United States Environmental Protection Agency

Steam Electric Power Generating Effluent Guidelines Rulemaking

Supplemental Information Package #2 for Federalism and Unfunded Mandates Reform Act (UMRA) Consultations

October 18, 2011

1. BACKGROUND

The U.S. Environmental Protection Agency is currently engaged in a rulemaking process to revise the effluent limitations guidelines and standards (ELGs) for the steam electric power generating point source category. The steam electric power generating ELGs are nationally applicable, technology-based discharge requirements. These ELGs are incorporated into NPDES discharge permits, and in control mechanisms for discharges to Publically Owned Treatment Works (POTWS). This document was prepared to facilitate a dialogue about the ELG rulemaking as part of the Federalism and Unfunded Mandates Reform Act (UMRA) consultations.

This document provides information about preliminary compliance cost estimates for pollution controls being considered as the technology basis for regulatory options. Additional information about the steam electric industry, the processes generating wastewater, and treatment technologies can be found in *Steam Electric Power Generating Point Source Category: Final Detailed Study Report* (EPA 821-R-09-008, October 2009), which presents information that EPA collected over the course of the detailed study. The report, as well as additional information about the progression of the rulemaking since its inception, is available at EPA's project web site at http://water.epa.gov/scitech/wastetech/guide/steam_index.cfm.

The Steam Electric Power Generating ELGs apply to a subset of the electric power industry, namely those plants "primarily engaged in the generation of electricity for distribution and sale which results primarily from a process utilizing fossil-type fuel (coal, oil, gas) or nuclear fuel in conjunction with a thermal cycle employing the steam-water system as the thermodynamic medium." (See 40 CFR 423.10) Figure 1 broadly depicts the various types of electric generating plants and identifies which are regulated by the Steam Electric Power Generating effluent guidelines. For more information on this industry and the processes used, see Chapter 3 of the *Steam Electric Power Generating Point Source Category: Final Detailed Study Report* (EPA 821-R-09-008, October 2009).

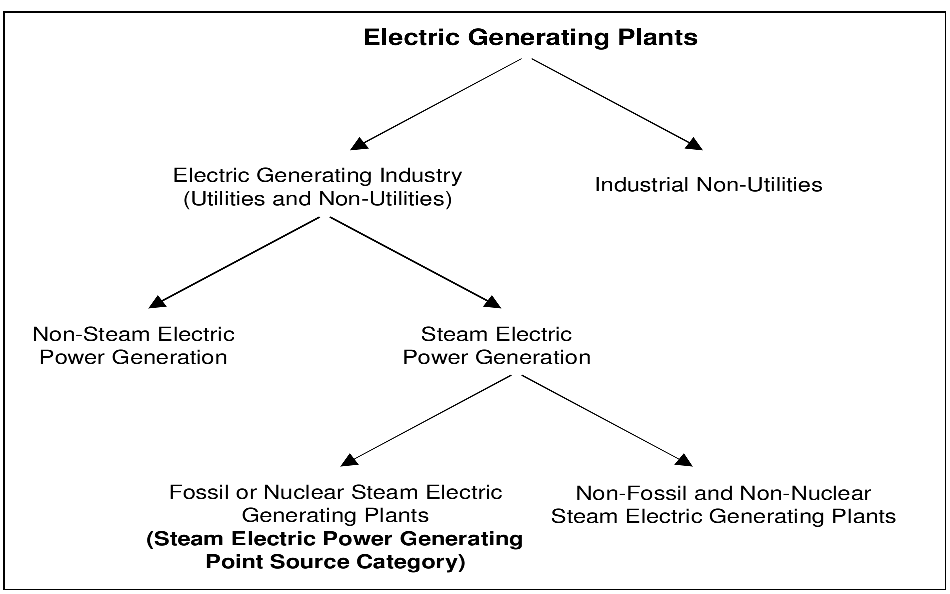

Figure 1. Types of U.S. Electric Generating Units

Section 304 (m) of the Clean Water Act (CWA) requires EPA to periodically review all effluent guidelines to determine whether revisions are warranted. During its 2005 annual review of discharges from point source categories, EPA's analysis of publicly available data reported through the NPDES permit program and the Toxics Release Inventory (TRI) indicated that this industry sector ranks as one of the highest dischargers of toxic and nonconventional pollutants. Because of this, EPA initiated a more detailed study of the industry's wastewater discharges by collecting data through facility inspections, wastewater sampling, a data request to a small subset of the industry, and secondary sources of information.

