Environmental Compliance

updated June 2011

Overview

ecomaine serves the solid waste needs of 41 municipalities in Southern Maine utilizing a waste-to-energy power plant, single-sort recycling center and a 250 acre landfill/ashfill. The **ecomaine** waste-to-energy (WTE) facility is licensed by the Maine Department of Environmental Protection (MDEP) to process 550 tons per day of municipal solid waste (MSW). In 2010, **ecomaine** handled over 170,000 tons of MSW which was converted into 105,000 megawatts of electricity - enough to power 15,000 homes. The recycling center is the State of Maine's only single-stream system and in 2010 over 35,000 tons of recycled material were sorted. WTE reduces the volume of MSW by 90% which means the remaining 10% ash is sent to the ashfill which translates into the longevity of the landfill well beyond the year 2030. **ecomaine** monitors air emission releases and adjacent waters to assure that none of its facility operations adversely impact the surrounding environment.

Air Quality

ecomaine is particularly focused on air emissions at the WTE from the combustion process and continuously monitors criteria pollutants carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO_2) and particulate known as opacity. Each year, **ecomaine** also measures levels of hydrogen chloride (HCl), less than 10 microns of particulate matter (PM), ammonia (NH_3), multiple metals such as cadmium (Cd), lead (Pb), mercury (Hg) and small amounts of dioxin/furans. **ecomaine** maintains state-of-the-art air pollution control technology (APCT) for increased removal efficiency of pollutants from emissions in compliance with air license limits. Two APCT systems have been installed for both municipal waste combustors at **ecomaine** and include:

- Electrostatic precipitators (ESP) entail five ionized fields which in conjunction with precipitator optimization systems (POS) control the electric voltage necessary to eliminate 99.9% of particulate from emissions and 99% removal of metals such as cadmium and lead.
- Activated carbon injection system captures particles containing mercury and dioxin/furan which are removed by **ecomaine**'s electrostatic precipitators and removed from the stack gas
- Spray dryer absorbers (SDA) which include lime slurry scrubbers are extremely effective to neutralize 80% of sulfur dioxide and 95% of hydrogen chloride from acid flue gases (see Lime scrubber system in photo below)
- Selective non-catalytic reduction (SNCR) system reduces nitrogen oxide emissions by 35-40% by injecting urea into the boiler and breaking down NOx into nitrogen, carbon dioxide and water.

Operation of the **ecomaine** waste-to-energy facility is governed by Federal and State air quality requirements. The WTE is defined as a major source of air pollutants requiring a Title V Operating Permit which is regulated by the Environmental Protection Agency (EPA) as 40CFR Part 70 Operating Permit and governed by the Maine Department of Environmental Protection (MDEP) in Chapter 140 rules. The 1990 amendments to the Clean Air Act (CAA) require stationary sources, or sources that stay in one place, such as power plants, paper mills, WTE/incinerators, and gas stations to improve air quality through the Title V program. The stationary sources, such as **ecomaine**'s WTE power plant, are mandated to obtain Title V permits to help find a solution to reduce air pollution by identifying the release of specific pollutants and install best practical technology (BPT) to control and monitor air emissions.

The EPA identified a category of widely distributed pollutants known as ‘criteria pollutants’ that may cause health and environmental effects, as well as reduce visibility and property damage. **ecomaine**’s permit specifies monitoring and testing requirements for criteria pollutants CO, NOx, SO_2 and opacity. Complete combustion results in low CO levels and SNCR reduces levels of NOx. Acid flue gases such as SO_2 are neutralized by the lime slurry scrubber system and particulates associated with opacity are removed by the ESP. The emissions of criteria pollutants are monitored through a system of continuous monitors on each flue and **ecomaine** ensures that emissions are monitored at least 90% of the time for CO, NOx and SO_2 and 95% of the time for opacity. Both A-Boiler & B-Boiler trains are equipped with redundant primary and back-up continuous emission monitoring systems (CEMS); primary continuous opacity monitoring system (COMS); and primary continuous emission rate monitoring system (CERMS). In conformance with its Title V air permit, **ecomaine** also performs annual stack testing to measure releases of HCl, PM, NH_3, Cd, Pb, Hg and dioxin/furans.

