourless	yellow	yellow	yellow	yellow	yellow
Precipitate:	no	no	no	yes	yes	yes	yes	yes
Odour:	none	none	none	none	none	none	none	none
Pre-aeration Time (min):	90	90	90	90	90	90	90	90

AQUATIC SCIENCES INC.

48 HOUR STATIC DAPHNIA MAGNA SINGLE CONCENTRATION TEST
EPS 1/RM/14

Project Number:	L9387	Sample Number:	01 - 32
Client:	Inco Ltd	Test Number:	D01 - D32
	Copper Cliff, Ontario	Sample Date/Time:	04/28/97//-:- hrs
Sample Name/ID:	**Experimental Treatments for CCWWTP**	Sample Technician:	S Clark
	Sample Identification #101 - 132	Test Date/Time:	05/01/97// 14:10 - 17:40 hrs
Sample Location:	CCWWTP	Technician:	J Farquharson/W Masters/S Hillier
Chain of Custody #:	2112		
Sample Method:	Grab		

RESULTS

48 HOUR RESULT:	01: 101:	**PASS (50% mortality)**	09: 109:	**FAIL (100% mortality)**	17: 117:	**FAIL (50% mortality)**	25: 125:	**FAIL (50% mortality)**
	02: 102:	**PASS (0% mortality)**	10: 110:	**PASS (0% mortality)**	18: 118:	**PASS (0% mortality)**	26: 126:	**PASS (0% mortality)**
	03: 103:	**PASS (0% mortality)**	11: 111:	**PASS (0% mortality)**	19: 119:	**PASS (0% mortality)**	27: 127:	**PASS (0% mortality)**
	04: 104:	**PASS (0% mortality)**	12: 112:	**PASS (0% mortality)**	20: 120:	**PASS (0% mortality)**	28: 128:	**PASS (0% mortality)**
	05: 105:	**FAIL (50% mortality)**	13: 113:	**FAIL (100% mortality)**	21: 121:	**FAIL (100% mortality)**	29: 129:	**FAIL (100% mortality)**
	06: 106:	**PASS (0% mortality)**	14: 114:	**PASS (0% mortality)**	22: 122:	**PASS (0% mortality)**	30: 130:	**PASS (0% mortality)**
	07: 107:	**PASS (0% mortality)**	15: 115:	**PASS (0% mortality)**	23: 123:	**PASS (0% mortality)**	31: 131:	**PASS (0% mortality)**
	08: 108:	**PASS (0% mortality)**	16: 116:	**PASS (0% mortality)**	24: 124:	**PASS (0% mortality)**	32: 132:	**PASS (0% mortality)**

QUALITY ASSURANCE INFORMATION

REFERENCE TEST CONDITIONS

Test Organism:	Daphnia magna	Photoperiod:	16 hours light/8 hours dark
Brood Culture:	040197	Dilution Water:	Dechlorinated Tap
Test Type:	Static	Organism Age:	<24 hours
Test Temperature:	20 +/- 2C	Stock Source:	in house cultures
Test Volume:	150 mL	Time of First Brood:	7 days
Loading Density:	15 mL/neonate	Average Brood Size:	37 neonates
Control Water Hardness:	136 mg/L	Ephippia Frequency:	0

REFERENCE TOXICANT DATA

Chemical Used:	Sodium Chloride	Historic Mean LC50:	6171 mg/L
Date of Test:	April 22/97	Warning Limits:	4952-7390 mg/L
48-hour LC50:	5734 mg/L		
95% Confidence Interval:	5479-6001 mg/L		

TEST PROTOCOL

Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna.
Environment Canada. July 1990

COMMENTS

The reference toxicant results show that test reproducibility and organism sensitivity are within acceptable limits.
All data is scrutinized for errors daily during the test, at test termination and during the report Technical and Final Review stages.
Instruments used to monitor parameters are calibrated daily and continuously maintained.

QUALITY REVIEW

S. Hillier
Technical Review

Final Review

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/28/97/17
Sample Number:	Controls A + B	Sample Tech:	S. Clark
Test Number:		Test Initiation Date/Time:	AE/[illegible]/97/1510
Chain of Custody #:	2112	Technician:	[illegible] WM SH

TIME	PARAMETER	CONTROL (Control A) (01–04)	CONTROL	CONTROL	(Control B) (05–08)			PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.1			9.1			JF 16:00	CW
	pH	8.24			8.24				
	Temperature(C)	19.3			19.2				
	Conductivity(uS)	296			296				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.17	8.21	8.13	8.23	8.19	8.22	1330 [illegible]	CG
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.6	8.6	8.7	8.7	8.7	8.6	WM 1444	CG
	pH	8.09	8.14	8.16	8.19	8.17	8.19		
	Temperature (C)	19.5	19.9	20.0	20.0	20.0	20.0		
	Conductivity	298	298	298	298	298	299		
	# Immobile	0	0	0	0	0	0	CG 1430	— 0
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: CONTROL A (0% mortality) // CONTROL B (0% mortality)

TEST CONDITIONS

Brood Culture:	AUD197	Preaeration Time:	start	/
Time to First Brood:	7 days		end	/
Average Brood Size:	32 neonates		total	
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:		N/A
Control Water Hardness:	136	Preaeration Rate:		25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	NA yes / no	pH Adjustment:		no / yes
Test Replication (for QA/QC):	N/A yes / no	Hardness Adjustment:		no / yes
		Test Solution Volume:		200 mL / 150 mL
		Loading Density:		20 / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen:	/	Adj. pH (if applicable):	/
Initial pH:	/	Adjustment Details:	/
Temperature:	/	Adj. Hardness (if applicable):	/
Conductivity:	/	Adjustment Details:	/
Initial Hardness:	/		
Physical State Upon Receipt:	/		
Clarity:			
Colour:			
Precipitate:			
Odour:			

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/29/97 // 10:00
Sample Number:	01 + 02	Sample Tech:	S. Clark.
Test Number:	D01 + D02	Test Initiation Date/Time:	05/01/97 // 1410
Chain of Custody #:	2112	Technician:	SH VKM

TIME	PARAMETER	CONTROL-A (D01)	CONTROL-B	CONTROL-C	100-A (D02)	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.6			9.8			1425	
	pH	9.74			8.60				
	Temperature(C)	19.7			19.7				
	Conductivity(uS)	2290			2330				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	9.28	9.31	9.20	8.25	8.27	8.30	1420	
	Temperature(C)	20.0							
	# Immobile	3	6	3	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.7	8.7	8.6	8.7	8.7	VKM	
	pH	8.94	8.94	8.95	7.83	7.79	7.83	15:00	
	Temperature (C)	20.4	20.5	20.6	20.4	20.3	20.3		
	Conductivity	2290	2280	2300	2320	2330	2330		
	# Immobile	4	3	4	0	0	0		
	# Dead (10 exposed)	5	6	4	0	0	0	1530	
TOTAL MORTALITIES		5	6	4	0	0	0		
MEAN % MORTALITY		50%			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: ~~201~~ #101 : PASS (50% mortality) // 102: PASS (0% mortality)

TEST CONDITIONS for both tests:

Brood Culture:	040197	Preaeration Time:	start 1340
Time to First Brood:	7 days		end 1410
Average Brood Size:	33 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates		
Control Water Hardness:	136	Reason for Preaeration:	DO > 100% saturation
Effluent Subsampled from 25L pail for Testing:	(yes) / no	Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)	pH Adjustment:	(no) / yes
		Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

CONTROL A

INITIAL PARAMETERS (prior to testing)

	01	02
Dissolved Oxygen:	10.5	10.5
Initial pH:	9.95	8.77
Temperature:	18.8	18.5
Conductivity:	2290	2330
Initial Hardness:	1156	1054
Physical State Upon Receipt:	liquid	liquid
Clarity:	clear	clear
Colour:	colourless	colourless
Precipitate: settled solids	[illegible]	no
Odour:	yes	yes

Adj. pH (if applicable): —

Adjustment Details:

Adj. Hardness (if applicable): —

Adjustment Details:

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/29/97//10:00
Sample Number:	03+04	Sample Tech:	S. Clark
Test Number:	003+004	Test Initiation Date/Time:	05/01/97// 1410
Chain of Custody #:	2112	Technician:	[illegible]

TIME	PARAMETER	CONTROL-A (003)	CONTROL-B	CONTROL-C	100-A (004)	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.2			10.0			1425	[illegible]
	pH	8.06			7.46				
	Temperature(C)	19.8			19.8				
	Conductivity(uS)	2340			2340				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.87	7.75	7.70	7.33	7.31	7.28	1408	[illegible]
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.8	8.8	8.7	8.8	8.7	NM	[illegible]
	pH	7.35	7.42	7.43	7.19	7.23	7.23		
	Temperature (C)	20.6	20.6	20.5	20.3	20.3	20.3	15:10	
	Conductivity	2320	2340	2340	2330	2330	2330		
	# Immobile	0	0	0	0	0	0	1430	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #103: PASS (0% mortality) // #104 PASS (0% mortality)

TEST CONDITIONS for both tests:

Brood Culture:	040197	Preaeration Time:	start 1340
Time to First Brood:	7 days		end 1410
Average Brood Size:	23 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	DO?100% saturation
Control Water Hardness:	136	Preaeration Rate:	25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	yes / no	pH Adjustment:	no / yes
Test Replication (for QA/QC):	yes / no	Hardness Adjustment:	no / yes
		Test Solution Volume:	300 mL / 150 mL
		Loading Density:	30 / 15 mL/neonate

CONTROL A

INITIAL PARAMETERS (prior to testing)

	03	04		
Dissolved Oxygen:	10.6	10.6		
Initial pH:	8.14	7.57	Adj. pH (if applicable):	—
Temperature:	19.5	18.8	Adjustment Details:	
Conductivity:	2360	2320		
Initial Hardness:	140	1173	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	liquid	liquid	Adjustment Details:	
Clarity:	clear	clear		
Colour:	[illegible]	[illegible]		
Precipitate:	no	none		
Odour:	yes	yes		

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/28/97//20:00
Sample Number:	05 + 06	Sample Tech:	S. Clark
Test Number:	005 + 006	Test Initiation Date/Time:	05/01/97//1410
Chain of Custody #:	2112	Technician:	[illegible] SH WM

SAMPLE ID: 005 (Controls) / 006 (100)

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.5			9.6			1425 [initials]	[initials]
	pH	9.71			8.66				
	Temperature(C)	19.8			19.8				
	Conductivity(uS)	2290			2330				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	9.37	9.57	9.51	8.41	8.37	8.42	1425 [initials]	[initials]
	Temperature(C)	20.0							
	# Immobile	~~9~~ 5	9	8	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.8	8.7	7.6	8.7	8.7	WM 15:27	[initials]
	pH	8.97	9.08	9.05	7.91	7.86	7.89		
	Temperature (C)	20.9	20.7	20.9	20.3	20.1	20.3		
	Conductivity	2280	2300	2300	2330	2340	2340		
	# Immobile	4 (2)	1	2	0	0	0	[initials] 1515	
	# Dead (10 exposed)	3	4	8	0	0	0		
TOTAL MORTALITIES		3/9	9	8	0	0	0		
MEAN % MORTALITY		69%			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #105 FAIL (69% mortality) // #106 PASS (0% mortality)

TEST CONDITIONS for both tests.

Brood Culture:	040197	Preaeration Time:	start 1340 / end 1410 / total 30 min
Time to First Brood:	7 days		
Average Brood Size:	33 neonates		
Total Number Exposed/Concentration:	3X10 neonates		
Control Water Hardness:	130	Reason for Preaeration:	DO >100% Saturated
Effluent Subsampled from 25L pail for Testing:	(yes) / no	Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)	pH Adjustment:	(no) / yes
		Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

CONTROL B

INITIAL PARAMETERS (prior to testing)

	05	06		
Dissolved Oxygen:	10.5	10.3		
Initial pH:	9.97	8.86	Adj. pH (if applicable):	–
Temperature:	19.1	19.4	Adjustment Details:	
Conductivity:	2250	2270		
Initial Hardness:	173	155	Adj. Hardness (if applicable):	–
Physical State Upon Receipt:	liquid	liquid	Adjustment Details:	
Clarity:	clear	clear		
Colour:	green	yellow		
Precipitate:	no	? suspended solids		
Odour:	yes	yes		

Additional Observations:

Comments/Deviations: @ 24 hrs 3? in C rep. were caught on surface (05) [illegible file path]

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/28/97//10:00
Sample Number:	07+08	Sample Tech:	S. Clark
Test Number:	D07+D08	Test Initiation Date/Time:	05/01/97 // 1410
Chain of Custody #:	2112	Technician:	Jn WM SH

TIME	PARAMETER	CONTROL-A (007)	CONTROL-B	CONTROL-C	100-A (008)	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8			9.8			1430 Jn	
	pH	8.15			7.23				
	Temperature(C)	19.8			19.9				
	Conductivity(uS)	2340			2340				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.88	7.79	7.90	7.20	7.18	7.29	1427 Jn	
	Temperature(C)	20.0							
	# Immobile	1	1	1	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.7	8.8	8.5	8.5	8.6	WM 15:30	
	pH	7.43	7.45	7.52	7.16	7.15	7.23		
	Temperature (C)	20.7	20.5	20.7	20.5	20.2	20.3		
	Conductivity	2330	2340	2340	2340	2340	2340		
	# Immobile	0	0	0	0	0	0	1530	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #107 PASS (0% mortality) // #108 PASS (0% mortality)

TEST CONDITIONS for Daphnia ESK

Brood Culture:	040197 ~~040497~~	Prearation Time:	start	1340
Time to First Brood:	7 days		end	1410
Average Brood Size:	33 neonates		total	30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Prearation:		DO>100% saturation
Control Water Hardness:	139 136	Prearation Rate:		25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	yes / no	pH Adjustment:		no / yes
Test Replication (for QA/QC):	yes / no	Hardness Adjustment:		no / yes
		Test Solution Volume:		200 mL / 150 mL
	CONTROL B	Loading Density:		20 // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	07	08		
Dissolved Oxygen:	10.5	10.4		
Initial pH:	8.41	7.25	Adj. pH (if applicable):	—
Temperature:	19.3	19.5	Adjustment Details:	
Conductivity:	2310	2270		
Initial Hardness:	1190	1159	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	[illegible]	[illegible]	Adjustment Details:	
Clarity:	clear	clear		
Colour:	green	brown		
Precipitate:	[illegible]			
Odour:	yes			

Additional Observations:

Comments/Deviations: @48 hrs. daphnia [illegible] precipitate (07)

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/28/97/??
Sample Number:	Controls C+D	Sample Tech:	C. Clark
Test Number:		Test Initiation Date/Time:	05/01/97//1510
Chain of Custody #:	2112	Technician:	[illegible]

TIME	PARAMETER	SAMPLE ID: CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
		Control C (09-10)			Control D (13-16)				
0 HOURS	Dissolved Oxygen	9.1			9.1			JF 16:00	[illegible]
	pH	8.24			8.24				
	Temperature(C)	19.3			19.3				
	Conductivity(uS)	296			296				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.24	8.28	8.26	8.23	8.23	8.25	1430	[illegible]
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0	[illegible]	
48 HOURS	Dissolved Oxygen	8.7	8.5	8.5	8.5	8.6	8.6	[illegible] 15:45	[illegible]
	pH	8.18	8.19	8.09	8.16	8.16	8.20		
	Temperature (C)	20.5	20.4	20.6	20.5	20.4	20.6		
	Conductivity	297	295	298	299	298	297		
	# Immobile	0	0	0	0	0	0	[illegible] 1535	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: * CONTROL C PASS (0% mortality) // CONTROL D PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	040197	Preaeration Time:	start / end / total —
Time to First Brood:	7 days		
Average Brood Size:	33 neonates		
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	NA
Control Water Hardness:	156		
Effluent Subsampled from 25L pail for Testing:	NA yes / no	Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	NA yes / no	pH Adjustment:	no / yes
		Hardness Adjustment:	no / yes
		Test Solution Volume:	200 mL / 150 mL
		Loading Density:	20 // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen:	—	Adj. pH (if applicable):	—
Initial pH:		Adjustment Details:	
Temperature:			
Conductivity:		Adj. Hardness (if applicable):	
Initial Hardness:		Adjustment Details:	
Physical State Upon Receipt:			
Clarity:			
Colour:			
Precipitate:			
Odour:			

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/28/97/10:00
Sample Number:	09+10	Sample Tech:	S. Clark
Test Number:	D09+D10	Test Initiation Date/Time:	05/01/97/1410
Chain of Custody #:	2112	Technician:	[illegible] WM SH

SAMPLE ID: D09 (Control) / D10 (100)

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8			9.8			1430 [illegible]	[illegible]
	pH	9.52			8.77				
	Temperature(C)	19.9			20.1				
	Conductivity(uS)	2290			2330				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	9.81	9.68	9.64	8.57	8.61	8.59	1035 [illegible]	[illegible]
	Temperature(C)	20.0							
	# Immobile	10	10	10	0	0	0		
48 HOURS	Dissolved Oxygen	8.8	8.8	8.8	8.7	8.7	8.7	WM 15:52	[illegible]
	pH	9.56	9.29	9.26	8.19	8.19	8.20		
	Temperature (C)	20.8	20.7	20.8	20.8	20.6	20.6		
	Conductivity	2280	2290	2290	2320	2340	2340		
	# Immobile	—	—	—	0	0	0	[illegible] 1547	
	# Dead (10 exposed)	10	10	10	0	0	0		
TOTAL MORTALITIES		10	10	10	0	0	0		
MEAN % MORTALITY		100			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #109 FAIL (100% mortality) // #110 PASS (0% mortality)

TEST CONDITIONS for both tests

Brood Culture:	040197		
Time to First Brood:	7 days	Preaeration Time:	start 1340
Average Brood Size:	44 neonates		end 1410
Total Number Exposed/Concentration:	3X10 neonates		total 30 min
Control Water Hardness:	[illegible] 136 [illegible]	Reason for Preaeration:	DO 100% Saturation
Effluent Subsampled from 25L pail for Testing:	(yes) / no	Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)	pH Adjustment:	(no) / yes
		Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

Control C

INITIAL PARAMETERS (prior to testing)

	09	10		
Dissolved Oxygen:	10.4	10.4		
Initial pH:	10.02	9.75	Adj. pH (if applicable):	—
Temperature:	19.3	19.3	Adjustment Details:	
Conductivity:	2260	2290		
Initial Hardness:	1134	1129	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	[illegible]	[illegible]	Adjustment Details:	
Clarity:	[illegible]	[illegible]		
Colour:	[illegible]	~~[illegible]~~ yellow		
Precipitate:	[illegible]	[illegible]		
Odour:	yes			

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9397	Sample Date/Time:	04/29/97 // 10:00
Sample Number:	111+112	Sample Tech:	S. Clark
Test Number:	D11 + D12	Test Initiation Date/Time:	05/01/97 // 1510
Chain of Custody #:	3443	Technician:	[illegible]

SAMPLE ID: D11 / D12

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.4			9.0			1520 [illegible]	[illegible]
	pH	8.03			7.51				
	Temperature(C)	19.4			19.6				
	Conductivity(uS)	2350			2350				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.77	7.69	7.69	7.35	7.32	7.36	1440 [illegible]	[illegible]
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.7	8.7	8.5	8.5	8.6	[illegible] 16:00	[illegible]
	pH	7.40	7.40	7.40	7.22	7.20	7.24		
	Temperature (C)	20.6	20.5	20.6	20.4	20.3	20.3		
	Conductivity	2330	2340	2340	2330	2340	2340		
	# Immobile	0	0	0	0	0	0	[illegible]	
	# Dead (10 exposed)	0	0	0	0	0	0	15:55	
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #111 PASS (0% mortality) // #112 PASS (0% mortality)

TEST CONDITIONS for both tests.

Brood Culture:	C040197	Preaeration Time:	start 1440
Time to First Brood:	7 days		end 1510
Average Brood Size:	33 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	DO2:DO/saturation
Control Water Hardness:	136	Preaeration Rate:	25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	yes/ no	pH Adjustment:	(no) / yes
Test Replication (for QA/QC):	yes / (no)	Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) // 15 mL/neonate

Control C

INITIAL PARAMETERS (prior to testing)

	11	12		
Dissolved Oxygen:	10.2	10.5		
Initial pH:	8.31	7.49	Adj. pH (if applicable):	–
Temperature:	19.2	19.2	Adjustment Details:	
Conductivity:	2300	2290		
Initial Hardness:	1156	1173	Adj. Hardness (if applicable):	–
Physical State Upon Receipt:	liquid	liquid	Adjustment Details:	
Clarity:	clear	clear		
Colour:	green	clear		
Precipitate:	no	no		
Odour:	yes	yes		

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/28/97//10:00
Sample Number:	13 + 14	Sample Tech:	S. Clark
Test Number:	D13 + D14	Test Initiation Date/Time:	05/01/97//15:10
Chain of Custody #:	2112	Technician:	JR WM

TIME	PARAMETER	SAMPLE ID: CONTROL-A (D13)	CONTROL-B	CONTROL-C	100-A (D14)	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.2			9.2			1520 JR	CM
	pH	9.81			8.72				
	Temperature(C)	19.3			19.4				
	Conductivity(uS)	2290			2340				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	9.59	9.51	9.50	8.53	8.60	8.60	1445 JR	CM
	Temperature(C)	20.0							
	# Immobile	10	10	10	1	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.8	8.5	8.7	8.7	8.7	WM 16:10	CM
	pH	9.27	9.09	9.14	8.19	8.22	8.37		
	Temperature (C)	20.5	20.5	20.5	20.4	20.3	20.2		
	Conductivity	2280	2300	2300	2330	2340	2340		
	# Immobile	–	–	–	0	0	0	CM 1602	
	# Dead (10 exposed)	10	10	10	0	0	0		
TOTAL MORTALITIES		10	10	10	0	0	0		
MEAN % MORTALITY		100			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #113 FAIL (100% mortality) // #114 PASS (0% mortality)

TEST CONDITIONS for both tests:

Brood Culture:	040797	Preaeration Time:	start	1440
Time to First Brood:	8 days		end	1510
Average Brood Size:	16 neonates		total	30 min
Total Number Exposed/Concentration:	3X10 neonates			
Control Water Hardness:	130	Reason for Preaeration:		DO? 100% saturation
Effluent Subsampled from 25L pail for Testing:	(yes) / no	Preaeration Rate:		25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)	pH Adjustment:		(no) / yes
		Hardness Adjustment:		(no) / yes
		Test Solution Volume:		(200 mL) / 150 mL
		Loading Density:		(20) // 15 mL/neonate

Control D

INITIAL PARAMETERS (prior to testing)

	13	14		
Dissolved Oxygen:	10.4	10.5	Adj. pH (if applicable):	–
Initial pH:	10.00	8.89	Adjustment Details:	
Temperature:	19.7	19.5		
Conductivity:	2250	2290	Adj. Hardness (if applicable):	–
Initial Hardness:	1105	1105	Adjustment Details:	
Physical State Upon Receipt:	[illegible]	[illegible]		
Clarity:	[illegible]	[illegible]		
Colour:	[illegible]	[illegible]		
Precipitate:	[illegible]	[illegible]		
Odour:	[illegible]	[illegible]		

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387
Sample Number: 15 + 16
Test Number: 015 - 016
Chain of Custody #: 2112

Sample Date/Time: 04/29/97//20:00
Sample Tech: J. Clark
Test Initiation Date/Time: 05/01/97//15:10
Technician: Jh WM

TIME	PARAMETER	CONTROL-A (015)	CONTROL-B	CONTROL-C	100-A (016)	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.6			9.2			1520 Jh	GM
	pH	8.36			7.51				
	Temperature(C)	19.6			19.6				
	Conductivity(uS)	2340			2340				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.03	8.00	8.07	7.31	7.30	7.29	1540 Jh	Gs
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.8	8.8	8.5	8.4	8.6	WM 16:18	Gs
	pH	7.55	7.59	7.63	7.20	7.20	7.19		
	Temperature (C)	20.6	20.5	20.6	20.3	20.3	~~2350~~ 20.2		
	Conductivity	2340	2350	2350	2340	2350	2350		
	# Immobile	0	0	0	0	0	0	Gs 1610	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #115 PASS (0% mortality) // #116 PASS (0% mortality)

TEST CONDITIONS for both tests:

Brood Culture: DUC797
Time to First Brood: 8 days
Average Brood Size: 16 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 130
Effluent Subsampled from 25L pail for Testing: yes / no
Test Replication (for QA/QC): yes / no

Preaeration Time: start 1440 end 1510 total 30 min
Reason for Preaeration: DO 100% saturation
Preaeration Rate: 25 - 50mL/min/L
pH Adjustment: no / yes
Hardness Adjustment: no / yes
Test Solution Volume: 200 mL / 150 mL
Loading Density: 20 // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	15	16
Dissolved Oxygen:	10.1	10.0
Initial pH:	8.42	7.22
Temperature:	16.2	16.5
Conductivity:	2310	2370
Initial Hardness:	1156	1165
Physical State Upon Receipt:	liquid	liquid
Clarity:	clear	clear
Colour:	straw	straw
Precipitate:	no	no
Odour:	no	no

Adj. pH (if applicable): —
Adjustment Details:
Adj. Hardness (if applicable): —
Adjustment Details:

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387
Samples Number:
Test Number: Control E - F
Chain of Custody #: 212

Sample Date/Time: 04/29/97 // P
Sample Tech: S. Clark
Test Initiation Date/Time: 05/01/97 // 16:30
Technician: JF WM SH

TIME	PARAMETER	SAMPLE ID:	CONTROL-E (17 - 20)	CONTROL-E	CONTROL-E	100-A	Control F (21 - 24) 100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen		9.1			9.1			JF 16:00	CM
	pH		8.24			8.24				
	Temperature(C)		19.3			19.3				
	Conductivity(uS)		296			296				
	Immobility @ 30 minutes (10 exposed)		0	0	0	0	0	0		
24 HOURS	pH		8.31	8.31	8.30	8.31	8.28	8.29	15:43	GS
	Temperature(C)		20.0							
	# Immobile		0	0	0	0	0	0	JF	
48 HOURS	Dissolved Oxygen		9.7	9.8	8.8	8.7	9.7	8.6	WM 16:24	GS
	pH		8.20	8.25	8.22	8.21	8.18	8.21		
	Temperature (C)		20.3	20.4	20.5	20.4	20.3	20.3		
	Conductivity		297	295	297	298	298	298		
	# Immobile		0	0	0	0	0	0	SH	
	# Dead (10 exposed)		0	0	0	0	0	0		
TOTAL MORTALITIES			0	0	0	0	0	0	16:14	
MEAN % MORTALITY			0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: CONTROL E PASS (07-0-tails) // CONTROL F PASS (09-0-tails)

TEST CONDITIONS

Brood Culture: 040797
Time to First Brood: 8 days
Average Brood Size: 16 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 126
Effluent Subsampled from 25L pail for Testing: N/A yes / no
Test Replicates (for QA/QC): N/A yes / no

Preaeration Time: start / end / total
Reason for Preaeration: N/A
Preaeration Rate: 25 - 50mL/min/L
pH Adjustment: (no) / yes
Hardness Adjustment: (no) / yes
Test Solution Volume: 200 mL / 190 mL
Loading Density: 10 / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen:
Initial pH:
Temperature:
Conductivity:
Initial Hardness:
Physical State Upon Receipt:
Clarity:
Colour:
Precipitate:
Odour:

Adj. pH (if applicable):
Adjustment Details:
Adj. Hardness (if applicable):
Adjustment Details:

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9397	Sample Date/Time:	04/29/97//10:00
Sample Number:	617+18	Sample Tech:	S. Clark
Test Number:	D17 + D18	Test Initiation Date/Time:	05/01/97//16:55
Chain of Custody #:	2112	Technician:	JF WM SH

TIME	PARAMETER	CONTROL-A	CONTROL-B (D17)	CONTROL-C	100-A	100-B (D18)	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.4			~~9.4~~ 8.9			SA 1700	[illegible]
	pH	9.68			~~9.68~~ 8.45				
	Temperature(C)	21.3			~~21.3~~ 21.0				
	Conductivity(uS)	2260			~~2260~~ 2280				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	9.52	9.57	9.58	8.30	8.38	8.24	CH 1435	[illegible]
	Temperature(C)	20.0							
	# Immobile	4	8	4	0	0	0		
48 HOURS	Dissolved Oxygen	8.9	8.9	8.9	8.4	8.6	8.6	WM 16:32	[illegible]
	pH	9.14	9.17	9.23	7.84	7.94	7.77		
	Temperature (C)	20.7	20.9	21.0	20.5	20.3	20.4		
	Conductivity	2290	2300	2300	2340	2340	2340		
	# Immobile	—	1	1	0	0	0	[illegible] 1625	
	# Dead (10 exposed)	10	9	9	0	0	0		
TOTAL MORTALITIES		10	9	9	0	0	0		
MEAN % MORTALITY		93%			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #117 FAIL (93% mortality) // #118 PASS (0% mortality)

TEST CONDITIONS for Both tests:

Brood Culture:	040797	Preaeration Time:	start	1620
Time to First Brood:	8 days		end	1650
Average Brood Size:	16 neonates		total	30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:		DO > 100% saturation
Control Water Hardness:	130	Preaeration Rate:		25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	yes / (no)	pH Adjustment:		(no) / yes
Test Replication (for QA/QC):	yes / (no)	Hardness Adjustment:		(no) / yes
		Test Solution Volume:		(200 mL) / 150 mL
		Loading Density:		(20) // 15 mL/neonate

Control E

INITIAL PARAMETERS (prior to testing)

	17	18		
Dissolved Oxygen:	~~[illegible]~~ 10.2	9.0		
Initial pH:	9.93	8.50	Adj. pH (if applicable):	—
Temperature:	15.5	19.5	Adjustment Details:	
Conductivity:	2260	2250		
Initial Hardness:	1105	1037	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	[illegible]	[illegible]	Adjustment Details:	
Clarity:	[illegible]	[illegible]		
Colour:	[illegible]	[illegible]		
Precipitate:	[illegible]	[illegible]		
Odour:	[illegible]	[illegible]		

Additional Observations:

Comments/Deviations: @ 24hrs #17 - 21/30 daphnids floating at the effluent surface

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/28/97//10:00
Sample Number:	19 + 20	Sample Tech:	S. Clark
Test Number:	D19 - D20	Test Initiation Date/Time:	05/01/97//17:00
Chain of Custody #:	2162	Technician:	CM SH

TIME	PARAMETER	CONTROL-A (D19)	CONTROL-B	CONTROL-C	100-A (D20)	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.9			8.9			SH 1703	CM
	pH	7.96			7.33				
	Temperature(C)	21.1			21.1				
	Conductivity(uS)	2300			2290				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.55	7.51	7.56	7.20	7.21	7.21	CM 1441	CM
	Temperature(C)	20.0							
	# Immobile	0	0	0	1	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.7	8.7	8.8	8.8	8.8	CM 1800	S
	pH	7.25	7.30	7.32	7.14	7.10	7.11		
	Temperature (C)	20.3	20.4	20.4	~~20.3~~ 20.3	20.2	20.2		
	Conductivity	2350	2360	2340	~~2350~~ 2350	2320	2320		
	# Immobile	0	0	0	0	0	0	CM 1630	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #119 PASS (0% mortality) // #120 PASS (0% mortality)

TEST CONDITIONS for Both tests

Brood Culture:	040797	Preaeration Time:	start 1620
Time to First Brood:	9 days		end 1650
Average Brood Size:	16 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates		
Control Water Hardness:	150	Reason for Preaeration:	DO > 100% saturation
Effluent Subsampled from 25L pail for Testing:	yes / no	Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes / no	pH Adjustment:	no / yes
		Hardness Adjustment:	no / yes
		Test Solution Volume:	200 mL / 150 mL
		Loading Density:	20 / 15 mL/neonate

(control) B

INITIAL PARAMETERS (prior to testing)

	19	20		
Dissolved Oxygen:	9.2	9.2		
Initial pH:	7.73	7.29	Adj. pH (if applicable):	—
Temperature:	14.5	14.5	Adjustment Details:	
Conductivity:	2260	2290		
Initial Hardness:	1071	1070	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	[illegible]	[illegible]	Adjustment Details:	
Clarity:	[illegible]	[illegible]		
Colour:	[illegible]	[illegible]		
Precipitate:	[illegible]	[illegible]		
Odour:	[illegible]	[illegible]		

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387
Sample Number: 21 + 22
Test Number: 021 + 022
Chain of Custody #: 3112

Sample Date/Time: 04/28/97/10:00
Sample Tech: S. Clark
Test Initiation Date/Time: 05/01/97 17:05
Technician:

[redacted]

TIME	PARAMETER	CONTROL-A (021)	CONTROL-B	CONTROL-C	100-A (022)	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.0			8.9			1705	
	pH	9.78			8.73				
	Temperature(C)	21.1			21.1				
	Conductivity(uS)	2230			2270				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	9.62	9.53	9.72	8.47	8.53	8.53	1446	
	Temperature(C)	20.0							
	# Immobile	10	9	10	0	0	0		
48 HOURS	Dissolved Oxygen	8.9	8.9	9.0	8.9	8.9	8.9	1800	
	pH	9.30	9.24	9.27	7.99	8.02	8.10		
	Temperature (C)	20.3	20.3	20.3	20.4	20.4	20.4		
	Conductivity	2300	2280	2270	2350	2300	2310		
	# Immobile	—	—	—	0	0	0	1640	
	# Dead (10 exposed)	10	10	10	0	0	0		
TOTAL MORTALITIES		10	10	10	0	0	0		
MEAN % MORTALITY		100			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: ~~PASS~~ FAIL (100% mortality) #121 // #122 PASS (0% mortality)

TEST CONDITIONS for Both tests.

