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United States Government Accountability Office
Washington, DC 20548

October 30, 2009

The Honorable Barbara Boxer
Chairman
Committee on Environment and Public Works
United States Senate

The Honorable Edolphus Towns
Chairman
Committee on Oversight and Government Reform
House of Representatives

Subject: *Coal Combustion Residue: Status of EPA's Efforts to Regulate Disposal*

On December 22, 2008, a breach in a surface impoundment (or storage pond) dike at the Tennessee Valley Authority (TVA) Kingston Fossil Plant in Tennessee resulted in the release of 5.4 million cubic yards of coal ash—also referred to as coal combustion residue (CCR)—into the nearby Emory River. The spill covered more than 300 acres and made 3 homes uninhabitable; it damaged 23 other homes, plus roads, rail lines, and utilities. TVA estimated the cleanup will cost between $933 million and $1.2 billion and take 2 to 3 years to complete. In light of the spill in Kingston, you asked us to identify: (1) the number of surface impoundments for storing CCR in the United States and their location; (2) problems, if any, with the storage of coal ash, and how those problems are being addressed; and (3) the type of federal oversight that exists for CCR and what, if any, issues need to be resolved. We briefed your staffs on October 1, 2009, and September 28, 2009, respectively, on the results of this work. This report summarizes and transmits that briefing. The full briefing is reprinted in the enclosure.

To respond to your request, we obtained and reviewed Environmental Protection Agency (EPA) policy and program documents. We also interviewed senior officials from EPA's Office of Solid Waste and Emergency Response and Office of Water and collected statistics compiled by the Department of Energy's Energy Information Administration. To obtain perspective on the oversight that exists for CCR, we gathered and analyzed documents and opinions from industry and state representatives and environmental groups. To understand coal power plant activities and surface impoundments, we obtained and analyzed documentation from TVA senior officials on TVA facilities, visited TVA's Bull Run facility to observe a coal-fired plant in operation, and observed the ongoing cleanup at its Kingston facility. We conducted our work from March to October 2009 in accordance with all sections of GAO's Quality Assurance Framework that are relevant to our objectives. The

framework requires that we plan and perform the engagement to obtain sufficient and appropriate evidence to meet our stated objectives and to discuss any limitations in our work. We believe that the information and data obtained, and the analysis conducted, provide a reasonable basis for any findings and conclusions in this product.

Summary

Our review found the following:

- The exact number of surface impoundments at utility coal fired power plants is not known. However, EPA is currently undertaking an effort to identify the number and location of all surface impoundments in the United States and, as of September 14, 2009, had identified over 580 surface impoundments nationwide.
- Problems that have been identified with the storage of coal ash include potential structural defects and other risks of collapse of the surface impoundment, such as at TVA Kingston Facility; health and environmental risks from CCR storage due to potential leaching of contaminants into surface or groundwater from unlined or failed liners at surface impoundments, landfills, or sand and gravel pits; and potential risks from the discharge of wastewater containing CCR into surface waters from surface impoundments. EPA is currently analyzing the structural hazards and environmental risks associated with surface impoundments.
- EPA does not directly regulate CCR disposal in surface impoundments or landfills to prevent releases or a catastrophic spill, and states have a variety of regulatory controls on surface impoundments. EPA is developing proposed regulations but, as part of this effort, needs to address issues of federal and state roles for control and enforcement.

Agency Comments

We provided a draft of this report and the attached briefing to EPA for review and comment. EPA provided technical comments that we incorporated into the briefing slides, as appropriate.