Upon completing the detailed study in 2009, EPA determined that the current regulations have not kept pace with the significant changes that have occurred in this industry over the last three decades. The development of new technologies for generating electric power (e.g., coal gasification) and the widespread implementation of air pollution controls (e.g., flue gas desulfurization (FGD), selective catalytic reduction (SCR)) have altered existing or created new wastewater streams at many power plants. Wastewater discharges from power plants have been identified as the source for a number of environmental impacts to ground water and surface water, including contaminated drinking water and other effects. The main pollutants of concern for these discharges include metals (e.g., mercury, arsenic, selenium), nitrogen, and total dissolved solids (TDS). The environmental concerns include impacts to ground water and surface water, contaminated sediments and drinking water, fish mortality & non-lethal effects (e.g., altered populations), bioaccumulation in aquatic organisms, fish advisories, and risks to human health. More information about the potential environmental impacts is presented in Chapter 6 of *Steam Electric Power Generating Point Source Category: Final Detailed Study Report* (EPA 821-R-09-008, October 2009). EPA's analysis of the wastewater discharges associated with steam electric power generating led the Agency to announce, in September 2009, the start of a rulemaking process.

EPA first issued effluent guidelines for the Steam Electric Power Generating Point Source Category (i.e., the Steam Electric effluent guidelines) in 1974 with subsequent revisions in 1977 and 1982. The Steam Electric effluent guidelines are codified at 40 CFR Part 423 and include limitations for the following waste streams:

- Once-through cooling water;
- Cooling tower blowdown;
- Fly ash transport water;
- Bottom ash transport water;
- Metal cleaning wastes;
- Coal pile runoff; and
- Low-volume waste sources, including but not limited to wastewaters from wet scrubber air pollution control systems, ion exchange water treatment systems, water treatment evaporator blowdown, laboratory and sampling streams, boiler blowdown, floor drains, cooling tower basin cleaning wastes, and recirculating house service water systems (sanitary and air conditioning wastes are not included) [40 CFR 423.11(b)].

The current effluent guidelines are summarized in Table 1.

Although the rulemaking may address aspects of the regulation that apply to all fossil/nuclear units covered by the existing effluent guidelines, the focus of the rulemaking is on the following wastes:

- Flue gas desulfurization (FGD) wastewater from SO_2 air pollution controls;
- Discharges of fly ash and bottom ash transport water;
- Leachate from ponds and landfills containing coal combustion residues;
- Gasification wastewater from integrated gasification combined cycle (IGCC) plants; and
- Wastewater associated with flue gas mercury controls (e.g., wastewater resulting from transporting/handling solids from activated carbon injection).

In addition to evaluating possible requirements for the discharges identified above, EPA may also clarify the applicability of the existing steam electric ELGs to discharges from combined cycle generating units. EPA is also considering clarifications to the definition of "metal cleaning waste" and "chemical metal cleaning waste" to reduce confusion about the existing definitions.

EPA expects that clarifications for combined cycle generating units (which would affect gas-fired generating units) and the definitions for metal cleaning wastes (which would apply to all fossil- and nuclear-fueled units) would result in negligible, if any, compliance costs. New requirements for FGD wastewater, fly and bottom ash wastewater, pond/landfill leachate, gasification wastewater, and wastewater from mercury controls or SCRs could result in compliance costs for some units that use coal or petroleum coke. Requirements for ash transport water could also result in compliance costs for some oil-fired generating units.