Continuous Emissions Monitoring for Criteria Pollutants

Carbon Monoxide (CO)

ecomaine monitors carbon monoxide (CO) both for environmental and process control reasons. The lower the CO emissions, the more complete the combustion process and the less likely that other products of incomplete combustion will form. CO is produced by the incomplete combustion of fuels containing carbon. CO can contribute to the deterioration of the boiler tubes by corrosion. Complete combustion requires three important ingredients: heat, fuel and oxygen where equal amounts of each are necessary for combustion and if any part of the triad is removed the result will extinguish the fire and risk incomplete ignition. It is important to maintain good combustion with proper fuel mixing of MSW and combustion air feeding to create steam flow – steam is crucial to turning the turbine and generating electricity.

ecomaine has a carbon monoxide limit of 100 ppm (parts per million) over a four-hour block average and in 2010 it averaged only 29 ppm of CO. **ecomaine** was in compliance with the CO limit for all but 20 hours in 2010 significantly down from 66 hours noted in 2005. Carbon monoxide excursions are primarily due to incomplete combustion associated with boiler startup and shutdown incidents. In 2006 **ecomaine** installed flow monitors to measure mass emission rates with a CO mass emission rate limit of 16.64 lbs/hr for 4-hour block and in 2010 the average mass emission rate for CO was 2.5 lbs/hr.

Nitrogen Oxides (NOx)

Nitrogen oxides (NOx) are formed during the combustion process of either nitrogen-bearing material in the fuel itself or from the reaction of nitrogen in the combustion air with excess oxygen in the boiler (thermal NOx). The primary environmental impact of NOx, is as a precursor to the formation of photochemical smog, or ground level ozone.

At **ecomaine** nitrogen oxide is controlled by a selective non-catalytic reduction (SNCR) system which was installed in early 2000. SNCR utilizes the reagent urea which is most effective at high temperature and is injected directly above the combustion zone, reducing NOx emissions by 40-50%. NOx is removed through the following reaction:
CO(NH2)2 + 2NO + ½ O2 > 2N2 + CO2 + H2O resulting in nitrogen, carbon dioxide and water.

ecomaine’s NOx limit is 180 ppm over a 24-hour average and in 2010 the annual average was 136 ppm compared to 150 ppm in 2005. There have been no violations related to emissions of nitrogen oxides since 1999. In 2006 **ecomaine** installed flow monitors to measure mass emission rates with a limit for a 24-hour period of 49.22 lbs/hr. In 2010 the average mass emission rate for NOx was 21 lbs/hr.

Sulfur Dioxides (SO_2)

Sulfur dioxide (SO_2) is formed from the combustion of sulfur found in the waste stream such as in plastics and gypsum board. SO_2 is a pollutant of concern because it may contribute to the formation of acid deposition if the sulfur dioxide mixes with moisture in the atmosphere. Removal of acid by-products (SO_2 HCl) is accomplished with a dry scrubber into which an alkaline lime slurry is injected to neutralize the acid flue gas. **ecomaine** has SO_2 monitors located at the inlets to the air pollution control system and at the outlets after the flue gas has been cleaned by the dry scrubber system, thus **ecomaine** is able to calculate the percent of SO_2 removed from the emissions. Part of **ecomaine**’s regulatory limit is to demonstrate a removal efficiency rate of least 80% as well as a 24-hour daily geometric average of 29 ppm SO_2. Average emissions from the **ecomaine** unit during 2010 were 1.9 ppm as compared to 6.4 ppm in 2005 and **ecomaine** continues to remove more than 80% of the SO_2 averaging 94% removal efficiency in 2010. In 2006 **ecomaine** installed flow monitors to measure mass emission rates with a limit for a 24-hour period of 11.04 lbs/hr. In 2010 the average mass emission rate for SO_2 was 2.0 lbs/hr.