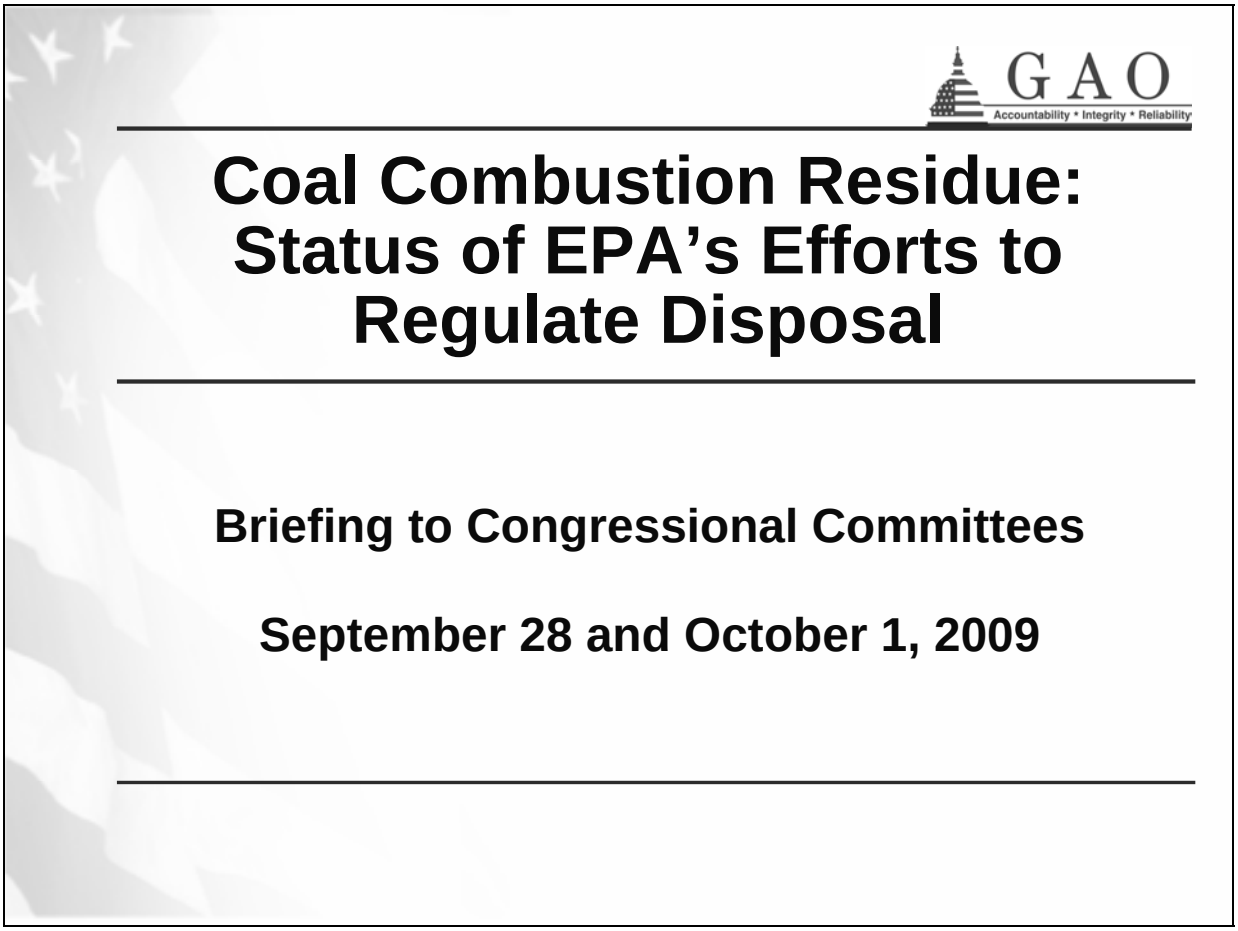
We are sending copies of this report to the Administrator of EPA and interested congressional committees. This report also is available at no charge on the GAO Web site at http://www.gao.gov.

If you or your staffs have any questions concerning this report, please contact me at (202) 512-3841 or ruscof@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Individuals making key contributions to this report included Ernie Hazera, Assistant Director; Greg Carroll; Julia Coulter; Elizabeth Beardsley; and Ben Shouse.

Frank Rusco
Director, Natural Resources
and Environment

Enclosure

Enclosure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Accountability • Integrity • Reliability
Coal Combustion Residue: Status of EPA's Efforts to Regulate Disposal
Briefing to Congressional Committees
September 28 and October 1, 2009

Introduction

- On December 22, 2008, a breach in a dike at the Tennessee Valley Authority (TVA) Kingston Fossil Plant resulted in the release of 5.4 million cubic yards of coal ash—also referred to as coal combustion residue (CCR)—into the nearby Emory River. The spill covered more than 300 acres, made 3 homes uninhabitable and damaged 23 other homes, plus roads, rail lines, and utilities.

- TVA states it has made progress in the cleanup the last several months; however, it estimates the cleanup will cost between $933 million and $1.2 billion and could take 2-3 years. TVA's cost estimate does not include potential costs associated with regulatory actions, litigation, fines or penalties, and final remediation activities.

- The TVA spill has raised concerns about potential risks associated with other similar facilities nationwide.

