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AquAeTer
optimizing resources | water, air, earth

The AquAeTerian

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Hot Topics

Dr. Wesley Eckenfelder has recently completed his memoirs about his life as an environmental pioneer. The book will be published this Fall with AuthorHouse. Dr. Eckenfelder is also working on an updated version of his Activated Sludge book with Joseph Cleary of Hydroqual. Dr. Jim Clarke participated in an International Atomic Energy Agency meeting in Cherbourg, France on Post-Closure Monitoring and Surveillance of Radioactive Waste Disposal Facilities. Steve Smith from our Helena, Montana office presented on "Life Cycle Analysis for Treated Wood Crossties" at the recent Railway Tie Association Conference in Baltimore.

The President's Corner

Tempus cogitare gravibus rebus in vitae
"A time to reflect on the important things in life"

AquAeTerians have been active in several areas over the last few months. Both the Brentwood office and the Centennial office have added new staff. Paul Marotta has added Lew Ditto, P.G., as a Technical Director for the Brentwood office. Lew formerly ran the RMT office in Nashville. Lew is off to a fast start working with the Inland Mill in New Johnsonville on their landfill monitoring. Chris Bolin has added Daniel Gezon, a Michigan Tech civil & environmental engineer, to assist on several landfill design projects for Waste Management and US Ecology.

Steve Wampler and Cathryn Stewart continue to help Waste Management and Waste Connections with routine groundwater and landfill gas monitoring and a variety of special projects at landfills in Colorado, Nebraska, New Mexico and Utah. Terra Plute, Sarah Gelsinger, and Laura Major have been assisting with the solid waste monitoring and reporting efforts. Steve and Chris Bolin are also working on an Alternative Landfill Cover design for a Waste Management landfill located in Utah. Chris Bolin and Steve Smith have completed the first of six Life Cycle Assessments for the Treated Wood Council, and have made presentations on the subject at several industry group meetings.

Paul Marotta and Wes Eckenfelder are assisting two pulp and paper mills on upgrades to their wastewater treatment facilities. Paul is assisting the IPC Riceboro Mill with start-up of their new treatment plan. Paul is also beginning a pilot plant test on a nitrification-denitrification wastewater with 500 mg/L ammonia loading. Chris Green and Chrisie Brown have been continuing work on an in-situ groundwater neutralization system in Alabama. They are also conducting a Risk-Based Corrective Action (RBCA) on a site in Florida.

John Michael Corn and his team of Mandy Klink, Miriam Sielbeck, and Trey Lewis have been assisting the GP Brewton Mill on their NPDES permitting. John Michael is working with the GP Monticello Mill on a TMDL for nutrients on the Pearl River. His team is also conducting a wasteload allocation study on the Tombigbee River for the GP Naheola Mill. Mandy and Miriam recently completed Clean-Hands/Dirty-Hands sampling for mercury at an industrial plant with excellent results. Pam Hoover and Todd Olsen have been working on air permitting for a wood treating facility in Kentucky and Amanda Safford has been working on air toxics issues in Alabama. Pam has also been preparing and reviewing stormwater pollution prevention plans including BMPs for a pulp and paper mill and two inorganic chemical plants.

SOD sampling for TMDL modeling

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Surface Water Sampling for Low-Level Mercury and Dioxins

AquAeTer was approached by a client to sample for mercury and dioxins at their industrial site. The client was renewing their NPDES permit and needed to determine background levels of these chemicals. Knowing that mercury and dioxins are pervasive in the environment, **AquAeTer** recommended and sampled several effluent discharge points using United States Environmental Protection Agency (USEPA) Method 1669, also known as "Clean-Hands/Dirty-Hands" sampling. The "Clean-Hands/Dirty-Hands" sampling protocol requires specific training for the sampling personnel and close attention to detail. Any hand placed causally in the dirt or on a non-clean surface could potentially contaminate the sample. Using the "Clean-Hands/Dirty-Hands" method, only low levels of mercury and non-detects for dioxins were identified in the wastewater effluents.

BACKGROUND

Water quality standards are continually revised, sometimes setting extremely low concentrations. The sampling and analytical methodologies employed to test for constituents at these low levels must be improved in order to meet these standards. As a result, laboratory methods are also improving to achieve reduced detectable limits for constituents. Historically, the dioxin standards were set lower than laboratory detection limits. As a result of improvements in analysis, some commercial laboratories can report to the water quality standards that were not previously achievable by commercial laboratories.

As with dioxin, mercury limits have also been set to minimal concentrations. The Great Lakes Initiative strives to reduce the amount of mercury released to the Great Lakes and has resulted in water quality standards for mercury in the low nanograms per liter (1.3 ng/L or 0.0000000013 grams per liter). The Federal water quality standard for mercury outside the Great Lakes basin is 12 ng/L.