Opacity

ecomaine's visible emission limit for opacity is 10% over a 6-minute block average. According to the EPA, Opacity is the amount of light which is blocked by a medium represented as a percentage. For example, a reading of 0% means that all light can pass through a medium, and an opacity of 100% means that no light can pass through. EPA has recognized the significance of Opacity because it reflects the concentration of pollutants released from a stack. The more particles emitted from a stack, the more light will be blocked, and a higher opacity percentage will be recorded. Opacity is an indirect measure of particulate matter and PM is regulated for allowable mass of emissions that exit the stack (ie: # pounds of particulate matter per hour). Particulate matter is aesthetically unpleasing (smoke) and small particles (<10 microns) may result in respiratory problems when inhaled. **ecomaine** measures opacity every minute through instrumentation known as COMS (continuous opacity monitoring system). The mass of emissions of particulate matter is measured through planned annual stack tests. **ecomaine**'s environmental staff maintain certification for visible emissions in conformance with EPA Method 9 for human observance of stack smoke.

ecomaine operates an electrostatic precipitator (ESP) which removes over 99% of the particulate matter generated by the combustion process. In 2010, **ecomaine** averaged 0.5% opacity as compared to the 2005 average of 2% opacity from the combustion process. **ecomaine** was in compliance with the opacity limit for all but 60 minutes in 2010 for both boilers combined or just 1 hour in 17,520 (8760 hours x 2) operating hours.

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Stack Emissions Testing

Annually, **ecomaine** performs compliance stack tests to evaluate the emissions from the WTE combustion processes, as required in the Title V air license. The EPA mandates the use of specific protocols to conduct the stack test. Method 3 is used for gas analysis to determine dry molecular weight while Method 5 measures Particulate Matter; Method 23 – dioxin/furan; Method 26A - Hydrogen Chloride; Conditional Test Method (CTM) 027 – Ammonia and Method 29 - Multiple Metals (Cd, Pb, Hg). Annual emission reports are submitted to the Maine Department of Environmental Protection (MDEP).

In 2007, MDEP reviewed Chapter 121 rules for stack emissions and established more stringent limits for PM, D/F, Cd and Pb. In 2009, the Maine Legislature revised its Statute for mercury releases, developing a lower limit of 25 pounds per year or 90% removal efficiency between inlet and outlet sample collection points. The 90% reduction is the most rigorous limit in the US. More on **ecomaine**'s performance is described in the Mercury section below. After the brief summaries of each parameter, a Table with recent stack test data is also presented.

Particulate Matter

The **ecomaine** emission limit for particulate matter is 24 mg/dscm for each boiler while the former limit was 25 mg/dscm per unit. Method 5 measures PM and includes three 60-minute tests. The results from the most recent stack test in November 2010 for A-Boiler was 3.5 mg/dscm and B-Boiler was 3.8 mg/dscm. **ecomaine** conducted an extra in-house diagnostic test at the inlets and outlets which revealed a removal efficiency of 99.9% - a very impressive reduction across the air pollution control system.

Dioxins and Furans (D/F)

Dioxin or its formal name polychlorinated dibenzo-p-dioxins (PCDD) and furan or polychlorinated dibenzofurans (PCDF) are two hazardous organic substance compounds that can form under conditions of incomplete combustion – thus it is extremely important for the operation of the WTE to achieve complete combustion to inhibit the formation of D/F. **ecomaine** plant operators are trained to maintain complete combustion processes which not only destroy D/F but garner low CO levels and efficient operating conditions.

The emission limit for dioxin and furan was formerly 60 ng/dscm but is currently 25 ng/dscm corrected to 7% oxygen per unit. Stack test Method 23 entails three tests of 4-hrs each and the average of the most recent D/F results show A-Boiler at 0.5 ng/dscm and B-Boiler of 1.2 ng/dscm. The emission results are far below the regulatory limit of 25 ng/dscm. During the stack test for D/F while carbon injection rates are at 20 lbs/hr, **ecomaine** also establishes the annual limits for steam flow (lbs/hr) and ESP temperatures (F°) which are important to assure the destruction and removal of D/F.

