Quality Assurance Project Plan

A Survey of Zinc Concentrations in Industrial Stormwater Runoff

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April 2005

Waterbody Number: WA-09-1015 (Springbrook/Mill Creek)

Approvals

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Table of Contents

Abstract

Effective April 2003, permittees under the Industrial Stormwater General Permit (ISGP) have been required to provide self-monitoring data of runoff discharge. Results from the first year of self-monitoring show elevated levels of zinc. Two potential sources of elevated zinc in runoff have been identified. They are runoff from galvanized roofs and leakage of hydraulic fluid from heavy equipment. In this screening level study, sources of zinc in industrial stormwater runoff will be evaluated. In addition, results from self monitoring will be verified and individual locations for taking self-monitoring samples evaluated.

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- Marilou Pivirotto, SWRO, for her guidance in sampling stormwater from roofs and identifying sources of zinc in industrial stormwater discharges.
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- Art Johnson for his peer review.

Background/Problem Statement

Self-monitoring reports to the Washington State Department of Ecology (Ecology) were first required in 2003 under the ISGP (Ecology, 2002). Once per quarter, all industries under the permit must monitor turbidity, pH, total zinc(Zn), and petroleum oil and grease. Additional parameters are required for some industry groups.

High levels of zinc in stormwater have been reported by a majority of industries in self-monitoring reports. These reports show a median zinc concentration of 169 µg/L. The distribution of self-reported zinc concentrations is skewed toward higher concentrations. Over 20% of the sample analyses exceeded 500µg/L.

The finding of high zinc concentrations in industrial stormwater runoff in Washington is consistent with national data showing typical zinc concentrations from industrial parking lots of 224 µg/L (Claytor and Schueler, 1996). Typical zinc concentrations in urban stormwater are lower. The national median concentration of zinc in stormwater (pooled NURP/USGS data) has been estimated to be 129 µg/L (Smullen and Cave, 1998).

Greater than 60% of the self-reported industrial stormwater samples in Washington State exceed the 117 µg/L benchmark value for zinc. Benchmark values, which appear in the ISGP, are stormwater discharge concentrations below which it is presumed that water quality standards in receiving waters will not be exceeded (Ecology, 1992). If the value for total, or total recoverable zinc, exceeds the benchmark value for two consecutive quarters, copper and lead analyses are also required.

Two principal sources of zinc in runoff from industrial facilities are believed to be:

- Runoff from galvanized roofs and other galvanized materials.
- Leakage of hydraulic fluids and motor oil and wear from tires.

Concentrations of zinc (total recoverable) in galvanized roof runoff have been reported in a range of 1,100 – 12,200 µg/L (Good, 1993; Quek and Förster, 1993; and Thomas and Greene, 1993). The Port of Seattle monitored stormwater runoff from galvanized roofs at Sea-Tac International Airport and found similar concentrations: 400 – 15,000 µg/L total recoverable zinc (12,000 dissolved, maximum – Indumark, 2004). Zinc concentrations in runoff from other roof types are considerably lower, typically 30 – 500 µg/L (Boller, 1997; Good, 1993; Heaney et al., 1999; Mason et al., 1999; Quek and Forster, 1993; Thomas and Greene, 1993; and Zobrist et al., 2000).

Zinc is a critical component of most hydraulic fluids and motor oils. It provides anti-wear protection and is cost effective (Lubrizol, 2005). Hydraulic fluid and motor oil typically contain approximately 0.1% zinc by weight (1,000 mg/L) (Travell, 2003; Hackett, 1999). Although some hydraulic fluids without zinc are available, their acceptance is limited (Hackett, 1999). Sources of zinc from hydraulic fluid and motor oil in industrial stormwater runoff are leakages from heavy equipment and spills from uncontained storage areas.

Evidence of high levels of zinc in runoff associated with hydraulic fluid and motor oil leakage has been found in runoff data from log yards where heavy equipment is operated (Golding, 2004a). In that study, runoff from five of six log yards had higher concentrations of zinc than the benchmark of 117 µg/L. The runoff sampled was from areas that had no building roofs or minor roof areas compared with yard areas. Historically, high zinc concentrations have been found at logyards in Tacoma tide flats in which the ground was prepared with smelter slag (Norton and Johnson, 1985). The 2004 study included one logyard in the Tacoma tide flats; however, it was not affected as it had been cleaned up and paved.