Table 1. Current Effluent Guidelines and Standards for the Steam Electric Power Generating Point Source Category

Waste Stream	Existing Sources that are Direct Dischargers		New Sources that are Direct Dischargers	Existing and New Sources that are Indirect Dischargers
	BPT [a]	BAT [a]	NSPS [a]	PSES and PSNS [a]
All Waste Streams	pH: 6-9 S.U. [b] PCBs: Zero discharge	PCBs: Zero discharge	pH: 6-9 S.U. [b] PCBs: Zero discharge	PCBs: Zero discharge
Low-Volume Wastes	TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L		TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L	
Fly Ash Transport	TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L		Zero discharge	Zero discharge (PSNS only) No limitation for PSES
Bottom Ash Transport	TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L		TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L	
Once-Through Cooling	Free Available Chlorine: 0.5 mg/L; 0.2 mg/L	Total Residual Chlorine: If ≥ 25 MW: 0.20 mg/L instantaneous maximum; If < 25 MW, equal to BPT	Total Residual Chlorine: If ≥ 25 MW: 0.20 mg/L instantaneous maximum; If < 25 MW, equal to BPT	
Cooling Tower Blowdown	Free Available Chlorine: 0.5 mg/L; 0.2 mg/L	Free Available Chlorine: 0.5 mg/L; 0.2 mg/L 126 Priority Pollutants: Zero discharge, except: Chromium: 0.2 mg/L; 0.2 mg/L Zinc: 1.0 mg/L; 1.0 mg/L	Free Available Chlorine: 0.5 mg/L; /0.2 mg/L 126 Priority Pollutants: Zero discharge, except: Chromium: 0.2 mg/L; 0.2 mg/L Zinc: 1.0 mg/L; 1.0 mg/L	126 Priority Pollutants: Zero discharge, except: Chromium: 0.2 mg/L; 0.2 mg/L Zinc: 1.0 mg/L; 1.0 mg/L
Coal Pile Runoff	TSS*: 50 mg/L instantaneous maximum		TSS*: 50 mg/L instantaneous maximum	
Metal Cleaning Wastes	TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L Copper: 1.0 mg/L; 1.0 mg/L Iron: 1.0 mg/L; 1.0 mg/L	See *Chemical Metal Cleaning Wastes* below	See *Chemical Metal Cleaning Wastes* below	See *Chemical Metal Cleaning Wastes* below
Chemical	See *Metal Cleaning Wastes* above	Copper: 1.0 mg/L; 1.0 mg/L Iron: 1.0 mg/L; 1.0 mg/L	TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L Copper: 1.0 mg/L; 1.0 mg/L Iron: 1.0 mg/L; 1.0 mg/L	Copper: 1.0 mg/L (daily maximum)
Non-chemical	See *Metal Cleaning Wastes* above	Reserved	Reserved	Reserved

Source: [40 CFR Part 423].

a – The limitations for TSS, oil & grease, copper, iron, chromium, and zinc are presented as daily maximum (mg/L); 30-day average (mg/L). For all effluent guidelines, where two or more waste streams are combined, the total pollutant discharge quantity may not exceed the sum of allowable pollutant quantities for each individual waste stream. BPT, BAT, and NSPS allow either mass- or concentration-based limitations.
b – The pH limitation is not applicable to once-through cooling water.
Free Available Chlorine: 0.5 mg/L; 0.2 mg/L - 0.5 mg/L instantaneous maximum, 0.2 mg/L average during chlorine release period. Discharge is limited to 2 hrs/day/unit. Simultaneous discharge of chlorine from multiple units is prohibited. Limitations are applicable at the discharge from an individual unit prior to combination with the discharge from another unit.
Total Residual Chlorine: 0.20 mg/L instantaneous maximum. Total residual chlorine (TRC) = free available chlorine (FAC) + combined residual chlorine (CRC). TRC discharge is limited to 2 hrs/day/unit. TRC is applicable to plants ≥25 MW, and FAC is applicable to plants <25 MW. The TRC limitation is applicable at the discharge point to surface waters of the United States and may be subsequent to combination with the discharge from another unit.
126 Priority Pollutants: zero discharge - 126 priority pollutants from added maintenance chemicals (refer to App. A to 40 CFR 423). At the permitting authority's discretion, compliance with the zero-discharge limitations for the 126 priority pollutants may be determined by engineering calculations, which demonstrate that the regulated pollutants are not detectable in the final discharge by the analytical methods in 40 CFR part 136.
TSS*: 50 mg/L instantaneous maximum on coal pile runoff streams. No limitation on TSS for coal pile runoff flows ≥10-year, 24-hour rainfall event.
BPT: Best practicable control technology currently available.
BAT: Best available control technology economically achievable.
NSPS: New source performance standards.
PSES: Pretreatment standards for existing sources.
PSNS: Pretreatment standards for new sources.