Hydrogen Chloride

US EPA Method 26A for hydrogen chloride includes 3x runs of 1-hr each and the emission limit for HCl is 29 ppm at 7% oxygen, or a 95% reduction from samples collected prior to the air pollution control devices and after. The dry scrubber is designed to remove 95% or more of hydrogen chloride generated by the combustion process. The recent November 2010 stack test results showed the dry scrubber technology reduced HCl by 99% in A-Boiler with 11.6 ppm concentration and a 99.5% reduction of HCl emissions in B-Boiler with a concentration of 3.7 ppm.

Ammonia

Ammonia is a volatile chemical that has the potential to form chlorides if it fails to react with urea as part of the SNCR process to remove NOx. Ammonia stack emissions are analyzed using Conditional Test Method (CTM) 027 which entails three 1-hr tests averaged for one result. The NH_3 emission limit is 10 ppm corrected to 7% oxygen. The most recent 2010 stack test data showed an average of 1.5 ppm for A-Boiler and 2.7 ppm for B-Boiler

Lead

US EPA Method 29 for multiple methods, which applies to Pb, Cd and Hg, entails three 2-hr tests with the average of the tests generated for the final value. The lead emission limit was formerly 440 ug/dscm and currently is 400 ug/dscm corrected to 7% oxygen. The most recent 2010 stack test data for **ecomaine** shows a lead average of 40 ug/dscm for A-Boiler and 60 ug/dscm for B-Boiler.

Cadmium

The test for cadmium is also Method 29 with 3x 120-mins tests. The emission limit was previously 40 ug/dscm and is currently 35 ug/dscm, corrected to 7% oxygen. The average of **ecomaine**'s recent test for cadmium in 2010 for A-Boiler was 6 ug/dscm and B-Boiler was also 6 ug/dscm.

Mercury

MDEP Chapter 121 limit for mercury emissions is 28 ug/dscm (7%O_2) or demonstrating a removal efficiency of 85% between the inlet and outlet sampling ports. US EPA Method 29 test for multiple metals is also the protocol for Hg, including three two hour tests. The test results for **ecomaine** in 2010 for A-Boiler was 2 ug/dscm with 97% removal efficiency and for the B-Boiler was 6 ug/dscm with 94% reduction.

Beyond the MDEP Ch121 limits for Mercury noted above, the Legislature of the State of Maine established public law 38 MRSA §585-B which articulates a limit for the release of Hg for both boilers combined of 25 lbs/yr or 90% removal efficiency. Sub-section 5 mandated the following standards for mercury releases beginning January 1, 2000 of100 pounds per year; 50 lbs/yr after January 1, 2004; 35 lbs/yr after January 1, 2007; and the current rule as of January 1, 2010 of 25 lbs/yr of total facility Hg or 90% reduction. From both boilers combined in 2010, **ecomaine** released 7.8 lbs of mercury and demonstrated 94% removal efficiency across the air pollution control system. Below is a summary of emission results from the November 2010 stack test.

	PM	D/F	HCl	NH3	Pb	Cd	Hg MDEP		Hg Statute
A-Boiler	3.5 mg/dscm	0.5 ng/dscm	3.5 mg/dscm	1.5 ppm	40 µg/dscm	6 µg/dscm	2 µg/dscm 97.0% redctn	A-Boiler	2.13 lbs/yr 96.1% redctn
B-Boiler	3.8 mg/dscm	1.2 ng/dscm	3.8 mg/dscm	2.7 ppm	60 µg/dscm	6 µg/dscm	6 µg/dscm 94.4% redctn	B-Boiler	5.65 lbs/yr 92.3% redctn
								A&B Boilers	7.8 lbs/yr 94% redctn
Limit	24	25	24	10 ppm	400	35	28 µg/dscm	Limit	25 lbs/yr

MDEP Ch121	mg/dscm	ng/dscm (w/ ESP)	mg/dscm		µg/dscm	µg/dscm	or 85% reduction	38 MRSA §585-B	Combined units or 90% reduction