Tire wear is also associated with zinc in stormwater runoff (EPA, 1995b). With a roadway traffic count of 2,000 cars per day (three vehicles per minute over an eight-hour workday), zinc in runoff has been estimated to be only 100 µg/L (horsleywitten.com, 2002). Because industrial sites experience less traffic over a broader area, tire wear can be assumed to be a minor source of zinc in this study and will be disregarded.

Zinc applied to roofs for moss control may be a source in stormwater runoff. This practice is more common with residential than industrial facility roofs.

The primary goals of this study are to identify potential sources of zinc in industrial stormwater runoff from the sites studied and to assess their relative contributions. Potential sources, including galvanized metals from roofs and other surfaces as well as hydraulic fluid from heavy equipment related activities, will be considered.

Project Description

The central focus of this study is the identification of sources of zinc responsible for high concentrations in self-reported data and Ecology data. This screening-level survey is intended to identify and characterize sources of zinc in stormwater runoff from industrial facilities, rather than to quantify typical levels.

Evaluations will be made and samples taken from sixteen facilities under the ISGP that have provided Ecology with self-reported data. The Stormwater Pollution Prevention Plan (SWPP) at each facility will be reviewed and a ground survey will be conducted to assess potential sources of zinc from roofs, heavy equipment, and other sources.

Facilities with buildings having galvanized roofs, as well as those with non-galvanized roofs, will be included in this project. Samples from both roof runoff and the major stormwater discharge from each facility will be collected as single grabs and analyzed for total recoverable zinc, dissolved zinc, total suspended solids (TSS), and hardness. Sampling at each site will take place during two periods of precipitation. For each facility, a grab sample of roof runoff as well as stormwater discharge will be collected during each of the two periods of precipitation.

Roof and facility areas will be estimated. From these estimates and zinc concentrations in roof runoff and stormwater discharge, the relative contribution of roof runoff and other sources of zinc will be assessed.

Zinc concentrations from Ecology grab samples of stormwater discharges will be compared with those self reported by each facility. Evaluations will be made of sampling sites used for collecting samples for self monitoring.

Study Area

The study area for this project is the Springbrook Creek/Mill Creek drainage area in Kent, Washington (Figure 1). This study area, approximately 10.8 square miles, was selected because of a high density of industrial facilities in the drainage. Also, a study of stormwater quality documented elevated zinc concentrations in Mill Creek (King County, 2004). Logistics favor a small study area to facilitate sampling during wet weather. Sixty-one facilities with Ecology permits under the ISGP are located within the study area.

Selection of Facilities to be Surveyed

Thirty-nine of the industrial facilities in the study area under the ISGP reported self-monitoring results during the first year that self monitoring was required. Of these, thirty-two facilities reported at least one result higher than the benchmark of 117 µg/L. Eight facilities with galvanized roofs and eight with non-galvanized roofs from among these thirty-two facilities will be selected at random for this survey. If needed, the population of facilities to be sampled will be expanded to include all sixty-one facilities under the ISGP within the study area.

Sites will be selected at random and telephone calls made to the facilities to explain the project, gain preliminary information on roof type, and select sites to be surveyed.