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Objectives

In light of the Kingston spill, you asked us to identify:

1. the number of CCR surface impoundments and their locations;

2. problems, if any, with the storage of coal ash and how those problems are being addressed; and

3. the type of federal oversight that exists for CCR, and what, if any, issues need to be resolved.

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Scope and Methodology

- To conduct this review, we:
  - Analyzed Environmental Protection Agency (EPA) policy and program documents, reports, studies, and legal documents and interviewed senior officials from EPA's Office of Solid Waste and Emergency Response and Office of Water.
  - Collected statistics compiled by Department of Energy's (DOE) Energy Information Administration (EIA).
  - Obtained and analyzed documents and opinions from industry, state representatives, and environmental groups.
  - Obtained and analyzed documentation from TVA senior officials on TVA facilities, interviewed TVA officials, visited TVA's Bull Run facility to observe a coal-fired plant in operation, and observed the ongoing cleanup at its Kingston facility.

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Scope and Methodology (cont'd)

- We conducted our work from March to October 2009 in accordance with all sections of GAO's Quality Assurance Framework that are relevant to our objectives. The framework requires that we plan and perform the engagement to obtain sufficient and appropriate evidence to meet our stated objectives and to discuss any limitations in our work. We believe that the information and data obtained, and the analysis conducted, provide a reasonable basis for any findings and conclusions in this product.

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Background

The combustion of coal leaves behind various materials—the noncombustible portion of the coal itself and residues collected by air pollution control technologies which we refer to as CCR.[1] See figure 1 for an illustration of a coal-fired power plant.

[1]Other terms used include: coal combustion waste, coal combustion product, coal combustion material, coal combustion ash, and coal combustion by-product. We chose to use "coal combustion residue" to avoid implying that these materials are destined for particular fates. The National Research Council of the National Academies used this term in its 2006 report "*Managing Coal Combustion Residues in Mines"* for the same reason.

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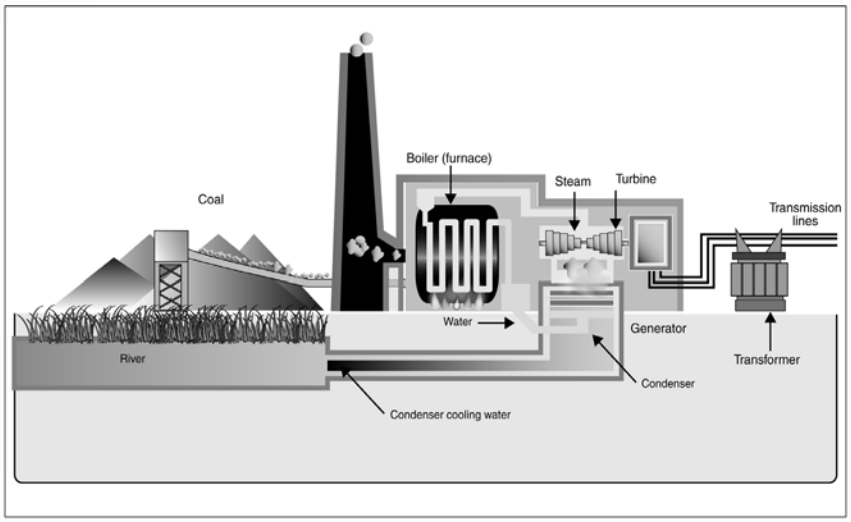
Background (cont'd)

Figure 1: Typical Coal-Fired Power Plant



Source: TVA.

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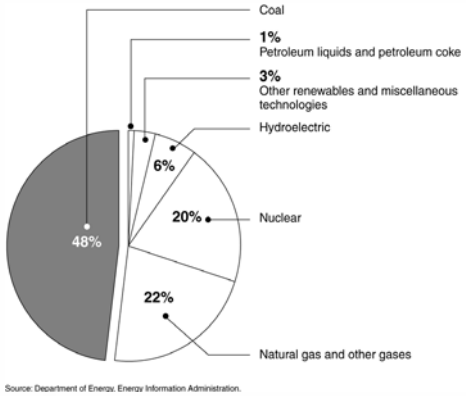
Background (cont'd)

Coal-fired power plants accounted for almost half of U.S. electric power production in 2008 and generated an estimated 131 million tons of CCR in 2007. See figure 2 below.