With these minimal concentrations, it is important that the sampling team does not introduce contamination into the collected sample. Both mercury and dioxins are ubiquitous, that is they can be found nearly anywhere in our environment. Contamination of the sample, and thus a false positive, can come from atmospheric deposition, material transferred from clothing, and even from laboratory workers with dental amalgams who breathe on the sample. The Clean-Hands sampling methodology was developed to test for "low levels" of constituents. The method was designed to either eliminate or to account for ambient sources of contamination. It is easy to put on protective clothing, such as Tyvek and gloves, to eliminate transfer from the samplers. It is not easy to remove the potential from atmospheric deposition; therefore, field blanks are collected.

This method is not intended for sampling media which has concentrations of the constituent that can be detected using previous methods, such as the USEPA 200 series for metals. Therefore, if mercury levels are unknown, it may be a good idea to perform a mercury balance comparison prior to collecting samples.

SOURCES

Mercury is a naturally occurring element that can be found to varying degrees in the Earth's crust. Mercury can be recovered by mining mercury ores, or as a by-product of other processes, such as gold refining. Most of the mercury produced in the United States is from secondary sources, i.e., recycling. The USEPA states that the major anthropogenic sources of mercury releases are mining and smelting; industrial processes; combustion of fossil fuels; production of cement; medical and municipal waste incinerators; and industrial/commercial boilers. It is noted that mercury is present in most soils in the high nanograms per kilogram to micrograms per kilogram range. Vehicular traffic, both auto and truck, is the most common anthropogenic source for mercury considering the sheer number of cars and trucks.

The major identified sources of environmental releases for dioxins have been grouped into the following categories: 1) combustion sources, including incineration, fuel burning, and poorly or uncontrolled combustion sources, such as, the burning of trash in barrels; 2) metals smelting, refining and processing sources; 3) chemical manufacturing; 4) biological and photochemical processes; and 5) reservoir sources, which are media that have captured and/or stored previously formed dioxins with the potential for releasing dioxins in the future. Due to the wide range of combustion activity present in our everyday society, dioxins can be and are formed daily and are therefore pervasive in our environment. Like mercury sources, vehicular traffic is a common anthropogenic source for dioxin.

METHODOLOGY

During the sampling of the mill's effluent discharge points, Ms. Amanda Klink was designated as the "Dirty-Hands" sampler and Ms. Miriam Sielbeck was designated as the "Clean-Hands" sampler. The "Clean-Hands" performed operations involving contact with the sample bottle and transfer of the sample from the sample collection device to the sample bottle. The "Dirty-Hands" prepared the sample equipment (except the sample container itself), the operation of any machinery, and all other activities that did not require direct contact with the sample.

To prevent contamination of the samples during sampling procedures, **AquAeTer** personnel wore wind suits and two pairs of gloves, as per Method 1669. The wind suits were disposable Tyvek and a new suit was used at each sampling site. Personnel wore one pair of shoulder-length polyethylene

Clean-Hands/Dirty-Hands Sampling

inner gloves and one pair of latex outer gloves. In addition to the sampling gear, the samplers wore the following Personal Protection Equipment (PPE) while on site: hard hat, safety glasses, steel-toed boots, long pants, and an escape respirator.

Samples were collected using a peristaltic pump loaded with silicon tubing. During sampling, the peristaltic pump was handled only by the "Dirty-Hands" with latex gloves. The ends of the silicone tubing were handled only by the Clean-Hands personnel. Samples were taken in order from the site where the lowest mercury concentration was expected to the site where the highest mercury concentration was expected.

Gloves, storage bags, and Tyvek suits were used new without any additional cleaning. The sample bottles were cleaned by the laboratory prior to shipment. Silicon tubing, used to collect the sample, was cleaned by soaking it in 5% hydrochloric acid for eight hours. The tubing was dried with mercury-free nitrogen, as per the Method.

Mercury samples were taken in eight 40 mL glass VOA vials. Samples were not preserved in the field to minimize the potential for sample contamination, as suggested by the protocol. Dioxin samples were taken in two 1-L amber glass wide-mouth bottles. Sampling personnel shipped all collected samples in double-sealable clear plastic bags.

Equipment blanks were collected each day in the field laboratory prior to sampling. Field blanks were taken each day at a selected site prior to sampling the actual effluent. Laboratory-grade reagent water was used for the equipment and field blank samples. One field duplicate was taken each day of sampling.