Brood Culture: 040797
Time to First Brood: days
Average Brood Size: 16 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 130
Effluent Subsampled from 25L pail for Testing: yes / no
Test Replication (for QA/QC): yes / no

~~Control~~ E Control F

Preaeration Time: start 1620 end 1650 total 30 min
Reason for Preaeration: DO>100% saturation
Preaeration Rate: 25 - 50mL/Min/L
pH Adjustment: no / yes
Hardness Adjustment: no / yes
Test Solution Volume: 200 mL / 150 mL
Loading Density: 20 // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	21	22
Dissolved Oxygen:	9.8	9.5
Initial pH:	9.95	8.93
Temperature:	19.1	19.4
Conductivity:	2230	2250
Initial Hardness:	1020	1032
Physical State Upon Receipt:	[illegible]	[illegible]
Clarity:	[illegible]	[illegible]
Colour:	[illegible]	[illegible]
Precipitate:	[illegible]	[illegible]
Odour:	[illegible]	[illegible]

Adj. pH (if applicable): —
Adjustment Details:
Adj. Hardness (if applicable): —
Adjustment Details:

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/28/97//10:00
Sample Number:	23 + 24	Sample Tech:	S. Clark.
Test Number:	D23 + D24	Test Initiation Date/Time:	05/01/97//17:10
Chain of Custody #:	2112	Technician:	[illegible] TF SH

TIME	PARAMETER	SAMPLE ID: CONTROL-A	CONTROL-B (D23)	CONTROL-C	100-A	100-B (D24)	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.9			9.0			[illegible] 1707	[illegible]
	pH	7.92			7.15				
	Temperature(C)	21.0			19.5				
	Conductivity(uS)	2280			2250				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.69	7.69	7.75	7.17	7.21	7.19	CH 1451	[illegible]
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.8	8.8	8.9	8.9	8.9	[illegible] 1805	[illegible]
	pH	7.43	7.43	7.45	7.11	7.08	7.07		
	Temperature (C)	20.6	20.6	20.6	20.5	20.5	20.5		
	Conductivity	2340	2330	2340	2350	2330	2340		
	# Immobile	0	0	0	0	0	0	[illegible] 1654	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #123 PASS (0% mortality) // #124 PASS (0% mortality)

TEST CONDITIONS for both tests

Brood Culture:	041797		23	24
Time to First Brood:	8 days	Preaeration Time:	start 1620	/
Average Brood Size:	16 neonates		end 1650	/
Total Number Exposed/Concentration:	3X10 neonates		total 30 min	/
Control Water Hardness:	180 132 [illegible]	Reason for Preaeration:	DO > 100% sat	n/a
Effluent Subsampled from 25L pail for Testing:	yes / no (circled no)	Preaeration Rate:	25 - 50mL/min/L	
Test Replication (for QA/QC):	yes / no (circled no)	pH Adjustment:	no / yes (circled no)	
		Hardness Adjustment:	no / yes (circled no)	
		Test Solution Volume:	200 mL / 150 mL (circled 200 mL)	
		Loading Density:	20 // 15 mL/neonate (circled 20)	

Control F

INITIAL PARAMETERS (prior to testing)

	23	24		
Dissolved Oxygen:	9.2	9.0		
Initial pH:	8.21	7.15	Adj. pH (if applicable):	—
Temperature:	19.5	19.5	Adjustment Details:	
Conductivity:	2250	2780		
Initial Hardness:	1090	1054	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	[illegible]	[illegible]	Adjustment Details:	
Clarity:	[illegible]	[illegible]		
Colour:	[illegible]	[illegible]		
Precipitate:	[illegible]	[illegible]		
Odour:	[illegible]	[illegible]		

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/29/97/1?
Sample Number:		Sample Tech:	S. Clark
Test Number:	Control G - H	Test Initiation Date/Time:	05/01/97/17:30
Chain of Custody #:	2113	Technician:	SH, JF, NM

TIME	PARAMETER	SAMPLE ID: CONTROL-A (Control G (25-28))	CONTROL-B	CONTROL-C	100-A (Control H (29-32))	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.1			9.1			JF 16:00	NM
	pH	8.24			8.24				
	Temperature(C)	19.3			19.3				
	Conductivity(uS)	296			296				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.19	8.21	8.21	8.22	8.27	8.27	CH 1456 1512	cm
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.8	8.8	8.8	8.7	8.8	8.8	cm 18[10]	cm
	pH	8.19	8.20	8.20	8.21	8.21	8.22		
	Temperature (C)	20.6	20.5	20.6	20.6	20.6	20.5		
	Conductivity	302	303	306	304	305	303		
	# Immobile	0	0	0	0	0	0	cm 17[01]	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0							

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: Control G PASS (0% mortality) // Control H PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	040797	Preexposure Time:	start / end / total: /
Time to First Brood:	8 days		
Average Brood Size:	16 neonates		
Total Number Exposed/Concentration:	3X10 neonates		
Control Water Hardness:	156	Reason for Preaeration:	N/A
Effluent Subsampled from 25L pail for Testing:	NA yes / no	Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	NA yes / no	pH Adjustment:	no / yes
		Hardness Adjustment:	no / yes
		Test Solution Volume:	400 mL / 150 mL
		Loading Density:	40 // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen:	/		
Initial pH:	/	Adj. pH (if applicable):	/
Temperature:	/	Adjustment Details:	/
Conductivity:	/		
Initial Hardness:	/	Adj. Hardness (if applicable):	/
Physical State Upon Receipt:	/	Adjustment Details:	/
Clarity:	/		
Colour:	/		
Precipitate:			
Odour:			

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9397
Sample Number: 25 + 26
Test Number: 025 + 026
Chain of Custody #: 2163

Sample Date/Time: 04/29/97 // 10:00
Sample Took: S. Clark
Test Initiation Date/Time: 05/01/97 // 17:15
Technician: JF SH WM

TIME	PARAMETER	SAMPLE ID: CONTROL-A	025 CONTROL-B	CONTROL-C	026 100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.8			9.0			SA 1711	CM
	pH	9.77			8.61				
	Temperature(C)	21.6			20.2				
	Conductivity(uS)	2220			2290				
	Immobility @ 30 minutes (10 exposed)	C	C	C	C	C	C		
24 HOURS	pH	9.45	9.42	9.50	8.22	8.23	8.26	CG 1503	CG
	Temperature(C)	20.0							
	# Immobile	8	6	7	0	0	0		
48 HOURS	Dissolved Oxygen	8.3	8.6	8.6	8.7	8.3	8.4	1810	
	pH	9.02	9.00	9.09	7.78	7.80	7.80		
	Temperature (C)	20.6	20.6	20.6	20.5	20.5	20.5	CG	
	Conductivity	2290	2250	2290	2340	2330	2330		
	# Immobile	-	0	0	0	0	0	CG 1715	
	# Dead (10 exposed)	10	9	9	0	0	0		
TOTAL MORTALITIES		10	9	9	0	0	0		
MEAN % MORTALITY		90%			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #125 FAIL (90% mortality) // #126 PASS (0% mortality)

TEST CONDITIONS for ISCHKS.

Brood Culture:	AD797	Preaeration Time:	start 1620
Time to First Brood:	5 days		end 1150
Average Brood Size:	16 neonates		total ~~[illegible]~~ 30 min
Total Number Exposed/Concentration:	3X10 neonates		
Control Water Hardness:	130	Reason for Preaeration:	DO >100% saturation
Effluent Subsampled from 25L pail for Testing:	yes / no	Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes / no	pH Adjustment:	no / yes
		Hardness Adjustment:	no / yes
		Test Solution Volume:	200 mL / 130 mL
		Loading Density:	10 // 15 mL/neonate

Control G

INITIAL PARAMETERS (prior to testing)

	25	26		
Dissolved Oxygen:	9.6	9.2		
Initial pH:	[illegible]	[illegible]	Adj. pH (if applicable):	—
Temperature:	19.5	19.7	Adjustment Details:	
Conductivity:	2230	2250		
Initial Hardness:	[illegible]	1050	Adj. Hardness (if applicable):	
Physical State Upon Receipt:	[illegible]	[illegible]	Adjustment Details:	
Clarity:	[illegible]	[illegible]		
Colour:	[illegible]	[illegible]		
Precipitate:	[illegible]	[illegible]		
Odour:	[illegible]	[illegible]		

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/28/97//10:00
Sample Number:	27-28	Sample Tech:	J. Clark
Test Number:	027+028	Test Initiation Date/Time:	05/01/97
Chain of Custody #:	2112	Technician:	[illegible]

SAMPLE ID: 027 / 028

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.0			8.9			27: 17:55H	
	pH	8.07			7.10				
	Temperature(C)	21.0			20.7			28: 17:50	
	Conductivity(uS)	2280			2280				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.70	7.71	7.70	7.24	7.22	7.23		
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0	1508	
48 HOURS	Dissolved Oxygen	8.8	8.8	8.8	8.7	8.6	8.6		
	pH	7.45	7.50	7.51	7.18	7.18	7.14	1815	
	Temperature (C)	20.4	20.4	20.5	20.4	20.4	20.4		
	Conductivity	2340	2350	2350	2340	2350	2340		
	# Immobile	0	0	0	0	0	0		
	# Dead (10 exposed)	0	0	0	0	0	0	1723	
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #127 PASS (0% mortality) // #128 PASS (0% mortality)

TEST CONDITIONS for both tests

				27	28
Brood Culture:	040797	Preaeration Time:	start	1620	17:00
Time to First Brood:	9 days		end	16:50	17:30
Average Brood Size:	16 neonates		total	30min	30min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:		DO>100% sat	DO>100% sat.
Control Water Hardness:	180	Preaeration Rate:		25-50mL/min/L	
Effluent Subsampled from 25L pail for Testing:	yes / no	pH Adjustment:		no / yes	
Test Replication (for QA/QC):	yes / no	Hardness Adjustment:		no / yes	
		Test Solution Volume:		200 mL / 150 mL	
		Loading Density:		20 // 15 mL/neonate	

Control G

INITIAL PARAMETERS (prior to testing)

	27	28
Dissolved Oxygen:	9.2	9.4
Initial pH:	8.24	7.02
Temperature:	19.5	19.6
Conductivity:	2200	2260
Initial Hardness:	1057	1058
Physical State Upon Receipt:	[illegible]	[illegible]
Clarity:	[illegible]	[illegible]
Colour:	[illegible]	[illegible]
Precipitate:	no	no
Odour:	no	yes

Adj. pH (if applicable): —

Adjustment Details:

Adj. Hardness (if applicable): —

Adjustment Details:

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/29/97//10:00
Sample Number:	29+30	Sample Tech:	S. Clark
Test Number:	D29+D30	Test Initiation Date/Time:	05/01/97//17:35
Chain of Custody #:	2112	Technician:	MM JF

SAMPLE ID: D29 (Control A–C), D30 (100-A to 100-C)

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.2			8.9			MM 17:54	CJ
	pH	9.74			8.60				
	Temperature(C)	20.5			20.5				
	Conductivity(uS)	2220			2230				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	9.71	9.62	9.71	8.45	8.41	8.50	CY 1518	SJ
	Temperature(C)	20.0							
	# Immobile	9	10	10	0	0	0		
48 HOURS	Dissolved Oxygen	8.9	8.5	8.9	8.7	8.8	8.7	CY 1820	SA
	pH	9.34	9.40	9.38	8.01	8.08	8.01		
	Temperature (C)	20.4	20.4	20.4	20.5	20.5	20.5		
	Conductivity	2300	2310	2310	2350	2340	2340		
	# Immobile	—	—	—	0	0	0	JD 1732	
	# Dead (10 exposed)	10	10	10	0	0	0		
TOTAL MORTALITIES		10	10	10	0	0	0		
MEAN % MORTALITY		100			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #129 FAIL (100% mortality) // #130 PASS (0% mortality)

TEST CONDITIONS for Both tests:

Brood Culture:	040797	Preaeration Time:	start 17:00
Time to First Brood:	5 days		end 17:30
Average Brood Size:	16 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	DO > 100% saturation
Control Water Hardness:	130	Preaeration Rate:	25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	yes / (no)	pH Adjustment:	(no) / yes
Test Replication (for QA/QC):	yes / (no)	Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) // 15 mL/neonate

Control H

INITIAL PARAMETERS (prior to testing)

	29	30		
Dissolved Oxygen:	9.8	9.6	Adj. pH (if applicable):	—
Initial pH:	9.95	8.90	Adjustment Details:	
Temperature:	19.6	19.6		
Conductivity:	2240	2270		
Initial Hardness:	1003	1003	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	liquid	liquid	Adjustment Details:	
Clarity:	clear	clear		
Colour:	colourless	colourless		
Precipitate:	no	no		
Odour:	yes	yes		

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	04/28/97//10:00
Sample Number:	31 + 32	Sample Tech:	S. Clark
Test Number:	D31 + D32	Test Initiation Date/Time:	05/01/97//17:40
Chain of Custody #:	2112	Technician:	WM JF

TIME	PARAMETER	SAMPLE ID: CONTROL-A (D31)	CONTROL-B	CONTROL-C	100-A (D32)	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.0			8.9			WM 1756	CM
	pH	8.03			7.21				
	Temperature(C)	20.3			19.7				
	Conductivity(uS)	2290			2270				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.53	7.84	7.87	7.28	7.25	7.22	CG 1523	CG
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.8	8.8	8.7	8.7	8.8	CG 1820	CG
	pH	7.54	7.60	7.62	7.21	7.20	7.19		
	Temperature (C)	20.5	20.5	20.5	20.4	20.5	20.5		
	Conductivity	2340	2340	2340	2350	2340	2340		
	# Immobile	0	0	0	0	0	0	CG 1743	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: #131 PASS (0% mortality) // #132 PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	040797			
Time to First Brood:	X days	Preaeration Time:	start	17:00
Average Brood Size:	16 neonates		end	17:30
Total Number Exposed/Concentration:	3X10 neonates		total	30 min
Control Water Hardness:	138	Reason for Preaeration:		DO>100% saturation
Effluent Subsampled from 25L pail for Testing:	yes / (no)	Preaeration Rate:		25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)	pH Adjustment:		(no) / yes
		Hardness Adjustment:		(no) / yes
		Test Solution Volume:		(200 mL) / 150 mL
		Loading Density:		(20) / 15 mL/neonate

Control H

INITIAL PARAMETERS (prior to testing)

	31	32		
Dissolved Oxygen:	9.3	9.1		
Initial pH:	8.45	7.01	Adj. pH (if applicable):	–
Temperature:	19.7	19.6	Adjustment Details:	
Conductivity:	2260	2250		
Initial Hardness:	1005	1003	Adj. Hardness (if applicable):	–
Physical State Upon Receipt:	[illegible]	[illegible]	Adjustment Details:	
Clarity:	[illegible]	[illegible]		
Colour:	[illegible]	[illegible]		
Precipitate:	[illegible]	[illegible]		
Odour:	[illegible]	[illegible]		

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

96 HOUR STATIC RAINBOW TROUT SINGLE CONCENTRATION TEST
EPS 1/RM/13

Project Number:	L387	Sample Number:	01 - 16
Client:	Inco Ltd	Test Number:	T01 - T16
	Copper Cliff, Ontario	Sample Date/Time:	04/28/97//-:- hrs
Sample Name/ID:	Experimental Treatments for CCWWTP	Sample Technician:	S Clark
	Sample Identification #101 - 116	Test Date:	05/01/97//17:00 hrs
Sample Location:	CCWWTP	Technician:	C Huras/J Farquharson
Chain of Custody #:	2112		
Sample Method:	Grab		

RESULTS

96 HOUR RESULTS:	01: 101:	FAIL (100% mortality)	09: 109:	FAIL (100% mortality)
	02: 102:	PASS (0% mortality)	10: 110:	PASS (0% mortality)
	03: 103:	PASS (0% mortality)	11: 111:	PASS (0% mortality)
	04: 104:	PASS (0% mortality)	12: 112:	PASS (0% mortality)
	05: 105:	FAIL (100% mortality)	13: 113:	FAIL (100% mortality)
	06: 106:	PASS (0% mortality)	14: 114:	PASS (0% mortality)
	07: 107:	PASS (0% mortality)	15: 115:	PASS (0% mortality)
	08: 108:	PASS (0% mortality)	16: 116:	PASS (0% mortality)

QUALITY ASSURANCE INFORMATION

REFERENCE TEST CONDITIONS

Test Organism:	Rainbow Trout	Test Aeration Rate:	6.5 +/- 1 mL/min/L
Trout Batch Number:	041497	Photoperiod:	16 hours light/8 hours dark
Test Type:	Static	Dilution Water:	Dechlorinated Tap
Test Temperature:	15+/-1C	Organism Age:	Fingerlings
Test Volume:	15 Litres	Stock Source:	Rainbow Springs Hatchery
Test Solution Depth:	27 cm	Mean Weight:	0.43 +/- 0.17 g

REFERENCE TOXICANT DATA

Chemical Used:	Sodium Chloride	Historic Mean LC50:	16153 mg/L
Date of Test:	April 30/97	Warning Limits:	12017 - 20288 mg/L
96-hour LC50:	14693 mg/L		
95% Confidence Interval:	13363 - 16177 mg/L		

TEST PROTOCOL

Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout.
Environment Canada. July 1990

COMMENTS

The reference toxicant results show that test reproducibility and organism sensitivity are within acceptable limits.
All data is scrutinized for errors daily during the test, at test termination and during the report Technical and Final Review stages.
Instruments used to monitor parameters are calibrated daily and continuously maintained.

QUALITY REVIEW

S. Hillier
Technical Review

Final Review

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	9397	Sample Date/Time:	04/25/97/17
Sample Number:	Controls A-B	Sample Tech:	S. Clark
Test Number:		Test Initiation Date/Time:	05/01/97/1700
Custody #:	2113	Technician:	CH/SF

TIME	PARAMETER	Control A 100	Control B 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.5	9.3	CH	CH
	pH	7.81	7.93	1740	
	Temperature(C)	14.5	14.6		
	Conductivity(uS)	299	298	1748	
	Immobility @ 30 minutes (10 exposed)	0	0		
15 - 18 HOURS	pH	7.71	7.64	RM 0900	
24 HOURS	Dissolved Oxygen	9.8	9.5	1600 gn	
	pH	8.02	8.01		
	Temperature(C)	14.1	14.2		
	Conductivity(uS)	299	300		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.5	9.9	RM 14:10	
	pH	7.95	RM ~~8.07~~ 8.01		
	Temperature(C)	14.5	14.3		
	Conductivity(uS)	300	RM ~~330~~ 301		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.4	10.0	1500 gn	
	pH	7.86	7.92		
	Temperature(C)	14.1	14.3		
	Conductivity(uS)	300	302		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.5	9.6	CH 1505	
	pH	7.85	7.92		
	Temperature(C)	14.7	14.3		
	Conductivity(uS)	302	303		
	# Immobile	0	0	1510	
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS
96 Hour Results: (control) A: Pass (0% mortality) (control) B: Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: CH1497C-A,B,F,G,K; % Mortality of Culture 7 Days Prior to Test: 1% Previous Day Last Feeding Time: 1600

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.20/27	0.43/33	0.72/38	0.54/35	0.52/35	0.54/30	0.39/32	0.39/32	0.46/32	0.46/32

Con A

Sample Size:	10	Mean Weight:	0.44 +/- 0.14g
Mean Fork Length:	33 +/- 3.6mm	Weight Min/Max:	0.20 - 0.72g
Fork Length Min/Max:	27 - 38 mm	Loading Density:	0.28 g/L

TEST CONDITIONS

Total Preaeration Time:	start 1530	Test Solution Volume (L):	16L
	end 1700	Test Solution Depth (10cm:10L; 20cm:16L; 35cm:20L):	29cm
	total 90min	Total Number Exposed/Concentration:	10
Reason for Preaeration > 30 minutes:	DO 7100% saturation	Test Replication (for QA/QC):	yes/no
Preaeration & Test Aeration Rate:	6.5 +/- 1 mL/min/L		
pH Adjustment:	yes/no		

INITIAL PARAMETERS (prior to loading)

Dissolved Oxygen (ppm):		Physical State Upon Receipt:	
pH:		Clarity:	
Temperature (C):		Colour:	
Conductivity (uS/cm):		Precipitate:	
(Adj. pH [if applicable]):		Odour:	
(Adjustment Details):			

Comments/Deviations:

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9387	Sample Date/Time:	04/29/97//10:00
Sample Number:	01 + 02	Sample Tech:	S. Clark
Test Number:	T01 + T02	Test Initiation Date/Time:	05/01/97// 1700
Custody #:	2112	Technician:	SF/CH

TIME	PARAMETER	T01 100	T02 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.8	10.6	CH 1743	CH
	pH	10.03	8.79		
	Temperature(C)	13.7	15.1		
	Conductivity(uS)	2310	2350		
	Immobility @ 30 minutes (10 exposed)	0	0		
15 - 16 HOURS	pH	9.64	7.61	WM 0515	[illegible]
T01 - 15-16 hr / T02 - 24 HOURS	Dissolved Oxygen	10.2	9.9	T01: 0840 CH / 1603 SF	[illegible]
	pH	9.79	7.51		
	Temperature(C)	14.4	14.2		
	Conductivity(uS)	2310	2370		
	# Immobile	—	0		
	Total # Dead	10	0		
48 HOURS	Dissolved Oxygen	[illegible]	9.8	WM 1410	[illegible]
	pH		7.49		
	Temperature(C)		14.2		
	Conductivity(uS)		2390		
	# Immobile		0		
	Total # Dead		0		
72 HOURS	Dissolved Oxygen		10.0	1500 SF	[illegible]
	pH		7.47		
	Temperature(C)		14.3		
	Conductivity(uS)		2380		
	# Immobile		0		
	Total # Dead		0		
96 HOURS	Dissolved Oxygen		9.7	CH 1507	[illegible]
	pH		7.47		
	Temperature(C)		14.5		
	Conductivity(uS)		2380		
	# Immobile		0		
	Total # Dead		0		
TOTAL MORTALITY		10	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR

TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS

96 Hour Results: #01: Fail (100% mortality) // #02: Pass (0% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: 041497C - A, B, F, G, E, C % Mortality of Culture 7 Days Prior to Testing: 1% Previous Day Last Feeding Time: 1600

Control Weight (g) / Length (mm): (Control A)

1	2	3	4	5	6	7	8	9	10
0.20 / 22	0.43 / 33	0.72 / 38	0.49 / 35	0.50 / 35	0.34 / 30	0.37 / 32	0.39 / 32	0.46 / 32	0.46 / 33

Sample Size: 10

Mean Fork Length: 32 +/- 3.2 mm

Fork Length Min/Max: 22 - 38 mm

Mean Weight: 0.44 +/- 0.14 g

Weight Min/Max: 0.20 - 0.72 g

Loading Density: 0.28 g/L

TEST CONDITIONS T01: 15 +/- 1 °C

Total Preaeration Time: start 1530; end 1700; total 90 min

Reason for Preaeration > 30 minutes: DO ≥ 100%

Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L

pH Adjustment: yes / (no)

Test Solution Volume (L): 16 L

Test Solution Depth (15cm:10L; 28cm:16L; 35cm:20L): 29 cm

Total Number Exposed/Concentration: 10

Test Replication (for QA/QC): yes / (no)

INITIAL PARAMETERS (prior to testing)

	T01	T02
Dissolved Oxygen (ppm):	~~10.2~~ 11.0	11.0
pH:	10.14	8.96
Temperature (C):	14.0	15.5
Conductivity (uS/cm):	2310	2350

(Adj. pH (if applicable)): —

(Adjustment Details):

Physical State Upon Receipt: liquid

Clarity: clear

Colour: [illegible]

Precipitates: yes

Odour: yes

Comments/Deviations: 2 hr 8/L trout lethality (01)

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9387	Sample Date/Time:	04/28/97//10:00
Sample Number:	03 + 04	Sample Tech:	S. Clark
Test Number:	T03 + T04	Test Initiation Date/Time:	05/01/97// 1700
Custody #:	2112	Technician:	CH / SF

TIME	PARAMETER	T03 100	T04 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.2	9.9	CH 1746	CM
	pH	8.13	7.54		
	Temperature(C)	15.5	15.6		
	Conductivity(uS)	2360	2360		
	Immobility @ 30 minutes (10 exposed)	0	0		
15 - 16 HOURS	pH	7.30	7.40	0513 AM	G
24 HOURS	Dissolved Oxygen	9.6	10.0	1605 [illegible]	G
	pH	7.35	7.27		
	Temperature(C)	14.3	14.3		
	Conductivity(uS)	2370	2360		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.2	9.9	14:15 NM	G
	pH	7.03	7.29		
	Temperature(C)	14.3	14.1		
	Conductivity(uS)	2380	2380		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.8	10.0	1502 [illegible]	G
	pH	7.14	7.29		
	Temperature(C)	14.0	14.3		
	Conductivity(uS)	2350	2380		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.6	9.8	CH 1509	SA
	pH	7.25	7.32		
	Temperature(C)	14.4	14.3		
	Conductivity(uS)	2390	2380		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR   TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS

96 Hour Results: #103: Pass (0% mortality) // #104 Pass (0% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: 041497C-A,B,F,G,K,L   % Mortality of Culture 7 Days Prior to Testing: 1%   Previous Day Last Feeding Time: 1600

control A

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.20 / 22	0.43 / 33	0.72 / 38	0.47 / 35	0.37 / 35	0.34 / 30	0.39 / 32	0.39 / 32	0.46 / 32	0.46 / 32

Sample Size: 10   Mean Weight: 0.44 +/- 0.14 g

Mean Fork Length: 33 +/- 5.0 mm   Weight Min/Max: 0.20 - 0.72 g

Fork Length Min/Max: 22 - 38 mm   Loading Density: 0.28 g/L

TEST CONDITIONS 6 Batch 35.