Figure 2: Net Generation by Fuel Source, 2008



Source: Department of Energy, Energy Information Administration.

Background (cont'd)

- The coal combustion process results in different types of CCR produced, including fly ash, bottom ash, boiler slag and flue gas desulfurization (FGD) material.
  - Fly ash—a product of burning finely ground coal in a boiler. Fly ash is a gray or tan powder.
  - Bottom ash—the heavier mineral residue from a pulverized coal unit, which falls to the bottom of the boiler as small particles.
  - Boiler slag—molten ash that collects at the base of certain furnaces which is then quenched in water and crushed resulting in shiny black, opaque particles.
  - FGD material—wet sludge or dry powder (such as FGD gypsum) that results from the chemical process used to meet sulfur dioxide emission requirements.

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Background (cont'd)

- In 2007, according to industry survey data,[2] the amount of estimated CCR produced by type was as follows:
  - Fly ash: 55%
  - Bottom ash: 14%
  - Boiler slag: 2%
  - FGD material 25%
  - Other 5%

- CCR includes toxics such as arsenic, lead, chromium, and selenium, which can present health and environmental risks.

[2]Data are based on information submitted by 161 coal-fired power plants to the American Coal Ash Association in 2007

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Background (cont'd)

- Several factors help determine CCR's potential uses and the risk it poses to human health and the environment.
  - Chemical and physical characteristics of the source coal,
  - Presence of co-fired materials.
  - Processes used to burn coal and handle the residue.
  - Site characteristics.

- Utilities dispose of CCRs by placing them in surface impoundments, landfills, or mines or by finding alternative, or beneficial, uses for them. Additional details on these options:
  - Surface impoundment—A depression, excavation, or diked area primarily formed from earthen materials to store liquid, sludge, or other waste. Examples include storage ponds and sludge pits. Impoundments may be buried after final deposition.

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Background (cont'd)

  - Waste is generally sluiced directly from a power plant to the impoundment unit, where solids settle out, leaving relatively clear water at the surface.
  - Solids may accumulate in the impoundment, or they may be dredged periodically and taken to another disposal unit, such as a landfill.

- Landfilling—involves the long-term disposal of generally dry waste that is placed on land or in an excavation.

- Minefill—CCR can be used as minefill in mine reclamation. For example, CCR is alkaline, so it can abate acid mine drainage and improve already disturbed mine lands. Minefill can also be used to avoid construction of landfills and storage ponds.

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Background (cont'd)

- Beneficial use—CCR can be used as a component in products, such as cement and gypsum wallboard, or as structural or embankment fill for roads.

- According to EPA, the estimated 131 million tons of CCR generated by utilities in 2007 were disposed of in the following manner:
  - Surface impoundments/ponds; 21%
  - Landfills; 36%
  - Mines; 5% (Minefill is considered by some as a beneficial use or product.)
  - Beneficial uses; 38%
- Between 2000 and 2006, the power industry reported depositing into surface impoundments and landfills CCR containing more than 124 million pounds of six toxic pollutants (arsenic, chromium, lead, nickel, selenium, and thallium).

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Objective 1: Information on CCR Surface Impoundments

The exact number of CCR surface impoundments at utility coal fired power plants is not known:

- No industry organization or government agency tracks this information.
- However, industry groups and federal agencies have obtained estimates through surveying coal-fired power plants as part of efforts to collect and analyze data on CCR disposal practices and state regulatory requirements.

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Objective 1: Information on CCR Surface Impoundments (cont'd)

- In March 2009, in response to the Kingston incident, EPA sent out information request letters to 162 facilities and 61 corporate offices. These companies identified 48 additional plants that operated CCR impoundments, and EPA sent a second round of letters to these facilities. EPA has received responses from all companies and power plants that were sent letters.
  - EPA's purpose was to determine the number of CCR surface impoundments and similar units and specific information about them.[3]
  - Ultimately, EPA aims to assess the structural stability of these impoundments and determine if and where corrective measures are needed.

[3]EPA included in this request similar diked or bermed units or management units designated as landfills that receive liquid-borne material for storage or disposal of CCR because of the different definitions of impoundments used by facilities. EPA did not request information on or access to minefilling or dry landfills.

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Objective 1: Information on CCR Surface Impoundments (cont'd)

- As of July 2009, EPA had collected data from all the power plants to which it originally sent out information request letters. It has created a database that contains information on 584 surface impoundments or similar units in 35 states that were identified by utilities. According to EPA, some of these units may contain negligible amounts of CCRs.