Because of a commitment toward continuous improvement, in 2010, **ecomaine** updated its ESP control system by installing a Precipitator Optimization System (POS). During episodes of particulate loading, the POS maximizes power (kilowatts) applied to collect and remove the light particulate, known as 'flyash,' onto ionized ESP curtains. Particulate matter is directly correlated to heavy metals, and since the installation of POS, **ecomaine** has seen impressive removal of Cd, Pb and Hg from the flue emissions. Flyash is the deleterious residue from cleaned flue gas and represents 10% of the end product "combined ash." The other 90% is the bottom ash collected from beneath the boiler grates. The total ash by-product is tested 16x per year as part of the ash characterization sampling program described in the next section.

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Ash Characterization

Visualizing **ecomaine**'s municipal waste combustor (MWC) is a much larger version of your home woodstove with its stack pipe to release flue gas and the residual ash collected beneath the grates. In the MWC, the bottom ash is comprised of non-combustible material that remain in the furnace after combustion. It is a residue by-product of the combustion process which flows through the boilers below the grates into the quench tank and through the ash extractor onto a vibrating conveyor. Fly ash is the finer, lighter residual material that is removed from the air pollution control systems and collected in ESP hoppers and conveyed to a mixer-conditioner for treatment before combining with the bottom ash on an incline conveyor.

Most metals remain in the bottom ash, which is removed by a ferrous recovery magnet just before the ash is placed into **ecomaine** dump trucks. Fly ash is collected from flue gas which is injected with carbon and lime slurry spray to remove acids. The spray cools the gas, causing volatile compounds and metals to condense. The fine surface of the fly ash provides a platform for the adsorption of heavy metals and dioxin/furan compounds. The quantity of fly ash is low compared to the bottom ash, but the concentration of the adsorbed pollutants in it can be very high. The treated ash streams are joined to form a combined ash in a ratio of 90% bottom ash and 10% fly ash which is taken by **ecomaine** trucks and transported for disposal at **ecomaine**'s own landfill/ashfill facility 2.5 miles from the waste-to-energy plant.

The characterization of ash is subject to specific EPA ash testing protocols mandated in **ecomaine**'s site license in compliance with MDEP Chapters 400 & 403 of Maine Solid Waste Rules. The ash sampling program requires samples collected every 4-hrs for four weeks conducted over four quarters per year. This translates into 672 sample collection events. The primary purpose of the ash testing program is to confirm **ecomaine**'s combined ash does not contain elevated amounts of RCRA (Resource Conservation & Recovery Act) hazardous material as defined in MDEP Ch 850 hazardous waste regulations.

ecomaine performs a rigorous ash monitoring regime and the compliance threshold for metal analyses uses Toxicity Characteristic Leaching Procedure (TCLP). Examples of TCLP metals include: arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver. Several statistical tests are performed (ie: student t-tests, arcsine transform for lead, standard deviations, etc) of significance is the long-term statistical summary for the TCLP metal results. **ecomaine**'s long-term average concentration has never exceeded the regulatory threshold for TCLP metals, and for 85 consecutive quarters, **ecomaine** continues to record heavy metal levels below the TCLP limits, therefore characterizing **ecomaine's** combined ash as a non-hazardous material or 'special waste' permitted for disposal at **ecomaine**'s own landfill/ashfill.

Although ash generation from the combustion process also produce environmental impacts, ashfills have a distinct advantage over traditional raw MSW landfills. Ash occupies just one-tenth the space needed for burial and is the difference between filling a 300-acre site to a depth of 15 feet and filling a 30-acre site to a depth of 15 feet deep. In addition, weight is reduced by 75% due to the removal of ferrous metals and the dryer ash from the mixer/conditioner. The total storage capacity of **ecomaine**'s landfill/ashfill is over two million tons. This figure is based on the storage occupied by the closed balefill (the area that accepted MSW from mid-1970's until 1988) and the areas of the ashfill and ashfill expansion (first used 1988 through present day).   Each year **ecomaine** determines the air space available and remaining capacity of the ashfill in a document called the Public Benefit Determination which is submitted to the MDEP. To date, the ashfill has been used for 23 years and has more than 23 years remaining. At the end of 2010, over one million tons of capacity remain which represents 55% available space through the year 2038. Below is a picture of the closed ‘balefill’ whose closure permit was granted in 1998 and today is a viable and stable site home to many species of wildlife. (see Closed balefill in photo below)