2. TECHNOLOGY OPTIONS UNDER EVALUATION

EPA is evaluating several technology-based options for the control of wastewater discharges from power plants. With the exception of NSPS for fly ash transport water, the options for each waste stream are being considered for both existing sources and new sources. Revised ELGs for existing sources would be promulgated under Clean Water Act (CWA) provisions for best available technology economically achievable (BAT) and pretreatment standards for existing sources (PSES). [33 USC 1311(b); 33 USC 1314(b); 33 USC 1317(b)] Revised ELGs for new sources would be promulgated under CWA provisions for new source performance standards (NSPS) and pretreatment standards for new sources (PSNS). [33 USC 1316(b); USC 1317(c)] No new NSPS requirements are being considered fly ash transport water since the current NSPS states "[t]here shall be no discharge of wastewater pollutants from fly ash transport water." [40 CFR 423.15(g)]

2.1 FGD Wastewater

Power plants use FGD scrubber systems to remove SO_2 and other pollutants from stack emissions. In wet FGD scrubbers, the flue gas stream comes in contact with a liquid stream containing a sorbent, such as lime or limestone, which is used to transfer pollutants from the flue gas to the liquid stream. FGD scrubber system wastewaters, including the wastewater stream from dewatering and scrubber blowdown, contain elevated levels of metals (e.g., mercury, arsenic, selenium), nitrogen, and total dissolved solids.

EPA identified and investigated wastewater treatment systems operated by steam electric plants for the treatment of FGD scrubber purge. Most plants currently discharging FGD wastewater use settling ponds; however, the use of more advanced wastewater treatment systems is increasing to a limited extent due to more stringent requirements imposed by some states on a site-specific basis. Figure shows the distribution of management/treatment for wastewater from wet FGD systems reported in the 2010 questionnaire for 150 plants.

The current ELGs include these discharges within the definition of "low volume wastes." EPA is considering establishing revised effluent limits for FGD wastewater based on the following technologies.

Option 1 – No change

No change to the current ELG requirements.

Option 2 – Chemical precipitation

Chemical precipitation involves removing metallic contaminants from aqueous solutions by converting soluble heavy metals to insoluble salts. The precipitated solids are then removed from solution by flocculation followed by sedimentation and/or filtration. EPA is evaluating chemical precipitation/iron co-precipitation specifically designed to target removal of mercury and arsenic. This system utilizes hydroxide precipitation (i.e., using calcium hydroxide (lime) as the precipitant to convert dissolved metals to insoluble metal hydroxides) followed by sulfide precipitation (using organosulfide as the precipitant to convert dissolved metals to insoluble metal sulfides). Ferric chloride and polymers are added to facilitate coagulation and removal of the precipitated solids.

Option 3 – Chemical precipitation with biological treatment

This option includes the chemical precipitation technology evaluated under Option 2, followed by a fixed film anoxic/anaerobic bioreactor treatment system. While the primary purpose of the bioreactor treatment system is to increase the removal of metals, particularly selenium, addition of a bioreactor is also effective in removing nitrates and sulfates.

Option 4 – Chemical precipitation with vapor-compression evaporation

This option includes the chemical precipitation technology evaluated under Option 2, followed by a vapor-compression evaporation system that uses heat to evaporate the wastewater and generate a clean distillate stream. The key steps of the treatment process include pretreatment of the wastewater by chemical precipitation and softening, followed by sending the wastewater to a mechanical vapor compression brine concentrator (also referred to as a falling-film evaporator) and a forced-circulation crystallizer. In addition to the distillate that is generated as the water vapor cools, the process produces a solid by-product (i.e., crystallized salts) that would be disposed of in a landfill.