- According to EPA officials, this total is subject to change as EPA obtains more information through actual site visits.

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Objective 1: Information on CCR Surface Impoundments (cont'd)

- Total number of surface impoundments (or similar units) and power plants by state as of September 14, 2009[4]

State	Surface impoundments	Power plants
Indiana	53	16
Kentucky	44	17
Iowa	43	13
Colorado	40	10
Missouri	32	14
Ohio	28	11
North Carolina	26	14
Texas	26	7
South Carolina	22	9
Illinois	21	12
Tennessee	18	8
Minnesota	18	7
Wisconsin	18	5
Wyoming	17	5
Pennsylvania	16	6
Arizona	15	3
Alabama	14	8

State	Surface impoundments	power plants
Kansas	13	6
Virginia	12	7
Michigan	11	5
Louisiana	11	3
West Virginia	10	7
Georgia	10	6
Florida	9	2
New Mexico	9	2
Montana	9	1
North Dakota	8	3
Massachusetts	7	2
New York	6	2
Utah	6	1
Oklahoma	5	2
Delaware	3	2
Maryland	2	1
Arkansas	1	1
Mississippi	1	1
Total	**584**	**219**

Source: EPA.

[4]Data are based on responses to EPA's data request, and are subject to change.

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Objective 2: Problems with CCR Storage and How EPA Is Addressing Them

Problems identified with CCR storage:

- Potential structural defects and other risks of collapse of the surface impoundment, such as at TVA Kingston facility.
- Health and environmental risks from CCR storage due to potential leaching of contaminants into surface or groundwater from unlined or failed liners at surface impoundments, landfills, or sand and gravel pits.
- Potential risks from the discharge of wastewater containing CCR into surface waters from surface impoundments.

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Objective 2: Problems with CCR Storage and How EPA Is Addressing Them (cont'd)

EPA is analyzing the structural hazards associated with surface impoundments:

- Twenty-six reporting facilities cited spills or unpermitted releases from a total of 35 surface impoundments within the last 10 years.
- EPA has identified 49 units with a high hazard potential rating based on criteria developed by the National Dam Safety Program (NDSP) for the National Inventory of Dams (NID).[5]
  - A high rating indicates that a failure would probably cause loss of human life, not that structural integrity is compromised.
  - EPA has committed to assess all of these 49 units.

[5]The NDSP, led by the Federal Emergency Management Agency, is a partnership of the states, federal agencies, and other stakeholders to encourage individual and community responsibility for dam safety. It provides grant assistance to state dam programs, and funding for dam safety research and training. Hazard potential ratings are generally assigned by state dam safety officials. NID is maintained and published by the U.S. Army Corps of Engineers and contains information on dams throughout the United States that are more than 25 feet high, hold more than 50 acre-feet of water, or are considered a significant hazard if they fail.

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Objective 2: Problems with CCR Storage and How EPA Is Addressing Them (cont'd)

- As of October 1, 2009, EPA had visited 38 facilities to conduct structural assessments of their surface impoundments. EPA has made the reports on the first 22 facilities available to the public.

- In a separate effort initiated in 2009, EPA is looking at whether to regulate the structural integrity of CCR surface impoundments through wastewater discharge permits. In addition, because an evaluation found that state wastewater permits vary widely in their structural requirements for impoundments, EPA plans to draft best management practices for state wastewater permits.

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Objective 2: Problems with CCR Storage and How EPA Is Addressing Them (cont'd)

EPA is also analyzing the environmental risk of CCR storage:

- Over the last several years, EPA has analyzed the environmental risk of CCR storage by reviewing cases suggested by environmental groups and others.
- 2007 Damage Case Assessment Report: From 1999 to 2005, EPA gathered or received information on 135 sites where alleged danger to human health and the environment had been caused by CCR deposits. According to EPA, approximately 65 cases were not evaluated because they lacked adequate supporting information. Of the remaining cases, EPA found that 24 cases in 13 states were proven cases of damage to groundwater and surface water, and an additional 39 were potential damage cases.[6] EPA followed up on 16 cases of proven damage to groundwater and, as of July 2009, corrective actions have been completed at seven sites and are ongoing at nine sites.

[6]Since the report was issued, EPA has identified 3 additional cases of proven damage and one additional case of potential damage.