Conversion of MSW into an inert ash, through the **ecomaine** waste-to-energy plant, eliminates nuisance odors and vectors, eliminates the MSW decomposition process and associated methane (CH_4), thus eliminating greenhouse gases that degrade the environment and contribute to global warming. If not processed through the WTE plant, a decomposition byproduct could yield acidic, heavy metal-bearing leachate. Leachate is contaminated water that has passed through solid waste or ash that could pollute groundwater and surface water. The ash from waste-to-energy processing contain high pH due to the lime slurry and the alkaline leachate results in insoluble metals that are not released to leachate. Leachate from MSW landfills is acidic and soluble, releasing metals into it. In WTE ash, however, the heavy metals are stabilized into compounds such as hydroxides and sulfates that remain with the ash and pose minimal risk of release into the environment.

Waste-to-energy plants address consumption practices of a population longer into the future and WTE processing of MSW stabilizes the waste for efficient and secure disposal at landfill/ashfills. Ash generates less leachate due to the smaller volume of waste exposed to precipitation and provides for a sustainable future by using less land area and producing less pollutants. These are just some of the advantages of processing MSW through a waste-to-energy facility and disposing the residual at an ashfill as compared to storing raw MSW at a landfill where no value is derived from the waste. (Please see "Landfill/Ashfill" section of this web-site for more information).

To demonstrate visually the small amount of residue resulting from processing 1 ton of MSW at a WTE when compared to storing 1 ton raw MSW at a landfill, the photo below reinforces the benefit of the 90% volume reduction of MSW and the longevity of **ecomaine**’s landfill/ashfill capacity. [see Photo below, Reference from: Lancaster County Solid Waste District , PA]

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Water Quality

In accordance with requirements from the Maine Department of Environmental Protection (MDEP) **ecomaine** rigorously evaluates the water quality of streams surrounding its facilities and consistently demonstrates that **ecomaine** operations do not adversely impact surrounding surface waters.

STORMWATER:

In conformance with MDEP Chapter 500 rules, **ecomaine** maintains a Stormwater Pollution Prevention Plan (SWPPP) to limit adverse impacts from the operations of the Waste-to-Energy and Recycling facilities on the surrounding environment. **ecomaine** holds a Multi-Sector General Permit (MSGP) for stormwater discharge associated with industrial activities for the WTE/Recycling centers and for the landfill/ashfill. Also, the landfill/ashfill has a National Pollutant Discharge Elimination Permit (NPDES) as part of the Long Creek General Permit for stormwater associated with non-industrial activities.

To limit water runoff from carrying pollutants to adjacent streams from impervious parking lots and paved areas, **ecomaine** has a series of Best Management Practices (BMPs) in place at its Blueberry Road facilities. For example, stormwater is collected in catch basins and transported in a system of sub-surface pipes to the sedimentation pond. The natural processes of the sedimentation pond reduce contaminant concentrations by allowing particles to settle-out as opposed to float uncontrollably through the outflow. Other BMPs include 'good house- keeping' through daily road sweeping to collect debris, routine litter patrols, installation of a concrete pad and sump to collect liquids/drippage from roll-off trucks and covering materials to limit dispersal of loose sediment from entering surrounding water bodies. Behind the **ecomaine** facilities, a small un-named tributary passes by the outfall of **ecomaine**'s sedimentation pond and meanders through aquatic vegetation that allow biodegradation and bioremediation to purify water discharges. The tributary flows into the Stroudwater River, and eventually enters the Fore River and Casco Bay.

ecomaine collects stormwater samples for visual evaluation quarterly from two locations. One location is the sedimentation pond outfall and the other is in the un-named tributary. The sites were selected because they represent the operations from the Recycling Center and WTE Plant. In conformance with the MSGP, specific conditions must be met to fulfill the stormwater protocol. For example, the stormwater discharge must be sampled at least 72 hours after a rainfall event of 0.1 inches or more of precipitation. Examination of the water must occur within 30 minutes from collection but no more than 1-hour. MDEP Chapter 500 requires the use of Imhoff cones to collect and view the sample. The following parameters must be evaluated: color/clarity, odor, floating solids, settled solids, suspended solids, presence of foam or oil sheen. All records of quarterly evaluations are kept on file at **ecomaine.** (see photo below illustrating use of the Imhoff cones).