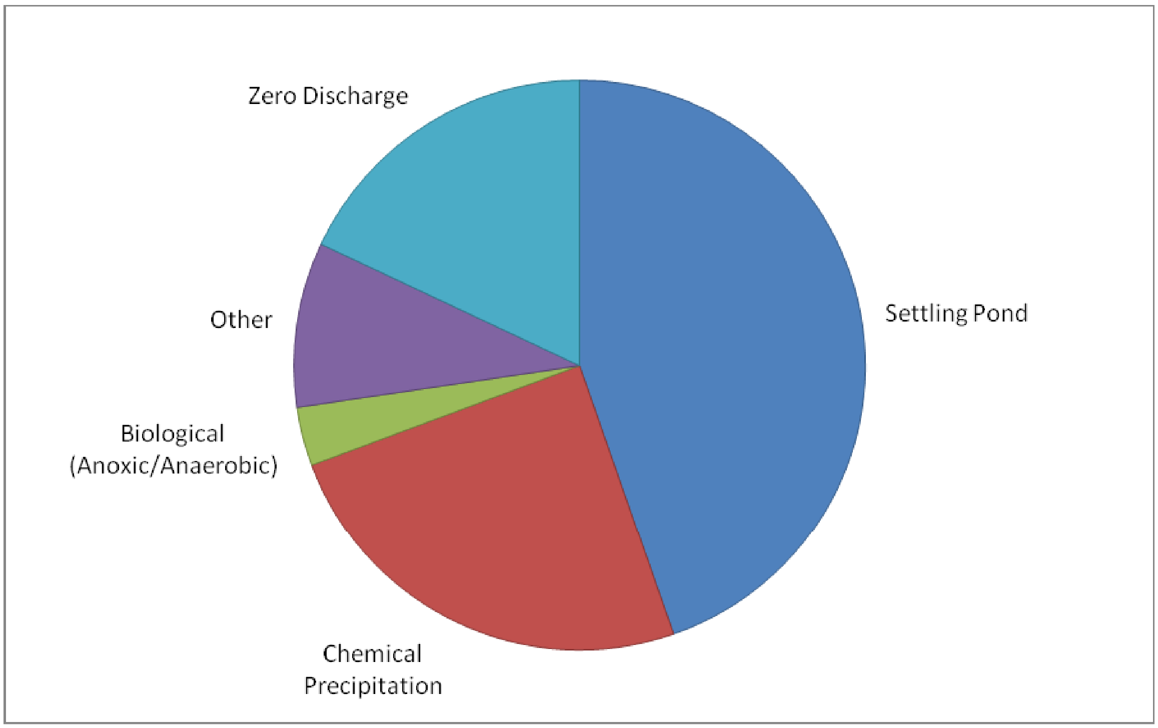

Figure 2. Distribution of FGD Wastewater Treatment Systems Among Plants Operating Wet FGD Systems

2.2 Fly Ash Transport Water

Fly ash is generated by pulverized coal furnaces and consists of very fine particles that are light enough to be entrained in the flue gas and carried out of the furnace. The fly ash particles that remain entrained in the flue gases are carried to the particulate control equipment, such as baghouses and electrostatic precipitators, for removal. The removed fly ash is collected in hoppers and then either pneumatically transferred as dry ash to silos for temporary storage or sluiced with water to a surface impoundment (i.e., ash pond). Ash ponds discharge large volumes of fly ash wastewater containing significant levels of metals and nutrients.

Over 70% of plants generating fly ash operate dry fly ash transport systems, while another 15% operate both wet and dry systems. In cases where a plant has both wet and dry handling, the wet handling system is a legacy system that was retained during conversion of the ash handling system and retained as a backup to the dry system. New source performance standards require "… no discharge of wastewater pollutants from fly ash transport water." [40 CFR Part 423.15]

Option 1 – No change

No change to the current ELG requirements.

Option 2 – Zero discharge of fly ash transport water (Based on conversion to dry fly ash transport)

This option is based on the conversion of wet fly ash handling systems (specifically a wet fly ash sluicing system) to a dry vacuum fly ash handling system. This is the same technology basis used for NSPS requirements promulgated in 1982. The fly ash is initially collected in the hoppers of the particulate control system (e.g., electrostatic precipitator or baghouse) for both a wet and dry transport system. EPA is evaluating a dry handling system that uses a vacuum system to pneumatically transport the ash from the hopper to an intermediate storage location (e.g., a storage silo). The ash is then unloaded from the silo into trucks for transport to the final ash disposal destination (e.g., landfill or beneficial use).