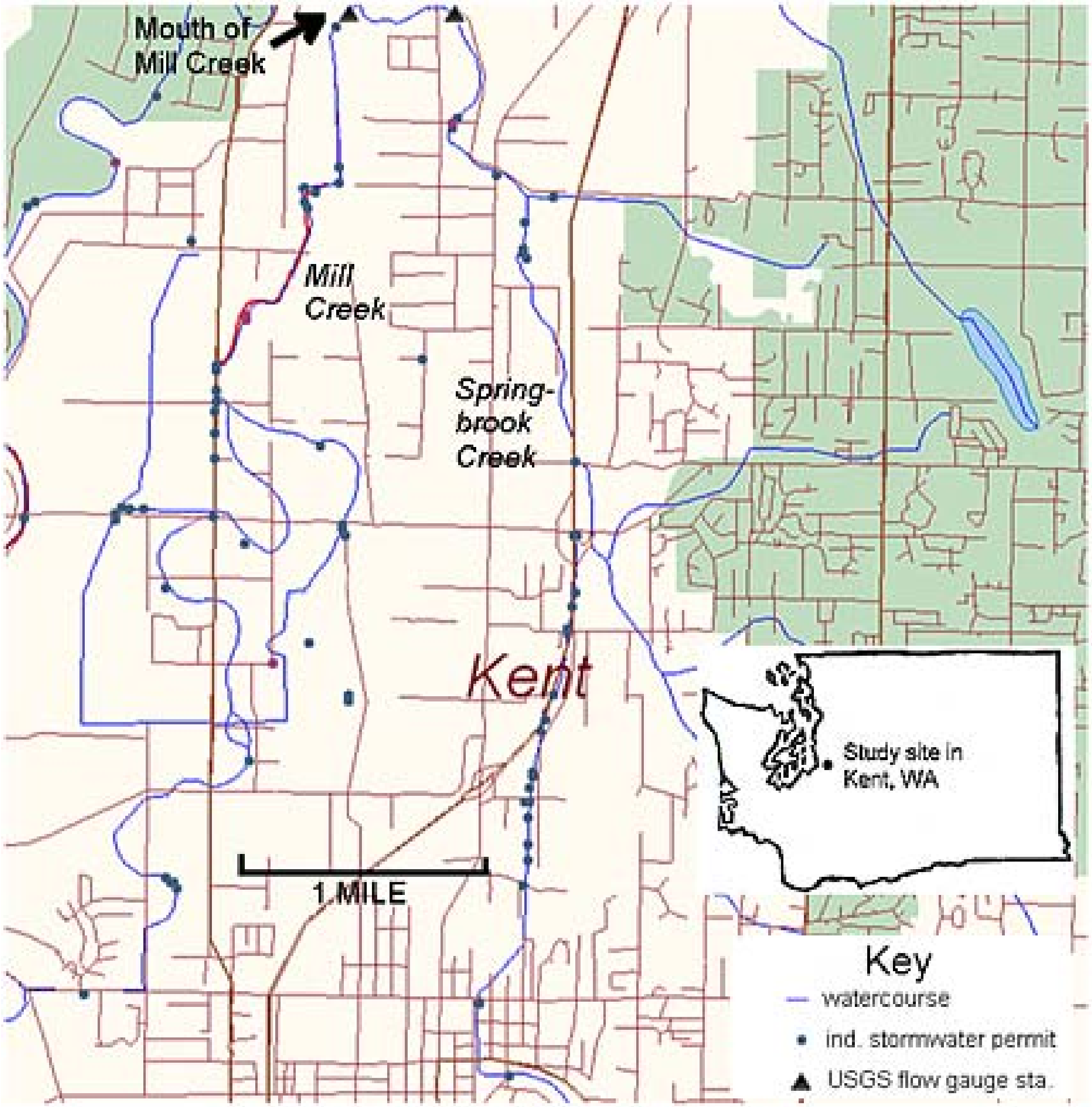

Figure 1 – Study Area

Project Objectives

- Inventory and assess potential sources of zinc in runoff from industrial facilities.
- Measure total and dissolved zinc levels in runoff from galvanized and non-galvanized roofs.
- Measure total and dissolved zinc levels in stormwater discharges from industrial facilities.
- Assess the relative contribution of sources of zinc in industrial stormwater.
- Evaluate sampling locations selected by each facility for self monitoring as well as results from self-reported monitoring.

Organization and Schedule

Organization

Environmental Assessment (EA) Program Project Manager – Steven Golding (360-407-6701)
Prepare Quality Assurance (QA) Project Plan, collect data, and prepare draft and final report.

EA Program Field Support – Brandi Lubliner (360-40-/7140)
Provide field support and collect samples.

WQ Client – Ed O'Brien (360-407-6438)
Provide input for QA Project Plan, review QA Project Plan, and review final report.

EA Program Toxics Studies Unit Supervisor – Dale Norton (360-407-6765)
Review QAPP and report.