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Objective 2: Problems with CCR Storage and How EPA Is Addressing Them (cont'd)

- As part of another study, begun in 2005, EPA examined the toxins present in CCR wastewater discharges to surface water from coal ash ponds. In September 2009, EPA completed its study. EPA told us it found that current effluent guidelines should be revised because of the high level of toxic-weighted pollutant discharges from coal-fired power plants and the expectation that these discharges will increase significantly in the next few years as new air pollution controls are installed (e.g., scrubbers used to meet air quality regulations).

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Objective 3: Federal Oversight Role and Issues to Be Resolved

EPA does not directly regulate CCR disposal in surface impoundments or landfills to prevent releases or a catastrophic spill but is developing proposed regulations:

- The Resource Conservation and Recovery Act (RCRA) of 1976, as amended, is the key federal law generally regulating solid and hazardous wastes.
- RCRA established a framework for regulation of wastes, including
  - Subtitle C: Federal "cradle-to-grave" regulation of hazardous wastes, including a tracking system and federally enforceable permits.
  - Subtitle D: Inducements for state solid waste programs and implementation of federal minimum regulations for landfills.

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Objective 3: Federal Oversight Role and Issues to Be Resolved (cont'd)

The 1980 Bevill Amendment to RCRA

- Exempted "special study" wastes, including CCR, from RCRA Subtitle C until EPA conducted study and, if EPA determined them warranted, promulgated regulations.
- Required EPA to submit a report to Congress by October 1982 evaluating the adverse effects on human health and the environment, if any, from the storage and utilization of these special wastes.
- Required EPA to make a regulatory determination (within 6 months of the report to Congress) as to whether these wastes warrant regulation under RCRA Subtitle C.

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Objective 3: Federal Oversight Role and Issues to Be Resolved (cont'd)

EPA did not meet some requirements of the Bevill Amendment until years later but has recently taken steps toward regulatory oversight of CCR:

- June 1992—EPA entered a consent decree to settle a citizen suit to enforce Bevill Amendment requirements.

  Pursuant to this, EPA divided CCR into two categories: (1) certain large-volume CCR from electric utilities and independent power producers that is not co-managed and (2) the "remaining wastes" originally identified by Congress.
- Aug. 1993—EPA found that wastes from the first category do not warrant regulation as hazardous waste under Subtitle C, and retained their exclusion from the regulatory definition of hazardous waste.

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Objective 3: Federal Oversight Role and Issues to Be Resolved (cont'd)

- May 2000—EPA issued a Regulatory Determination concluding that the remaining CCR wastes do not warrant regulation as hazardous waste and retaining the exclusion from the regulatory definition of hazardous waste. However:
  - For CCR wastes disposed of in landfills or impoundments, EPA determined that federal regulations under Subtitle D are warranted to provide incentive for states to provide minimum regulatory coverage and that improvement is likely to be slower without them. EPA intended that the regulations would apply to all CCR (e.g., including category 1).
  - EPA left open the possibility that it could revise the determination and decide to regulate under Subtitle C based on additional information in the future.

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Objective 3: Federal Oversight Role and Issues to Be Resolved (cont'd)

- In the 2000 Regulatory Determination, EPA also determined for beneficial uses of CCR wastes:
  - For minefilling, federal regulations under Subtitle D (or possibly the Surface Mining Control and Reclamation Act) are warranted to reduce potential risks.
  - Other beneficial uses (e.g., use in cement, concrete, and wallboard products, and roadbeds and structural fill) were not considered a concern at that time. EPA now notes that indiscriminate use of unencapsulated CCRs in large fill operations has been shown to be problematic in several instances.

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Objective 3: Federal Oversight Role and Issues to Be Resolved (cont'd)

- After 2000, EPA conducted studies to obtain more information on CCR disposal, including:
  - EPA Damage Case Assessment (report published in 2007) (discussed earlier—see slide 21)
  - Draft EPA *Human and Ecological Risk Assessment of Coal Combustion Wastes* (2007) identified potential risk associated with CCR practices. Results suggested that landfills and surface impoundments may present risks to human health and the environment.
  - EPA/DOE joint report *Coal Combustion Waste Management at Landfills and Surface Impoundments 1994-2004* (published in 2006) identified recent and current CCR disposal practices (excluding minefill), state regulatory requirements, and the extent to which states waive or vary regulatory requirements. The study found that most new units have liners and groundwater monitoring. New units, however, are a small subset of the total number of existing units.