Total Preaeration Time: start 1530; end 1700; total 90 min

Reason for Preaeration > 30 minutes: DO >100%

Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L

pH Adjustment: yes / (no)

Test Solution Volume (L): 16L

Test Solution Depth (18cm:10L; 28cm:16L; 35cm:20L): 29cm

Total Number Exposed/Concentration: 10

Test Replication (for QA/QC): yes / (no)

INITIAL PARAMETERS (prior to testing)

	T03	T04
Dissolved Oxygen (ppm):	11.0	11.0
pH:	8.37	7.71
Temperature (C):	16.7	16.2
Conductivity (uS/cm):	[illegible]	2350
(Adj. pH (if applicable)):		
(Adjustment Details):		

Physical State Upon Receipt: liquid

Clarity: clear

Colour: green/yellow

Precipitate: yes

Odour: yes

Comments/Deviations: [illegible]

OPFD [illegible]

AQUATIC SCIENCES INC.
96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number: L9387
Sample Number: 05 + 06
Test Number: T05 + T06
Custody #: 2112

Sample Date/Time: 04/28/97//10:00
Sample Tech: S. Clark
Test Initiation Date/Time: 05/01/97//1700
Technician: [illegible]

TIME	PARAMETER	T05 100	T06 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.4	10.6	CY 1750	[illegible]
	pH	10.56	9.02		
	Temperature(C)	14.6	13.7		
	Conductivity(uS)	2300	2350		
	Immobility @ 30 minutes (10 exposed)	0	0		
15 - 16 HOURS	pH	see 24 hrs	8.33	0815 Gr	[illegible]
T05 - 15-16 hrs; T06 - 24 HOURS	Dissolved Oxygen	10.0	9.6	Dm T05 0815 / 1615 Gr T06	[illegible]
	pH	9.63	7.57		
	Temperature(C)	14.9	14.1		
	Conductivity(uS)	2290	2370		
	# Immobile	—	0		
	Total # Dead	10 @ 15hrs	0		
48 HOURS	Dissolved Oxygen		9.9	MM 14:17	[illegible]
	pH		7.45		
	Temperature(C)		14.1		
	Conductivity(uS)		2370		
	# Immobile		0		
	Total # Dead		0		
72 HOURS	Dissolved Oxygen		10.2	1508 Gr	[illegible]
	pH		7.42		
	Temperature(C)		14.2		
	Conductivity(uS)		2370		
	# Immobile		0		
	Total # Dead		0		
96 HOURS	Dissolved Oxygen		9.5	CY 1511	[illegible]
	pH		7.43		
	Temperature(C)		14.2		
	Conductivity(uS)		2380		
	# Immobile		0		
	Total # Dead	✓	0		
TOTAL MORTALITY		10	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: T05 Fail (100% mortality) // T06 Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: AY1497C FG % Mortality of Culture 7 Days Prior to Testing: 1% Previous Day Last Feeding Time: 1600

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.56/34	0.62/35	0.61/35	0.56/34	0.62/35	0.36/31	0.44/32	0.56/34	0.59/35	0.37/30

Sample Size: 10
Mean Fork Length: 34 +/- 1.8 mm
Fork Length Min/Max: 30 - 35 mm
Mean Weight: 0.53 +/- 0.10 g
Weight Min/Max: 0.36 - 0.61 g
Loading Density: 0.33 g/L

TEST CONDITIONS [illegible]
Total Preaeration Time: start 1530 end 1700 total 90 min
Reason for Preaeration > 30 minutes: DO [illegible]
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes/no
Test Solution Volume (L): 16 L
Test Solution Depth (15cm:10L; 28cm:16L; 35cm:20L): 29cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes/no

INITIAL PARAMETERS (prior to testing)

	T05	T06
Dissolved Oxygen (ppm):	11.0	11.0
pH:	[illegible]	9.0[illegible]
Temperature (C):	[illegible]	14.0
Conductivity (uS/cm):	2200	2300
(Adj. pH (if applicable)):	—	
(Adjustment Details):		

Physical State Upon Receipt: liquid
Clarity: clear
Colour: [illegible]
Precipitate: yes
Odour: yes

Comments/Deviations: @ 1hr 10% trout lethargic (05)

[illegible]

AQUATIC SCIENCES INC.
96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9387	Sample Date/Time:	04/28/97// 10:00
Sample Number:	07 + 08	Sample Tech:	S. Clarke
Test Number:	T07 + T08	Test Initiation Date/Time:	05/01/97// 1700
Custody #:	2112	Technician:	[illegible] CH

TIME	PARAMETER	T07 100	T08 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.2	10.4	CH 1755	CM
	pH	7.23	7.37		
	Temperature(C)	14.0	14.6		
	Conductivity(uS)	2370	2360		
	Immobility @ 30 minutes (10 exposed)	2	2		
15 - 16 HOURS	pH	7.62	7.33	0810 [illegible]	[illegible]
24 HOURS	Dissolved Oxygen	9.4	8.8	1620 [illegible]	[illegible]
	pH	7.41	7.17		
	Temperature(C)	14.0	14.1		
	Conductivity(uS)	2370	2370		
	# Immobile	0	0		
	Total # Dead	[illegible]	0		
48 HOURS	Dissolved Oxygen	10.0	9.9	NM 14:20	[illegible]
	pH	7.44	7.18		
	Temperature(C)	14.[illegible]	14.2		
	Conductivity(uS)	2380	2380		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	10.1	9.8	1510 [illegible]	[illegible]
	pH	7.42	7.20		
	Temperature(C)	14.1	14.3		
	Conductivity(uS)	2380	2380		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.7	9.7	CH 1513	SH
	pH	7.45	7.24		
	Temperature(C)	14.1	14.2		
	Conductivity(uS)	2390	2380		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR   TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: #107: Pass (0% mortality) #108: Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 0VU497C [illegible] % Mortality of Culture 7 Days Prior to Testing: 1% Previous Day Last Feeding Time: 1600

Control Weight (g) / Length (mm): (control 5)

1	2	3	4	5	6	7	8	9	10
0.56 / 34	0.60 / 35	0.61 / 35	0.56 / 34	0.54 / 35	0.36 / 31	0.44 / 33	0.56 / 34	0.59 / 35	0.59 / 35

Sample Size: 10
Mean Fork Length: 34 +/- 1.8 mm
Fork Length Min/Max: 30 - 35 mm
Mean Weight: 0.53 +/- 0.10 g
Weight Min/Max: 0.36 - 0.61 g
Loading Density: 0.33 g/L

TEST CONDITIONS w/ Drain tests.
Total Preaeration Time: start 1530 end 1700 total 90 min
Reason for Preaeration > 30 minutes: DO: [illegible]
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes/no (no circled)
Test Solution Volume (L): 16 l
Test Solution Depth (15cm:10L; 28cm:16L; 35cm:20L): 29cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes/no (no circled)

INITIAL PARAMETERS (prior to testing)

	T07	T08
Dissolved Oxygen (ppm):	11.4	11.2
pH:	7.60	7.57
Temperature (C):	14.0	14.8
Conductivity (uS/cm):	2380	2340
(Adj. pH (if applicable)):	—	
(Adjustment Details):		

Physical State Upon Receipt: liquid
Clarity: Clear
Colour: [illegible]
Precipitate: yes
Odour: yes

Comments/Deviations:

[illegible]

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number: L9387
Sample Number:
Test Number: Controls C + D
Custody #: 2112

Sample Date/Time: 04/29/97 // ?
Sample Tech: S. Clerk
Test Initiation Date/Time: 05/01/97 // 1700
Technician: CH / SF

TIME	PARAMETER	Control C 100	Control D 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.3	9.2	CH 1756	CH
	pH	7.99	7.96		
	Temperature(C)	14.5	14.5		
	Conductivity(uS)	299	296		
	Immobility @ 30 minutes (10 exposed)	0			
15 - 16 HOURS	pH	7.70	7.63	N.M CECC	CH
24 HOURS	Dissolved Oxygen	9.5	9.5	1600 JF	CH
	pH	8.03	8.02		
	Temperature(C)	14.4	14.1		
	Conductivity(uS)	300	300		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.8	9.9	14.5 NMM	CH
	pH	8.00	8.11		
	Temperature(C)	14.5	14.1		
	Conductivity(uS)	301	301		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	10.0	10.2	1501 CH	CH
	pH	8.00	8.07		
	Temperature(C)	14.4	14.2		
	Conductivity(uS)	301	302		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.6	9.7	CH 1515 / 1519	CH
	pH	8.11	8.10		
	Temperature(C)	14.5	14.3		
	Conductivity(uS)	303	303		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: Control C. Pass (0% mortality) Control D. Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 041497C-A,B,E,G (12°C) @ COND - added % Mortality of Culture 7 Days Prior to Testing: 1/. Previous Day Last Feeding Time: 1600

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.51/33	0.45/33	0.39/31	0.61/35	0.55/34	0.58/34	0.43/32	0.46/32	0.51/34	0.27-28

Sample Size: 10
Mean Fork Length: 33 +/- 2.0 mm
Fork Length Min/Max: 28 - 35 mm

Mean Weight: 0.48 +/- 0.10 g
Weight Min/Max: 0.27 - 0.61 g
Loading Density: 0.30 g/L

TEST CONDITIONS

Total Preaeration Time: start 1530; end 1700; total 90 min
Reason for Preaeration > 30 minutes: DO 2160's in Samples
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes / no

Test Solution Volume (L): 16 l
Test Solution Depth (15cm:10L; 29cm:16L; 35cm:20L): 29 cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen (ppm):
pH:
Temperature (C):
Conductivity (uS/cm):
(Adj. pH (if applicable)):
(Adjustment Details):

Physical State Upon Receipt:
Clarity:
Colour:
Precipitate:
Odour:

Comments/Deviations:

AQUATIC SCIENCES INC.
96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9387	Sample Date/Time:	04/29/97/1700:00
Sample Number:	09+10	Sample Tech:	S. Clark
Test Number:	T09+T10	Test Initiation Date/Time:	05/01/97/1700
Custody #:	2112	Technician:	[illegible]

TIME	PARAMETER	T09 100	T10 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.2	10.4	C4 1800	CW
	pH	10.12	9.02		
	Temperature(C)	13.7	13.7		
	Conductivity(uS)	2310	2350		
	Immobility @ 30 minutes (10 exposed)	0	0		
15 - 16 HOURS	pH	[illegible]	9.52	0835	[illegible]
T09 - 15-16 hrs; T10 - 24 HOURS	Dissolved Oxygen	10.0	10.0	T09 0835 [illegible] / T10 1605 [illegible]	[illegible]
	pH	9.67	7.51		
	Temperature(C)	12.9	14.2		
	Conductivity(uS)	2300	2370		
	# Immobile	—	0		
	Total # Dead	10	0		
48 HOURS	Dissolved Oxygen	|	9.9	NM 14:2[illegible]	[illegible]
	pH	|	7.54		
	Temperature(C)	|	14.3		
	Conductivity(uS)	|	2350		
	# Immobile	|	0		
	Total # Dead	|	0		
72 HOURS	Dissolved Oxygen	|	9.9	1504 [illegible]	[illegible]
	pH	|	7.46		
	Temperature(C)		14.4		
	Conductivity(uS)		2350		
	# Immobile		0		
	Total # Dead		0		
96 HOURS	Dissolved Oxygen		9.6	C4 1516	[illegible]
	pH		7.51		
	Temperature(C)		14.4		
	Conductivity(uS)		2390		
	# Immobile		0		
	Total # Dead	V	0		
TOTAL MORTALITY		10	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR   TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: #T09: Fail (100% mortality) // #T10 Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 041U97C [illegible] % Mortality of Culture 7 Days Prior to Testing: 1% Previous Day Last Feeding Time: 1650

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.59 / 35	0.27 / 28	0.56 / 34	0.58 / 35	0.71 / 37	0.32 / 29	0.76 / 39	0.39 / 31	0.37 / 30	0.31 / 29

Sample Size: 10
Mean Fork Length: 33 +/- 3.5 mm
Fork Length Min/Max: 28 - 39 mm
Mean Weight: 0.49 +/- 0.18 g
Weight Min/Max: 0.27 - 0.76 g
Loading Density: 0.31 g/L

TEST CONDITIONS
Total Preaeration Time: start 1530; end 1700; total 90 min
Reason for Preaeration > 30 minutes: [illegible]
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes / (no)
Test Solution Volume (L): 16 L
Test Solution Depth (16cm:10L; 28cm:16L; 35cm:20L): 24cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes / (no)

INITIAL PARAMETERS (prior to testing)

	T09	T10
Dissolved Oxygen (ppm):	10.8	11.2
pH	10.80	9.05
Temperature (C).	16.9	14.0
Conductivity (uS/cm):	2300	2350
(Adj. pH (if applicable)):	—	
(Adjustment Details):		

Physical State Upon Receipt: liquid
Clarity: [illegible]
Colour: [illegible]
Precipitate: [illegible]
Odour: [illegible]

Comments/Deviations: @ 1 hr 9/10 lethargic trout (09)

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number: L9387
Sample Number: 11 + 12
Test Number: T11 + T12
Custody #: @ 2112

Sample Date/Time: 03/25/97 // 10:00
Sample Took: S. Clark
Test Initiation Date/Time: 05/01/97 // 1700
Technician: CH TCL

TIME	PARAMETER	T11 100	T12 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.4	10.3	CH 1802	CH
	pH	8.32	7.56		
	Temperature(C)	14.0	13.9		
	Conductivity(uS)	2360	2370		
	Immobility @ 30 minutes (10 organisms)	0	0		
15 - 16 HOURS	pH	7.51	7.46	0930 CH	
24 HOURS	Dissolved Oxygen	9.8	10.0	1606 JR	
	pH	7.32	7.26		
	Temperature(C)	14.3	14.2		
	Conductivity(uS)	2370	2370		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	~~9.4~~ 10.0	9.9	NM 1426	
	pH	7.49	7.31		
	Temperature(C)	14.2	14.1		
	Conductivity(uS)	2340	2350		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	10.6	10.1	1505 JR	
	pH	7.32	7.26		
	Temperature(C)	14.4	14.4		
	Conductivity(uS)	2380	2380		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.6	9.8	CH 1515	
	pH	7.34	7.33		
	Temperature(C)	14.4	14.3		
	Conductivity(uS)	2390	2390		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: #11: Pass (0% mortality) // 12: Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: CY1497C F6 % Mortality of Culture 7 Days Prior to Testing: 1/. Previous Day Last Feeding Time: 1600

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.51 / 33	0.45 / 33	0.34 / 31	0.61 / 35	0.55 / 34	0.55 / 34	0.43 / 32	0.46 / 32	0.51 / 34	0.37 / 28

Sample Size: 10
Mean Fork Length: 23 +/- 2.0 mm
Fork Length Min/Max: 28 - 35 mm

Mean Weight: 0.45 +/- 0.10 g
Weight Min/Max: 0.27 - 0.61 g
Loading Density: 0.30 g/L

TEST CONDITIONS

Total Preaeration Time: start 1530
end 1700
total 90 min
Reason for Preaeration > 30 minutes: BOTTOM SATURATED
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes (no)

Test Solution Volume (L): 16 L
Test Solution Depth (10cm:10L; 20cm:16L; 35cm:20L): 24 cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to testing)

	T11	T12
Dissolved Oxygen (ppm):	11.1	11.0
pH:	8.09	7.64
Temperature (C):	10.0	14.0
Conductivity (uS/cm):	3360	3370
(Adj. pH [if applicable]):	—	
(Adjustment Details):		

Physical State Upon Receipt: Good
Clarity: Clear
Colour: Colourless
Precipitate: None
Odour: None

Comments/Deviations:

AQUATIC SCIENCES INC.
96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9387	Sample Date/Time:	04/29/97/1700:00
Sample Number:	13 + 14	Sample Tech:	S. Clark
Test Number:	T13 + T14	Test Initiation Date/Time:	05/01/97/1700
Custody #:	2112	Technician:	JN CH

TIME	PARAMETER	T13 100	T14 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.2	10.0	1804	
	pH	10.16	9.04		
	Temperature(C)	14.0	14.0		
	Conductivity(uS)	~~2497~~ 2310	2350		
	Immobility @ 30 minutes (10 exposed)	0	0		
15 - 16 HOURS	pH	see 24 hrs	9.17	0820	
T13-15-16 HRS T14 -24 HOURS	Dissolved Oxygen	10.2	9.6	0830 T13 / 1617	
	pH	9.77	7.51		
	Temperature(C)	14.5	14.1		
	Conductivity(uS)	2310	2370		
	# Immobile	—	0		
	Total # Dead	10	0		
48 HOURS	Dissolved Oxygen		9.9	MM 14:30	
	pH		7.48		
	Temperature(C)		14.0		
	Conductivity(uS)		2330		
	# Immobile		0		
	Total # Dead		0		
72 HOURS	Dissolved Oxygen		10.0	1513	
	pH		7.41		
	Temperature(C)		14.2		
	Conductivity(uS)		2350		
	# Immobile		0		
	Total # Dead		0		
96 HOURS	Dissolved Oxygen		9.7	CH 1520	
	pH		7.46		
	Temperature(C)		14.0		
	Conductivity(uS)		2380		
	# Immobile		0		
	Total # Dead	✓	0		
TOTAL MORTALITY		10	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: #113: Fail (100% mortality) // 114: Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 041497C FB / EG / IKN % Mortality of Culture 7 Days Prior to Testing: 1% Previous Day Last Feeding Time: 1600

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.51/33	0.45/32	0.29/31	0.41/33	0.55/34	0.58/34	0.43/32	0.46/32	0.51/34	0.37/28

Sample Size:	10	Mean Weight:	0.48 +/- 0.10 g
Mean Fork Length:	33 +/- 2.0 mm	Weight Min/Max:	0.37 - 0.61 g
Fork Length Min/Max:	28 - 35 mm	Loading Density:	0.30 g/L

TEST CONDITIONS for both tests.

Total Preaeration Time: start	1530	Test Solution Volume (L):	16 L
end	1700	Test Solution Depth (16cm:10L; 29cm:16L; 35cm:20L):	29 cm
total	90 min	Total Number Exposed/Concentration:	10
Reason for Preaeration > 30 minutes:	DO >100% sat.	Test Replication (for QA/QC):	yes / no (no circled)
Preaeration & Test Aeration Rate:	6.5 +/- 1 mL/min/L		
pH Adjustment:	yes / no (no circled)		

INITIAL PARAMETERS (prior to testing)

	T13	T14		
Dissolved Oxygen (ppm):	11.0	11.0	Physical State Upon Receipt:	liquid
pH:	[illegible]	9.04	Clarity:	clear
Temperature (C):	14.0	14.0	Colour:	green yellow
Conductivity (uS/cm):	2310	2330	Precipitate:	yes
			Odour:	yes
(Adj. pH (if applicable)):	—			
(Adjustment Details):				

Comments/Deviations: 2 day old trout to charge. (13)

AQUATIC SCIENCES INC.
96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number: L9387
Sample Number: 15 + 16
Test Number: T15 + T16
Custody #: 2112

Sample Date/Time: 04/29/97//10:00
Sample Tech: S. Clark
Test Initiation Date/Time: 05/01/97//1700
Technician: [illegible]

TIME	PARAMETER	T15 100	T16 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.1	10.0	1805	[illegible]
	pH	8.54	7.53		
	Temperature(C)	14.0	14.0		
	Conductivity(uS)	2310	2270		
	Immobility @ 30 minutes (10 exposed)	0	0		
15 - 18 HOURS	pH	7.50	7.36	0817	[illegible]
24 HOURS	Dissolved Oxygen	9.7	9.4	1621	[illegible]
	pH	7.31	7.27		
	Temperature(C)	14.0	14.0		
	Conductivity(uS)	2370	2390		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.5	9.5	[illegible] 14:34	[illegible]
	pH	7.34	7.27		
	Temperature(C)	14.0	14.0		
	Conductivity(uS)	2350	2330		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	10.2	9.4	1515	[illegible]
	pH	7.26	7.21		
	Temperature(C)	14.1	14.1		
	Conductivity(uS)	2350	2380		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.6	9.8	[illegible] 1522	[illegible]
	pH	7.34	7.26		
	Temperature(C)	14.0	14.0		
	Conductivity(uS)	2390	2390		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR   TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS
96 Hour Results: #15: Pass (0% mortality) // 16: Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: [illegible] [illegible]
% Mortality of Culture 7 Days Prior to Testing: 1%
Previous Day Last Feeding Time: 1600

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.59 / 35	[illegible] / 28	0.56 / 34	0.55 / 35	0.31 / 37	0.32 / 29	0.7[illegible] / 34	0.59 / 31	0.37 / 30	0.31 / 29

Sample Size: 10
Mean Fork Length: 33 +/- 3.5 mm
Fork Length Min/Max: 28 - 39 mm
Mean Weight: 0.49 +/- 0.18 g
Weight Min/Max: 0.27 - 0.76 g
Loading Density: 0.31 g/L

TEST CONDITIONS
Total Preaeration Time: start 1530
end 1700
total 90 min
Reason for Preaeration > 30 minutes: [illegible]
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes / no (no circled)
Test Solution Volume (L): 16 L
Test Solution Depth (16cm:10L; 28cm:16L; 36cm:20L): 29 cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes / no (no circled)

INITIAL PARAMETERS (prior to testing)

	T15	T16
Dissolved Oxygen (ppm):	11.4	10.4
pH:	8.66	7.[illegible]
Temperature (C):	14.0	[illegible]
Conductivity (uS/cm):	2360	23[illegible]
(Adj. pH (if applicable)):	—	
(Adjustment Details):		

Physical State Upon Receipt: liquid
Clarity: [illegible]
Colour: [illegible]
Precipitate: [illegible]
Odour: [illegible]

Comments/Deviations:

Aquatic Sciences Inc.

Ms. Carolyn Hunt
Inco Ltd.
Copper Cliff, Ontario
L2J 3G2

Reference #: L9387-33-64
Received: 05/09/97
Total Number of Pages: 34

Toxicity Testing Results
Report Date: 05/12/97

Sample Information

Sample #	Sample Description	Date Collected
L9387-33-64	Experimental Treatments for CCWWTP Sample Identification #201 - 232	05/05/97

Approved by:
Gill Shriner, Laboratory Supervisor

Approval Date:

Inquiries may be made to Gill Shriner.

Disposal of toxic samples will occur within seven (7) days of reporting unless alternate arrangements have been made.

AQUATIC SCIENCES INC.

48 HOUR STATIC DAPHNIA MAGNA SINGLE CONCENTRATION TEST
EPS 1/RM/14

Project Number:	LS367	Sample Number:	33 - 64
Client:	Inco Ltd	Test Number:	D33 - D64
	Copper Cliff, Ontario	Sample Date/Time:	05/05/97//-:- hrs
Sample Name/ID:	Experimental Treatments for CCWWTP	Sample Technician:	S Clark
	Sample Identification #201 - 232	Test Date/Time:	05/08/97// 13:50 - 16:35 hrs
Sample Location:	CCWWTP	Technician:	J Farquharson/C Hurst
Chain of Custody #:	2115		
Sample Method:	Grab		

RESULTS

48 HOUR RESULT:	33: 201:	Fail (100% mortality)	41: 209:	FAIL (100% mortality)	49: 217:	FAIL (100% mortality)	57: 225:	FAIL (100% mortality)
	34: 202:	PASS (0% mortality)	42: 210:	PASS (0% mortality)	50: 218:	PASS (0% mortality)	58: 226:	PASS (3% mortality)
	35: 203:	PASS (0% mortality)	43: 211:	PASS (0% mortality)	51: 219:	PASS (0% mortality)	59: 227:	PASS (0% mortality)
	36: 204:	PASS (0% mortality)	44: 212:	PASS (0% mortality)	52: 220:	PASS (0% mortality)	60: 228:	PASS (3% mortality)
	37: 205:	FAIL (100% mortality)	45: 213:	FAIL (100% mortality)	53: 221:	FAIL (100% mortality)	61: 229:	FAIL (100% mortality)
	38: 206:	PASS (0% mortality)	46: 214:	PASS (0% mortality)	54: 222:	PASS (0% mortality)	62: 230:	PASS (0% mortality)
	39: 207:	PASS (0% mortality)	47: 215:	PASS (0% mortality)	55: 223:	PASS (0% mortality)	63: 231:	PASS (0% mortality)
	40: 208:	PASS (0% mortality)	48: 216:	PASS (0% mortality)	56: 224:	PASS (7% mortality)	64: 232:	PASS (3% mortality)

QUALITY ASSURANCE INFORMATION

REFERENCE TEST CONDITIONS

Test Organism:	Daphnia magna	Photoperiod:	16 hours light/8 hours dark
Brood Culture:	040197 + 040797	Dilution Water:	Dechlorinated Tap
Test Type:	Static	Organism Age:	<24 hours
Test Temperature:	20 +/- 2C	Stock Source:	in house cultures
Test Volume:	150 mL	Time of First Brood:	8 days
Loading Density:	15 mL/neonate	Average Brood Size:	24 neonates
Control Water Hardness:	136 mg/L	Ephippia Frequency:	0

REFERENCE TOXICANT DATA

Chemical Used:	Sodium Chloride	Historic Mean LC50:	6147 mg/L
Date of Test:	May 5/97	Warning Limits:	4908-7386 mg/L
48-hour LC50:	5857 mg/L		
95% Confidence Interval:	5000-6400 mg/L		

TEST PROTOCOL

Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna. Environment Canada. July 1990

COMMENTS

The reference toxicant results show that test reproducibility and organism sensitivity are within acceptable limits.
All data is scrutinized for errors daily during the test, at test termination and during the report Technical and Final Review stages.
Instruments used to monitor parameters are calibrated daily and continuously maintained.

QUALITY REVIEW

Technical Review

S. Hilliker
Final Review

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	LQ387	Sample Date/Time:	05/05/97 // 1000
Sample Number:	33	Sample Tech:	S. Cloth
Test Number:	D33	Test Initiation Date/Time:	05/08/97 // 1310
Chain of Custody #:	2115	Technician:	gm CH

[redacted]

SAMPLE ID: CONTROL A / 33-201

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	~~100-B~~	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.1			9.4			1350 g	CM
	pH	8.18			10.39				
	Temperature(C)	19.2			19.8				
	Conductivity(uS)	298			2400				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.96	7.96	8.04	10.01	10.23	9.97	1432 g	
	Temperature(C)	20.0							
	# Immobile	0	0	0	10	10	10		
48 HOURS	Dissolved Oxygen	8.6	8.7	8.7	8.6	8.6	8.7	WM 1255	
	pH	7.85	7.85	7.87	9.44	9.75	9.47	1240 g	
	Temperature (C)	20.0	20.0	20.0	20.1	20.0	20.1		
	Conductivity	303	304	304	2400	2410	2410		
	# Immobile	~~0~~ 0	0	0	—	—	—		
	# Dead (10 exposed)	0	0	0	11/11	10	10		
TOTAL MORTALITIES		0	0	0	11/11	10	10		
MEAN % MORTALITY		0%			100%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 201 - FAIL (100% mortality)

TEST CONDITIONS

Brood Culture:	040797	Preaeration Time:	start 1310
Time to First Brood:	8 days		end 1340
Average Brood Size:	15 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	DO > 100% saturation
Control Water Hardness:	119	Preaeration Rate:	25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	(yes) / no	pH Adjustment:	(no) / yes
Test Replication (for QA/QC):	yes / (no)	Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen:	9.5	Adj. pH (if applicable):	—
Initial pH:	10.45	Adjustment Details:	
Temperature:	19.9		
Conductivity:	2440		
Initial Hardness:	1020	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	liquid	Adjustment Details:	
Clarity:	clear		
Colour:	yellow		
Precipitate:	no		
Odour:	yes		

Additional Observations:

Comments/Deviations: @ 48 hrs 3/30 caught at surface.

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387-34+35-~~35~~
Sample Number: 34 + 35
Test Number: D34 , D35
Chain of Custody #: 2115

Sample Date/Time: 05/05/97 / 1000
Sample Taken: S. Clark
Test Initiation Date/Time: 07/05/97 // 1335
Technician: JG CH

[redacted]

TIME	PARAMETER	CONTROL-A (Sample ID: 34-202)	CONTROL-B	CONTROL-C	100-A (Sample ID: 35-203)	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.0			9.1			1335 JG	CH
	pH	8.82			8.35				
	Temperature(C)	19.7			19.6				
	Conductivity(uS)	2450			2450				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.34	8.44	8.54	8.07	8.09	8.12	1440 or	
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.4	8.6	8.6	8.5	8.5	8.6	WM 13:10	CH
	pH	7.55	7.58	8.04	7.67	7.67	7.71		
	Temperature (C)	20.1	20.1	20.1	20.2	20.1	20.1		
	Conductivity	2470	2470	2470	2460	2480	2470		
	# Immobile	0	0	0	0	0	0	1250 JG	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0/11	0	0	0		
MEAN % MORTALITY		0%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 202 - Pass (0% mortality) | 203 - Pass (0% mortality)

TEST CONDITIONS

Brood Culture: 040797
Time to First Brood: 8 days
Average Brood Size: 19 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 119
Effluent Subsampled from 25L pail for Testing: (yes) / no
Test Replication (for QA/QC): yes / (no)

Preaeration Time: start 1310 end 1340 total 30 min
Reason for Preaeration: DO > 100% saturation
Preaeration Rate: 25 - 50mL/min/L
pH Adjustment: (no) / yes
Hardness Adjustment: (no) / yes
Test Solution Volume: (200 mL) / 150 mL
Loading Density: (20) // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	34	35
Dissolved Oxygen:	9.7	9.6
Initial pH:	8.80	8.38
Temperature:	20.0	19.7
Conductivity:	2470	2440
Initial Hardness:	952	1020
Physical State Upon Receipt:	liquid	liquid
Clarity:	clear	clear
Colour:	yellow	yellow
Precipitate:	no	no
Odour:	yes	yes

Adj. pH (if applicable): —
Adjustment Details:
Adj. Hardness (if applicable): —
Adjustment Details:

Additional Observations:

Comments/Deviations: @24 hrs precipitate forming on bottom of vessel. Some daphnia trailing fibres in #35(203)

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387
Sample Number: 316
Test Number: D316
Chain of Custody #: 2115

Sample Date/Time: 05/05/97 // 1000
Sample Took: S. Clark
Test Initiation Date/Time: 05/08/97 / 1355
Technician: JF CH

TIME	PARAMETER	SAMPLE ID:	36-204 CONTROL A			CONTROL B			PARAMETERS TECHNICIAN	QA/QC REVIEW
			CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C		
0 HOURS	Dissolved Oxygen		9.1			9.1			JF 1355	CH
	pH		7.31			8.18				
	Temperature(C)		19.7			19.2				
	Conductivity(uS)		2420			298				
	Immobility @ 30 minutes (10 exposed)		0	0	0	0	0	0		
24 HOURS	pH		7.23	7.20	7.17	8.14	8.19	8.20	1447 JF	
	Temperature(C)		20.0							
	# Immobile		0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen		8.6	8.5	8.5	8.6	8.7	8.6	NM 13:25	QA
	pH		6.95	6.96	6.99	8.09	8.14	8.14		
	Temperature (C)		20.6	20.6	20.6	20.2	20.2	20.3		
	Conductivity		2450	2470	2480	302	302	302		
	# Immobile		0	1	1	0	0	0	1405 JF	
	# Dead (10 exposed)		0	0	0	0	0	0		
TOTAL MORTALITIES			0	0	0	0	0	0		
MEAN % MORTALITY			0%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 204 - Pass (0% mortality) (7% immobile)

TEST CONDITIONS

Brood Culture: 040797
Time to First Brood: 8 days
Average Brood Size: 19 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 119
Effluent Subsampled from 25L pail for Testing: (yes) / no
Test Replication (for QA/QC): yes / (no)

Preservation Time: start 1310, end 1340, total 30 min
Reason for Preservation: DO >100 / saturation
Preservation Rate: 20 - 60mL/min/L
pH Adjustment: (no) / yes
Hardness Adjustment: (no) / yes
Test Solution Volume: (200 mL) / 150 mL
Loading Density: (10) / 13 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen: 9.8
Initial pH: 7.61
Temperature: 19.8
Conductivity: 2400
Initial Hardness: 105y
Physical State Upon Receipt: liquid
Clarity: clear
Colour: yellow
Precipitate: no
Odour: yes

Adj. pH (if applicable): —
Adjustment Details:
Adj. Hardness (if applicable): —
Adjustment Details:

Additional Observations:

Comments/Deviations:

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387-	Sample Date/Time:	05/05/97//1000
Sample Number:	37, 38	Sample Tech:	S. Clark
Test Number:	D37, D38	Test Initiation Date/Time:	05/08/97//1400
Chain of Custody #:	2115	Technician:	[illegible]

[redacted]

TIME	PARAMETER	~~CONTROL-A~~ 37-205	~~CONTROL-B~~	~~CONTROL-C~~	100-A 38-206	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.1			9.0			1400 [initials]	CM
	pH	10.37			8.81				
	Temperature(C)	19.8			19.7				
	Conductivity(uS)	2380			2420				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	10.25	10.13	10.08	8.61	8.65	8.61	1458 [initials]	
	Temperature(C)	20.0							
	# Immobile	10	10	10	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.8	8.8	8.5	8.6	8.4	WM 13:35	[initials]
	pH	10.02	9.81	9.58	8.43	8.44	8.32		
	Temperature (C)	20.1	20.0	20.0	20.2	20.2	20.2		
	Conductivity	2390	2410	2410	2450	2470	2470		
	# Immobile	—	—	—	0	0	0	1320 [initials]	
	# Dead (10 exposed)	10	10	10	0	0	0		
TOTAL MORTALITIES		10	10	10	0	0	0		
MEAN % MORTALITY		100%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 205 - Fail (100% mortality) | 206 - Pass (0% mortality)