Manchester Environmental Laboratory Director – Stuart Magoon (360-871-8801)
Manage laboratory analyses and QA.

Ecology Quality Assurance Officer – Cliff Kirchmer (360-407-6455)
Review QA Project Plan and advise on QA during implementation and assessment.

EA Program – Carolyn Lee (360-407-6430)
Enter EIM data.

Schedule

Field Work	March 2005 – May 31, 2005
Laboratory Analysis	March 2005 – June, 2005
Draft Investigative Report	October 2005
Final Investigative Report	December 2005

Cost Estimate

Total Analytical Cost = $13,168

Table 1 – Estimated Laboratory Costs

Parameter	# Samples	Cost Per Sample	Total Cost
Low-Level Zn (Dissolved)	64	$36 + $24 filter	$3840
Low-Level Zn (Dissolved), QA	12	$36 + $24 filter	$720
Low-Level Zn (Dissolved), Trnsfr Blank	2	$36 + $24 filter	$120
Low-Level Zn (Total Recoverable)	80	$36 + $28 prep	$5120
Low-level Zn (Total Recoverable), QA	15	$36 + $28 prep	$960
Low-level Zn (T. Recov), Trnsfr Blank	2	$36 + $28 prep	$128
TSS	64	$10	$640
TSS, QA	12	$10	$120
Hardness	64	$20	$1280
Hardess, QA	12	$20	$240
Total			$13,168

Costs include 50% discount for the Manchester Environmental Laboratory.

Quality Objectives

This project is a screening-level study. The intent is informative and descriptive and to provide an indication of typical zinc concentrations at industrial sites. Data quality should be consistent with making comparisons with benchmarks specified in the ISGP, as well as with acute water quality criteria. Acute and not chronic criteria are generally used when evaluating stormwater because periods of precipitation tend to be relatively short term as compared with conditions in receiving waters (O'Brien, 2005). Although water quality criteria apply directly only to receiving waters, they may be compared with runoff discharge concentrations. Lowest concentrations of interest are shown in Table 2.

Table 2. Measurement Quality Objectives

Parameter	Accuracy	Precision	Bias	Lowest Concentrations of Interest
	% Deviation from True Value	RSD	% of True Value	Concentration Units
Zn (Dissolved)	24	10	5	2.9 µg/L
Zn (Total Recoverable)	24	10	5	6 µg/L
Hardness	25	10	5	1 mg/L
TSS	25	10	5	1 mg/L

Because freshwater acute criteria apply to dissolved metals, lowest concentrations of interest for dissolved zinc are more stringent than for total recoverable. The acute criterion for dissolved zinc is hardness dependent. With a hardness of 20 mg/L, the minimum found in typical self-monitoring data under the ISGP, the acute criterion for dissolved zinc is 29µg/L. The corresponding required reporting limit for dissolved zinc is 2.9 µg/L (Table 2). This meets the rule of thumb that the lowest concentration of interest be ten times lower than the criterion of interest.

Required reporting limits for total recoverable zinc are somewhat higher, as they must only be sufficiently low for the anticipated minimum concentration of 30 µg/L. This is considerably more stringent than the benchmark of 117 µg/L. The corresponding required reporting limit is 6 µg/L, meeting a lesser standard of being five times lower than the benchmark criterion. This is adequate for this survey-level study.

Experimental Design

Facility site assessments and sampling will take place between February and May, 2005, during the winter/spring wet season. The criterion for collection of samples will be the occurrence of a stormwater discharge and roof runoff from a site

Stormwater discharges from each of the 16 sites, as well as roof runoff, will be sampled by grab sample. Analytes are total recoverable zinc, dissolved zinc, TSS, and hardness.

The rationale for selecting analytes is as follows: total recoverable zinc is the form analyzed by ISGP permittees for self reporting. TSS provides an indication of solids upon which metals, including zinc, can sorb. Dissolved zinc is the basis for comparisons with water quality standards. Water quality criteria for zinc are hardness dependent.