SURFACEWATER:

ecomaine is fortunate to be in the watershed of the Stroudwater River and to have a tributary which attracts wildlife and lush vegetation. The **ecomaine** properties are located at Latitude 43°39' and Longitude 70°20' on the Portland West quadrangle geologic map prepared by the US Geological Survey. Surface water monitoring is required under the original WTE facility license. Three times per year, **ecomaine** collects and analyzes surface water samples from five locations for analysis of 36 parameters and submits these results to the Maine Department of Environmental Protection. The sampling locations represent surface water conditions upstream of and downstream from the **ecomaine** site.

The water bodies that surround **ecomaine** are monitored to confirm that neither the activities at the Recycling center nor WTE are adversely contributing pollutants to them. Of note, are the strategic locations of the sampling sites. The sampling locations were specifically selected to trace pollutants - if they exist - back to the activities of **ecomaine**. For example, the five sampling locations represent surface water conditions upstream and downstream from the **ecomaine** facilities with the upstream locations acting as a 'control' while the downstream sites reflect all facility operation inputs.

At the time of sample collection, **ecomaine** collects the following measurements of the water sample: temperature, potential of hydrogen (pH), dissolved oxygen, specific conductivity, turbidity and oxygen-reduction potential. A certified lab performs the following analyses: total metals, chemical oxygen demand (COD), phosphorus, hexavalent chromium (Cr^{+6}), total organic carbon (TOC), oil & grease (hexane extractable), total dissolved solids (TDS), total suspended solids (TSS), Nitrite (NO_2), nitrate (NO_3) and sulfate (SO_4). The tri-annual results continue to show that the **ecomaine** Stormwater Pollution Prevention Plan has been successful and that **ecomaine**'s WTE and Recycling operations do not significantly impact surrounding surface waters. (see Photo below of **ecomaine** personnel collecting surface water data).

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Environmental Management System

HISTORY:

ecomaine's Environmental Management System (EMS) is based on the international standard called ISO 14001 which has its roots in industrial activity with environmental stewardship. The term "sustainable development" was first articulated in 1987 at the World Commission on Environment and Development to address the tension yet interdependence between environment and industry, defining it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

To further global discussions on environmental and industrial development, the United Nations sponsored the Earth Summit in 1992 in Rio de Janeiro, Brazil. The term, sustainable development, was expanded to include the complimentary goals of economic achievement and environmental protection. As a result of the Earth Summit, best environmental practices and voluntary initiatives were advanced. For example, the Strategic Advisory Group of the Environment (SAGE) was tasked with creating a set of international standards for an environmental management system. SAGEs research was transferred to the International Organization for Standardization (ISO) in Geneva, Switzerland which resulted in the environmental international standards that became known as the ISO 14000 series. ISO 14001 is a voluntary program first released in 1996 and revised in 2004 offering guidance and certification to organizations that manage their environmental responsibilities.