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Objective 3: Federal Oversight Role and Issues to Be Resolved (cont'd)

- February 2003—While not specific to coal ash facilities, EPA worked with state solid waste programs, industries, and citizens groups to issue a set of voluntary guidelines in the "Guide of Industrial Waste Management."
- August 2007—EPA issued a Notice of Data Availability (NODA), informing the public of the additional information about CCR available since the 2000 Regulatory Determination (the three studies above) and requested comments. The NODA did not affirm EPA commitment to issuing Subtitle D regulations for CCR.
- March 2009—EPA announced plans to issue proposed regulations for CCR by the end of the year. EPA will consider results of the above studies and comments received as well as results of its assessment of the structural stability of surface impoundments in developing its regulations.

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Objective 3: Federal Oversight Role and Issues to Be Resolved (cont'd)

Current Issues To Be Resolved:

- Despite the 1993 and 2000 Regulatory Determinations, which concluded that EPA would regulate CCR using Subtitle D, EPA has stated it is reconsidering options for regulation including:
  - RCRA Subtitle C;
  - RCRA Subtitle D;
  - a hybrid approach, by which CCR would be considered a solid waste if certain conditions are met, but a hazardous waste if they are not; and
  - EPA has more recently stated it is also considering another hybrid approach whereby wet CCRs (in surface impoundments) would be regulated as hazardous wastes and dry CCRs (in landfills) would be regulated as non-hazardous wastes.
- Current debate by interested groups focuses on these options, which implicate issues of federal versus state control and enforcement.

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Objective 3: Federal Oversight Role and Issues to Be Resolved (cont'd)

Stakeholders have taken positions on RCRA C and RCRA D options being considered by EPA in upcoming regulation.

Option	Industry and state agency associations	Environmental groups
Regulation under Subtitle C	Oppose • Cost and complexity (e.g., lack of hazardous waste storage). • Beneficial use could be hindered by hazardous waste stigma. • Beneficial use would be automatically prohibited by some states' regulations.	Support • Would provide minimum safeguards in every state and be enforceable by EPA. • Would not hinder beneficial use because EPA could regulate CCR differently when disposed of in a landfill versus safely recycled.
Regulation under Subtitle D	Support • Allows for variability and flexibility of rules in states with different geography or topography. • Could require regulation similar to solid waste (e.g., bottom liners, groundwater monitoring, post-closure monitoring). • Would not inhibit beneficial use.	Oppose • EPA could not routinely inspect CCR disposal sites or require permits for CCR disposal; opportunity for public involvement in permits may be limited. • States may not be able to regulate as well as EPA (e.g., lack of resources).

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Objective 3: Federal Oversight Role and Issues to Be Resolved (cont'd)

Most states have RCRA Subtitle D solid waste programs; however, regulatory controls for CCR vary among states:

- According to a 2009 Association of State and Territorial Solid Waste Management Officials survey, to which 44 states responded, 42 had CCR landfills, and 36 had CCR surface impoundments:
  - Of the 42 states with landfills, 36 had a permit program for landfills, 3 did not, and 3 did not respond. Of the 36 states with surface impoundments, 25 had permit programs for surface impoundments, 3 did not, and 8 did not respond. 27 of 42 states required liners for landfills, while 12 of 36 states required liners for surface impoundments.[7]
  - 29 of 42 states had minimum regulatory requirements for structural stability of CCR landfills, while 13 of 36 had such requirements for surface impoundments.

[7]EPA has emphasized that states that do not have a liner requirement may still require liners under some general performance based standard, while states with a liner requirement may have other provisions which allow for variances.

Outlook for CCR Regulation

- EPA projections of near term actions:
  - September 2009—EPA began releasing the reports of the assessment of the high hazard coal ash impoundments.
  - October 2009—EPA plans to forward draft proposed CCR disposal rule to the Office of Management and Budget.
  - December 2009—EPA plans to issue proposed rule. The proposal will be out for public notice and comment. EPA could choose to hold public hearings as well.
- In September 2009, EPA announced its decision to initiate a rulemaking effort to revise the effluent guidelines, including those related to CCR wastewater discharges. Proposed regulations are expected in 2012. EPA has not set target dates for wastewater related efforts such as issuance of best management practices for state wastewater permits and structural requirements to be included in permits.

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