Self-reporting data indicate most zinc concentrations are in the range of 100-700 µg/L, a relatively narrow range for a stormwater pollutant constituent. Two sampling events at 16 facilities are considered sufficient to characterize sites and to determine the relative contribution of sources of zinc.

Table 3 presents a summary of planned samples. Grab samples for laboratory analysis will be taken at 16 sites. One grab sample each will be collected from the major stormwater discharge from each site as well as from roof runoff during two precipitation events. In addition, in the case that Ecology has selected the same sample site as has the facility, one grab sample will be collected. Table 3 shows the maximum number of potential samples at facility sample sites.

Table 3. Sampling Summary

Stormwater Discharge at Ecology Sample Site	Analyte			
	Zn, Total Recoverable	Zn, Dissolved	Hardness	TSS
Samples/Storm	16	16	16	16
# of Storms	2	2	2	2
Total # Samples	32	32	32	32
Total # Field Reps	6	6	6	6
Total # Transfer Blanks	1	--	--	--
Total # Filter Blanks	--	1	--	--

Stormwater Discharge at Facility Sample Site	Analyte			
	Zn, Total Recoverable	Zn, Dissolved	Hardness	TSS
Samples/Storm	16	--	--	--
# of Storms	1	--	--	--
Total # Samples	16	--	--	--
Total # Field Reps	3	--	--	--

Roof Runoff	Analyte			
	Zn, Total Recoverable	Zn, Dissolved	Hardness	TSS
Samples/Storm	16	16	16	16
# of Storms	2	2	2	2
Total # Samples	32	32	32	32
Total # Field Reps	6	6	6	6
Total # Transfer Blanks	1	--	--	--
Total # Filter Blanks	--	1	--	--

Each facility's SWPP will be reviewed to determine potential sources of zinc in runoff. Factors relating to roof runoff, as well as the extent of any hydraulic fluid/motor oil leakages and spills, will be noted on the field form in Appendix A. Other potential sources of zinc in runoff also will be noted.

Relative areas of roofs and drainage area of major discharges will be estimated from SWPP maps or on the ground. Relative flow between roofs and overall principal discharges will be estimated as proportionate to these relative areas. Estimates of the relative flow from roofs and overall discharge also will be made by catching the flow in a bucket, noting the flow over weirs, or through field observations.

From a mass balance applied to zinc levels from both the principal discharge and roofs, the level of zinc in runoff from all sources other than roofs will be estimated. On a study-wide basis, these comparisons will be used to evaluate the relative contribution of hydraulic fluid/motor oil to the principal discharges of the facilities in the study. To the extent that zinc levels in non-roof runoff do not correlate with the presence of hydraulic fluid/motor oil, the relative contribution of additional known, or unknown, sources of zinc will be estimated.

Discharge sampling points chosen by facility personnel for self monitoring will be evaluated and compared with those selected by Ecology for this study. Zinc concentrations from Ecology grab samples of the major discharge will be compared with those collected by Ecology at the sampling site chosen by the permittee. These zinc concentrations will also be compared with those self reported by each facility.

Criteria for Time of Sampling

In most parts of the United States, storm events are discrete, following periodic weather systems. For this reason, it is commonly considered appropriate to sample during individual storm events. In western Washington, however, wet-season storm events often overlap, so that long periods of precipitation, days and even weeks at a time, characterize the precipitation pattern. For this reason, sampling during the wet season in western Washington can take place during long, continuous or nearly continuous, periods of precipitation.

First flush or *first discharge* of stormwater after a period of dry weather is considered the worst case for pollutants such as hydraulic fluid or motor oil that accumulate on the ground. In this study, the emphasis will be on more typical conditions. The sampling conducted by industrial permittees which resulted in high zinc concentrations typically has taken place during extended wet-weather periods rather than *first flush* conditions.

When first introduced, the self-monitoring program for facilities under the ISGP called for sampling during the first hour of stormwater discharge from a facility. Practical considerations and a recent study of stormwater runoff from log yards--that found that the first hour of discharge is often not the critical case--have suggested that the requirement that sampling be conducted during the first hour of discharge should be relaxed (Golding, 2004a). The criteria for sampling will be the occurrence of precipitation during the wet season for which a facility is discharging runoff and while roof runoff is taking place.