2.3 Bottom Ash Transport

Bottom ash is referred as the heavier ash that settles in the furnace or dislodged from furnace walls and that is collected at the bottom of the boiler. Bottom ash is usually hydraulically conveyed (i.e., sluiced with water) to either an ash pond or dewatering bin. In such a wet sluicing system, the hot bottom ash drops to the bottom of the furnace where it is quenched in a water-filled hopper. Ash from the hopper is fed into a conveying line where it is diluted into slurry and pumped to the ash pond or dewatering bin. Some plants operate large settling ponds for bottom ash, while others use a system of relatively small ponds operating in series and/or parallel. The ash sent to a dewatering bin is separated from the transport water, then sent to a landfill or transported offsite.

In the mechanical drag chain system, the bottom ash is collected in a water bath trough at the bottom of the boiler to cool the ash. The plant operates a drag chain that moves along the bottom of the trough and drags the bottom ash out of the boiler. At the end of the trough, the drag chain reaches an incline, which dewaters the bottom ash by gravity, draining the water back to the trough as the ash moves upward. The bottom ash is often conveyed to a nearby collection area, such as a small bunker outside the boiler building, from which it is loaded onto trucks and either sold for beneficial use or stored on-site in a landfill.

Over 60% of plants generating bottom ash operate wet bottom ash transport systems, while approximately 30% operate only dry systems.

Option 1 – No change

No change to the current ELG requirements.

Option 2 – Zero discharge of bottom ash transport water (based on either complete recycle of transport water or conversion to dry bottom ash transport)

This option is based on the conversion of wet bottom ash handling systems (specifically a wet bottom ash sluicing system) to a dry bottom ash handling system such as a mechanical drag system, or a closed-cycle remote mechanical drag system. The mechanical drag system conveys the bottom ash out of the boiler to a nearby storage area. The remote mechanical drag system operates by sluicing the bottom ash to a water trough and sump located away from the boiler, where a stand-alone mechanical drag system is used to dewater the ash. The sluice water for the remote mechanical drag system is continually reused to prevent discharge of ash transport water, and the dewatered ash solids are landfilled or beneficially reused.

2.4 Leachate from Landfills/Ponds Containing Coal Combustion Residuals

Coal combustion residues (CCR) comprise a variety of wastes from the coal combustion process, including fly ash, bottom ash, boiler slag, and FGD solids (e.g., gypsum and calcium sulfite). CCR may be stored at the plant in on-site landfills or surface impoundments. Leachate is the liquid that drains or leaches from a landfill or an impoundment. The two sources of landfill leachate are precipitation that percolates through the waste deposited in the landfill and the liquids produced from the CCR placed in the landfill.

Figure 3 presents a diagram depicting the collection system for landfill leachate. In a lined landfill, the leachate collected from the landfill typically flows through a collection system consisting of ditches and/or underground pipes. From the collection system, the leachate is transported to a collection pond. Some plants discharge the effluent from these collection ponds directly to surface water, while other plants send the leachate to the ash pond. Surface impoundments may also have liners and collection systems similar to the landfills. Unlined ponds and landfills do not collect leachate migrating away from the pond/landfill.

Option 1 – No change

No change to the current ELG requirements.

Option 2 – Chemical precipitation

Chemical precipitation involves removing metallic contaminants from aqueous solutions by converting soluble heavy metals to insoluble salts. The precipitated solids are then removed from solution by flocculation followed by sedimentation and/or filtration. EPA is evaluating chemical precipitation/iron coprecipitation technology for the treatment of leachate from CCR landfills/ponds, specifically designed to target removal of mercury and arsenic. Note that this is the same Option 2 described above for FGD wastewater and that EPA is also evaluating co-treatment of FGD wastewater and landfill/pond leachate.

Option 3 – Chemical precipitation with biological treatment

This option includes the chemical precipitation technology evaluated under Option 2, followed by a fixed film anoxic/anaerobic bioreactor treatment system. The primary purpose of the bioreactor treatment system is to increase the removal of metals, particularly selenium, from the landfill/pond leachate; however, this treatment step is also effective in removing nitrate and sulfates. Note that this is the same Option 3 described above that EPA is evaluating for FGD wastewater and that EPA is also evaluating co-treatment of FGD wastewater and landfill/pond leachate.