TEST CONDITIONS

Brood Culture:	040797	Preaeration Time:	start 1310
Time to First Brood:	9 days		end 1340
Average Brood Size:	19 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	DO > 100% saturate.
Control Water Hardness:	119	Preaeration Rate:	25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	(yes) / no	pH Adjustment:	(no) / yes
Test Replication (for QA/QC):	yes / (no)	Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	37	38
Dissolved Oxygen:	9.6	9.6
Initial pH:	10.38	8.92
Temperature:	20.1	20.1
Conductivity:	2390	2430
Initial Hardness:	1054	1037
Physical State Upon Receipt:	liquid	liquid
Clarity:	clear	clear
Colour:	yellow	yellow
Precipitate:	no	no
Odour:	yes	yes

Adj. pH (if applicable): —

Adjustment Details:

Adj. Hardness (if applicable): —

Adjustment Details:

Additional Observations:

Comments/Deviations: @ 48 hrs #37 strong smelling
precipitate in both samples ~~is present~~ on bottom of vessels

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/05/97 // 1000
Sample Number:	39 & 40	Sample Tech:	S. Clark
Test Number:	D39 & D40	Test Initiation Date/Time:	05/08/97 // 1420
Chain of Custody #:	2115	Technician:	JG CH

[redacted]

TIME	PARAMETER	SAMPLE ID: 39-207 ~~CONTROL-A~~	~~CONTROL-B~~	~~CONTROL-C~~	40-208 ~~100-A~~	~~100-B~~	~~100-C~~	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.0			9.0			1420 JG	CM
	pH	8.18			7.52				
	Temperature(C)	19.8			19.8				
	Conductivity(uS)	2430			2410				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.00	8.06	8.15	7.49	7.46	7.43	1507 JG	
	Temperature(C)	20.0							
	# immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.5	8.3	8.4	8.2	8.2	8.3	MM 13:45	CM
	pH	7.53	7.48	7.59	7.25	7.24	7.24		
	Temperature (C)	20.1	20.2	20.2	20.3	20.3	20.3		
	Conductivity	2470	2480	2480	2470	2490	2480		
	# immobile	0	0	0	0	0	0	1324 JG	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 207 - Pass (0% mortality) | 208 - Pass (0% mortality)

TEST CONDITIONS

Brood Culture:	040797	Preaeration Time:	start 1345
Time to First Brood:	8 days		end 1415
Average Brood Size:	19 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates		
Control Water Hardness:	119	Reason for Preaeration:	DO 7100 % saturation
Effluent Subsampled from 25L pail for Testing:	(yes) / no	Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)	pH Adjustment:	(no) / yes
		Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	39	40
Dissolved Oxygen:	9.7	9.5
Initial pH:	8.49	7.63
Temperature:	20.0	20.2
Conductivity:	2420	2410
Initial Hardness:	986	969
Physical State Upon Receipt:	liquid	liquid
Clarity:	clear	clear
Colour:	yellow	yellow
Precipitate:	no	no
Odour:	yes	yes

Adj. pH (if applicable): –

Adjustment Details:

Adj. Hardness (if applicable): –

Adjustment Details:

Additional Observations:

Comments/Deviations: @48 hrs. 1 daphnid in each vessel of sample #39 was trailing fibres

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387
Sample Number: 41
Test Number: 241
Chain of Custody #: 2115

Sample Date/Time: 05/05/97 // 1000
Sample Tech: S. Clark
Test Initiation Date/Time: 05/08/97 // 1420
Technician: [illegible]

[redacted]

SAMPLE ID: CONTROL C — 41 - 209

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.1			9.0			1422	
	pH	8.18			10.34				
	Temperature(C)	19.2			20.0				
	Conductivity(uS)	298			2380				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.22	8.23	8.21	10.15	9.91	10.20	1515	
	Temperature(C)	20.0							
	# Immobile	0	0	0	10	10	10		
48 HOURS	Dissolved Oxygen	8.6	8.7	8.7	8.8	8.7	8.8	WM	
	pH	8.15	8.19	8.21	9.73	9.76	9.96	13:54	
	Temperature (C)	20.1	20.1	20.2	20.2	20.1	20.1		
	Conductivity	302	303	303	2380	2400	2400		
	# Immobile	0	0	0	—	—	—	1343	
	# Dead (10 exposed)	0	0	0	10	10	10		
TOTAL MORTALITIES		0	0	0	10	10	10		
MEAN % MORTALITY		0%			100%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 209 - Fail (100% mortality)

TEST CONDITIONS

Brood Culture: 040797
Time to First Brood: 8 days
Average Brood Size: 19 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 115
Effluent Subsampled from 25L pail for Testing: (yes) / no
Test Replication (for QA/QC): yes / (no)

Preparation Time: start 1245, end 1415, total 30 min
Reason for Preaeration: DO 7.180% saturation
Preaeration Rate: 25 - 50mL/min/L
pH Adjustment: (no) / yes
Hardness Adjustment: (no) / yes
Test Solution Volume: (200 mL) / 150 mL
Loading Density: (20) // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen: 9.6
Initial pH: 10.41
Temperature: 20.0
Conductivity: 256
Initial Hardness: 1020
Physical State Upon Receipt: liquid
Clarity: clear
Colour: yellow
Precipitate: no
Odour: yes

Adj. pH (if applicable): —
Adjustment Details:
Adj. Hardness (if applicable): —
Adjustment Details:

Additional Observations:

Comments/Deviations:

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/05/97 // 1000
Sample Number:	42 ; 43	Sample Task:	S. Clark
Test Number:	D42 ; D43	Test Initiation Date/Time:	05/08/97 // 1420
Chain of Custody #:	2115	Technician:	JC CH

[redacted]

TIME	PARAMETER	~~CONTROL-A~~ 42-210	~~CONTROL-B~~	CONTROL-C	100-A 43-211	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.1			9.1			1425 JC	CH
	pH	8.80			8.47				
	Temperature(C)	20.0			20.1				
	Conductivity(uS)	2440			2420				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.62	8.42	8.39	8.12	8.04	8.22	1528 JC	
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.5	8.6	8.5	8.5	8.4	8.6	NM 14:05	CH
	pH	8.47	8.15	8.00	7.83	~~7.84~~ 7.75	7.86		
	Temperature (C)	20.2	20.3	20.3	20.4	20.3	20.3		
	Conductivity	2450	2480	2480	2470	2480	2480		
	# Immobile	0	0	0	0	0	0	1345 JC	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 210 - Pass (0% mortality) | 211 - Pass (0% mortality)

TEST CONDITIONS

Brood Culture:	D#0797	Prescreation Time:	start 1345
Time to First Brood:	8 days		end 1415
Average Brood Size:	19 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates		
Control Water Hardness:	119	Reason for Prescreation:	DO? 100% saturation
Effluent Subsampled from 25L pail for Testing:	(yes) no	Prescreation Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes (no)	pH Adjustment:	(no) / yes
		Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	42	43		
Dissolved Oxygen:	9.7	9.9		
Initial pH:	8.83	8.56	Adj. pH (if applicable):	-
Temperature:	20.0	20.6	Adjustment Details:	
Conductivity:	2420	~~2480~~ 2460		
Initial Hardness:	964	1088	Adj. Hardness (if applicable):	-
Physical State Upon Receipt:	liquid		Adjustment Details:	
Clarity:	clear			
Colour:	yellow			
Precipitate:	no			
Odour:	yes			

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: 2387
Sample Number: 44
Test Number: D46
Chain of Custody #: 2115

Sample Date/Time: 05/05/97 // 1000
Sample Tech: [illegible]
Test Initiation Date/Time: 05/08/97 // 1400
Technician: JR CH

TIME	PARAMETER	SAMPLE ID: 44-212 CONTROL-A	CONTROL-B	CONTROL-C	100-A CONTROL D	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.0			9.1			1425 JR	CM
	pH	7.82			8.18				
	Temperature(C)	20.1			19.2				
	Conductivity(uS)	2450			298				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.66	7.68	7.63	8.15	8.19	8.19	1535 JR	
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.4	8.3	8.4	8.6	8.7	8.7	WM	QA
	pH	7.43	7.39	7.45	8.11	8.20	8.21		
	Temperature (C)	20.5	20.5	20.4	20.3	20.2	20.3	14:17	
	Conductivity	2470	2480	2480	302	302	302		
	# Immobile	0	0	0	0	0	0	1400 JR	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 212 - Pass (0% mortality) | 24

TEST CONDITIONS

Brood Culture:	040797		
Time to First Brood:	8 days	Preparation Time:	start 1345
Average Brood Size:	14 neonates		end 1415
Total Number Exposed/Concentration:	3X10 neonates		total 30 min
Control Water Hardness:	1.9	Reason for Preparation:	100% effluent
Effluent Subsampled from 25L pail for Testing:	yes / no	Preparation Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes / no	pH Adjustment:	no / yes
		Hardness Adjustment:	no / yes
		Test Solution Volume:	200 mL / 150 mL
		Loading Density:	20 // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen:	9.3		
Initial pH:	7.96	Adj. pH (if applicable):	—
Temperature:	20.4	Adjustment Details:	
Conductivity:	2440		
Initial Hardness:	1037	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	liquid	Adjustment Details:	
Clarity:	clear		
Colour:	yellow		
Precipitate:	no		
Odour:	yes		

Additional Observations:

Comments/Deviations: @ 24 hrs. sample 44 has precipitate on the bottom of the 4 test vessels.

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	LG387	Sample Date/Time:	05/05/97 / 1000
Sample Number:	45 ; 46	Sample Tech:	S. [illegible]
Test Number:	D45 : D46	Test Initiation Date/Time:	05/08/97 / 1445
Chain of Custody #:	215	Technician:	[illegible]

[redacted]

SAMPLE ID: 45 - 213 / 46 - 214

TIME	PARAMETER	~~CONTROL-A~~	~~CONTROL-B~~	~~CONTROL-C~~	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.2			8.8			1450	CM
	pH	10.31			8.72				
	Temperature(C)	20.2			20.3				
	Conductivity(uS)	2380			2400				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	10.23	10.11	10.10	8.56	8.47	8.58	1544	
	Temperature(C)	20.0							
	# Immobile	10	10	10	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.7	8.7	8.5	8.5	8.5	14:23	[illegible]
	pH	9.98	9.90	9.93	8.42	8.17	8.35		
	Temperature (C)	20.1	20.1	20.1	20.4	20.3	20.5		
	Conductivity	2400	2410	2410	2450	2470	2460		
	# Immobile	–	–	–	0	0	0	1405	
	# Dead (10 exposed)	10	10	10	0	0	0		
TOTAL MORTALITIES		10	10	10	0	0	0		
MEAN % MORTALITY		100%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 213 - Fail (100% mortality) | 214 - Pass (0% mortality)

TEST CONDITIONS

Brood Culture:	040797	Preaeration Time:	start 1415
Time to First Brood:	8 days		end 1445
Average Brood Size:	19 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	DO 7 [illegible]
Control Water Hardness:	119	Preaeration Rate:	25 - 50 mL/min/L
Effluent Subsampled from 25L pail for Testing:	(yes) / no	pH Adjustment:	(no) / yes
Test Replication (for QA/QC):	yes / (no)	Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen:	9.9	9.9	Adj. pH (if applicable):	–
Initial pH:	10.46	8.92	Adjustment Details:	
Temperature:	20.2	20.1		
Conductivity:	2390	2390		
Initial Hardness:	1020	1037	Adj. Hardness (if applicable):	–
Physical State Upon Receipt:	liquid		Adjustment Details:	
Clarity:	clear			
Colour:	yellow			
Precipitate:	no			
Odour:	yes			

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/05/97//1000
Sample Number:	47 : 48	Sample Team:	S. Clark
Test Number:	D47 : D48	Test Initiation Date/Time:	05/08/97//1455
Chain of Custody #:	215	Technician:	JM CH

[redacted]

SAMPLE ID: 47 - 215 | 48 - 216

TIME	PARAMETER	CONTROL-A	~~CONTROL-B~~	~~CONTROL-C~~	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.1			9.0			1455 JM	CH
	pH	8.34			7.05				
	Temperature(C)	20.4			20.3				
	Conductivity(uS)	2440			2420				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.94	7.97	8.01	6.87	6.90	6.89	1550 JM	
	Temperature(C)	20.0							
	# Immobile	0	0	0	2	2	1		
48 HOURS	Dissolved Oxygen	8.5	8.5	8.6	8.5	8.6	8.5	WM 1436	CH
	pH	7.50	7.63	7.66	6.83	6.88	6.80		
	Temperature (C)	20.4	20.6	20.6	21.0	20.9	20.9		
	Conductivity	2450	2480	2470	2460	2470	2470		
	# Immobile	0	0	0	6/9	7	~~6~~ 7	1415 JM	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 215 - Pass (0% mortality) | 216 - Pass (0% mortality) (69% immobile)

TEST CONDITIONS

Brood Culture:	040797	Preaeration Time:	start 1415
Time to First Brood:	5 days		end 1445
Average Brood Size:	19 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	DO<90% saturation
Control Water Hardness:	119	Preaeration Rate:	25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	(yes) / no	pH Adjustment:	(no) / yes
Test Replication (for QA/QC):	yes / (no)	Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen:	9.9	9.9		
Initial pH:	5.52	6.79	Adj. pH (if applicable):	—
Temperature:	20.0	20.2	Adjustment Details:	
Conductivity:	2450	2440		
Initial Hardness:	1020	1071	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	liquid		Adjustment Details:	
Clarity:	clear			
Colour:	yellow			
Precipitate:	no			
Odour:	yes			

Additional Observations:

Comments/Deviations: #48 - immobile daphnids very small with black in digestive tract

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/05/97 // ?
Sample Number:	49	Sample Tech:	S. Clark
Test Number:	D49	Test Initiation Date/Time:	05/08/97 // 1500
Chain of Custody #:	2115	Technician:	Gr CH

[redacted]

SAMPLE ID: ~~49-217~~ CONTROL E / ~~CONTROL E~~ 49-217

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	HANDLER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.1			9.0			1100 Gr	CH
	pH	8.18			10.44				
	Temperature(C)	19.2			19.7				
	Conductivity(uS)	298			2400				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.12	8.14	8.15	10.23	10.18	10.30	1600 Gr	
	Temperature(C)	20.0							
	# Immobile	0	0	0	10	10	10		
48 HOURS	Dissolved Oxygen	8.6	8.6	8.7	8.8	8.8	8.9	WM 14:50	CB
	pH	8.18	8.16	8.20	10.13	9.86	10.12		
	Temperature (C)	20.3	20.3	20.3	20.3	20.2	20.3		
	Conductivity	301	303	303	2390	2400	2410		
	# Immobile	0	0	0	–	–	–	1437 Gr	
	# Dead (10 exposed)	0	0	0	10	10	10		
TOTAL MORTALITIES		0	0	0	10	10	10		
MEAN % MORTALITY		0%			100%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 217 - Fail (100% mortality)

TEST CONDITIONS

Brood Culture:	040797	Preparation Time:	start / end / total: na
Time to First Brood:	8 days		
Average Brood Size:	19 neonates		
Total Number Exposed/Concentration:	3X10 neonates		
Control Water Hardness:	119	Reason for Preparation:	na
Effluent Subsampled from 25L pail for Testing:	yes (no)	Preparation Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes (no)	pH Adjustment:	(no) yes
		Hardness Adjustment:	(no) yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/daphnid

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen:	9.0	Adj. pH (if applicable):	–
Initial pH:	10.44	Adjustment Details:	
Temperature:	19.7		
Conductivity:	2400		
Initial Hardness:	1037	Adj. Hardness (if applicable):	–
Physical State Upon Receipt:	liquid	Adjustment Details:	
Clarity:	clear		
Colour:	yellow		
Precipitate:	no		
Odour:	yes		

Additional Observations:

Comments/Deviations: @24 hrs sample 49 has no precipitate.

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: LQ387
Sample Number: 50 : 51
Test Number: DS0 : DS1
Chain of Custody #: 2115

Sample Date/Time: 05/05/97 // ?
Sample Taken: S. Clark
Test Initiation Date/Time: 05/05/97 // 1505
Technician: [illegible]

[redacted]

SAMPLE ID: 50 - 218 | 51 - 219

TIME	PARAMETER	~~CONTROL-A~~	~~CONTROL-B~~	~~CONTROL-C~~	100-A	100-B	100-C	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.7			8.5			1503 [illegible]	[illegible]
	pH	7.91			7.97				
	Temperature(C)	20.0			19.9				
	Conductivity(uS)	2400			2430				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.42	8.54	8.60	7.77	7.81	7.71	1605 [illegible]	
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.4	8.6	8.6	8.8	8.4	8.4	MM 14:58	[illegible]
	pH	8.09	8.23	8.16	7.49	7.48	7.45		
	Temperature (C)	20.5	20.4	20.4	20.5	20.4	20.3		
	Conductivity	2450	2470	2470	2460	2470	2480		
	# Immobile	0	0	0	0	0	0	1444 [illegible]	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 218 - Pass (0% mortality) | 219 - Pass (0% mortality)

TEST CONDITIONS

Brood Culture: 040797
Time to First Brood: 8 days
Average Brood Size: 19 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 119
Effluent Subsampled from 25L pail for Testing: yes / (no)
Test Replication (for QA/QC): yes / (no)

Preaeration Time: start / end / total —
Reason for Preaeration: n/a
Preaeration Rate: 25 - 50mL/min/L
pH Adjustment: (no) / yes
Hardness Adjustment: (no) / yes
Test Solution Volume: (200 mL) / 150 mL
Loading Density: (20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	50	51
Dissolved Oxygen:	8.7	8.5
Initial pH:	7.91	7.97
Temperature:	20.0	19.9
Conductivity:	2400	2430
Initial Hardness:	1003	935
Physical State Upon Receipt:	liquid	liquid
Clarity:	clear	clear
Colour:	yellow	yellow
Precipitate:	no	no
Odour:	yes	yes

Adj. pH (if applicable): —
Adjustment Details:
Adj. Hardness (if applicable): —
Adjustment Details:

Additional Observations:

Comments/Deviations: @24 hrs. no precipitate has formed in either sample.

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	19387	Sample Date/Time:	05/05/97 // ?
Sample Number:	52	Sample Tech:	S. Vask
[illegible]	252	Test Initiation Date/Time:	05/08/97 // 1505
Chain of Custody #:	2115	Technician:	[illegible] CH

SAMPLE ID: 52-220 | CONTROL F

	PARAMETER	~~CONTROL-A~~	~~CONTROL-B~~	~~CONTROL-C~~	~~100-A~~	~~100-B~~	~~100-C~~	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.7			9.1			1505	
	pH	6.78			8.18				
	Temperature(C)	20.0			19.2				
	Conductivity(uS)	2440			298				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	6.91	6.86	6.74	7.91	8.15	8.16	1613	
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.4	8.4	8.4	8.5	8.7	8.7	WM	
	pH	6.95	6.94	6.71	8.18	8.19	8.21		
	Temperature (C)	20.7	20.6	20.5	20.6	20.4	20.4	1506	
	Conductivity	2460	2470	2470	301	302	302		
	# Immobile	0	0	0	0	0	0	1450	
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0/9	0	0		
MEAN % MORTALITY		0%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 220 - Pass (0% mortality) / [illegible]

TEST CONDITIONS

Brood Culture:	040797	Preaeration Time:	start / end / total: —
Time to First Brood:	9 days	Reason for Preaeration:	na
Average Brood Size:	19 neonates	Preaeration Rate:	25 - 50mL/min/L
Total Number Exposed/Concentration:	3X10 neonates	pH Adjustment:	(no) / yes
Control Water Hardness:	119	Hardness Adjustment:	(no) / yes
Effluent Subsampled from 25L pail for Testing:	yes / (no)	Test Solution Volume:	(200 mL) / 150 mL
Test Replication (for QA/QC):	yes / (no)	Loading Density:	(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen:	8.7	Adj. pH (if applicable):	—
Initial pH:	6.78	Adjustment Details:	
Temperature:	20.0	Adj. Hardness (if applicable):	—
Conductivity:	2440	Adjustment Details:	
Initial Hardness:	918		
Physical State Upon Receipt:	liquid		
Clarity:	clear		
Colour:	colourless		
Precipitate:	no		
Odour:	yes		

Additional Observations:

Comments/Deviations: @24hrs. no precipitate has formed.

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	19387	Sample Date/Time:	25/05/97 // ?
Sample Number:	53 · 54	Sample Tech:	S Clark
Test Number:	D53 · D54	Test Initiation Date/Time:	25/08/97 // 1510 (54) / 1635 (53)
Chain of Custody #:	2115	Technician:	[illegible]

[redacted]

SAMPLE ID: 53-221 (CONTROL-A, CONTROL-B, CONTROL-C) · 54-222 (100-A, 100-B, 100-C)

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.9			8.7			#54 1510 / #53 1635	[illegible]
	pH	10.27			8.95				
	Temperature(C)	19.4			20.0				
	Conductivity(uS)	2350			2400				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	10.20	10.21	10.09	8.70	8.62	8.51	1620	
	Temperature(C)	20.0							
	# Immobile	10	10	10	0	0	0		
48 HOURS	Dissolved Oxygen	8.8	8.8	8.9	8.5	8.6	8.4	AWM 1512	[illegible]
	pH	10.16	10.12	9.93	8.43	8.26	8.25		
	Temperature (C)	20.5	20.3	20.3	20.5	20.3	20.2		
	Conductivity	2380	2410	2410	2470	2480	2470		
	# Immobile	—	—	—	0	0	0	1458	
	# Dead (10 exposed)	10	10	10	0	0	0		
TOTAL MORTALITIES		10	10	10/10	0	0	0		
MEAN % MORTALITY		100%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 221 - Fail (100% mortality) | 222 - Pass (0% mortality)

TEST CONDITIONS

Brood Culture:	040797		#53 (221) only
Time to First Brood:	8 days	Preaeration Time:	start 1605
Average Brood Size:	19 neonates		end 1635
Total Number Exposed/Concentration:	3X10 neonates		total 30 min
Control Water Hardness:	119	Reason for Preaeration:	DO>100% saturation
Effluent Subsampled from 25L pail for Testing:	yes (no)	Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes (no)	pH Adjustment:	(no) / yes
		Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20)/ 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	53	54		
Dissolved Oxygen:	9.3	8.7	Adj. pH (if applicable):	—
Initial pH:	10.31	8.95	Adjustment Details:	
Temperature:	19.9	20.0		
Conductivity:	2390	2400		
Initial Hardness:	554	452	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	liquid		Adjustment Details:	
Clarity:	clear			
Colour:	colourless			
Precipitate:	no			
Odour:	yes			

Additional Observations: —

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/05/97 // ?
Sample Number:	55 : 56	Sample Tech:	S. Clark
Test Number:	D55 : D56	Test Initiation Date/Time:	05/05/97 // 1515
Chain of Custody #:	2115	Technician:	Jn

[redacted]

TIME	PARAMETER	SAMPLE ID: 55-223 CONTROL-A	CONTROL-B	CONTROL-C	56-224 100%A	100%B	100%C	PARAMETERS TECHNICIAN	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.5			8.6			1515 Jn	Jn
	pH	8.28			7.11				
	Temperature(C)	20.0			20.3				
	Conductivity(uS)	2440			2420				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.99	7.99	7.90	7.07	7.08	7.07	1625 Jn	
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.3	8.5	8.6	8.4	8.4	8.3	NM 15:20	[illegible]
	pH	7.62	7.65	7.65	7.06	7.06	7.05		
	Temperature (C)	20.6	20.3	20.4	20.7	20.5	20.5		
	Conductivity	2460	2470	2480	2460	2480	2470		
	# Immobile	0	0	0	0	0	0	1507 Jn	
	# Dead (10 exposed)	0	0	0	0	0	2		
TOTAL MORTALITIES		0	0	0	0	0	2		
MEAN % MORTALITY		0%			7%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 223 - Pass (0% mortality) | 224 - Pass (7% mortality)

TEST CONDITIONS

Brood Culture:	040797	Preaeration Time:	start / end / total — /
Time to First Brood:	8 days		
Average Brood Size:	14 neonates		
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	na
Control Water Hardness:	115	Preaeration Rate:	25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	yes / no	pH Adjustment:	no / yes
Test Replication (for QA/QC):	yes / no	Hardness Adjustment:	no / yes
		Test Solution Volume:	200 mL / 150 mL
		Loading Density:	20 / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	55	56		
Dissolved Oxygen:	8.5	8.6	Adj. pH (if applicable):	—
Initial pH:	8.28	7.11	Adjustment Details:	
Temperature:	20.0	20.3		
Conductivity:	2440	2420	Adj. Hardness (if applicable):	—
Initial Hardness:	1054	1071	Adjustment Details:	
Physical State Upon Receipt:	liquid			
Clarity:	clear			
Colour:	colourless			
Precipitate:	no			
Odour:	yes			

Additional Observations:

Comments/Deviations: @48 hrs. sample # 56, one dead daphnid was green inside along back of body.

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387
Sample Number: 57
Test Number: D57
Chain of Custody #: 2115

Sample Date/Time: 05/05/97 // ?
Sample Taken: S. Clark
Test Initiation Date/Time: 05/08/97 // 1635
Technician: JR CH

[redacted]

SAMPLE ID: ~~57-225~~ CONTROL 6 (CONTROL-A, CONTROL-B, CONTROL-C); ~~CONTROL 6~~ 57-225 (100%A, 100%B, 100%C)

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100%A	100%B	100%C	PARAMETERS VERIFIED	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.1			9.0			1635 J	CH
	pH	8.18			10.30				
	Temperature(C)	19.2			19.9				
	Conductivity(uS)	298			2360				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.15	8.14	8.19	10.22	10.21	10.17	1633 J	
	Temperature(C)	20.0							
	# Immobile	~~10~~ 0	0	0	10	10	10		
48 HOURS	Dissolved Oxygen	8.6	8.7	8.7	8.9	8.9	8.9	WM 15:25	PB
	pH	8.22	8.27	8.23	10.04	9.97	9.91		
	Temperature (C)	20.5	20.3	20.4	20.4	20.4	20.3		
	Conductivity	301	302	302	2400	2410	2410		
	# Immobile	0	0	0	—	—	—	1515 Jm	
	# Dead (10 exposed)	0	0	0	10	10	10		
TOTAL MORTALITIES		0	0	0	10	10	10		
MEAN % MORTALITY		0%			100%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 225 - Fail (100% mortality)

TEST CONDITIONS

#57 (225) only

Brood Culture: 040797
Time to First Brood: 8 days
Average Brood Size: 19 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 119
Effluent Subsampled from 25L pail for Testing: yes / (no)
Test Replication (for QA/QC): yes / (no)

Preaeration Time: start 1605 end 1635 total 30 min
Reason for Preaeration: DO>100% saturation
Preaeration Rate: 25 - 50mL/min/L
pH Adjustment: (no) / yes
Hardness Adjustment: (no) / yes
Test Solution Volume: (200 mL) / 150 mL
Loading Density: (20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen: 9.3
Initial pH: 10.50
Temperature: 20.1
Conductivity: 2370
Initial Hardness: 867
Physical State Upon Receipt: Liquid
Clarity: Clear
Colour: colourless
Precipitate: no
Odour: Yes

Adj. pH (if applicable): —
Adjustment Details:
Adj. Hardness (if applicable): —
Adjustment Details:

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387
Sample Number: 58 ; 59
Test Number: D58 ; D59
Chain of Custody #: 2115

Sample Date/Time: 05/05/97 // ?
Sample Tech: S. Clark
Test Initiation Date/Time: 05/08/97 // 1520
Technician: gr

SAMPLE ID: [redacted]

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
	Sample	58-226			59-227				
0 HOURS	Dissolved Oxygen	8.6			8.5			1520 gr	a
	pH	9.19			8.17				
	Temperature(C)	19.9			20.2				
	Conductivity(uS)	2470			2390				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.54	8.54	8.60	7.78	7.75	7.78	1635 gr	
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.4	8.4	8.4	8.4	8.4	8.4	NM 15:34	✱
	pH	8.27	8.22	8.24	7.42	7.45	7.46		
	Temperature (C)	20.6	20.5	20.4	20.4	20.4	20.4		
	Conductivity	2450	2470	2470	2470	2470	2480		
	# Immobile	0	0	0	0	0	0	1520 gr	
	# Dead (10 exposed)	1	0	0	0	0	0		
TOTAL MORTALITIES		1	0	0	0	0	0		
MEAN % MORTALITY		3%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 226 - Pass (3% mortality) / 227 - Pass (0% mortality)

TEST CONDITIONS

Brood Culture: 040797
Time to First Brood: 5 days
Average Brood Size: 19 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 119
Effluent Subsampled from 25L pail for Testing: yes / (no)
Test Replication (for QA/QC): yes / (no)

Preaeration Time: start / end / total: /
Reason for Preaeration: na
Preaeration Rate: 25 - 50mL/min/L
pH Adjustment: (no) / yes
Hardness Adjustment: (no) / yes
Test Solution Volume: (200 mL) / 150 mL
Loading Density: (20) // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	58	59
Dissolved Oxygen:	8.6	8.5
Initial pH:	9.14	8.17
Temperature:	19.9	20.2
Conductivity:	2470	2390
Initial Hardness:	486	469
Physical State Upon Receipt:	liquid	
Clarity:	clear	
Colour:	colourless	
Precipitate:	no	
Odour:	yes	

Adj. pH (if applicable): —
Adjustment Details:
Adj. Hardness (if applicable): —
Adjustment Details:

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387
Sample Number: 60
Test Number: 560
Chain of Custody #: 2115

Sample Date/Time: 05/05/97 11:?
Sample Taxa: S. Daph
Test Initiation Date/Time: 05/08/97 // 1530
Technician: JR

SAMPLE ID: 60 - 228 (CENTRIC-A, CENTRIC-B, CENTRIC-C) CONTROL H (100-A, 100-B, 100-C)

TIME	PARAMETER	CENTRIC-A	CENTRIC-B	CENTRIC-C	100-A	100-B	100-C	PARAMETERS VERIFIED	BASIC REVIEW
0 HOURS	Dissolved Oxygen	8.7			9.1			1530 JR	CH
	pH	6.98			8.18				
	Temperature(C)	20.3			19.2				
	Conductivity(uS)	2380			298				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	6.93	6.83	6.86	8.19	8.16	8.20	CH 1646	
	Temperature(C)	20.0							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.4	8.4	8.5	8.6	8.7	8.6	MM 1545	CH
	pH	6.85	6.89	6.93	8.16	8.12	8.13		
	Temperature (C)	20.7	20.7	20.7	20.6	20.5	20.4		
	Conductivity	2460	2470	2470	302	303	303		
	# Immobile	0	1	0	0	0	0	1528 JR	
	# Dead (10 exposed)	0	1	0	0	0	0		
TOTAL MORTALITIES		0	1	0	0	0	0		
MEAN % MORTALITY		3%			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 228 - Pass (3% mortality) (3% immobile)

TEST CONDITIONS

		CONTROL H
Brood Culture:	040797	041497
Time to First Brood:	8 days	7 days
Average Brood Size:	19 neonates	34 neonates
Total Number Exposed/Concentration:	3X10 neonates	
Control Water Hardness:	119	
Effluent Subsampled from 25L pail for Testing:	yes / no	
Test Replication (for QA/QC):	yes / no	

Presession Time: start / end / total
Reason for Presession:
Presession Rate:
pH Adjustment:
Hardness Adjustment:
Test Solution Volume:
Loading Density:

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen:	8.7
Initial pH:	6.98
Temperature:	20.3
Conductivity:	2350 2355
Initial Hardness:	
Physical State Upon Receipt:	liquid
Clarity:	clear
Colour:	colourless
Precipitate:	no
Odour:	yes

Adj. pH (if applicable):
Adjustment Details:
Adj. Hardness (if applicable):
Adjustment Details:

Additional Observations:

Comments/Deviations: CONTROL H had 041497 neonates @48 hrs. sample #60 - 1 dead daphnid, 1 immobile & a few of the alive ones had green on upper, inside of bodies. (digestive track.)