Field Procedures

Field personnel will review the SWPP at each facility, identify the composition of building roofs, note roof area and facility area, and assess the intensity of heavy equipment traffic and evidence of hydraulic fluid and/or motor oil leakage.

Field personnel will fill out a copy of the field form that appears in Appendix A of this project plan. Information to be included on the field form includes roof composition and use of zinc for moss control, area of roofs and facility site, intensity of heavy equipment operation, and presence and extent of hydraulic fluid/motor oil on ground surfaces subject to runoff. Discharge flow rates will be estimated. Weather observations, and type of BMPs such as oil/water separators and their functionality, will also be noted. Weather conditions will be noted and latitude and longitude recorded as measured by a portable GPS receiver.

Sampling Procedures

Field personnel will identify the major discharge from each facility as defined by the ISGP. In cases where there is more than one discharge, this is the discharge with the greatest exposure to ground disturbance or equipment operations or the discharge believed to have the highest concentration of pollutants. A sampling site will be determined for each facility. This site will be selected at a distinct discharge point when possible where the discharge is flowing rapidly and well mixed. Discharge flow rates will be estimated. The location of each facility's sampling point will be determined with a portable GPS receiver. The same sampling site for each facility will be maintained throughout the study. The project manager will document the way in which the discharge and sampling point were determined.

The sampling site used by facility personnel for self reporting will be located and its appropriateness as a site representing worst-case assessed. The site will be evaluated in terms of representing the major discharge and localized sampling conditions such as degree of mixing and lack of entraining sediments into the sample.

Roof sampling locations will be at the exit of downspouts. Grab samples will be collected directly from a downspout discharge. In cases where there are roofs of unlike composition, a sample will be collected as a composite of the roofs.

Discharge runoff samples will be collected directly into sample containers using powder-free nitrile gloves or with the container attached to a pole. Sampling containers will be held with container openings facing upstream to prevent contamination during sampling.

Samples for dissolved zinc will be filtered in the field through pre-cleaned 0.45 µm Nalgene filter units (#450-0045, Type S). Filtering will take place within a non-running Ecology vehicle to prevent wind-entrained metals from entering the sample. Both dissolved metals and total recoverable metals samples will be preserved by acidifying in the field.

Samples will be given a field identification, tagged, and kept cool at 4ºC. Chain-of-custody procedures will be observed and samples delivered to the laboratory within the allowable holding times for each parameter.

A summary of parameters, collection containers, preservation, and holding times appears in Table 4.

Table 4. Sample Size, Container, Preservation, and Holding Time by Parameter

Parameter (Analyte)	Sample Size	Container	Preservation	Holding Time
Zn (Total Recov.)	500 mL	1 L HDPE	HNO_3 to pH<2	6 months
Zn (Dissolved)	500 mL	1 L HDPE	HNO_3 to pH<2	6 months
Hardness	100 mL	125 mL n/m poly	HNO_3 to pH<2	6 months
TSS	1000 mL	1L w/m poly	Cool to 4ºC	7 days

Analytical Procedures

The samples will be analyzed at the Manchester Environmental Laboratory (MEL). A summary of laboratory procedures for the analysis of project samples, anticipated ranges of results, and method reporting limits appears in Table 5. Anticipated results are based on self-reporting data from industrial facilities in the study area.

Table 5. Analytical Procedures and Anticipated Range of Results

Analyte	Sample Matrix	Samples [Number/ Arrival Date]	Anticipated Range of Results	Sample Prep Method	Analytical Method	Reporting Limit
Zn (Total Recoverable)	water	78/ Feb '05- May-05	30-800 µg/L	digested with mixture of nitric acid and hydrochloric acid	EPA 200.8, ICP-MS	5 µg/L
Zn (Dissolved)		78/ Feb '05- May-05	30-600 µg/L	filtered in field	EPA 200.8, ICP-MS	1.0 µg/L
Hardness	water	78/ Feb '05- May-05	20 -300 mg/L	--	Std Methods 2340B	1 mg/L
TSS	water	78/ Feb '05- May-05	1 – 800 mg/L	--	Std Methods 2540	1 mg/L

The required reporting limits listed in Table 2 for low-level metals analyses, hardness, and TSS are met by the method reporting limits of Table 5.