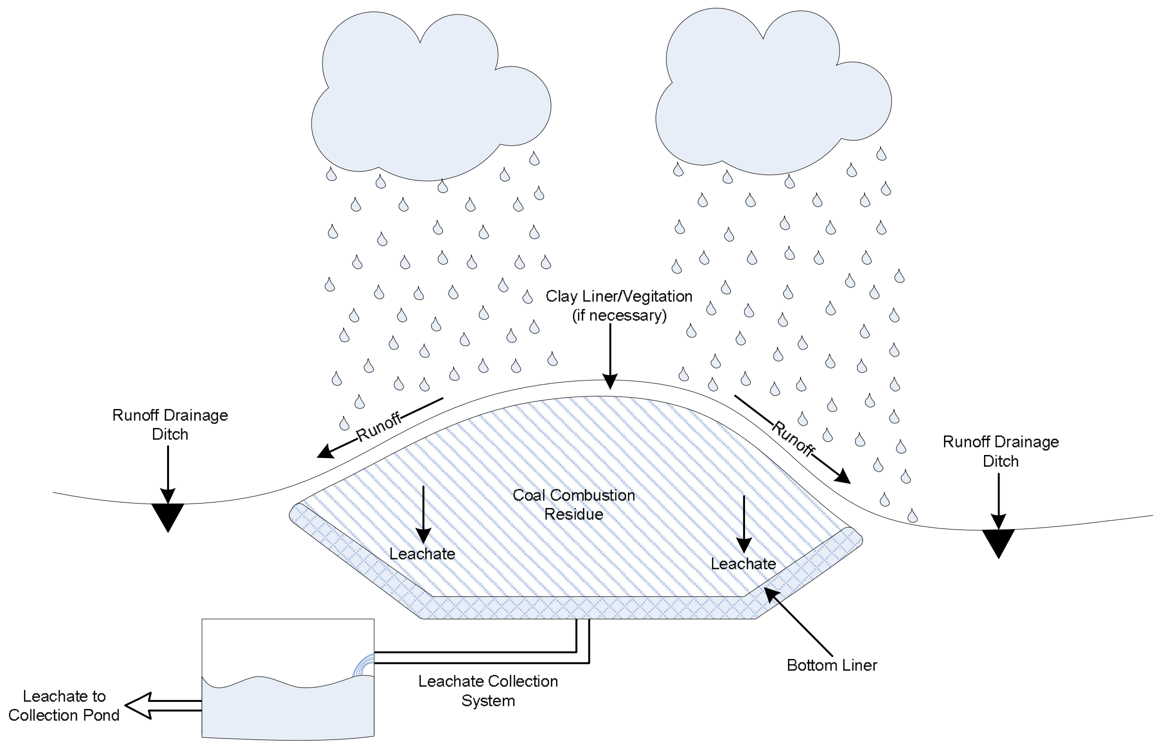

Figure 3. Diagram of Landfill Leachate Collection

2.5 Mercury Control System Wastewater

Some plants have or plan to install systems to control the emission of mercury via flue gas. The vast majority of these systems report handling mercury control solid waste in a dry manner. Eight plants have reported handling such wastes in a wet system. Typically, these plants inject activated carbon into the flue gas either upstream or downstream of the ESP and the carbon and mercury waste is collected with their fly ash. These wet systems tend to be ash sluice systems that combine the mercury control wastes with the fly ash sluiced to an ash pond. In some cases, the plants report treating their coal with an oxidant that works to fully oxidize mercury when the coal is burned. The oxidized mercury is then removed in their normal air pollution controls and handled with ash or FGD wastewater.

2.6 Gasification Wastewater

Currently, there are two operating IGCC plants in the U.S. and a third plant scheduled to come on line soon. These plants treat their gasification wastewater using a vapor-compression evaporation system that uses heat to evaporate the wastewater and generate a clean distillate stream. The distillate stream is either discharged or reused in plant operations.