[redacted]

[redacted] CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

[redacted]	19387	Sample Date/Time:	05/05/97 11?
[redacted]	61 ; 62	Sample Temp:	5 [illegible]
[redacted]	D62 ; D62	Test Initiation Date/Time:	05/08/97 1545
[redacted] #:	215	Technician:	[illegible]

[redacted]

SAMPLE ID: 61 - 229 / 62 - 230

	PARAMETER	~~CONTROL A~~	~~CONTROL B~~	~~CONTROL C~~	~~100-A~~	~~100-B~~	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.7			8.7			1545 [illegible]	[illegible]
	pH	10.23			8.83				
	Temperature(C)	20.2			20.2				
	Conductivity(uS)	2760			2420				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	9.83	10.08	10.23	8.79	8.81	8.68	1640 ~~[illegible]~~ [illegible]	
	Temperature(C)	20.0							
	# Immobile	10	10	10	0	0	0		
48 HOURS	Dissolved Oxygen	8.8 WM	8.7 WM	8.8 WM	8.5	8.6	8.4	WM 15:52	[illegible]
	pH	9.45	9.79	10.05	8.45	8.48	8.35		
	Temperature (C)	20.5	20.3	20.3	20.6	20.4	20.5		
	Conductivity	2390	2410	2400	2450	2470	2470		
	# Immobile	–	–	–	0	0	0	1537 [illegible]	
	# Dead (10 exposed)	10	10	10	0	0	0		
TOTAL MORTALITIES		10	10	10	0	0	0		
MEAN % MORTALITY		100%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 229 - ~~Pass~~ Fail (100% mortality) | 230 - Pass (0% mortality)

TEST CONDITIONS

Brood Culture:	041497			
Time to First Brood:	7 days	Preparation Time:	start	/
Average Brood Size:	34 neonates		end	
Total Number Exposed/Concentration:	1X10 neonates		total	
Control Water Hardness:	115	Reason for Preparation:		na
Effluent Subsampled from 25L pail for Testing:	yes / (no)	Preparation Rate:		25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)	pH Adjustment:		(no) / yes
		Hardness Adjustment:		(no) / yes
		Test Solution Volume:		(200 mL) / 150 mL
		Loading Density:		(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	61	62		
Dissolved Oxygen:	8.7	8.7		
Initial pH:	10.23	8.83	Adj. pH (if applicable):	–
Temperature:	20.2	20.2	Adjustment Details:	
Conductivity:	2360	2420		
Initial Hardness:	1156	173	Adj. Hardness (if applicable):	–
Physical State Upon Receipt:	liquid		Adjustment Details:	
Clarity:	clear			
Colour:	colourless			
Precipitate:	no			
Odour:	yes			

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/05/97 // ?
Sample Number:	63 : 64	Sample Tech:	S Clark
Test Number:	D63 : D64	Test Initiation Date/Time:	05/08/97 // 1600
Chain of Custody #:	2115	Technician:	Jr

SAMPLE ID: [redacted] 63-231 / 64-232

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.7			8.4			1600 Jr	CM
	pH	8.28			7.14				
	Temperature(C)	20.4			20.1				
	Conductivity(uS)	2410			2420				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.05	7.98	7.79	7.02	6.99	6.97	CY 1653	
	Temperature(C)	20.0							
	# Immobile	0	0	0	1	0	0		
48 HOURS	Dissolved Oxygen	8.5	8.6	8.6	8.3	8.5	8.5	NM 16:00	PR
	pH	7.65	7.69	7.62	6.89	6.94	7.01		
	Temperature (C)	20.6	20.5	20.4	20.8	20.7	20.7		
	Conductivity	2440	2470	2480	2440	2480	2480		
	# Immobile	0	0	0	0	2	0	1545 Jr	
	# Dead (10 exposed)	0	0	0	1	0	0		
TOTAL MORTALITIES		0	0	0	1	0	0		
MEAN % MORTALITY		0%			3%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 231- Pass (0% mortality) | 232 - Pass (3% mortality) (7% immobile

TEST CONDITIONS

Brood Culture:	041497	Preaeration Time:	start	/
Time to First Brood:	7 days		end	
Average Brood Size:	34 neonates		total	
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:		na
Control Water Hardness:	119	Preaeration Rate:		25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	yes / (no)	pH Adjustment:		no / yes
Test Replication (for QA/QC):	yes / (no)	Hardness Adjustment:		(no) / yes
		Test Solution Volume:		(200 mL) / 150 mL
		Loading Density:		(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	63	64		
Dissolved Oxygen:	8.7	8.4		
Initial pH:	8.28	7.14	Adj. pH (if applicable):	–
Temperature:	20.4	20.1	Adjustment Details:	
Conductivity:	2410	2420		
Initial Hardness:	1022	1105	Adj. Hardness (if applicable):	–
Physical State Upon Receipt:	liquid		Adjustment Details:	
Clarity:	clear			
Colour:	colourless			
Precipitate:	no			
Odour:	no			

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

96 HOUR STATIC RAINBOW TROUT SINGLE CONCENTRATION TEST
EPS 1/RM/13

Project Number:	L9387	Sample Number:	33 - 48
Client:	Inco Ltd	Test Number:	T17 - T32
	Copper Cliff, Ontario	Sample Date/Time:	05/05/97//-:- hrs
Sample Name/ID:	Experimental Treatments for CCWWTP	Sample Technician:	S Clark
	Sample Identification #201 - 216	Test Date:	05/07/97//16:45 hrs
Sample Location:	CCWWTP	Technician:	C Hurse/J Farquharson
Chain of Custody #:	2115		
Sample Method:	Grab		

RESULTS

96 HOUR RESULTS:	33: 201:	FAIL (100% mortality)	41: 209:	FAIL (100% mortality)
	34: 202:	PASS (10% mortality)	42: 210:	PASS (0% mortality)
	35: 203:	PASS (0% mortality)	43: 211:	PASS (0% mortality)
	36: 204:	PASS (0% mortality)	44: 212:	PASS (0% mortality)
	37: 205:	FAIL (100% mortality)	45: 213:	FAIL (100% mortality)
	38: 206:	PASS (0% mortality)	46: 214:	PASS (0% mortality)
	39: 207:	PASS (0% mortality)	47: 215:	PASS (0% mortality)
	40: 208:	PASS (0% mortality)	48: 216:	PASS (0% mortality)

QUALITY ASSURANCE INFORMATION

REFERENCE TEST CONDITIONS

Test Organism:	Rainbow Trout	Test Aeration Rate:	6.5 +/- 1 mL/min/L
Trout Batch Number:	041897A	Photoperiod:	16 hours light/8 hours dark
Test Type:	Static	Dilution Water:	Dechlorinated Tap
Test Temperature:	15+/-1C	Organism Age:	Fingerlings
Test Volume:	15 Litres	Stock Source:	Rainbow Springs Hatchery
Test Solution Depth:	27 cm	Mean Weight:	0.52 +/- 0.12 g

REFERENCE TOXICANT DATA

Chemical Used:	Sodium Chloride	Historic Mean LC50:	16246 mg/L
Date of Test:	May 6/97	Warning Limits:	12252 - 20239 mg/L
96-hour LC50:	15693 mg/L		
95% Confidence Interval:	14826 - 16611 mg/L		

TEST PROTOCOL

Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout. Environment Canada. July 1990

COMMENTS

The reference toxicant results show that test reproducibility and organism sensitivity are within acceptable limits.
All data is scrutinized for errors daily during the test, at test termination and during the report Technical and Final Review stages.
Instruments used to monitor parameters are calibrated daily and continuously maintained.
All tests were presented for 90 minutes at the request of Sandford Clark of Laurentian University.

QUALITY REVIEW

K Greenbridge
Technical Review

S. Hillike
Final Review

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9387	Sample Date/Time:	05/05/97 // 1000
Sample Number:	33	Sample Tech:	S. Clark
Test Number:	I17	Test Initiation Date/Time:	05/07/97 // 1645
Custody #:	2115	Technician:	CH

TIME	PARAMETER	CONTROL A 100	33-201 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.1	10.2	1645 CH	
	pH	7.51	10.54		
	Temperature(C)	14.7	14.4		
	Conductivity(uS)	297	2,440		
	Immobility @ 30 minutes (10 exposed)	0	0		
#33 15-16hrs 46-48 HOURS	pH	7.78	10.24	1900 CH	
#33-15-16 hrs	Dissolved Oxygen	9.6	10.0	0837 CH #33	
	pH	7.97	9.50		
	Temperature(C)	14.3	14.9		
	Conductivity(uS)	302	2,440		
	# Immobile	0	—	1617	
	Total # Dead	0	10		
48 HOURS	Dissolved Oxygen	9.8		CH 1608	
	pH	7.87			
	Temperature(C)	14.5			
	Conductivity(uS)	300			
	# Immobile	0			
	Total # Dead	0			
72 HOURS	Dissolved Oxygen	9.5		1620 CH	
	pH	7.84			
	Temperature(C)	15.0			
	Conductivity(uS)	303			
	# Immobile	0			
	Total # Dead	0			
96 HOURS	Dissolved Oxygen	9.6		NM 16:44	CH
	pH	7.87			
	Temperature(C)	14.7			
	Conductivity(uS)	304			
	# Immobile	0			
	Total # Dead	0	10		
TOTAL MORTALITY		0	10		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS

96 Hour Results: 201 - Fail (100% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: 041897A % Mortality of Culture 7 Days Prior to Testing: 1.4% Previous Day Last Feeding Time: 1630

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.53 / 35	0.44 / 33	0.49 / 34	0.73 / 40	0.37 / 32	0.81 / 40	0.58 / 35	0.68 / 37	0.58 / 36	0.64 / 37

Sample Size: 10 Mean Weight: 0.59 +/- 0.13 g

Mean Fork Length: 36 +/- 3 mm Weight Min/Max: 0.37 - 0.81 g

Fork Length Min/Max: 32 - 40 mm Loading Density: 0.37 g/L

TEST CONDITIONS

Total Preaeration Time: start 1615; end 1645; total 30 min

Reason for Preaeration > 30 minutes: na

Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L

pH Adjustment: yes / (no)

Test Solution Volume (L): 16L

Test Solution Depth (10cm:10L; 20cm:16L; 30cm:20L): 29cm

Total Number Exposed/Concentration: 10

Test Replication (for QA/QC): yes / (no)

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen (ppm):	10.2	Physical State Upon Receipt:	liquid
pH:	10.63	Clarity:	clear
Temperature (C):	~~14~~ 14.5	Colour:	green
Conductivity (uS/cm):	2460	Precipitate:	yes
		Odour:	no
(Adj. pH [if applicable]):	—		
(Adjustment Details):			

Comments/Deviations: @30 min sample #1 trout dark in colour, trying to hide in corners of liner
@1hr all trout swimming sideways, upside down, some immobile.
@~2hr, all trout dead in 33, subsampled.

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number: L9387
Sample Number: 34 : 35
Test Number: T18 : T19
Custody #: 2115

Sample Date/Time: 05/05/97 // 1000
Sample Tech: S. CLARK
Test Initiation Date/Time: 05/07/97 // 1645
Technician: CM

TIME	PARAMETER	34 - 202 (100)	35 - 203 (100)	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8	9.9	1645 CM	
	pH	8.90	8.58		
	Temperature(C)	14.6	14.4		
	Conductivity(uS)	2490	2500		
	Immobility @ 30 minutes (10 expected)	0	0		
15 - 18 HOURS	pH	7.38	7.43	0810	
24 HOURS	Dissolved Oxygen	9.3	9.3	CM	
	pH	7.28	7.17		
	Temperature(C)	14.3	14.2		
	Conductivity(uS)	2510	2510	1620	
	# Immobile	0	0		
	Total # Dead	0 1 cm	0		
48 HOURS	Dissolved Oxygen	9.5	9.5	CM	
	pH	7.28	7.13		
	Temperature(C)	14.4	14.3		
	Conductivity(uS)	2520	2520	1611	
	# Immobile	0	0		
	Total # Dead	1	0		
72 HOURS	Dissolved Oxygen	9.1	9.3		
	pH	7.35	7.17		
	Temperature(C)	14.6	14.8		
	Conductivity(uS)	2520	2510	1621	
	# Immobile	0	0		
	Total # Dead	1	0		
96 HOURS	Dissolved Oxygen	9.6	9.3		
	pH	7.39	7.11		
	Temperature(C)	14.5	14.5		
	Conductivity(uS)	2520	2520		
	# Immobile	0	0	16:46	
	Total # Dead	1	0		
TOTAL MORTALITY		1	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 202 - Pass (10% mortality) | 203 - Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 041897A % Mortality of Culture 7 Days Prior to Testing: 1.4% Previous Day Last Feeding Time: 1630

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.53 / 35	0.44 / 33	0.49 / 34	0.73 / 40	0.37 / 32	0.81 / 40	0.58 / 35	0.68 / 37	0.81 / 36	0.64 / 37

Sample Size: 10
Mean Fork Length: 36 +/- 3 mm
Fork Length Min/Max: 32 - 40 mm
Mean Weight: 0.59 +/- 0.13 g
Weight Min/Max: 0.37 - 0.81 g
Loading Density: 0.37 g/L

TEST CONDITIONS
Total Preaeration Time: start 1615; end 1645; total 30 min
Reason for Preaeration > 30 minutes: NA
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes (no)
Test Solution Volume (L): 16
Test Solution Depth (10cm:10L; 20cm:16L; 30cm:22L): 29cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to testing)

	34	35
Dissolved Oxygen (ppm):	10.0	10.2
pH:	8.94	8.57
Temperature (C):	14.6	14.5
Conductivity (uS/cm):	2500	2500
(Adj. pH (if applicable)):		
(Adjustment Details):		

	34	35
Physical State Upon Receipt:	Liquid	Liquid
Clarity:	clear	clear
Colour:	green	green
Precipitate:	yes	yes
Odour:	no	no
	breaking	

Comments/Deviations:
- note #202 (34) arrived with a leaking liner bag

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	19387	Sample Date/Time:	05/05/97 // 1000
Sample Number:	36 : B	Sample Taxis:	S Clark
Test Number:	T20	Test Initiation Date/Time:	05/07/97 // 1645
Custody #:	2115	Technician:	CM

TIME	PARAMETER	36-204 100	CONTROL B 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8	10.2	1650 CM	
	pH	7.10	7.67		
	Temperature(C)	14.1	14.0		
	Conductivity(uS)	2510	299		
	Immobility @ 30 minutes (10 exposed)	0	0		
15 - 16 HOURS	pH	7.11	7.87	0815	
24 HOURS	Dissolved Oxygen	9.7	9.8	CM 1721	
	pH	7.11	8.02		
	Temperature(C)	14.1	14.1		
	Conductivity(uS)	2520	301		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.8	9.7	CM 1683	
	pH	7.10	8.20		
	Temperature(C)	14.3	14.4		
	Conductivity(uS)	2520	302		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.8	9.7	1622 M	
	pH	7.16	7.91		
	Temperature(C)	14.5	14.6		
	Conductivity(uS)	2520	303		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.7	9.7	NM 1651 CM	
	pH	7.17	7.96		
	Temperature(C)	14.4	14.4		
	Conductivity(uS)	2530	303		
	# Immobile	0	0		
	Total # Dead	0	0/9		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS

96 Hour Results: 204 - Pass (0% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: 041897A % Mortality of Culture 7 Days Prior to Testing: 1.4% Previous Day Last Feeding Time: 1630

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.46 / 33	0.37 / 31	0.49 / 35	0.56 / 35	0.52 / 35	0.36 / 31	0.34 / 31	0.65 / 37	0.66 / 36	—

Sample Size:	9	Mean Weight:	0.49 +/- 0.12 g
Mean Fork Length:	34 +/- 2 mm	Weight Min/Max:	0.34 - 0.66 g
Fork Length Min/Max:	31 - 37 mm	Loading Density:	0.28 g/L

TEST CONDITIONS

Total Preaeration Time:	start 1615	Test Solution Volume (L):	16 L
	end 1645	Test Solution Depth (15cm:10L; 25cm:16L; 35cm:20L):	29 cm
	total 30 min	Total Number Exposed/Concentration:	10
Reason for Preaeration > 30 minutes:	na	Test Replication (for QA/QC):	yes / no
Preaeration & Test Aeration Rate:	6.5 +/- 1 mL/min/L		
pH Adjustment:	yes / no		

INITIAL PARAMETERS (prior to loading) 36

Dissolved Oxygen (ppm):	10.0	Physical State Upon Receipt:	36 Liquid
pH:	7.07	Clarity:	clear
Temperature (C):	14.1	Colour:	green
Conductivity (uS/cm):	2510	Precipitate:	yes
(Adj. pH (if applicable)):	—	Odour:	no
(Adjustment Details):			broken bag

Comments/Deviations:

note - #204 (36) arrived with a leaking liner bag

AQUATIC SCIENCES INC.
96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9387	Sample Date/Time:	05/05/97 // 7000
Sample Number:	37 : 38	Sample Tech:	S. Clark
Test Number:	T21 : T22	Test Initiation Date/Time:	05/07/97 // 1645
Custody #:	2115	Technician:	CH

[redacted]

TIME	PARAMETER	37-205 100	38-206 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8	10.0	1652 JR	AB
	pH	10.57	9.01		
	Temperature(C)	14.0	14.3		
	Conductivity(uS)	2450	2500		
	Immobility @ 30 minutes (10 exposed)	0	0	#37	
15 - 16 HOURS	pH	2hrs → 10.30	7.46	1900 / 1519	G
#37.15-16 hr. 24 HOURS	Dissolved Oxygen	9.4	9.8	0840 / CH / 1624	G
	pH	9.60	7.41		
	Temperature(C)	14.5	14.2		
	Conductivity(uS)	2440	2510		
	# Immobile	—	0		
	Total # Dead	10	0		
48 HOURS	Dissolved Oxygen		9.9	CH 1615	AB
	pH		7.43		
	Temperature(C)		14.3		
	Conductivity(uS)		2520		
	# Immobile		0		
	Total # Dead		0		
72 HOURS	Dissolved Oxygen		9.9	1623 JR	AB
	pH		7.41		
	Temperature(C)		14.4		
	Conductivity(uS)		2520		
	# Immobile		0		
	Total # Dead		0		
96 HOURS	Dissolved Oxygen		9.7	WM 16:53	CH
	pH		7.42		
	Temperature(C)		14.3		
	Conductivity(uS)		2520		
	# Immobile		0		
	Total # Dead	✓	0		
TOTAL MORTALITY		10	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR   TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 205 - Fail (100% mortality) | 206 - Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 041897A   % Mortality of Culture 7 Days Prior to Testing: 1.4%   Previous Day Last Feeding Time: 1630

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.46 / 33	0.37 / 31	0.49 / 35	0.56 / 35	0.56 / 35	0.36 / 31	0.34 / 31	0.65 / 37	0.66 / 36	— / —

Sample Size: 9
Mean Fork Length: 34 +/- 2 mm
Fork Length Min/Max: 31 - 37 mm
Mean Weight: 0.49 +/- 0.12 g
Weight Min/Max: 0.34 - 0.66 g
Loading Density: 0.28 g/L

TEST CONDITIONS
Total Preaeration Time: start 1615; end 1645; total 30 min
Reason for Preaeration > 30 minutes: na
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes (no)
Test Solution Volume (L): 16L
Test Solution Depth (16cm:10L; 29cm:16L; 35cm:20L): 29cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to testing)

	37	38
Dissolved Oxygen (ppm):	10.2	10.2
pH:	10.63	9.05
Temperature (C):	14.2	14.5
Conductivity (uS/cm):	2460	2490
(Adj. pH (if applicable)):	—	
(Adjustment Details):		

	37	38
Physical State Upon Receipt:	Liquid	Liquid
Clarity:	clear	clear
Colour:	green	green
Precipitate:	yes	yes
Odour:	no	no

Comments/Deviations: @ 30 min #37 - some trout dark in colour, swimming sideways, stressed
#37 @ 1hr all trout swimming erratically
@ 1830 hrs 05/07/97 - all died in #37; subsampled.

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	9387	Sample Date/Time:	05/05/97 // 1000
Sample Number:	39 : 40	Sample Tech:	S. Clark
Test Number:	T23 . T24	Test Initiation Date/Time:	05/07/97 // 1645
Custody #:	2115	Technician:	CM

TIME	PARAMETER	39 - 207 100	40 - 208 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.9	9.8	1655 JL	SAS
	pH	8.46	7.54		
	Temperature(C)	14.2	14.5		
	Conductivity(uS)	2500	2500		
	Immobility @ 30 minutes (10 expected)	0	0		
15 - 16 HOURS	pH	7.34	7.24	0816 JL	JL
24 HOURS	Dissolved Oxygen	9.4	9.5	CM	JL
	pH	7.31	7.28		
	Temperature(C)	14.2	14.2		
	Conductivity(uS)	2510	2520	1626	
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.5	9.6	CM	SAS
	pH	7.33	7.30		
	Temperature(C)	14.2	14.3		
	Conductivity(uS)	2520	2520	1617	
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.8	9.9	1624 JL	SAS
	pH	7.35	7.33		
	Temperature(C)	14.4	14.4		
	Conductivity(uS)	2520	2520		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.7	9.7	WM 16:55	CM
	pH	7.31	7.20		
	Temperature(C)	14.2	14.2		
	Conductivity(uS)	2530	2530		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 207 - Pass (0% mortality) | 208 - Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 941897 A % Mortality of Culture 7 Days Prior to Testing: 1.4% Previous Day Last Feeding Time: 1630

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.46 / 33	0.37 / 31	0.49 / 35	0.61 / 35	0.52 / 35	0.36 / 31	0.34 / 31	0.65 / 37	0.44 / 36	/

Sample Size:	9	Mean Weight:	0.49 +/- 0.12 g
Mean Fork Length:	34 +/- 2 mm	Weight Min/Max:	0.34 - 0.66 g
Fork Length Min/Max:	31 - 37 mm	Loading Density:	0.25 g/L

TEST CONDITIONS

Total Preaeration Time:	start 1615	Test Solution Volume (L):	16L
	end 1645	Test Solution Depth (16cm:10L; 25cm:16L; 39cm:25L):	29cm
	total 30 min	Total Number Exposed/Concentration:	10
Reason for Preaeration > 30 minutes:	nc	Test Replication (for QA/QC):	yes/(no)
Preaeration & Test Aeration Rate:	6.5 +/- 1 mL/min/L		
pH Adjustment:	yes (no)		

INITIAL PARAMETERS (prior to testing)

	39	40
Dissolved Oxygen (ppm):	10.2	10.0
pH:	8.59	7.71
Temperature (C):	14.5	14.5
Conductivity (uS/cm):	2500	2510
(Adj. pH (if applicable)):	—	
(Adjustment Details):		

	39	40
Physical State Upon Receipt:	Liquid	Liquid
Clarity:	clear	clear
Colour:	green	yellow
Precipitate:	yes	yes
Odour:	no	no

Comments/Deviations:

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	C9387	Sample Date/Time:	05/05/97 // 1000
Sample Number:	41	Sample Tech:	S. Clark
Test Number:	T25	Test Initiation Date/Time:	05/07/97 // 1645
Custody #:	3115	Technician:	CM

TIME	PARAMETER	CONTROL C 100	41-209 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.1	9.8	1645 JR	
	pH	7.65	10.43		
	Temperature(C)	14.0	14.3		
	Conductivity(uS)	300	2440		
	Immobility @ 30 minutes (10 exposed)	0	-		
2 HOURS	pH 15-16HR	7.96	10.21 ~2hrs	1900 KH	
24 HOURS	Dissolved Oxygen	10.0	9.8	0840 JR / CM 1634	
	pH	7.93	9.65		
	Temperature(C)	14.2	14.7		
	Conductivity(uS)	301	2460		
	# Immobile	0	-		
	Total # Dead	0	10		
48 HOURS	Dissolved Oxygen	9.8		CM 1698	
	pH	7.97			
	Temperature(C)	14.6			
	Conductivity(uS)	303			
	# Immobile	0			
	Total # Dead	0			
72 HOURS	Dissolved Oxygen	9.8		1620 JR	
	pH	8.04			
	Temperature(C)	14.8			
	Conductivity(uS)	303			
	# Immobile	0			
	Total # Dead	0			
96 HOURS	Dissolved Oxygen	9.8		MM 16:59	CM
	pH	7.92			
	Temperature(C)	14.7			
	Conductivity(uS)	305			
	# Immobile	0			
	Total # Dead	0			
TOTAL MORTALITY		0	10		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: c209 - Fail (100% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 041897A % Mortality of Culture 7 Days Prior to Testing: 1.4% Previous Day Last Feeding Time: 1630

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.48/35	0.80/40	0.44/33	0.78/40	0.51/37	0.46/38	0.74/38	0.35/32	0.70/38	0.53/34

Sample Size: 10
Mean Fork Length: 36 +/- 3 mm
Fork Length Min/Max: 32 - 40 mm
Mean Weight: 0.59 +/- 0.16 g
Weight Min/Max: 0.35 - 0.80 g
Loading Density: 0.37 g/L

TEST CONDITIONS

Total Preaeration Time: start 1615; end 1645; total 30 min
Reason for Preaeration > 30 minutes: na
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes / (no)
Test Solution Volume (L): 16 L
Test Solution Depth (15cm:10L; 20cm:16L; 35cm:30L): 29 cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes / (no)

INITIAL PARAMETERS (prior to loading)

	41		41
Dissolved Oxygen (ppm):	10.0	Physical State Upon Receipt:	Liquid
pH:	10.55	Clarity:	clear
Temperature (C):	14.9	Colour:	green
Conductivity (uS/cm):	2450	Precipitate:	yes
		Odour:	no
(Adj. pH (if applicable)):			
(Adjustment Details):			

Comments/Deviations: @ 30 min sample #41 showing signs of distress - dark in colour, swimming with stomach up.
@ 1 hr #41 - all trout swimming erratically, or immobile already
@ 2 hrs 11 trout dead in 41 submerged

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number: L9387
Sample Number: 42 : 43
Test Number: T26 : T27
Custody #: 2115

Sample Date/Time: 05/05/97 // 1000
Sample Took: S. Clark
Test Initiation Date/Time: 05/07/97 // 1645
Technician: CM

TIME	PARAMETER	42-210 100	43-211 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8	9.8	1702 JF	
	pH	8.87	8.56		
	Temperature(C)	14.6	14.4		
	Conductivity(uS)	2490	2500		
	Immobility @ 20 minutes (10 exposed)	0	0		
15 - 18 HOURS	pH	7.48	7.45	0830 JF	
24 HOURS	Dissolved Oxygen	9.5	9.7	CM	S
	pH	7.42	7.34		
	Temperature(C)	14.3	14.3		
	Conductivity(uS)	2510	2520	1636	
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.9	9.7	CM	
	pH	7.43	7.37		
	Temperature(C)	14.4	14.4		
	Conductivity(uS)	2520	2520	1631	
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.5	9.9	1627 JF	
	pH	7.48	7.40		
	Temperature(C)	14.8	14.6		
	Conductivity(uS)	2520	2520		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.7	9.3	MM	
	pH	7.32	7.20		
	Temperature(C)	14.5	14.5	17:02	CM
	Conductivity(uS)	2520	2520		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 210 - Pass (0% mortality) | 211 - Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 041897A % Mortality of Culture 7 Days Prior to Testing: 1.4% Previous Day Last Feeding Time: 1630

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.48 / 35	0.50 / 40	0.44 / 33	0.75 / 40	0.57 / 37	0.46 / 32	0.74 / 38	0.35 / 32	0.2 / 38	0.53 / 34

Sample Size: 10
Mean Fork Length: 36 +/- 3 mm
Fork Length Min/Max: 32 - 40 mm

Mean Weight: 0.59 +/- 0.16 g
Weight Min/Max: 0.35 - 0.80 g
Loading Density: 0.37 g/L

TEST CONDITIONS

Total Preaeration Time: start 1615
end 1645
total 30 min
Reason for Preaeration > 30 minutes: na
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes (no)

Test Solution Volume (L): 16 L
Test Solution Depth (15cm:10L; 25cm:16L; 35cm:22L): 29cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to testing)	42	43
Dissolved Oxygen (ppm):	10.0	10.0
pH:	8.92	8.63
Temperature (C):	14.6	14.6
Conductivity (uS/cm):	2500	2500
(Adj. pH (if applicable)):	—	
(Adjustment Details):		

	42	43
Physical State Upon Receipt:	Liquid	Liquid
Clarity:	clear	clear
Colour:	green	green
Precipitate:	yes	yes
Odour:	no	no

Comments/Deviations:

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number: L9387
Sample Number: 44
Test Number: T28
Custody #: 2115

Sample Date/Time: 05/05/97 // 1000
Sample Took: S. Clark
Test Initiation Date/Time: 05/07/97 // 1645
Technician: CM

TIME	PARAMETER	44-212 100	CONTROL D 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.5	10.2	1707 CM	
	pH	7.82	7.83		
	Temperature(C)	14.1	14.0		
	Conductivity(uS)	2510	300		
	Immobility @ 30 minutes (10 exposed)	0	0		
15 - 18 HOURS	pH	7.39	8.03	0825 CM	
24 HOURS	Dissolved Oxygen	9.5	9.9	CM 1638	
	pH	7.35	8.09		
	Temperature(C)	14.3	14.1		
	Conductivity(uS)	2520	301		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.9	9.8	CM 1632	
	pH	7.39	8.09		
	Temperature(C)	14.3	14.5		
	Conductivity(uS)	2530	303		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	~~9.00~~ 10.0	9.8	1626 CM	
	pH	7.58	8.00		
	Temperature(C)	14.4	14.4		
	Conductivity(uS)	~~9~~ 2530	303		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.8	9.9	WM 17:07	CM
	pH	7.37	8.15		
	Temperature(C)	14.5	14.3		
	Conductivity(uS)	2530	304		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 212 - Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 041697A % Mortality of Culture 7 Days Prior to Testing: 1.4% Previous Day Last Feeding Time: 1630

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.65 / 36	0.57 / 36	0.45 / 33	0.46 / 34	0.62 / 35	0.46 / 37	0.44 / 32	0.76 / 39	0.58 / 37	0.43 / 31

Sample Size: 10
Mean Fork Length: 35 +/- 2 mm
Fork Length Min/Max: 31 - 39 mm
Mean Weight: 0.56 +/- 0.11 g
Weight Min/Max: 0.43 - 0.76 g
Loading Density: 0.35 g/L

TEST CONDITIONS
Total Presession Time: start 1615; end 1645; total 30 min
Reason for Presession > 30 minutes: na
Presession & Test Aeration Rate: 0.5 +/- 1 mL/min/L
pH Adjustment: yes (no)
Test Solution Volume (L): 16 L
Test Solution Depth (16cm:10L; 28cm:16L; 35cm:22L): 29cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to testing) 44 / 44

Dissolved Oxygen (ppm): 10.2
pH: 8.02
Temperature (C): 14.3
Conductivity (uS/cm): 2510
(Adj. pH (if applicable)): —
(Adjustment Details):

Physical State Upon Receipt: Liquid
Clarity: clear
Colour: yellow
Precipitate: yes
Odour: no

Comments/Deviations:

AQUATIC SCIENCES INC.
96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	19387	Sample Date/Time:	05/05/97 // 1000
Sample Number:	45 : 46	Sample Taken:	S. Clark
Test Number:	T29 + T30	Test Initiation Date/Time:	05/07/97 // 1645
Custody #:	2115	Technician:	CU

[redacted]

TIME	PARAMETER	45-213 100	46-214 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.0	9.9	1708	
	pH	10.49	8.45		
	Temperature(C)	14.1	14.2		
	Conductivity(uS)	2450	2500		
	Immobility @ 30 minutes (10 exposed)	0	0	45	
15 - 16 HOURS	pH	2hrs → 10.24	7.47	1900 [illegible]	
24 HOURS (#45-15-16 hrs.)	Dissolved Oxygen	9.8	9.6	0840	
	pH	9.58	7.39		
	Temperature(C)	14.7	14.2	CU	
	Conductivity(uS)	2440	2510		
	# Immobile	–	0		
	Total # Dead	10	0	1629	
48 HOURS	Dissolved Oxygen		9.6	CU	
	pH		7.40		
	Temperature(C)		14.2	1634	
	Conductivity(uS)		2520		
	# Immobile		0		
	Total # Dead		0		
72 HOURS	Dissolved Oxygen		9.7	1625	
	pH		7.43		
	Temperature(C)		14.5		
	Conductivity(uS)		2520		
	# Immobile				
	Total # Dead		0		
96 HOURS	Dissolved Oxygen		9.6	NM	CU
	pH		7.45	17:09	
	Temperature(C)		14.3		
	Conductivity(uS)		2520		
	# Immobile		0		
	Total # Dead		0		
TOTAL MORTALITY		10	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR — TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 213 – Fail (100% mortality) / 214 Pass (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 041897A — % Mortality of Culture 7 Days Prior to Testing: 1.4% — Previous Day Last Feeding Time: 1630

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.65 / 36	0.57 / 36	0.45 / 33	0.46 / 34	0.62 / 35	0.66 / 37	0.44 / 32	0.76 / 39	0.58 / 37	0.43 / 31

Sample Size: 10
Mean Fork Length: 35 +/- 2 mm
Fork Length Min/Max: 31 - 39 mm
Mean Weight: 0.56 +/- 0.11 g
Weight Min/Max: 0.43 - 0.76 g
Loading Density: 0.35 g/L

TEST CONDITIONS
Total Preaeration Time: start 1615; end 1645; total 30 min
Reason for Preaeration > 30 minutes: na
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes / (no)
Test Solution Volume (L): 16L
Test Solution Depth (16cm:10L; 29cm:16L; 35cm:20L): 29cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes / (no)

INITIAL PARAMETERS (prior to testing)

	45	46
Dissolved Oxygen (ppm):	10.0	10.0
pH:	10.65	9.00
Temperature (C):	14.2	14.4
Conductivity (uS/cm):	2460	2500
(Adj. pH (if applicable)):	~	
(Adjustment Details):		

	45	46
Physical State Upon Receipt:	Liquid	Liquid
Clarity:	clear	clear
Colour:	green	green
Precipitate:	yes	yes
Odour:	no	no

Comments/Deviations:
@ 30 min some trout swimming sideways in sample #45
@ 1hr #45 some immobile, some lethargic.
@ 2hr all trout dead in 45. Subsampled.