RESULTS

Results of the "Clean-Hands/Dirty-Hands" sampling event determined that the site had levels of mercury that were less than the 12 nanograms per liter water quality standard required for their effluents. All dioxin levels were non-detect at detection limits in the low picograms per liter (10^{-12} grams/liter). The industrial site should not be limited in their NPDES-permitted effluent discharge to the river. Additionally, a mercury TMDL exists for downstream reaches of the receiving stream. The data can now be used to demonstrate that no mercury loadings are coming from the industrial site.

Miriam B. Sielbeck
aka "Clean-Hands Sampler"

Ms. Sielbeck received a B.S. in Geology from Vanderbilt University in 2004 and a M.S. in Earth Science from Dartmouth College in 2007. Her research included the transfer of solutes between porous streambeds and channel flow and rainsplash transport of wet and dry sand particles. Since joining **AquAeTer** in 2007, Ms. Sielbeck has assisted with a variety of projects including Phase I and Phase II Environmental Site Assessments, NEPA Screenings, Environmental Litigation Support, Water Quality Studies, and Soil and Groundwater Remediation. Ms. Sielbeck has also been assisting with several Water Quality Modeling projects and Life Cycle Assessments.

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Amanda J. Klink
aka "Dirty-Hands Sampler"

Ms. Klink graduated from San Diego State University in 2004 with a B.S. in Biology. She has been with **AquAeTer** three years and has worked as project manager for Phase I and II Environmental Site Assessments, and NEPA Screening and Reporting. She has also assisted with water quality fieldwork, soil cataloging and sampling, habitat and species studies, and wetlands delineations. Ms. Klink has been involved in oversight of Ground Penetrating Radar (GPR) Surveys for several sites and a wastewater treatment system. She also has experience with writing and preparing National Pollution Discharge Elimination System (NPDES) permits, Spill Prevention Control and Countermeasure (SPCC) plans, and Storm Water Pollution Prevention Plans (SWPPP).

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PARTNERING TO ACHIEVE BEST RESULTS

Joseph Cleary of HydroQual Inc. selected **AquAeTer**, Inc. as a teaming partner for wastewater treatment and process technical support for projects involving two South American pulp and paper mills. Wes Eckenfelder and Paul Marotta, both of **AquAeTer**, participated as technical experts on the team. Wes's 60+ years of industrial wastewater treatment experience and Paul's 20+ years of industrial pulp and paper experience added a broad experienced-based skill set to the HydroQual team.

The project objective was to develop a set of recommendations for upgrading the existing wastewater treatment system to meet current and future production goals. All recommendations were required to be based on engineering calculations, and included budgeting cost estimates within a two-month time frame. Joe Cleary and Hydroqual provided first-hand reconnaissance and technical data to the team in order to initiate analysis of the issues facing the facilities. The story of these pulp and paper mills is very similar to many in the United States today: wastewater facilities initially constructed with more than adequate capacity are nearing the end of their design life due to wastewater solids deposition. The biological wastewater treatment process is very flexible and can typically tolerate process upsets and periodic overloads. Over time, however, their ability to metabolize the additional load is decreased by the reduction in active treatment volume primarily from the deposition of solids. One obvious and seemingly straightforward resolution to this issue is to remove the solids and return the system to its original condition. As with most things, there are several options. But, the integration of experienced-based creativity into the solution typically provides the best option.

The team quickly analyzed the available data, both current and historic, and determined that analyzing the current wastewater treatment system's performance using mathematical models would not be beneficial due to the heavy solids deposition in the systems. Rather, the team reviewed the current process data and developed four primary upgrade scenarios ranging from cleaning out the solids in the existing system to return it to its initial design capacity, to abandoning the current system and constructing a totally new wastewater treatment facility. It turned out that the recommended alternative was neither of these options. After the team conducted a closer analysis of the data further up into the pulp and paper mill processes, opportunities were identified to apply alternative technologies on separate wastewater streams. The application of dissolved air flotation and anaerobic wastewater treatment technologies to a segregated wastewater stream provided a significant economic incentive. Installation of a new activated sludge wastewater treatment system was estimated to cost $11MM per facility. The recommended upgrade which included the "upstream" wastewater treatment system upgrades was estimated to cost $7MM, with an annual energy savings of $2MM from the anaerobically generated methane. The recommended approach saved 40% initial capital cost, and generated significant annual energy savings, demonstrating that the best team provides the most effective results.

For more information about our wastewater system evaluations, you can visit our website at www.aquaeter.com or contact Paul Marotta at (615) 373-8532 or pmarotta@aquaeter.com.

Typical Biological Pulp and Paper Mill Wastewater Treatment System Incorporating Aerated Settling Basin