The MEL analytical reporting limit for dissolved zinc is 1.0 µg/L with the use of clean filters and standard HDPE collection bottles and 5 µg/L for total recoverable zinc with HDPE bottles (Momohara, 2005).

Quality Control Procedures

Field Quality Control

Samples will be collected with proper technique as described in the *Sampling Procedures* section of this project plan. Field replicates will be collected as shown in Table 3. Transfer blanks for metals will be prepared in the field by transferring deionized blank water to a sample container and submitting the blanks for analysis as samples. Deionized water will be filtered in the field and transferred to a sample container.

Twenty percent of samples will be field replicates for quality assurance. Six facilities will be selected at random for field replicate samples of roof runoff and stormwater discharge. Three facilities will be selected for field replicate samples at the sampling site location chosen by the permittee. Each replicate sample will be grabbed immediately following the initial sample. Two facilities will be selected for transfer blank and filter blank samples.

Lab Quality Control

One laboratory duplicate will be analyzed per 20 samples. Matrix Spike and Matrix Spike Duplicate (MS/MSD) samples for metals will be performed. The MS/MSDs will provide sufficient accuracy without the use of check standards (Momohara, 2005).

Data Reduction and Management Procedures

Data and information from the field form in Appendix A will be tabulated. Roof runoff concentrations and overall discharge runoff zinc concentrations will be compared for each facility. Zinc concentrations from each facility will be tabulated, compared, and expressed as ranges within confidence limits.

Data from each of two precipitation events at each site will be compared. These data will be supplemented by self-reporting data to gage the extent of temporal variability.

Information from the field form (Appendix A) showing the presence of hydraulic leaks on the ground will be used to rate sites on a scale of high, medium, and low. The relative contribution of roof runoff, hydraulic fluid leakage, as well as other potential sources of zinc in runoff will be assessed. This assessment will fulfill the central focus of this study: the identification of sources of zinc responsible for high concentrations in self-reporting data and Ecology data.

TSS concentrations will be compared with relative proportion of total zinc and dissolved zinc concentrations and relationships between TSS and zinc concentrations explored.

Data Verification and Validation

MEL will verify that the methods specified in the QA Project Plan were followed and that all calibrations and checks on quality control were performed. Data generated in the laboratory will be verified by Manchester Environmental Laboratory and a case narrative prepared and submitted to the project manager. The lab data report and case narrative will provide documentation of data verification. Data will be reviewed for reasonableness and consistency and validated by the project manager.

The project manager will confirm that the data meets the measurement quality objectives of the project. Results that do not meet quality assurance requirements will be labeled with appropriate qualifiers and an explanation will be provided in a quality assurance memorandum attached to the data package.

Data Quality Assessment

The project manager will examine the complete data package to determine whether the data can be used to meet the project's objectives. While expected concentrations of the runoff sampled are expected to be well above lowest concentrations of interest, data will be assessed in this regard to determine that measurement quality objectives have been met (Table 2). The adequacy of the quantity of the data collected to meet the principal project objective of assessing the relative contribution of sources of zinc will be evaluated. This will be a function of data variability within like-grouped stormwater runoff streams as compared with the variability between such streams.

Whether the objective of comparing Ecology results with self-reported results from facilities can be met will depend on variability of the data collected as well as that of self-monitoring results. Either significant agreement will be found, or, if variability is too great, then results will be found to be inconclusive.

Mean, median, and ranges within 90% confidence limits will be presented to summarize data in tabular form representing roof runoff as well as major runoff discharges from all facilities sampled. Correlations, if any, between field observations of identified zinc sources with results of laboratory analyses, will be determined.

The success of meeting project objectives, as described above, will determine if the sampling design has been adequate or if, and to what extent, future sampling efforts need be expanded.

The project manager will be responsible for analyzing the data as well as documenting such analyses and presenting them in a published final report.