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	10387	Sample Date/Time:	05/05/97 // 1000
Sample Number:	47 : 48	Sample Tech:	S. Clark
Test Number:	T31 T32	Test Initiation Date/Time:	05/07/97 // 1645
Custody #:	2115	Technician:	CM

TIME	PARAMETER	47 - 215 100	48 - 216 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8	10.0	1710 CM	
	pH	6.44	7.03		
	Temperature(C)	14.2	14.2		
	Conductivity(uS)	2500	2500		
	Immobility @ 30 minutes (10 exposed)	0	0		
15 - 18 HOURS	pH	7.36	7.10	0820 CM	
24 HOURS	Dissolved Oxygen	9.8	9.9	CM 1641	
	pH	7.39	7.15		
	Temperature(C)	14.0	14.2		
	Conductivity(uS)	2510	2520		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.7	9.8	CM 1636	
	pH	7.32	7.18		
	Temperature(C)	14.2	14.2		
	Conductivity(uS)	2520	2520		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.9	9.9	1625 CM	
	pH	7.39	7.16		
	Temperature(C)	14.4	14.3		
	Conductivity(uS)	2520	2520		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.7	9.9	n/m 17:12	CM
	pH	7.34	7.26		
	Temperature(C)	14.2	14.1		
	Conductivity(uS)	2530	2530		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR **TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS**

RESULTS

96 Hour Results: 215 - Pass (0% mortality) / 216 - Pass (0% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: 041897A % Mortality of Culture 7 Days Prior to Testing: 1.4% Previous Day Last Feeding Time: 1630

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.651 36	0.571 36	0.451 33	0.461 34	0.621 35	0.661 37	0.441 32	0.761 39	0.581 37	0.431 31

Sample Size:	10	Mean Weight:	0.56 +/- 0.11 g
Mean Fork Length:	35 +/- 2 mm	Weight Min/Max:	0.43 - 0.76 g
Fork Length Min/Max:	31 - 35 mm	Loading Density:	0.35 g/L

TEST CONDITIONS

Total Preaeration Time: start	1615	Test Solution Volume (L):	16L
end	1645	Test Solution Depth (10cm:10L; 20cm:16L; 35cm:20L):	29cm
total	30 min	Total Number Exposed/Concentration:	10
Reason for Preaeration > 30 minutes:	N/A	Test Replication (for QA/QC):	yes / (no)
Preaeration & Test Aeration Rate:	6.5 +/- 1 mL/min/L		
pH Adjustment:	yes / (no)		

INITIAL PARAMETERS (prior to loading)

	47	48
Dissolved Oxygen (ppm):	10.0	10.0
pH:	8.55	8.71
Temperature (C):	14.4	14.4
Conductivity (uS/cm):	2500	2510
(Adj. pH (if applicable)):	—	
(Adjustment Details):		

	47	48
Physical State Upon Receipt:	Liquid	Liquid
Clarity:	clear	clear
Colour:	green	green
Precipitate:	yes	yes
Odour:	no	no

Comments/Deviations:

Aquatic Sciences Inc.

Ms. Carolyn Hunt
Inco Ltd.
Copper Cliff, Ontario
L2J 3G2

Reference #: L9387-65-96
Received: 05/13/97
Total Number of Pages: 34

Toxicity Testing Results
Report Date: 05/22/97

Sample Information

Sample #	Sample Description	Date Collected
L9387-65-96	Experimental Treatments for CCWWTP Sample Identification #301 - 332	05/12/97

Approved by:
Gill Shriner, Laboratory Supervisor

Approval Date:

Inquiries may be made to Gill Shriner.

Disposal of toxic samples will occur within seven (7) days of reporting unless alternate arrangements have been made.

AQUATIC SCIENCES INC.

48 HOUR STATIC DAPHNIA MAGNA SINGLE CONCENTRATION TEST
EPS 1/RM/14

Project Number:	L9387	Sample Number:	65 - 96
Client:	Inco Ltd	Test Number:	D65 - D96
	Copper Cliff, Ontario	Sample Date/Time:	05/12/87//-:- hrs
Sample Name/ID:	Experimental Treatments for CCWWTP	Sample Technician:	S Clark
	Sample Identification #301 - 332	Test Date/Time:	05/15/87// 11:45 - 13:09 hrs
Sample Location:	CCWWTP	Technician:	C Hurse/G Shriner/K Groombridge/W Masters
Chain of Custody #:	not received		
Sample Method:	Grab		

RESULTS

48 HOUR RESULT:	65: 301:	Fail (90% mortality)	73: 309:	FAIL (90% mortality)	81: 317:	FAIL (80% mortality)	89: 325:	FAIL (83% mortality)
	66: 302:	PASS (0% mortality)	74: 310:	PASS (0% mortality)	82: 318:	PASS (0% mortality)	90: 326:	PASS (3.3% mortality)
	67: 303:	PASS (0% mortality)	75: 311:	PASS (0% mortality)	83: 319:	PASS (0% mortality)	91: 327:	PASS (0% mortality)
	68: 304:	PASS (0% mortality)	76: 312:	PASS (0% mortality)	84: 320:	PASS (0% mortality)	92: 328:	PASS (0% mortality)
	69: 305:	FAIL (93.9% mortality)	77: 313:	FAIL (76.6% mortality)	85: 321:	FAIL (86.6% mortality)	93: 329:	FAIL (76.6% mortality)
	70: 306:	PASS (0% mortality)	78: 314:	PASS (0% mortality)	86: 322:	PASS (0% mortality)	94: 330:	PASS (0% mortality)
	71: 307:	PASS (0% mortality)	79: 315:	PASS (0% mortality)	87: 323:	PASS (0% mortality)	95: 331:	PASS (0% mortality)
	72: 308:	PASS (3.3% mortality)	80: 316:	PASS (0% mortality)	88: 324:	PASS (0% mortality)	96: 332:	PASS (0% mortality)

QUALITY ASSURANCE INFORMATION

REFERENCE TEST CONDITIONS

Test Organism:	Daphnia magna	Photoperiod:	16 hours light/8 hours dark
Brood Culture:	040197 + 040797	Dilution Water:	Dechlorinated Tap
Test Type:	Static	Organism Age:	<24 hours
Test Temperature:	20 +/- 2C	Stock Source:	in house cultures
Test Volume:	150 mL	Time of First Brood:	8 days
Loading Density:	15 mL/neonate	Average Brood Size:	24 neonates
Control Water Hardness:	138 mg/L	Ephippia Frequency:	0

REFERENCE TOXICANT DATA

Chemical Used:	Sodium Chloride	Historic Mean LC50:	6147 mg/L
Date of Test:	May 5/87	Warning Limits:	4906-7388 mg/L
48-hour LC50:	5857 mg/L		
95% Confidence Interval:	5000-6400 mg/L		

TEST PROTOCOL

Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna.
Environment Canada. July 1990

COMMENTS

The reference toxicant results show that test reproducibility and organism sensitivity are within acceptable limits.
All data is scrutinized for errors daily during the test, at test termination and during the report Technical and Final Review stages.
Instruments used to monitor parameters are calibrated daily and continuously maintained.
All tests were presented for 30 minutes at the request of Sandford Clark of Laurentian University.

QUALITY REVIEW

Technical Review

Final Review

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9287	Sample Date/Time:	05/12/97 11-
Sample Number:	65	Sample Tech:	—
Test Number:	DG5	Test Initiation Date/Time:	05/15/97 1145
Chain of Custody #:	—	Technician:	CR/65/WK

[redacted]

SAMPLE ID: (A) (65):301

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.9			9.4			CR/65/WK 1145	[illegible]
	pH	8.31			10.01				
	Temperature(C)	20.8			21.4				
	Conductivity(uS)	309			2540				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.04	8.12	8.13	9.32	9.31	9.73	WM 1325	[illegible]
	Temperature(C)	19.9							
	# Immobile	0	0	0	10	10	10		
48 HOURS	Dissolved Oxygen	8.5	8.6	8.6	8.6	8.5	8.5	CH 1224	W
	pH	7.84	7.90	7.92	8.91	9.00	9.46		
	Temperature (C)	20.1	20.0	19.9	20.0	20.0	20.1		
	Conductivity	318	317	317	2650	2660	2640		
	# Immobile	0	0	0	1	2	~~0~~		
	# Dead (10 exposed)	0	0	0	9	8	10		
TOTAL MORTALITIES		0	0	0	9	8	10		
MEAN % MORTALITY		0			90%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 301 : FAIL (90% mortality)

TEST CONDITIONS

Brood Culture:	04/14/97 & 04/28/97			
Time to First Brood:	7 days	Preaeration Time:	start	1055
Average Brood Size:	28 neonates		end	1125
Total Number Exposed/Concentration:	3X10 neonates		total	30 min
Control Water Hardness:	136	Reason for Preaeration:		DO>100% saturation
Effluent Subsampled from 25L pail for Testing:	(yes)/no	Preaeration Rate:		25 - 50mL/min/L
Test Replication (for QA/QC):	yes/(no)	pH Adjustment:		(no)/ yes
		Hardness Adjustment:		(no)/ yes
		Test Solution Volume:		(200 mL)/ 150 mL
		Loading Density:		(20)/ 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

		65		
Dissolved Oxygen:	~~10.1~~	10.0	Adj. pH (if applicable):	—
Initial pH:	~~10.05~~	10.07	Adjustment Details:	—
Temperature:	~~[illegible]~~	18.2		
Conductivity:	~~2660~~	2550		
Initial Hardness:		1291	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	liquid		Adjustment Details:	
Clarity:	clear			
Colour:	yellow			
Precipitate:	settled solids			
Odour:	yes			

Additional Observations:

Comments/Deviations:

C:\QPROLSER\DAPHNIA\SEDIMENT.WB1

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/12/97 // -
Sample Number:	66 - 67	Sample Tech:	-
Test Number:	D66 - D67	Test Initiation Date/Time:	05/15/97 // 1148
Chain of Custody #:	-	Technician:	CK/GS/WK

[redacted]

TIME	PARAMETER	SAMPLE ID: CONTROL-A	(66) 302 CONTROL-B	CONTROL-C	(67) 303 100-A	100-B	100-C	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.9			9.2			CK	SA
	pH	9.01			8.45				
	Temperature(C)	21.4			21.5			1148	
	Conductivity(uS)	2560			2590				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.82	8.54	8.50	7.79	7.97	7.83	NM	SA
	Temperature(C)	19.9						13:35	
	# Immobile	0	0	0		0	0		
48 HOURS	Dissolved Oxygen	8.2	8.0	8.2	7.5	7.4	7.4	CK	W
	pH	8.62	9.09	8.28	7.46	7.42	7.38		
	Temperature (C)	20.1	19.8	19.7	19.8	19.8	19.9	1237	
	Conductivity	2680	2690	2680	2690	2690	2690		
	# Immobile	0	0	0	1	0	0		
	# Dead (10 exposed)	0/0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 302 : PASS (0% mortality)
303 : PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	04/14/97 & 04/28/97		
Time to First Brood:	7 days	Preaeration Time:	start 1055
Average Brood Size:	29 neonates		end 1125
Total Number Exposed/Concentration:	3X10 neonates		total 30min
Control Water Hardness:	136	Reason for Preaeration:	DO > 100% saturation
Effluent Subsampled from 25L pail for Testing:	(yes) / no	Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)	pH Adjustment:	(no) / yes
		Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	66	67		
Dissolved Oxygen:	10.0	10.0		
Initial pH:	9.05	~~8.55~~ 8.54	Adj. pH (if applicable):	-
Temperature:	19.6	20.0	Adjustment Details:	
Conductivity:	2370	2570		
Initial Hardness:	1241	1343	Adj. Hardness (if applicable):	-
Physical State Upon Receipt:	liquid (both)		Adjustment Details:	
Clarity:	clear (both)			
Colour:	yellow (both)			
Precipitate:	settled solids (both)			
Odour:	yes (both)			

Additional Observations:

Comments/Deviations: @ 48 hrs 67: 303A sample - 1 immobile had brown-filled digestive tract

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/12/97 11 –
Sample Number:	68	Sample Tech:	–
Test Number:	D68	Test Initiation Date/Time:	05/15/97 1151
Chain of Custody #:	–	Technician:	CH/KS/WM

[redacted]

SAMPLE ID: (68) 304 (B)

TIME	PARAMETER	~~CONTROL-A~~ 100 A	~~CONTROL-B~~ 100 B	~~CONTROL-C~~ 100 C	~~100-A~~ CW-720-A	~~100-B~~ B	~~100-C~~ C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8			8.9			CH 1151	[initials]
	pH	7.24			8.31				
	Temperature(C)	21.4			20.8				
	Conductivity(uS)	2590			309				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.06	7.04	7.04	8.14	8.23	8.23	WM 13:46	[initials]
	Temperature(C)	19.9							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.3	8.3	8.3	8.6	8.6	8.6	CH 1243	[initials]
	pH	7.18	7.11	7.10	8.11	8.21	8.21		
	Temperature (C)	20.3	19.9	19.9	19.8	19.9	19.9		
	Conductivity	2690	2700	2690	318	315	318		
	# Immobile	0	0	1	0	0	0		
	# Dead (10 exposed)	1	0	0	0	0	0		
TOTAL MORTALITIES		1	0	0	0	0	2		
MEAN % MORTALITY		3%			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 304 : PASS (3% mortality)

TEST CONDITIONS

Brood Culture:	C41497 & C042897			
Time to First Brood:	7 days	Preaeration Time:	start	1055
Average Brood Size:	28 neonates		end	1125
Total Number Exposed/Concentration:	3X10 neonates		total	30 min
Control Water Hardness:	136	Reason for Preaeration:		DO > 100% saturation
Effluent Subsampled from 25L pail for Testing:	(yes) / no	Preaeration Rate:		25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)	pH Adjustment:		(no) yes
		Hardness Adjustment:		(no) yes
		Test Solution Volume:		(200 mL) / 150 mL
		Loading Density:		(20) // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	68	[illegible]		
Dissolved Oxygen:	10.0	10.2		
Initial pH:	7.1x	10.44	Adj. pH (if applicable):	–
Temperature:	20.3	20.5	Adjustment Details:	
Conductivity:	2620	2530		
Initial Hardness:	1326		Adj. Hardness (if applicable):	–
Physical State Upon Receipt:	Liquid		Adjustment Details:	
Clarity:	clear			
Colour:	yellow			
Precipitate:	x Vacsolids			
Odour:	yes			

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387
Sample Number: 69-70
Test Number: D69-D70
Chain of Custody #: –

Sample Date/Time: 05/12/97/–
Sample Tech: –
Test Initiation Date/Time: 05/13/97/1159
Technician: CH/GS/WM

[redacted]

TIME	PARAMETER / SAMPLE ID:	~~CONTROL-A~~ 100 A (69) 305	~~CONTROL-B~~ 100 B	~~CONTROL-C~~ 100 C	100-A (70) 306	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.7			9.7			CH 1159	[initials]
	pH	9.98			8.99				
	Temperature(C)	21.5			21.4				
	Conductivity(uS)	2520			2570				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	9.55	9.42	9.61	8.58	8.41	8.45	WM 13:55	[initials]
	Temperature(C)	19.9							
	# Immobile	10	10	10	0	0	0		
48 HOURS	Dissolved Oxygen	8.6	8.7	8.6	8.3	8.3	8.2	CH 1248	[initials]
	pH	9.31	9.31	9.31	8.24	8.13	8.07		
	Temperature (C)	20.4	20.2	20.1	20.0	20.0	19.9.		
	Conductivity	2640	2650	2650	2670	2690	2690		
	# Immobile	–	2		0	0	0		
	# Dead (10 exposed)	10	8	11/11	0	0/11	0		
TOTAL MORTALITIES		10	8	11	0	0	0		
MEAN % MORTALITY		93.5%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result:
305: FAIL (93.5% mortality)
306: PASS (0% mortality)

TEST CONDITIONS

Brood Culture: 041497 & 042897
Time to First Brood: 7 days
Average Brood Size: 28 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 136
Effluent Subsampled from 25L pail for Testing: (yes) / no
Test Replication (for QA/QC): yes / (no)

Preaeration Time: start 1055; end 1125; total 30 min
Reason for Preaeration: DO>100% saturation
Preaeration Rate: 25 - 50mL/min/L
pH Adjustment: (no) / yes
Hardness Adjustment: (no) / yes
Test Solution Volume: (200 mL) / 150 mL
Loading Density: (20) // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	69	70
Dissolved Oxygen:	10.2	~~10.2~~ 10.2 CH
Initial pH:	10.04	9.08
Temperature:	20.5	20.0
Conductivity:	2530	2540
Initial Hardness:	1309	1326
Physical State Upon Receipt:	Liquid (both)	
Clarity:	clear (both)	
Colour:	yellow (both)	
Precipitate:	settled solids (both)	
Odour:	yes (both)	

Adj. pH (if applicable): ——
Adjustment Details: ——
Adj. Hardness (if applicable): ——
Adjustment Details: ——

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/12/97 11
Sample Number:	71-72	Sample Test:	–
Test Number:	071-072	Test Initiation Date/Time:	05/14/97 12:10
Chain of Custody #:	–	Technician:	CH/JS/[illegible]/WM

[redacted]

SAMPLE ID: (71) 307 / (72) 308

TIME	PARAMETER	CONTROL-A (100-A)	CONTROL-B (100-B)	CONTROL-C (100-C)	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8			9.4			[illegible] 12:36	[illegible]
	pH	8.26			7.62				
	Temperature(C)	~~2560~~ 21.5			21.4				
	Conductivity(uS)	2566			2580				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.90	7.80	7.83	7.50	7.42	7.49	WM 14.05	[illegible]
	Temperature(C)	19.9							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	7.8	8.1	7.7	7.7	7.8	7.8	CH	CH
	pH	7.40	7.50	7.50	7.31	7.28	7.25		
	Temperature (C)	20.3	20.0	19.9	20.0	19.9	20.0		
	Conductivity	2680	2690	2690	2690	2710	2700	R54	
	# Immobile	0	0	0	0	0	0		
	# Dead (10 exposed)	0/11	0/11	0	0	1/9	0		
TOTAL MORTALITIES		0	0	0	0	1/9	0		
MEAN % MORTALITY		0%			3.5%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result:
307 : PASS (0% mortality)
308 : PASS (3.5% mortality)

TEST CONDITIONS

Brood Culture:	041497 & 042897	Preaeration Time:	start 11:34
Time to First Brood:	7 days		end 12:04
Average Brood Size:	25 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	DO>100% saturation
Control Water Hardness:	136	Preaeration Rate:	25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	(yes) / no	pH Adjustment:	(no) / yes
Test Replication (for QA/QC):	yes / (no)	Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	71	72		
Dissolved Oxygen:	10.2	10.2	Adj. pH (if applicable):	–
Initial pH:	8.54	7.89	Adjustment Details:	
Temperature:	20.5	20.7		
Conductivity:	2560	2590	Adj. Hardness (if applicable):	–
Initial Hardness:	1343	1326	Adjustment Details:	
Physical State Upon Receipt:	liquid (both)			
Clarity:	clear (both)			
Colour:	yellow (both)			
Precipitate:	settled (both)			
Odour:	yes (both)			

Additional Observations:

@ 48h 55/72 : 308 B - dead organism has brown - filled digestive tract

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: 49357
Sample Number: 73
Test Number: 273
Chain of Custody #:

Sample Date/Time: 05/12/97 11:-
Sample Tech:
Test Initiation Date/Time: 05/13/97 11:10
Technician: CH/KG/GS/DM

TIME	PARAMETER	SAMPLE ID: CONTROL-A	CONTROL-B (C)	CONTROL-C	100-A	100-B (73)	100-C 309	PARAMETERS TECH/REC	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.8			9.2			KG	
	pH	8.31			9.81				
	Temperature(C)	20.8			21.3			1241	
	Conductivity(uS)	309			2520				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.20	8.21	8.20	9.35	9.56	9.63	NM	
	Temperature(C)	19.9							
	# Immobile	0	0	0	10	10	10	14:15	
48 HOURS	Dissolved Oxygen	8.5	9.6	8.5	9.6	9.6	9.6	CH	
	pH	8.20	9.22	8.22	9.04	9.31	9.42		
	Temperature (C)	20.3	19.9	19.9	20.1	20.1	20.1		
	Conductivity	317	316	317	2640	2640	2650	1259	
	# Immobile	0	0	0	2	1	0		
	# Dead (10 exposed)	0	0	0	5	9	10		
TOTAL MORTALITIES		0	0	0	8	9	10		
MEAN % MORTALITY		0			90%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 309; FAIL (90% mortality)

TEST CONDITIONS

Brood Culture: 041497 & 042897
Time to First Brood: 7 days
Average Brood Size: 28 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 136
Effluent Subsampled from 25L pail for Testing: (yes) / no
Test Replication (for QA/QC): yes (no)

Presaeration Time: start 1134; end 1204; total 30min
Reason for Presaeration: DO > 100% saturation
Presaeration Rate: 25 - 50mL/min
pH Adjustment: (no) yes
Hardness Adjustment: (no) yes
Test Solution Volume: (200 mL) / 150 mL
Loading Density: (25) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

73
Dissolved Oxygen: 10.2
Initial pH: 9.99
Temperature: 20.9
Conductivity: 2520
Initial Hardness: 1292
Physical State Upon Receipt: Liquid
Clarity: clear
Colour: yellow
Precipitate: settled solids
Odour: yes

Adj. pH (if applicable):
Adjustment Details:
Adj. Hardness (if applicable):
Adjustment Details:

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	25/12/97 11:—
Sample Number:	74-75	Sample Type:	
Test Number:	D74-D75	Test Initiation Date/Time:	25/12/97 1213
Chain of Custody #:		Technician:	CH/KG/RS/NM

TIME	PARAMETER	SAMPLE ID: CONTROL-A 100-A	(74) 310 CONTROL-B 100-B	CONTROL-C 100-C	(75) 311 100-A	100-B	100-C	PARAMETERS TECH/DATE	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8			9.5			KB 1243	
	pH	8.90			8.47				
	Temperature(C)	21.4			21.3				
	Conductivity(uS)	2550			2580				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.45	8.46	8.45	7.91	8.00	7.93	NM 14:25	
	Temperature(C)	19.9							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.2	8.2	8.3	7.8	8.0	8.0	CH	
	pH	8.22	8.11	8.24	7.71	7.52	7.48		
	Temperature (C)	20.2	19.9	19.9	19.9	19.9	20.0		
	Conductivity	2680	2690	2690	2670	2690	2690	1306	
	# Immobile	0	0	0	0	0	6		
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS	300: PASS (0% mortality)
48-HOUR Result:	310: PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	04/14/97 & 04/23/97		
Time to First Brood:	7 days	Preaeration Time:	start 1134
Average Brood Size:	28 neonates		end 1204
Total Number Exposed/Concentration:	3X10 neonates		total 30 min
Control Water Hardness:	136	Reason for Preaeration:	DO ≥ 100% saturation
Effluent Subsampled from 25L pail for Testing:	(yes) no	Preaeration Rate:	2 - 6 bubbles/sec
Test Replicates (for QA/QC):	yes (no)	pH Adjustment:	(yes) no
		Hardness Adjustment:	yes (no)
		Test Solution Volume:	(200 mL) / 100 mL
		Loading Density:	(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	74	75		
Dissolved Oxygen:	10.0	10.0	Adj. pH (if applicable):	✓
Initial pH:	8.99	8.62	Adjustment Details:	
Temperature:	21.3	20.9		
Conductivity:	2560	2560		
Initial Hardness:	1360	1320	Adj. Hardness (if applicable):	✓
Physical State Upon Receipt:	Liquid		Adjustment Details:	
Clarity:	slight cloud			
Colour:	yellow			
Precipitate:	settled solids			
Odour:	yes			

Both

Additional Observations:

Comments/Deviations:

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L4357
Sample Number: 76
Test Number: D76
Chain of Custody #:

Sample Date/Time: 05/12/17 11
Sample Taxa:
Test Initiation Date/Time: 05/15/17 1216
Technician: CH/GS/KG/HM

TIME	PARAMETER	SAMPLE ID: 100 A	100 B	100 C	CON A	CON B	CON C	PARAMETERS TECHNIQUE	QA/QC REVIEW
			(76) 312			(D)			
0 HOURS	Dissolved Oxygen		9.5			8.9		KS	
	pH		7.72			8.31			
	Temperature(C)		21.4			20.8		1246	
	Conductivity(uS)		2570			309			
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	INV 7.43	7.38	7.30	8.11	[illegible]	8.18	NM 14:35	
	Temperature(C)				19.9				
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.0	7.9	7.8	8.4	8.5	8.5	CH	
	pH	7.26	7.22	7.21	8.19	8.22	8.21		
	Temperature (C)	20.2	19.9	19.9	19.9	19.8	19.9		
	Conductivity	2690	2700	2690	316	317	317	1311	
	# Immobile	0	0	0	0	0	0		
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY			0			0			

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 312 PASS (0% mortality.)

TEST CONDITIONS

Brood Culture: 041497 & 042897
Time to First Brood: 7 days
Average Brood Size: 28 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 136
Effluent Subsampled from 25L pail for Testing: yes / no
Test Replication (for QA/QC): yes / no

Preaeration Time:
Reason for Preaeration:
Preaeration Rate:
pH Adjustment:
Hardness Adjustment:
Test Solution Volume:
Loading Density:

start 1134
end 1204
total 30min
DO 2100% saturation
2 - 5 mL/min
yes / no
yes / no
200 mL / 150 mL
20 / 15 mL/neonate

INITIAL PARAMETERS (prior to testing) 76

Dissolved Oxygen: 10.2
Initial pH: 7.71
Temperature: 21.0
Conductivity: 2580
Initial Hardness: 1360
Physical State Upon Receipt: liquid
Clarity: clear
Colour: yellow
Precipitate: settled solids
Odour: yes

Adj. pH (if applicable): ✓
Adjustment Details:
Adj. Hardness (if applicable): ✓
Adjustment Details:

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387
Sample Number: 77-78
Test Number: D77-D78
Chain of Custody #: —

Sample Date/Time: 05/12/97 // —
Sample Temp: —
Test Initiation Date/Time: 05/18/97 // 1235
Technician: CH/GS/KG/WM

[redacted]

SAMPLE ID: (77) 313 (78) 314

TIME	PARAMETER	~~CONTROL-A~~ 122-A	~~CONTROL-B~~ 122-B	~~CONTROL-C~~ 122-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.3			9.1			1245	
	pH	9.88			8.83				
	Temperature(C)	21.2			21.2				
	Conductivity(uS)	2530			2550				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	9.29	9.36	9.34	8.36	8.26	8.42	WM 14:45	
	Temperature(C)	19.9							
	# Immobile	~~9.29~~ 10	10	10	0	0	0		
48 HOURS	Dissolved Oxygen	8.5	8.5	8.5	8.1	8.1	8.2	CH 1336	
	pH	9.05	9.13	9.31	8.17	7.95	8.06		
	Temperature (C)	20.5	20.2	20.1	20.1	20.0	20.0		
	Conductivity	2640	2650	2640	2670	2700	2690		
	# Immobile	3	1	0	0	2	1		
	# Dead (10 exposed)	4	9	10	0	0	6		
TOTAL MORTALITIES		4	9	10	0	0 ~~8 10~~	0		
MEAN % MORTALITY		76.6%			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS
48-HOUR Result: 313: FAIL (76.6% mortality)
314: PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	041497 & 042897	Preaeration Time:	start 12:00
Time to First Brood:	7 days		end 12:30
Average Brood Size:	28 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	DO > 100% saturation
Control Water Hardness:	136	Preaeration Rate:	25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	(yes) no	pH Adjustment:	(no) yes
Test Replication (for QA/QC):	yes (no)	Hardness Adjustment:	(no) yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	77	78
Dissolved Oxygen:	10.2	10.2
Initial pH:	10.01	8.96
Temperature:	21.0	21
Conductivity:	2530	2530
Initial Hardness:	1292	1326
Physical State Upon Receipt:	Both: liquid	
Clarity:	clear	
Colour:	yellow	
Precipitate:	settled solids	
Odour:	yes	

Adj. pH (if applicable): —
Adjustment Details:
Adj. Hardness (if applicable): —
Adjustment Details:

Additional Observations:

Comments/Deviations:

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- AQUATIC SCIENCES INC.