Option 1 – No change

No change to the current ELG requirements.

Option 2 – Vapor-compression evaporation

The gasification process at integrated gasification combined cycle (IGCC) facilities produces a wastewater purge stream (grey water). The treatment option being considered for the grey water is vapor compression evaporation followed by crystallization, producing an aqueous stream (distillate) and solid by-products (crystallized salts). The solids would be sent to a landfill for disposal. This is equal to the current level of treatment operated by IGCC facilities and would result in no incremental compliance costs.

Option 3 – Vapor-compression evaporation plus cyanide destruction

Similar to Option 2, but would also add a treatment step (such as hypochlorite addition) to reduce levels of cyanide in the discharge. Incremental compliance costs, if any, would be minimal.

2.7 Model Plant Results

Table 2 presents a preliminary estimate of compliance costs associated with EPA's technology options for three model plants ranging in size from 50 MW to 600 MW.

Table 2. Treatment Option Costs for Model Plants (Preliminary Estimates, October 2011)

ELG Option	Model Plant 1 (approx 50-100 MW)			Model Plant 2 (approx 250-350 MW)			Model Plant 3 (approx 500-600 MW)		
	Capital Cost (2010 $)	Annual O&M Cost (2010 $)	Annualized Cost (2010 $)	Capital Cost (2010 $)	Annual O&M Cost (2010 $)	Annualized Cost (2010 $)	Capital Cost (2010 $)	Annual O&M Cost (2010 $)	Annualized Cost (2010 $)
FGD Option 1: No change to ELG	---	---	---	---	---	---	---	---	---
FGD Option 2: CP	$4,869,000	$430,000	$889,000	$8,314,000	$866,000	$1,652,000	$15,391,000	$1,784,000	$3,237,000
FGD Option 3: CP + Bio	$9,823,000	$727,000	$1,654,000	$14,335,000	$1,216,000	$2,569,000	$23,610,000	$2,247,000	$4,476,000
FGD Option 4: CP + Evap	$27,949,000	$1,524,000	$4,162,000	$35,247,000	$2,784,000	$6,112,000	$50,527,000	$5,463,000	$10,232,000
Fly Ash Option 1: No change to ELG	---	---	---	---	---	---	---	---	---
Fly Ash Option 2: "No discharge"	$1,732,000	$164,000	$328,000	$2,189,000	$900,000	$1,107,000	$2,750,000	$1,928,000	$2,188,000
Bottom Ash Option 1: No change to ELG	---	---	---	---	---	---	---	---	---
Bottom Ash Option 2: "No discharge"	$2,465,000	$610,000	$878,000	$6,199,000	$864,000	$1,484,000	$12,024,000	$1,761,000	$2,966,000
Leachate Option 1: No change to ELG	---	---	---	---	---	---	---	---	---
Leachate Option 2: CP	$3,981,000	$145,000	$521,000	$6,740,000	$529,000	$1,165,000	$8,244,000	$846,000	$1,625,000
Leachate Option 3: CP + Bio	$6,987,000	$412,000	$1,072,000	$11,935,000	$838,000	$1,964,000	$14,216,000	$1,193,000	$2,535,000

1. Three "model plants" are presented to provide insight to the potential compliance costs for regulatory options under consideration. The generation capacity (MW) noted in the table header are approximate values.
2. Estimated costs do not reflect offsetting cost reductions associated with ceasing operation of an existing settling pond or avoiding installation of a settling pond to comply with the current effluent limits at 40 CFR part 423.
3. Leachate costs are based on construction of a stand-alone treatment system for leachate flow. Actual costs may be lower if leachate is co-treated with FGD wastewater.
4. Annualized costs sum the operating and maintenance (O&M) costs and annualized capital costs, using a 7% interest rate and a 20-year service life for the equipment.

"Option 1" for all waste streams presumes no change to the current ELG limits, which are based on a settling pond.
CP: Chemical precipitation treatment.
CP + Bio: Chemical precipitation plus biological treatment.
CP + Evap: Chemical precipitation plus evaporation.
Fly ash no discharge: Based on conversion to a dry vacuum ash handling system.
Bottom ash no discharge: Based on conversion to a mechanical drag system.