At the 2002 UN World Summit for Sustainable Development in Johannesburg, South Africa, the definition of sustainable development was extended to include social responsibility and community considerations. As a result of WSSD, in the US, the EPA worked with State authorities to promote compliance with environmental laws by encouraging industries to incorporate sustainable technologies and best environmental practices such as EMS. An EMS conveys to communities a commitment to continuous improvement, going beyond compliance, and advocating for environmental and social responsibility. In essence, sustainable development is a triple bottom line that embraces environmental stewardship, economic benefits and community relationships. The EMS is a set of procedures that define how an organization will manage its potential impacts on the natural world and on the health and welfare of its workers and nearby citizens. Below is a list of the elements of ISO 14001:

ISO 14001 - **Environmental Management System**

4.1 General Requirements
4.2 Environmental Policy
4.3.1 Environmental Aspects
4.3.2 Legal & Other Requirements
4.3.3 Objectives, Targets & Programs
4.4.1 Roles, Responsibility and Authority
4.4.2 Competence, Training & Awareness
4.4.3 Environmental Communications
4.4.4 Documentation
4.4.5 Control of Documents
4.4.6 Operational Control
4.4.7 Emergency Preparedness & Response
4.5.1 Monitoring & Measurement
4.5.2 Evaluation of Compliance
4.5.3 Nonconformity, Corrective Action & Preventive Action
4.5.4 Control of Records
4.5.5 Internal Audit
4.6 Management Review

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ISO 14001

In 1999 **ecomaine** started to develop an environmental management program at the Waste-to-Energy facility. An Environmental Management System (EMS) emerged to ensure that **ecomaine** identify and evaluate ways to minimize its impact on the surrounding environment. In March 2002, the WTE received its ISO 14001 certification by an accredited Registrar auditor. **ecomaine**'s ISO 14001 is Certificate #123. The Recycling facility received its ISO certification in October 2002 and the landfill/ashfill was certified in March 2007. The WTE was one of the early pioneers in achieving this honor and demonstrating its environmental excellence. **ecomaine** is the largest publically owned and operated facility to have this certification. The EMS for the landfill at **ecomaine** is also one of the first in America to achieve ISO 14001 certification - an achievement more common in Europe.

As part of the EMS roles and responsibilities, the **ecomaine** Board of Directors designated the General Manager to be responsible for on-going actions of the EMS. The GM imparted to the Environmental Manager responsibility to implement the EMS and a working group (EMS WG) was established to provide input on maintaining the EMS. The EMS WG is comprised of employees from each sector of **ecomaine** (ie: WTE operations, maintenance, landfill, recycling, management, environmental). The EMS WG identified objectives & targets based on a comprehensive evaluation of all environmental aspects of **ecomaine**'s three operations. The most significant aspects were targeted for on-going critique for improvement. At the WTE, emission of air pollutants and generation of ash from the municipal solid waste (MSW) combustion process were ranked at the top. As a result to address air emission impacts, **ecomaine** developed a startup/shutdown/ malfunction plan to minimize the occurrence of elevated CO emissions during these phases of operation. **ecomaine** also purchased new controls for its gas burner to allow for more efficient startup and shutdown of the units. And installation of new controls for the ESP for greater removal efficiency of pollutants. To minimize ash disposal needs, **ecomaine** installed a magnet in 2003 to recover ferrous metals from the ash. This recovered metal reduces the amount of ash landfilled by about 5%.

ecomaine strives for continuous improvement and ISO 14001 offers a system to stimulate and pursue new discussions. Recent projects have included installation of mixer/conditioner to treat fly ash, installation of reverse osmosis unit to purify boiler water and eliminate use of chemicals (ie: NaOH, HCl), and establish routine cleaning of leachate collection lines at the landfill/ashfill. Another project **ecomaine** instituted as a result of the EMS, was the installation of boiler drain tanks with storage capacity of 30,000 gallons to hold water during boiler shutdown; therefore, conserving water by reusing it back in the boilers and avoiding expense of replenishing from public water source.

Maintaining ISO 14001 certification, entails rigorous semi-annual audits by a third party to determine if the EMS is in compliance with its own policies and procedures. **ecomaine** has 4x audits each year, every 6 months, an internal audit and then a registrar audit are performed. **ecomaine** has undergone two full re-certification audits in 2008 and 2011 where all 18 elements of the EMS were critiqued by the registrar. **ecomaine** continues to demonstrate the commitment and capability to fulfill its environmental policy – compliance, communication, continuous improvement, pollution prevention - through maintenance of its environmental management system, including the commitment to pollution prevention and maintaining its registration to ISO 14001: 2004.

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