* 48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	LQ387	Sample Date/Time:	05/12/92 11:—
*Sample Number:	79-80	Sample Tech:	—
Test Number:	075-080	Test Initiation Date/Time:	05/18/92 1237
Chain of Custody #:	—	Technician:	CH/GS/KG/WM

TIME	PARAMETER	SAMPLE ID: CONTROL-A 100A	CONTROL-B 100B	CONTROL-C 100C	100-A (79) 315	100-B (80) 316	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.3			9.0			KG	
	pH	8.45			7.55				
	Temperature(C)	21.2			21.3			1237	
	Conductivity(uS)	2580			2560				
	Immobility @ 30 minutes (10 expected)	0	0	0	0	0	0		
24 HOURS	pH	7.99	7.97	7.98	7.38	7.33	7.31	WM	
	Temperature(C)	19.9						14:53	
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	7.9	8.0	8.1	8.2	8.2	8.1	CH	
	pH	7.65	7.72	7.64	7.29	7.26	7.22		
	Temperature (C)	20.2	19.9	19.9	19.9	19.9	19.9		
	Conductivity	2690	2680	2700	2690	2700	2700	1321	
	# Immobile	0	0	0	0	1	1		
	# Dead (10 expected)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0/9	0	0		
MEAN % MORTALITY		0				0			

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS	
315	PASS (0% mortality)
48-HOUR Result: 316	PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	C41497 & C42897		
Time to First Brood:	7 days	Presoreen Time:	start 12:00
Average Brood Size:	28 neonates		end 12:30
Total Number Exposed/Concentration:	3X10 neonates		total 30 min
Control Water Hardness:	136	Reason for Presoreen:	DO ≥ 100% saturation
Effluent Subsampled from 25L pail for Testing:	(yes) no	Presoreen Rate:	25 - 50 mL/min/L
Test Replicates (for QA/QC):	yes (no)	pH Adjustment:	(no) / yes
		Hardness Adjustment:	(no) yes
		Test Solution Volume:	200 mL / 150 mL
		Loading Density:	20 X 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	79	80		
Dissolved Oxygen:	10.2	10.2		
Initial pH:	8.00	7.76	Adj. pH (if applicable):	✓
Temperature:	20.9	21.1	Adjustment Details:	
Conductivity:	2570	2560		
Initial Hardness:	1292	1292	Adj. Hardness (if applicable):	✓
Physical State upon Receipt:	Liquid		Adjustment Details:	
Clarity:	clear			
Colour:	yellow			
Precipitate:	settled solids			
Odour:	yes			

Both

Additional Observations:

Comments/Deviations:

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	LG387	Sample Date/Time:	05/12/97 // –
*Sample Number:	81	Sample Temp:	–
Test Number:	D81	Test Initiation Date/Time:	05/15/97 // 1239
Chain of Custody #:	–	Technician:	CH/GS/RG

[redacted]

SAMPLE ID: E (Control-B); 81 (100-B); 317

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.0 *			8.8			KG 1257	[illegible]
	pH	8.01			9.53				
	Temperature(C)	21.2			20.7				
	Conductivity(uS)	306			2490				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.13	8.15	8.13	9.40	9.27	9.33	MM 15:00	[illegible]
	Temperature(C)	19.9							
	# Immobile	0	0	0	9	8	6		
48 HOURS	Dissolved Oxygen	8.7	8.6	8.7	8.7	8.7	8.7	CH 1327	CH
	pH	8.12	8.15	8.15	9.08	8.93	8.96		
	Temperature (C)	20.0	19.8	19.8	19.9	19.9	20.0		
	Conductivity	315	315	315	2650	2670	2650		
	# Immobile	0	0	0	1	4	2		
	# Dead (10 exposed)	0	0	0	9	5	4		
TOTAL MORTALITIES		0	0	0	9	5	4		
MEAN % MORTALITY		0			60%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 317: FAIL (60% mortality)

TEST CONDITIONS

Brood Culture:	04/14/97 & 04/28/97		
Time to First Brood:	7 days	Preaeration Time:	start 12:00
Average Brood Size:	28 neonates		end 12:30
Total Number Exposed/Concentration:	3X10 neonates		total 30min
Control Water Hardness:	136	Reason for Preaeration:	client request
Effluent Subsampled from 25L pail for Testing:	(yes) / no	Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)	pH Adjustment:	(no) / yes
		Hardness Adjustment:	(no) / yes
		Test Solution Volume:	200 mL / (150 mL)
		Loading Density:	20 // (15) mL/neonate

INITIAL PARAMETERS (prior to testing)

81

Dissolved Oxygen:	8.8		
Initial pH:	9.53	Adj. pH (if applicable):	–
Temperature:	21.4	Adjustment Details:	
Conductivity:	2470		
Initial Hardness:	1258	Adj. Hardness (if applicable):	–
Physical State Upon Receipt:	liquid	Adjustment Details:	
Clarity:	clear		
Colour:	colourless		
Precipitate:	none		
Odour:	yes		

Additional Observations:

Comments/Deviations: D.O >100% saturation however no daphnids were observed suspended at the surface throughout the duration of the test

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: LG387
Sample Number: 82 - 83
Test Number: 082 -083
Chain of Custody #:

Sample Date/Time: 05/12/97 11 -
Sample Took:
Test Initiation Date/Time: 05/12/97 11:47
Technician: LH/GS/LG

TIME	PARAMETER	SAMPLE ID: CONTROL-A 100A	CONTROL-B 82 318 100B	CONTROL-C 100C	100-A 1	100-B 83 319	100-C	PARAMETERS TECH/RSE	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.7			8.7			K	
	pH	8.72			8.06				
	Temperature(C)	20.8			20.9			1259	
	Conductivity(uS)	2560			2550				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.11	8.40	8.28	7.62	7.64	7.59	NM	
	Temperature(C)	19.9							
	# Immobile	0	0	0	0	0	0	15:07	
48 HOURS	Dissolved Oxygen	8.5	8.5	8.6	8.5	8.4	8.4		
	pH	7.74	7.92	7.80	7.48	7.41	7.26	CM	
	Temperature (C)	20.2	19.9	19.8	19.8	19.7	19.8		
	Conductivity	2680	2680	2690	2670	2680	2690	1336	
	# Immobile	0	0	0	0	0	0		
	# Dead (10 exposed)	0/0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS: 318 · PASS: (0% mortality)
48-HOUR Result: 319 · PASS: (0% mortality)

TEST CONDITIONS

Brood Culture: 041497 & 042897
Time to First Brood: 7 days
Average Brood Size: 28 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 136
Effluent Substituted from 25L cell for Testing: yes (no)
Test Replication (for QA/QC): yes (no)

Preparation Time: start 12:15 + 4hrs; end 12:45; total 30min
Reason for Preparation: client request
Preparation Ratio:
pH Adjustment: (no) yes
Hardness Adjustment: (no) yes
Test Solution Volume: 200 mL / 1000 mL
Loading Density: 20 / (15) neonates

INITIAL PARAMETERS (prior to testing)

	82	83
Dissolved Oxygen:	8.6	8.8
Initial pH:	8.81	8.38
Temperature:	21.5	21.5
Conductivity:	2536	2520
Initial Hardness:	1326	1292
Physical State Upon Receipt:	liquid	
Clarity:	clear	
Colour:	colourless	
Precipitate:	none	
Odour:	yes	

Both

Adj. pH (if applicable): ✓
Adjustment Details:
Adj. Hardness (if applicable):
Adjustment Details: ✓

Additional Observations:

Comments/Deviations:

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/12/97/11-
Sample Number:	37	Sample Temp:	-
Test Number:	D84	Test Initiation Date/Time:	05/15/97/1249
Chain of Custody #:	-	Technician:	CH/GS/KG

[redacted]

TIME	PARAMETER	SAMPLE ID: CONTROL A (100 A) (84 320)	CONTROL B (100 B)	CONTROL C (100 C)	100% (CON A) (F 321)	100% (CON B)	100% (CON C)	PARAMETER TECHNICIAN	DATA REVIEW
0 HOURS	Dissolved Oxygen	8.7			9.0 *			KG 1301	[illegible]
	pH	7.22			8.01				
	Temperature(C)	20.8			21.2				
	Conductivity(uS)	2580			306				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.16	7.12	7.09	8.10	8.13	8.13	WM 15:16	[illegible]
	Temperature(C)	19.9							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.6	8.5	8.5	8.6	8.6	8.5	CH 1341	CM
	pH	7.15	7.15	7.13	8.02	8.17	8.15		
	Temperature (C)	20.5	20.3	20.1	19.8	19.7	19.8		
	Conductivity	2680	2690	2680	315	315	316		
	# Immobile	0	0	0	0	0	0		
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 320: PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	04/14/97 & 04/28/97	Preaeration Time:	start 12:15
Time to First Brood:	7 days		end 12:45
Average Brood Size:	25 neonates		total 30min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	client request
Control Water Hardness:	136	Preaeration Rate:	25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	(yes) no	pH Adjustment:	(no) / yes
Test Replication (for QA/QC):	yes (no)	Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) [illegible]
		Loading Density:	[illegible]

INITIAL PARAMETERS (prior to testing) 84

Dissolved Oxygen:	8.7		
Initial pH:	7.17	Adj. pH (if applicable):	-
Temperature:	21.6	Adjustment Details:	
Conductivity:	2520		
Initial Hardness:	1411	Adj. Hardness (if applicable):	-
Physical State Upon Receipt:	liquid	Adjustment Details:	
Clarity:	clear		
Colour:	colourless		
Precipitate:	none		
Odour:	yes		

Additional Observations:

Comments/Deviations: DO >100% of saturation, however no daphnia were observed suspended at the surface of the control water during the test

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Manager: L9387
Sample Number: 85 - 86
Test Number: D85 - D86
Chain of Custody #:

Sample Date/Time: 05/12/97 11:-
Sample Type:
Test Initiation Date/Time: 05/15/97 1250
Technician: CH/GS/RG

TIME	PARAMETER	SAMPLE ID: CONTROL-A 100-A	CONTROL-B 100-B	CONTROL-C 100-C	100-A	100-B	100-C	PARAMETERS TECHNICIAN	QA/QC REVIEW
		85 32R			86 32R				
0 HOURS	Dissolved Oxygen	8.8			8.5			KS	
	pH	9.71			8.61				
	Temperature(C)	20.6			20.6			1253	
	Conductivity(uS)	2500			2560				
	Immobility @ 30 minutes (10 exhibited)	0	0	0	0	0	0		
24 HOURS	pH	9.45	9.65	9.48	8.29	8.22	8.45	NM	
	Temperature(C)	19.9						15:23	
	# Immobile	10	10	10	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.7	8.6	8.5	8.5	8.6	CH	
	pH	9.11	9.40	9.28	8.07	7.94	8.14		
	Temperature (C)	20.2	20.2	20.1	20.0	19.8	19.8		
	Conductivity	2650	2640	2640	2670	2680	2670		
	# Immobile	1	—	—	0	0	0	1346	
	# Dead (10 exhibited)	9	10	10	0	0	0		
TOTAL MORTALITIES		9	10	10	0	0	0		
MEAN % MORTALITY		96.6%			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS
48-HOUR Result: 321 : FAIL (96.6% mortality)
322 : PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	041497 & 042897	Presolution Tests:	start 12:15
Time to First Brood:	7 days		end 12:45
Average Brood Size:	28 neonates		total 30min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Presolution:	client request
Control Water Hardness:	136	Preparation Rate:	25 - 50 mL/min
Effluent Subsampled from 25L pail for Testing:	(yes) / no	pH Adjustment:	(no) yes
Test Replication (for QA/QC):	yes (no)	Hardness Adjustment:	(no) yes
		Test Solution Volume:	600 mL/rep
		Loading Density:	10 neonates/rep

INITIAL PARAMETERS (prior to loading)

	85	86		
Dissolved Oxygen:	9.0	8.4		
Initial pH:	9.97	8.86	Adj. pH (if applicable):	—
Temperature:	22.3	22.0	Adjustment Details:	
Conductivity:	2430	2470		
Initial Hardness:	1258	1190	Adj. Hardness (if applicable):	—
Physical State upon Receipt:	liquid		Adjustment Details:	
Clarity:	clear			
Colour:	none			
Precipitate:	none			
Odour:	yes			

Both

Additional Observations:

Comments/Deviations:

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/12/97 / –
Sample Number:	87-88	Sample Temp:	–
Test Number:	D87-D88	Test Initiation Date/Time:	05/15/97 / 1255
Chain of Custody #:	–	Technician:	[illegible]

[redacted]

SAMPLE ID: (87) 323 / (88) 324

TIME	PARAMETER	CONTROL-A (100-A)	CONTROL-B (100-B)	CONTROL-C (100-C)	100-A	100-B	100-C	PARAMETER TECHNICIAN	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.8			8.8			[illegible]	[illegible]
	pH	8.17			7.21				
	Temperature(C)	20.6			20.8				
	Conductivity(uS)	2550			2560				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.69	7.76	7.87	7.09	7.02	7.00	MM 15:30	[illegible]
	Temperature(C)	19.9							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.6	8.5	8.5	8.5	8.5	8.5	CY 1356	[illegible]
	pH	7.49	7.50	7.50	7.18	7.12	7.10		
	Temperature (C)	20.2	20.0	19.9	19.9	19.9	20.1		
	Conductivity	2670	2680	2680	2690	2690	2680		
	# Immobile	0	0	0	1	0	0		
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 323 : PASS (0% mortality)
324 : PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	041497 042897			
Time to First Brood:	7 days	Preaeration Time:	start	12:22
Average Brood Size:	25 neonates		end	12:52
Total Number Exposed/Concentration:	3X10 neonates		total	30min
Control Water Hardness:	136	Reason for Preaeration:		client request
Effluent Subsampled from 25L pail for Testing:	(yes) no	Preaeration Rate:		[illegible]
Test Replication (for QA/QC):	yes (no)	pH Adjustment:		(no) yes
		Hardness Adjustment:		(no) yes
		Test Solution Volume:		[illegible]
		Loading Density:		[illegible]

INITIAL PARAMETERS (prior to testing)

	87	88		
Dissolved Oxygen:	8.7	8.8		
Initial pH:	8.42	7.17	Adj. pH (if applicable):	–
Temperature:	21.9	21.8	Adjustment Details:	
Conductivity:	2430	2530		
Initial Hardness:	1241	1309	Adj. Hardness (if applicable):	–
Physical State Upon Receipt:	liquid (both)		Adjustment Details:	
Clarity:	clear (both)			
Colour:	colourless (both)			
Precipitate:	none (both)			
Odour:	yes (both)			

Additional Observations:

Comments/Deviations:

E:\[illegible]

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number: L9387
Sample Number: 89
Test Number: D89
Chain of Custody #:

Sample Date/Time: 05/12/97 11
Sample Tests:
Test Initiation Date/Time: 05/15/97 1257
Technician: GS CH/DH

TIME	PARAMETER	SAMPLE ID: CONTROL-A	CONTROL-B (G)	CONTROL-C	100-A	89	326 C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.0			8.9				
	pH	8.01			9.65				RK
	Temperature(C)	21.2			21.0			13A	
	Conductivity(uS)	306			2480			NM	
	Immobility @ 30 minutes (10 expected)	0	0	0	0	0	0		
24 HOURS	pH	8.09	8.08	8.12	9.61	9.44	9.66	NM	
	Temperature(C)	19.9						15:40	
	# Immobile	0	0	0	10	7	10*		
48 HOURS	Dissolved Oxygen	8.6	8.7	8.6	8.7	8.8	8.7	CH	
	pH	8.12	8.14	8.16	9.31	9.13	9.49		
	Temperature (C)	20.3	20.0	20.0	20.2	20.3	20.3	14:01	NM
	Conductivity	316	315	316	2640	2640	2640		
	# Immobile	0	0	0	—	1	0		
	# Dead (10 expected)	0	0	0	10	8	9/9		
TOTAL MORTALITIES		0	0	0	10	8	9/9		
MEAN % MORTALITY		0			93%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 325 : FAIL : 93% mortality

TEST CONDITIONS

Brood Culture: 04/14/97 04/28/97
Time to First Brood: 7 days
Average Brood Size: 18 neonates
Total Number Exposed/Concentration: 3X10 neonates
Control Water Hardness: 136
Effluent Subsampled from 25L pail for Testing: (yes) no
Test Replicates (for QA/QC): yes (no)

Preaeration Time:
Reason for Preaeration:
Preaeration Rate:
pH Adjustment:
Hardness Adjustment:
Test Solution Volume:
Loading Density:

start 12:22
end 12:52
total 30min
client request
20 - 60mL/min
(no) yes
(no) yes
(250 mL / 100 mL
(20) / 10 mL/replicate

INITIAL PARAMETERS (prior to testing)

89
Dissolved Oxygen: 9.1
Initial pH: 9.49
Temperature: 21.9
Conductivity: 2450
Initial Hardness: 1215
Physical State Upon Receipt: liquid
Clarity: clear
Colour: colourless
Precipitate: none
Odour: yes

Adj. pH (if applicable):
Adjustment Details:
Adj. Hardness (if applicable):
Adjustment Details:

Additional Observations:

Comments/Deviations: * all daphnids floating at surface in Crep
* DO > 100% saturation however no daphnids were observed suspended at the surface during the test.

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/12/97 // —
Sample Number:	~~090~~ ~~093~~	Sample Temp:	—
Test Number:	~~090~~ D90	Test Initiation Date/Time:	05/15/97 // 1259
Chain of Custody #:	—	Technician:	CH WM GS

[redacted]

SAMPLE ID: ~~90~~ 328 / ~~93~~ 329

TIME	PARAMETER	~~CONTROL-A~~ 100-A	~~CONTROL-B~~ 100-B	~~CONTROL-C~~ 100-C	100-A	100-B	100-C	PARAMETERS TAKEN BY	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.8			8.7			WM 13:22	[illegible]
	pH	8.60			7.89				
	Temperature(C)	20.8			20.9				
	Conductivity(uS)	2540			2550				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	8.41	8.46	8.44	7.83	7.71	7.68	WM 15:48	[illegible]
	Temperature(C)	19.9							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.5	8.5	8.5	8.5	8.5	8.4	CH 1407	W
	pH	8.01	8.03	8.10	7.65	7.52	7.51		
	Temperature (C)	20.2	20.2	20.1	20.0	20.0	20.0		
	Conductivity	2680	2680	2680	2680	2680	2680		
	# Immobile	1	0	0	0	0	0		
	# Dead (10 exposed)	1	0	0	0	0	0		
TOTAL MORTALITIES		1	0	0	0	0	0		
MEAN % MORTALITY		3.33%			0%				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 328: PASS (3.3% mortality)
329: PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	041497 042897			
Time to First Brood:	7 days	Preservation Time:	start	12:22
Average Brood Size:	28 neonates		end	12:52
Total Number Exposed/Concentration:	3X10 neonates		total	30min
Control Water Hardness:	136	Reason for Preservation:		client request
Effluent Subsampled from 25L pail for Testing:	(yes) / no	Preservation Rate:		25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)	pH Adjustment:		(no) / yes
		Hardness Adjustment:		(no) / yes
		Test Solution Volume:		(200 mL) / 150 mL
		Loading Density:		(20) // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	90	91		
Dissolved Oxygen:	8.6	8.6		
Initial pH:	8.83	7.92	Adj. pH (if applicable):	—
Temperature:	22.0	21.8	Adjustment Details:	
Conductivity:	2460	2500		
Initial Hardness:	1326	1241	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	liquid (both)		Adjustment Details:	
Clarity:	clear (both)			
Colour:	colourless (both)			
Precipitate:	none (both)			
Odour:	yes (both)			

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	26/12/97 // –
Sample Number:	~~[illegible]~~ 97	Sample Temp.:	–
Test Number:	D92	Test Initiation Date/Time:	25/12/97 // 1301
Chain of Custody #:	–	Technician:	CH NM GS

[redacted]

SAMPLE ID: (92) 328

TIME	PARAMETER	~~CONTROL-A~~ 100-A	~~CONTROL-B~~ 100-B	~~CONTROL-C~~ 100-C	~~TOX-A~~ CON-A	~~TOX-B~~ (H) CON-B	~~TOX-C~~ CON-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.7			9.0 *			NM 1326	GK
	pH	7.28			8.01				
	Temperature(C)	21.0			21.2				
	Conductivity(uS)	2530			306				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.20	7.20	7.17	8.04	8.11	8.13	NM 15:55	GK
	Temperature(C)	19.9							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.5	8.5	8.5	8.6	8.6	8.7	CH 1413	GK
	pH	7.22	7.21	7.20	8.09	8.17	8.16		
	Temperature (C)	20.3	20.1	20.1	20.0	20.0	20.0		
	Conductivity	2680	2690	2690	316	316	316		
	# Immobile	0	0	0	0	0	0		
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 328: PASS (0% mortality)

TEST CONDITIONS

	92	Control H		
Brood Culture:	041497 ~~042197~~ 042697	042197		
Time to First Brood:	7 days	10 days	Preaeration Time:	start 12:22
Average Brood Size:	28 neonates	48 neonates		end 12:52
Total Number Exposed/Concentration:	3X10 neonates			total 30 min
Control Water Hardness:	136		Reason for Preaeration:	client request
Effluent Subsampled from 25L pail for Testing:	(yes) / no		Preaeration Rate:	25 - 50mL/min/L
Test Replication (for QA/QC):	yes / (no)		pH Adjustment:	(no) / yes
			Hardness Adjustment:	(no) / yes
			Test Solution Volume:	(200) mL / 150 mL
			Loading Density:	(20) // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	92		
Dissolved Oxygen:	8.6		
Initial pH:	7.18	Adj. pH (if applicable):	/
Temperature:	21.4	Adjustment Details:	
Conductivity:	2340		
Initial Hardness:	1326	Adj. Hardness (if applicable):	/
Physical State Upon Receipt:	Liquid	Adjustment Details:	
Clarity:	clear		
Colour:	colourless		
Precipitate:	no		
Odour:	yes		

Additional Observations:

Comments/Deviations: * D.O. 100% of saturation, however no daphnia were observed suspended at the surface throughout the duration of the test.

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AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9382	Sample Date/Time:	25/12/97/ —
Sample Number:	93-97	Sample Temp:	—
Test Number:	D93-D97	Test Initiation Date/Time:	05/12/97/ 1303
Chain of Custody #:		Technician:	CH GS WM

[redacted]

SAMPLE ID: (93) 33329 — (94) 33T 330

TIME	PARAMETER	CONTROL-A	CONTROL-B	CONTROL-C	100-A	100-B	100-C	PARAMETERS TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen		8.8			8.8		WM	[illegible]
	pH		9.56			8.52			
	Temperature(C)		20.9			20.9		1330	
	Conductivity(uS)		2510			2550			
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	9.42	9.35	9.39	8.28	8.09	8.19	WM 16:03	[illegible]
	Temperature(C)				19.9				
	# Immobile	7/9	7	8	0	0	0		
48 HOURS	Dissolved Oxygen	8.7	8.7	8.7	8.6	8.6	8.6	CH	WI
	pH	9.19	9.08	9.20	8.01	7.78	7.83		
	Temperature (C)	20.6	20.5	20.5	20.0	20.0	20.0		
	Conductivity	2640	2640	2640	2660	2690	2640	1417	
	# Immobile	3	3	1	0	0	0		
	# Dead (10 exposed)	7	7	9	0	0	0		
TOTAL MORTALITIES		7	7	9	0	0	0		
MEAN % MORTALITY			76.6%			0			

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result:
329 : FAIL (76.6% mortality)
330 : PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	042197	Preaeration Time:	start 12:30
Time to First Brood:	10 days		end 13:00
Average Brood Size:	48 neonates		total 30 min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	client request
Control Water Hardness:	136	Preaeration Rate:	25 - 50mL/min/L ✓
Effluent Subsampled from 25L pail for Testing:	(yes) / no	pH Adjustment:	(no) / yes
Test Replication (for QA/QC):	yes / (no)	Hardness Adjustment:	(no) / yes
		Test Solution Volume:	(200 mL) / 150 mL
		Loading Density:	(20) / 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	93	94		
Dissolved Oxygen:	9.1	8.6		
Initial pH:	9.98	8.50	Adj. pH (if applicable):	—
Temperature:	21.4	21.4	Adjustment Details:	
Conductivity:	2500	2540		
Initial Hardness:	1360	1343	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	Liq.	LIQUID	Adjustment Details:	
Clarity:	clear	CLEAR		
Colour:	colourless	COLOURLESS		
Precipitate:	no	NO		
Odour:	yes	yes		

Additional Observations:

Comments/Deviations:

C:\[illegible]

AQUATIC SCIENCES INC.

48-HOUR STATIC SINGLE CONCENTRATION DAPHNIA MAGNA TEST (EPS 1/RM/14)

Project Number:	L9387	Sample Date/Time:	05/12/97 // –
Sample Number:	95 - 96	Sample Temp:	
Test Number:	D95 - D96	Test Initiation Date/Time:	05/15/97// 1309
Chain of Custody #:	–	Technician:	CH/GS/adm

[redacted]

TIME	PARAMETER	SAMPLE ID: CONTROL-A	95 332 331 CONTROL-B	CONTROL-C	100-A	96 332 100-B	100-C	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	8.8			8.7			adm 13:40	
	pH	7.71			7.01				
	Temperature(C)	20.8			20.9				
	Conductivity(uS)	2560			2520				
	Immobility @ 30 minutes (10 exposed)	0	0	0	0	0	0		
24 HOURS	pH	7.58	7.52	7.58	7.16	7.11	7.12	adm 16:08	
	Temperature(C)	19.9							
	# Immobile	0	0	0	0	0	0		
48 HOURS	Dissolved Oxygen	8.5	8.4	8.3	8.5	8.4	8.4	CH 1424	CH
	pH	7.41	7.40	7.40	7.23	7.07	7.14		
	Temperature (C)	20.2	20.1	20.2	20.1	20.2	20.2		
	Conductivity	2680	2690	2680	2690	2680	2690		
	# Immobile	0	0	0	0	0	0		
	# Dead (10 exposed)	0	0	0	0	0	0		
TOTAL MORTALITIES		0	0	0	0	0	0		
MEAN % MORTALITY		0			0				

REMEMBER TO COLLECT DAPHNIDS AND TEST SOLUTIONS AT 48 HRS

RESULTS

48-HOUR Result: 331 : PASS (0% mortality)
332 : PASS (0% mortality)

TEST CONDITIONS

Brood Culture:	042197	Preaeration Time:	start 12:30
Time to First Brood:	10 days		end 13:00
Average Brood Size:	45 neonates		total 30min
Total Number Exposed/Concentration:	3X10 neonates	Reason for Preaeration:	client request
Control Water Hardness:	136	Preaeration Rate:	25 - 50mL/min/L
Effluent Subsampled from 25L pail for Testing:	yes/no	pH Adjustment:	no / yes
Test Replication (for QA/QC):	yes/no	Hardness Adjustment:	no / yes CB
		Test Solution Volume:	200 mL / 150 mL
		Loading Density:	20 // 15 mL/neonate

INITIAL PARAMETERS (prior to testing)

	95	96		
Dissolved Oxygen:	8.7	8.7		—
Initial pH:	8.32	7.12	Adj. pH (if applicable):	
Temperature:	21.4	21.5	Adjustment Details:	
Conductivity:	2540	2560		
Initial Hardness:	1326	1343	Adj. Hardness (if applicable):	—
Physical State Upon Receipt:	liquid	Liquid	Adjustment Details:	
Clarity:	clear	clear		
Colour:	colourless	colourless		
Precipitate:	no	no		
Odour:	yes	yes		

Additional Observations:

Comments/Deviations:

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AQUATIC SCIENCES INC.

96 HOUR STATIC RAINBOW TROUT SINGLE CONCENTRATION TEST
EPS 1/RM/13

Project Number:	L9387	Sample Number:	65 - 80
Client:	Inco Ltd	Test Number:	T33 - T48
	Copper Cliff, Ontario	Sample Date/Time:	05/12/97//-:- hrs
Sample Name/ID:	Experimental Treatments for CCWWTP	Sample Technician:	S Clark
	Sample Identification #301 - 316	Test Date:	05/14/97//17:00 - 17:09 hrs
Sample Location:	CCWWTP	Technician:	S Hilliker/W Masters
Chain of Custody #:	not received		
Sample Method:	Grab		

RESULTS

96 HOUR RESULTS:	65: 301:	FAIL (100% mortality)	73: 309:	FAIL (100% mortality)
	66: 302:	PASS (0% mortality)	74: 310:	PASS (0% mortality)
	67: 303:	PASS (0% mortality)	75: 311:	PASS (0% mortality)
	68: 304:	PASS (0% mortality)	76: 312:	PASS (0% mortality)
	69: 305:	FAIL (100% mortality)	77: 313:	FAIL (100% mortality)
	70: 306:	PASS (0% mortality)	78: 314:	PASS (0% mortality)
	71: 307:	PASS (0% mortality)	79: 315:	PASS (0% mortality)
	72: 308:	PASS (0% mortality)	80: 316:	PASS (0% mortality)

QUALITY ASSURANCE INFORMATION

REFERENCE TEST CONDITIONS

Test Organism:	Rainbow Trout	Test Aeration Rate:	6.5 +/- 1 mL/min/L
Trout Batch Number:	041897	Photoperiod:	16 hours light/8 hours dark
Test Type:	Static	Dilution Water:	Dechlorinated Tap
Test Temperature:	15+/-1C	Organism Age:	Fingerlings
Test Volume:	15 Litres	Stock Source:	Rainbow Springs Hatchery
Test Solution Depth:	27 cm	Mean Weight:	0.52 +/- 0.12 g

REFERENCE TOXICANT DATA

Chemical Used:	Sodium Chloride	Historic Mean LC50:	16246 mg/L
Date of Test:	May 06/97	Warning Limits:	12252 - 20239 mg/L
96-hour LC50:	15693 mg/L		
95% Confidence Interval:	14826 - 16611 mg/L		

TEST PROTOCOL

Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout. Environment Canada. July 1990

COMMENTS

The reference toxicant results show that test reproducibility and organism sensitivity are within acceptable limits.
All data is scrutinized for errors daily during the test, at test termination and during the report Technical and Final Review stages.
Instruments used to monitor parameters are calibrated daily and continuously maintained.