Data Reporting

The final report will include a map of the study area showing approximate locations of sites included in the study. As described in *Data Reduction and Management Procedures* in this project plan, a summary of quantitative results will be presented. The presence of hydraulic fluid/motor oil will be tabulated and rated and a description of roof type and area relative to site size will be reported and used to assess the contribution of roofs, hydraulic fluid/motor oil leakage, and other potential sources of zinc in discharge runoff from industrial facilities under the ISGP.

Audits and Reports

The Manchester Environmental Laboratory participates in performance and system audits of their routine procedures. Results of these audits are available on request.

A draft investigative report will be completed on, or before, October 2005. The report will include the following:

- A site map showing sampling locations.
- Description of field and laboratory methods.
- Sample information (facility, dates, times, coordinates, etc.).
- Discussion of data quality and the significance of any problems encountered in the sampling or analysis.
- Analysis of relative contributions of roofs, hydraulic fluid leakage, and other potential sources of zinc in stormwater discharged from facilities under the ISGP.
- Comparisons of reported data with self-monitoring data.
- Summary of all laboratory analyses results. The summary will include descriptive statistics.

A final investigative report will be prepared on, or before, December 2005. Upon completion of the project, all project data will be entered into Ecology's EIM system. Public access to electronic versions of the data and report generated from this project will be available via Ecology's internet homepage (http://www.ecy.wa.gov).

Data Quality (Usability) Assessment

The project manager will examine the complete data package to determine whether the data meet required reporting limits. If portions of the data do not meet these limits, the data will be assessed in terms of its usability to characterize the monitored runoff. Any contamination found in transfer blanks will be considered in evaluating the usability of the data both for evaluating runoff samples and for the more stringent demands of meeting requirements to compare results with the acute water quality criterion for zinc.

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Appendix A
Field Form

General Information

Facility Name: ____

Date/Time: ______________________________

GPS: Lat: ______________________ Long: __________________________

1) Weather (e.g. dry, light rain, heavy rain, previous days of rain or dry):
____

2) Type of roof(s), galvanized or other (describe other material):
____ Moss control? ________________

3) Roof flat or sloped: ___________________________

4) Ask for SWPP and for all self-reporting data (over approximately 2 years since required, once per quarter).
Record data: ____
____

Permittee Sampling Point

1) Description and evaluation of permittee sampling point (includes description of drainage area sampled and potential zinc sources within drainage area. Appropriateness of sampling point, whether sampling point represents worst case, etc.). SWPP map can help with this:
____
____
____

Estimate or describe flow rate of discharge: _________________________________

Percent roof area contributing (from SWPP map or ground estimate – note which):
____

Percent ground area contributing (from SWPP map or ground estimate – note which):
____

Ground paved or unpaved? (Type of surface:) _________________________

2) Extent of leaking hydraulic fluid in sampling drainage area (estimate of ground area involved and/or qualitative estimate:
____
____
____

3) Oil/Water Separators upstream of sampling point. Presence and operating condition:
____

Ecology Sampling Points

Roof Runoff Sampling Point:
Estimate or describe discharge rate: ______________________________

Major Discharge Sampling Point:

1) Description of ECY sampling point (includes description of drainage area sampled and potential zinc sources within drainage area). SWPP map can help with this:

____

____

Estimate or describe flow rate of discharge: ______________________________

Percent roof area contributing (from SWPP map or ground estimate – note which):

____

Percent ground area contributing (from SWPP map or ground estimate – note which):

____

Ground paved or unpaved? (Type of surface):______________________________

2) Length of chain link fence in drainage area sampled: __________linear feet.

3) Oil/Water Separators upstream of sampling point. Presence and operating condition:

____

4) Suspected or known sources of zinc in runoff from the facility **other than** roofs or leaking hydraulic fluid/motor oil (describe nature and extent):

____

____

____

5) For ECY sampling point:

a) Ground wet or dry (from precipitation): ______________________________

b) Relative amount hydraulic fluid/motor oil on ground and description:______________________________

____

____

c) Area on ground covered with fluid (near heavy equipment and over site):______________________________

____

____

d) Condition of fluid storage, containment, leaks:

____

____

____

6) Type, number of heavy equipment:______________________________

7) Intensity of heavy equipment traffic (proportion of time operating, # operating):

____

____