QUALITY REVIEW

Technical Review

Final Review

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number: L4387
Sample Number: ~~65~~ 65
Test Number: T33
Custody #:

Sample Date/Time: 05/12/97 11:-
Sample Tech: -
Test Initiation Date/Time: 05/14/97 11:17:00
Technician: SH MM

TIME	PARAMETER	CONTROL A	65 - 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.1	10.4	MM 17:20	
	pH	8.09	10.11		
	Temperature(C)	14.4	14.7		
	Conductivity(uS)	214	2705		
	Immobility @ 30 minutes (10 exposed)	0	0		
15 - 16 HOURS	pH	7.96	9.52	CH/820	SH
24 HOURS	Dissolved Oxygen	10.0	10.0	CH 1650 / 0101	~~SH~~
	pH	8.08	9.52		
	Temperature(C)	14.5	14.9		
	Conductivity(uS)	324	2600		
	# Immobile	0	0		
	Total # Dead	0	10		
48 HOURS	Dissolved Oxygen	9.4		CH / 1605	CH
	pH	7.99			
	Temperature(C)	14.6			
	Conductivity(uS)	329			
	# Immobile	0			
	Total # Dead	0			
72 HOURS	Dissolved Oxygen	9.9 9.9		CH / 1657	CH
	pH	7.99 7.90			
	Temperature(C)	14.7 14.6			
	Conductivity(uS)	336 330			
	# Immobile	0 0			
	Total # Dead	0 0			
96 HOURS	Dissolved Oxygen	9.9		CH / 1725	CH
	pH	8.04			
	Temperature(C)	14.6			
	Conductivity(uS)	343			
	# Immobile	0			
	Total # Dead	0			
TOTAL MORTALITY		0	10		

CH - taken twice on same day

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 301 : FAIL (100% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 041897 % Mortality of Culture 7 Days Prior to Testing: 1.6 Previous Day Last Feeding Time: 17:00

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.52 / 39	0.56 / 35	0.66 / 37	0.60 / 36	0.56 / 35	0.68 / 38	0.92 / 41	0.81 / 38	0.94 / 37	0.53 / 35

Sample Size: 10
Mean Fork Length: 37 +/- 2.0 mm
Fork Length Min/Max: 35 - 41 mm

Mean Weight: 0.69 +/- 0.13 g
Weight Min/Max: 0.53 - 0.92 g
Loading Density: 0.38 g/L

TEST CONDITIONS

Total Preaeration Time: start 16:30; end 17:00; total 30 min
Reason for Preaeration > 30 minutes: N/A
Preaeration & Test Aeration Rate: 0.5 +/- 1 mL/min/L
pH Adjustment: yes / (no)

Test Solution Volume (L): 18L
Test Solution Depth (15cm:10L; 25cm:16L; 35cm:20L): 32cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen (ppm): 10.1
pH: 10.06
Temperature (C): 14.4
Conductivity (uS/cm): 2600

(Adj. pH (if applicable)): /
(Adjustment Details): /

Physical State Upon Receipt: Liquid
Clarity: Clear
Colour: Yellow
Precipitate: Suspended Solids
Odour: Yes

Comments/Deviations: Liner Broken at initial parameter check.

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9387	Sample Date/Time:	05/12/97 11:-
Sample Number:	66 - 67	Sample Tech:	-
Test Number:	T34 - T35	Test Initiation Date/Time:	05/14/97 17:02
Custody #:	-	Technician:	SH/WM

TIME	PARAMETER	(66) 100 302	(67) 100 303	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8	10.0	WM 17:25	
	pH	9.14	8.70		
	Temperature(C)	14.7	14.5		
	Conductivity(uS)	2740	2740		
	Immobility @ 30 minutes (10 exposed)	^	^		
15 - 18 HOURS	pH	7.68	7.44	0025/CH	SH
24 HOURS	Dissolved Oxygen	10.0	9.8	CH 1638	SH
	pH	7.60	7.32		
	Temperature(C)	14.6	14.6		
	Conductivity(uS)	2650	2650		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.8	9.7	CH 1607	CH
	pH	7.55	7.34		
	Temperature(C)	14.5	14.7		
	Conductivity(uS)	2660	2660		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.9 9.9	9.4 9.4	CH 1705	CH 752 CM
	pH	7.56 7.575	7.30 7.29		
	Temperature(C)	14.7 14.8	14.7 14.6		
	Conductivity(uS)	2730 2670	2730 2670		
	# Immobile	0 0	0 0		
	Total # Dead	0 0	0 0		
96 HOURS	Dissolved Oxygen	9.9	9.5	CH 1726	CH
	pH	7.59	7.29		
	Temperature(C)	14.6	14.6		
	Conductivity(uS)	2740	2740		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

- taken twice on same day CH. CH

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 302 & 303 (PASS (0% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: 041897 % Mortality of Culture 7 Days Prior to Testing: 1.67 Previous Day Last Feeding Time: 17:00

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.82 / 39	.56 / 35	.66 / 37	.60 / 36	.56 / 35	.68 / 34	.92 / 41	.81 / 38	.79 / 37	.55 / 35

Sample Size:	10	Mean Weight:	0.67 +/- 0.13 g
Mean Fork Length:	37 +/- 2.2 mm	Weight Min/Max:	0.53 - 0.92 g
Fork Length Min/Max:	35 - 41 mm	Loading Density:	0.35 g/L

TEST CONDITIONS

Total Preaeration Time: start	16:30	Test Solution Volume (L):	18L
end	17:00	Test Solution Depth (15cm:10L; 25cm:18L; 35cm:28L):	32cm
total	30min	Total Number Exposed/Concentration:	10
Reason for Preaeration > 30 minutes:	N/A	Test Replication (for QA/QC):	yes (no)
Preaeration & Test Aeration Rate:	6.5 +/- 1 mL/min/L		
pH Adjustment:	yes (no)		

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen (ppm):	10.1 10.1	Physical State Upon Receipt:	Liquid
pH:	9.14 8.74	Clarity:	Cloudy
Temperature (C):	14.7 14.5	Colour:	Yellow
Conductivity (uS/cm):	~~2730~~ 2730	Precipitate:	Suspended Solids
(Adj. pH (if applicable)):		Odour:	Yes.
(Adjustment Details):			

Comments/Deviations:

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number: 49387
Sample Number: 68 - 69
Test Number: 736 - 737
Custody #: -

Sample Date/Time: 05/12/97 11 -
Sample Type: -
Test Initiation Date/Time: 05/14/97 17:00
Technician: SH/NM

TIME	PARAMETER	(68) 100% 304	(69) CONTROL	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	10.0	9.9	17:35 NM	
	pH	7.29	5.15		
	Temperature(C)	14.4	14.1		
	Conductivity(uS)	2710C	315		
	Immobility @ 30 minutes (10 organisms)	0	0		
15 - 16 HOURS	pH	7.22	7.83	CH/0029	SH
24 HOURS	Dissolved Oxygen	9.8	9.5	CH	
	pH	7.15	7.80		
	Temperature(C)	14.6	14.5		
	Conductivity(uS)	2660	317		
	# Immobile	0	0	1641	
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.5	9.5	CH	
	pH	7.10	7.83		
	Temperature(C)	14.7	14.7		CM
	Conductivity(uS)	2670	318		
	# Immobile	0	0	1510	
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.4	9.3	CH	
	pH	7.17	7.79		
	Temperature(C)	14.8	14.8		
	Conductivity(uS)	2730	323		CM
	# Immobile	0	0	1755	
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.5	9.5	CH	
	pH	7.12	7.82		
	Temperature(C)	14.6	14.5		
	Conductivity(uS)	2740	325		
	# Immobile	0	0	1728	CM
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS

96 Hour Results: 304 : PASS (0% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: 04/18/97 % Mortality of Culture 7 Days Prior to Testing: 1.6 % Previous Day Last Feeding Time: 17:00

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
.70 / 38	.97 / 42	.49 / 42	.59 / 35	.66 / 37	.87 / 40	.66 / 35	.79 / 37	.88 / 39	.81 / 39

Sample Size: 10
Mean Fork Length: 38 +/- 2.5 mm
Fork Length Min/Max: 35 - 42 mm

Mean Weight: 0.84 +/- 0.26 g
Weight Min/Max: .66 - 1.49 g
Loading Density: 0.47 g/L

TEST CONDITIONS

Total Preaeration Time: start 16:30; end 17:00; total 30 min
Reason for Preaeration > 30 minutes: n/a
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes / (no)

Test Solution Volume (L): 18L
Test Solution Depth (19cm:10L; 25cm:18L; 35cm:28L): 32 cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to testing)

Dissolved Oxygen (ppm): 10.1
pH: 6.96
Temperature (C): 14.4
Conductivity (uS/cm): 2750

(Adj. pH (if applicable)): -
(Adjustment Details):

Physical State Upon Release: Liquid
Clarity: Clear
Colour: Yellow
Precipitate: Suspended Solids
Odour: None

Comments/Deviations:

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9387	Sample Date/Time:	05/12/9711 -
Sample Number:	~~70-71~~ 69-70	Sample Tech:	
Test Number:	~~T38-T38~~ T38	Test Initiation Date/Time:	05/14/9711 17:06
Custody #:	-	Technician:	SH NM

TIME	PARAMETER	(69) 100 305	(70) 100 306	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8	9.9	NM 17:38	
	pH	10.17	9.15		
	Temperature(C)	14.3	14.3		
	Conductivity(uS)	2710	2730		
	Immobility @ 30 minutes (10 expected)	0	-		
15 - 18 HOURS	pH	7.64	7.55	CH 0034	SH
24 HOURS	Dissolved Oxygen	10.0	9.8	CH 0907 / 1643	
	pH	9.64	7.41		
	Temperature(C)	14.7	14.4		
	Conductivity(uS)	2670	2650		
	# Immobile	~~14~~	0		
	Total # Dead	10	0		
48 HOURS	Dissolved Oxygen		9.6	CH 1711	CH
	pH		7.41		
	Temperature(C)		14.7		
	Conductivity(uS)		2650		
	# Immobile		0		
	Total # Dead		0		
72 HOURS	Dissolved Oxygen		9.5	CH 1757	CH
	pH		7.43		
	Temperature(C)		14.5		
	Conductivity(uS)		2710		
	# Immobile		0		
	Total # Dead		0		
96 HOURS	Dissolved Oxygen		9.5	CH 1730	CH
	pH		7.39		
	Temperature(C)		14.5		
	Conductivity(uS)		2730		
	# Immobile	V	0		
	Total # Dead	V	0		
TOTAL MORTALITY		10	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 305: FAIL (100% mortality) 306: PASS (0% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: C41897 % Mortality of Culture 7 Days Prior to Testing: 1.6 Previous Day Last Feeding Time: 17:00

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.75 / 38	0.97 / 42	1.44 / 42	0.59 / 35	0.66 / 37	0.87 / 43	0.66 / 35	0.74 / 37	0.88 / 39	0.81 / 39

Sample Size: 10
Mean Fork Length: 38 +/- 2.5 mm
Fork Length Min/Max: 35 - 42 mm
Mean Weight: 0.84 +/- 0.26 g
Weight Min/Max: 0.66 - 1.44 g
Loading Density: 0.42 g/L

TEST CONDITIONS

Total Preaeration Time: start 16:30
end 17:00
total 30 min
Reason for Preaeration > 30 minutes: n/a
Preaeration & Test Aeration Rate: 0.5 +/- 1 mL/min/L
pH Adjustment: yes (no)

Test Solution Volume (L): 18L
Test Solution Depth (18cm:10L; 28cm:16L; 36cm:20L): 32cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): (yes) / no

INITIAL PARAMETERS (prior to testing)

	(69)	(70)
Dissolved Oxygen (ppm):	10.0	10.2
pH:	10.22	9.20
Temperature (C):	14.4	14.3
Conductivity (uS/cm):	2670	2710
(Adj. pH (if applicable)):		
(Adjustment Details):		
Physical State Upon Receipt:	Liquid	Liquid
Clarity:	Clear	Clear
Colour:	Yellow	none
Precipitate:	Slup. Solids	Slup. Solids
Odour:	None	YES

Comments/Deviations:

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9387	Sample Date/Time:	05/12/17 11:-
Sample Number:	71 - 72	Sample Tech:	-
Test Number:	T4039 - T42	Test Initiation Date/Time:	05/14/17 17:08
Custody #:	-	Technician:	SH NM

TIME	PARAMETER	(71) 100 307	(72) 100 308	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8	9.5	NM 17:42	
	pH	8.167	7.85		
	Temperature(C)	14.3	14.4		
	Conductivity(uS)	2750	2760		
	Immobility @ 30 minutes (10 expected)	0	0		
15 - 18 HOURS	pH	7.30	7.92	CH/0837	
24 HOURS	Dissolved Oxygen	9.9	9.9	CH 1645	QA
	pH	7.34	7.33		
	Temperature(C)	14.4	14.4		
	Conductivity(uS)	2660	2660		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.4	9.7	CH 1712	CH
	pH	7.34	7.33		
	Temperature(C)	14.7	14.7		
	Conductivity(uS)	2660	2660		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.6	9.5	CH 1759	CH
	pH	7.39	7.34		
	Temperature(C)	14.7	14.7		
	Conductivity(uS)	2730	2730		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.6	9.5	CH 1732	CH
	pH	7.30	7.29		
	Temperature(C)	14.5	14.5		
	Conductivity(uS)	2740	2750		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 307 & 308 : PASS 0% mortality

TEST ORGANISM CONDITIONS
Trout Batch Number: 041897 % Mortality of Culture 7 Days Prior to Testing: 1.6 Previous Day Last Feeding Time: 17:00

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.70 / 38	0.97 / 42	1.49 / 42	0.59 / 37	0.66 / 37	0.81 / 40	0.66 / 35	0.79 / 37	0.83 / 37	0.81 / 39

Sample Size: 10
Mean Fork Length: 38 +/- 2.5 mm
Fork Length Min/Max: 35 - 42 mm
Mean Weight: 0.84 +/- 0.26 g
Weight Min/Max: 0.66 - 1.49 g
Loading Density: 0.47 g/L

TEST CONDITIONS

Total Preaeration Time: start 16:30; end 17:00; total 30 min
Reason for Preaeration > 30 minutes: n/a
Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L
pH Adjustment: yes (no)
Test Solution Volume (L): 18L
Test Solution Depth (10cm:10L; 20cm:18L; 30cm:28L): 32cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to loading)

	71	72
Dissolved Oxygen (ppm):	10.1	10.2
pH:	8.74	8.56
Temperature (C):	14.4	14.4
Conductivity (uS/cm):	2320	2720
(Adj. pH (if applicable)):	/	/
(Adjustment Details):	/	/
Physical State Upon Receipt:	Liquid	Liquid
Clarity:	Clear	clear
Colour:	yellow	yellow
Precipitate:	Susp. Solids	Susp. Solids
Odour:	Yes	none

Comments/Deviations:

71: liner Broken at initial parameter check.

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9387	Sample Date/Time:	05/12/97 11:—
Sample Number:	73	Sample Taste:	—
Test Number:	T41	Test Initiation Date/Time:	05/14/97 17:01
Custody #:	—	Technician:	SH Jim

TIME	PARAMETER	CONTROL	100 (73)	309	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.9	9.7		NM 17:50	
	pH	8.20	10.11			
	Temperature(C)	14.5	14.8			
	Conductivity(uS)	318	2700			
	Immobility @ 30 minutes (10 exposed)	0	0			
15 - 18 HOURS	pH	8.24	9.54		CH/0951	CH
24 HOURS	Dissolved Oxygen	9.9	10.0		CH	
	pH	8.11	9.54		DNW/CH	
	Temperature(C)	14.8	15.0			
	Conductivity(uS)	325	2690			
	# Immobile	0	—		/1656	
	Total # Dead	0	10			
48 HOURS	Dissolved Oxygen	9.9			CH	CH
	pH	8.08				
	Temperature(C)	14.4				
	Conductivity(uS)	331			1608	
	# Immobile	0				
	Total # Dead	0				
72 HOURS	Dissolved Oxygen	9.3			CH	CH
	pH	8.21				
	Temperature(C)	14.7				
	Conductivity(uS)	338			1809	
	# Immobile	0				
	Total # Dead	0				
96 HOURS	Dissolved Oxygen	9.8			CH	CH
	pH	8.31				
	Temperature(C)	14.6				
	Conductivity(uS)	340			1742	
	# Immobile	0	V			
	Total # Dead	0	V			
TOTAL MORTALITY		0	10			

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS

96 Hour Results: 309: FAIL (100% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: 041897 % Mortality of Culture 7 Days Prior to Testing: 16% Previous Day Last Feeding Time: 1700

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
1.17 / 43	.71 / 37	.55 / 33	.69 / 37	.64 / 36	.86 / 40	.55 / 34	.65 / 36	.90 / 40	.36 / 30

Sample Size: 10

Mean Fork Length: 37 +/- 3.8 mm

Fork Length Min/Max: 30 - 43 mm

Mean Weight: 0.71 +/- 0.23 g

Weight Min/Max: .36 - 1.17 g

Loading Density: 0.39 g/L

TEST CONDITIONS

Total Preaeration Time: start 16:30; end 17:00; total 30min

Reason for Preaeration > 30 minutes: n/a

Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L

pH Adjustment: yes (no)

Test Solution Volume (L): 18L

Test Solution Depth (10cm:10L; 20cm:18L; 25cm:20L): 32cm

Total Number Exposed/Concentration: 10

Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to loading)

Dissolved Oxygen (ppm): 10.0

pH: 10.30

Temperature (C): 14.5

Conductivity (uS/cm): 2630

(Adj. pH (if applicable)):

(Adjustment Details):

Physical State Upon Receipt: liquid

Clarity: clear

Colour: yellow

Precipitate: suspended solids

Odour: yes

Comments/Deviations:

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	69387	Sample Date/Time:	05/12/15 11-
Sample Number:	74-75	Sample Tech:	—
Test Number:	T42-T43	Test Initiation Date/Time:	05/14/15 17:03
Custody #:	—	Technician:	SH MM

TIME	PARAMETER	100 (74) 310	100 (75) 311	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.5	9.9	MM 17:55	
	pH	9.16	8.32		
	Temperature(C)	14.2	14.6		
	Conductivity(uS)	2732	2760		
	Immobility @ 30 minutes (10 expected)	0	0/11		
15 - 18 HOURS	pH	7.65	7.57	CH 0854	SA
24 HOURS	Dissolved Oxygen	10.0	9.7	CH 1654	
	pH	7.54	7.26		
	Temperature(C)	14.6	14.6		
	Conductivity(uS)	2660	2660		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.4	9.7	CH 1611	CH
	pH	7.52	7.33		
	Temperature(C)	14.3	14.4		
	Conductivity(uS)	2670	2660		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.7	9.3	CH 1807	CH
	pH	7.61	7.35		
	Temperature(C)	14.6	14.7		
	Conductivity(uS)	2740	2730		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.8	9.4	CH 1740	CH
	pH	7.53	7.35		
	Temperature(C)	14.5	14.5		
	Conductivity(uS)	2750	2740		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR — TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 310 & 311 : PASS (0% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: CU VG7 — % Mortality of Culture 7 Days Prior to Testing: 1.6 — Previous Day Last Feeding Time: 1700

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
1.17 / 43	0.71 / 37	0.55 / 33	0.64 / 37	0.64 / 36	0.38 / 40	0.55 / 34	0.65 / 36	0.90 / 40	0.36 / 32

Sample Size: 10
Mean Fork Length: 37 +/- 3.8 mm
Fork Length Min/Max: 30 - 043 mm

Mean Weight: 0.71 +/- 0.23 g
Weight Min/Max: 0.36 - 1.17 g
Loading Density: 0.39 g/L

TEST CONDITIONS

Total Preaeration Time: start 16:30; end 17:00; total 30 minutes
Reason for Preaeration > 30 minutes: N/A
Preaeration & Test Aeration Rate: 0.5 +/- 1 mL/min/L
pH Adjustment: yes (no)

Test Solution Volume (L): 18L
Test Solution Depth (16cm:10L; 28cm:18L; 35cm:28L): 32cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to testing) 24 +2

Dissolved Oxygen (ppm):	10.0	10.0
pH:	9.25	8.04
Temperature (C):	14.2	14.7
Conductivity (uS/cm):	2716	2730
(Adj. pH if applicable):		
(Adjustment Details):		

Physical State Upon Receipt:	liquid	liquid
Clarity:	clear	clear
Colour:	yellow	yellow
Precipitate:	v. slight	slight solids
Odour:	none	yes

Comments/Deviations:

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	L9337	Sample Date/Time:	05/12/17 11 -
Sample Number:	76	Sample Tech:	-
Test Number:	T44	Test Initiation Date/Time:	05/14/17 17:05
Custody #:	-	Technician:	NM

TIME	PARAMETER	(76) 100 3:2	CONTROL D	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.6	9.8	NM 18:00	
	pH	7.7	8.21		
	Temperature(C)	14.2	14.2		
	Conductivity(uS)	2750	2.8		
	Immobility @ 30 minutes (10 expected)	0	0		
15 - 18 HOURS	pH	7.42	8.11	CH/0852	SH
24 HOURS	Dissolved Oxygen	9.0	10.0	CH 1652	CM.
	pH	7.91	8.06		
	Temperature(C)	14.5	14.9		
	Conductivity(uS)	2660	322		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.7	9.6	CH 1613	CM.
	pH	7.32	8.02		
	Temperature(C)	14.4	14.5		
	Conductivity(uS)	2660	325		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.6	9.5	CH 1805	CH
	pH	7.46	8.11		
	Temperature(C)	14.6	14.6		
	Conductivity(uS)	2740	333		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.5	9.7	CH 1738	CH
	pH	7.45	8.16		
	Temperature(C)	14.5	14.5		
	Conductivity(uS)	2750	334		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR — TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS

96 Hour Results: 312 : PASS (0% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: [illegible] % Mortality of Culture 7 Days Prior to Testing: 1.6 Previous Day Last Feeding Time: 17:00

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
.575 / 35	.531 / 32	1.0642	.66136	.67137	.76138	.61134	1.06141	.70139	.66136

Sample Size: 10

Mean Fork Length: 37 +/- 3.0 mm

Fork Length Min/Max: 32 - 42 mm

Mean Weight: 0.73 +/- 0.19 g

Weight Min/Max: .53 - 1.06 g

Loading Density: 0.41 g/L

TEST CONDITIONS

Total Preaeration Time: start 16:30; end 17:00; total 30 min

Reason for Preaeration > 30 minutes: N/A

Preaeration & Test Aeration Rate: 6.5 +/- 1 mL/min/L

pH Adjustment: yes / no

Test Solution Volume (L): 15 L

Test Solution Depth (15cm:10L; 25cm:16L; 35cm:22L): 32 cm

Total Number Exposed/Concentration: 10

Test Replication (for QA/QC): yes / no

INITIAL PARAMETERS (prior to testing)

	76	77
Dissolved Oxygen (ppm):	9.4	10.6
pH:	7.99	8.24
Temperature (C):	14.6	14.7
Conductivity (uS/cm):	2730	332

(Adj. pH (if applicable)):

(Adjustment Details):

Physical State Upon Receipt:	Liquid	Liquid
Clarity:	clear	clear
Colour:	yellow	yellow
Precipitate:	SILT/SEDIMENT	SILT/SEDIMENT
Odour:	yes	yes

Comments/Deviations:

QA/QC software © [illegible]

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number:	19387	Sample Date/Time:	05 / 12 / 12 // -
Sample Number:	77 - 78	Sample Type:	-
Test Number:	T45 - T46	Test Initiation Date/Time:	05 / 14 / 12 // 17:07
Custody #:	-	Technician:	AM

TIME	PARAMETER	(77) 100	(78) 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.5	9.5	AM 18:04	
	pH	10.12	9.52		
	Temperature(C)	14.4	14.3		
	Conductivity(uS)	2600	2750		
	Immobility @ 30 minutes (10 exposed)	1	0		
15 - 16 HOURS	pH	9.72	7.92	CH/1007	CH
24 HOURS	Dissolved Oxygen	10.0	10.0	CH / 0905 / CH / 1649	SLS
	pH	9.72	7.96		
	Temperature(C)	14.7	14.3		
	Conductivity(uS)	2640	2760 CH		
	# Immobile	-	0		
	Total # Dead	10	8		
48 HOURS	Dissolved Oxygen		9.5	CH 1617	CH.
	pH		7.45		
	Temperature(C)		14.6		
	Conductivity(uS)		2660		
	# Immobile		0		
	Total # Dead		0		
72 HOURS	Dissolved Oxygen		9.3	CH 1803	CH
	pH		7.40		
	Temperature(C)		14.6		
	Conductivity(uS)		2730		
	# Immobile		0		
	Total # Dead		0		
96 HOURS	Dissolved Oxygen		9.5	CH 1736	CH
	pH		7.90		
	Temperature(C)		14.4		
	Conductivity(uS)		2740		
	# Immobile		0		
	Total # Dead		0		
TOTAL MORTALITY		10	8		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 16 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 313: FAIL (100% mortality) 314 PASS (0% mortality)

TEST ORGANISM CONDITIONS

Trout Batch Number: 12CH07 % Mortality of Culture 7 Days Prior to Testing: 1.6 Previous Day Last Feeding Time: 17:00

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.58 / 35	0.53 / 32	1.02 / 42	0.66 / 36	0.67 / 37	0.76 / 38	0.61 / 34	1.06 / 41	0.71 / 38	0.66 / 36

Sample Size:	10	Mean Weight:	0.73 +/- 0.19 g
Mean Fork Length:	37 +/- 3.0 mm	Weight Min/Max:	0.53 - 1.06 g
Fork Length Min/Max:	32 - 42 mm	Loading Density:	0.41 g/L

TEST CONDITIONS

Total Preaeration Time:	start 16:30	Test Solution Volume (L):	18L
	end 17:00	Test Solution Depth (15cm:10L; 20cm:16L; 25cm:20L):	32cm
	total 30 min	Total Number Exposed/Concentration:	10
Reason for Preaeration > 30 minutes:	n/a	Test Replication (for QA/QC):	yes (no)
Preaeration & Test Aeration Rate:	6.5 +/- 1 mL/min/L		
pH Adjustment:	yes/no		

INITIAL PARAMETERS (prior to testing)

	77	78
Dissolved Oxygen (ppm):	10.0	10.0
pH:	10.34	7.93
Temperature (C):	14.4	14.3
Conductivity (uS/cm):	2600	2750
(Adj. pH (if applicable)):		
(Adjustment Details):		

Physical State Upon Receipt:	liquid	liquid
Clarity:	clear	clear
Colour:	yellow	yellow
Precipitate:	susp. solids	susp. solids
Odour:	yes	yes

Comments/Deviations:

AQUATIC SCIENCES INC.

96-HOUR PASS/FAIL RAINBOW TROUT TEST (EPS 1/RM/13)

Project Number: LG 382
Sample Number: 79 - 80
Test Number: T47 - T48
Custody #: —

Sample Date/Time: 05/12/17 11:—
Sample Tech: —
Test Initiation Date/Time: 05/14/17 11:09
Technician: NM

TIME	PARAMETER	79 / 100	80 / 100	PARAMETER TECH/TIME	QA/QC REVIEW
0 HOURS	Dissolved Oxygen	9.8	9.8	NM 18:11	
	pH	9.66	7.52		
	Temperature(C)	14.2	14.3		
	Conductivity(uS)	2740	2750		
	Immobility @ 30 minutes (10 expected)	0	0		
15 - 18 HOURS	pH	7.52	7.17	CH/0843	SI
24 HOURS	Dissolved Oxygen	9.0	9.1	CH 1647	SM
	pH	7.51	7.07		
	Temperature(C)	14.3	14.3		
	Conductivity(uS)	2660	2670		
	# Immobile	0	0		
	Total # Dead	0	0		
48 HOURS	Dissolved Oxygen	9.6	9.2	CH 1619	CM.
	pH	7.50	7.15		
	Temperature(C)	14.6	14.6		
	Conductivity(uS)	2060	2670		
	# Immobile	0	0		
	Total # Dead	0	0		
72 HOURS	Dissolved Oxygen	9.3	9.3	CH 1802	CH
	pH	7.52	7.17		
	Temperature(C)	14.6	14.6		
	Conductivity(uS)	2740	2740		
	# Immobile	0	0		
	Total # Dead	0	0		
96 HOURS	Dissolved Oxygen	9.8	9.2	CH 1734	CH
	pH	7.53	7.08		
	Temperature(C)	14.4	14.5		
	Conductivity(uS)	2740	2740		
	# Immobile	0	0		
	Total # Dead	0	0		
TOTAL MORTALITY		0	0		

REMEMBER TO TAKE MEASUREMENTS IF 100% KILL IN 1 HOUR TAKE TEST SOLUTION SUBSAMPLES AT 1 HOUR OR 15 - 18 HOURS AND 96 HOURS

RESULTS
96 Hour Results: 315 & 316: PASS (0% mortality)

TEST ORGANISM CONDITIONS
Trout Batch Number: 041917 % Mortality of Culture 7 Days Prior to Testing: 1.6 Previous Day Last Feeding Time: 17:00

Control Weight (g) / Length (mm):

1	2	3	4	5	6	7	8	9	10
0.581 / 35	0.531 / 32	1.021 / 42	0.661 / 36	0.671 / 37	0.761 / 38	0.611 / 34	1.06 / 41	0.331 / 28	0.661 / 36

Sample Size: 10
Mean Fork Length: 37 +/- 3.0 mm
Fork Length Min/Max: 32 - 42 mm

Mean Weight: 0.73 +/- 0.19 g
Weight Min/Max: 0.53 - 1.06 g
Loading Density: 0.41 g/L

TEST CONDITIONS

Total Preaeration Time: start 16:30
end 17:00
total 30 min
Reason for Preaeration > 30 minutes: n/a
Preaeration & Test Aeration Rate: 0.5 +/- 1 mL/min/L
pH Adjustment: yes (no)

Test Solution Volume (L): 18L
Test Solution Depth (10cm:10L; 20cm:16L; 30cm:20L): 32cm
Total Number Exposed/Concentration: 10
Test Replication (for QA/QC): yes (no)

INITIAL PARAMETERS (prior to loading)

	79	80 *
Dissolved Oxygen (ppm):	10.0	9.9
pH:	8.41	7.55
Temperature (C):	14.3	14.3
Conductivity (uS/cm):	2730	2700
(Adj. pH (if applicable)):		
(Adjustment Details):		

	79	80
Physical State Upon Receipt:	LIQUID	LIQUID
Clarity:	CLEAR	CLEAR
Colour:	YELLOW	YELLOW
Precipitate:	SLSD. SOLIDS	SLSD. SOLIDS
Odour:	YES	YES

Comments/Deviations: * initial parameters missed at time "0". . taken on subsample from fridge NM