# Our Waters at Risk:

The health and environmental threats from coal ash disposal in Indiana, with a closer look at the coal ash ponds at IPL's Harding Street Station

## Credits and acknowledgements

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## Executive Summary

Indiana is heavily dependent on coal for its electricity – 78% of the state's electric power is generated in coal-burning power plants. But this reliance on coal comes at a high cost: forests and wetlands bulldozed when coal is mined, nearly 35 million pounds of dangerous pollutants released to the atmosphere each year when the coal is burned, and millions of tons of toxic ash left for disposal after the electricity is produced.

It is the final stage of the coal to electricity cycle that is the subject of this report – what becomes of the huge quantity of coal ash produced in Indiana, and what consequences occur for public health, drinking water supplies, rivers and streams. ***Our Waters at Risk*** describes the status of coal ash disposal in Indiana, the threats to public health, the environmental damage that has occurred, and recommendations for reducing this potent health and environmental hazard.

The wastes that are left over after coal is burned in electric generating plants are commonly known as coal ash. More specifically known as coal combustion wastes or residuals, they include fly ash, bottom ash, flue gas desulfurization (scrubber) sludge, and boiler slag.

Indiana electric utilities generated 6.6 million tons of coal ash in 2012. In Indiana, coal ash is disposed of at surface impoundments (ponds or lagoons), landfills, and in surface coal mines. Indiana has more coal ash ponds – 84 --than any other state in the country. When coal is burned, many of the trace elements – such as arsenic, selenium, lead, mercury, and chromium--remain in the ash and are susceptible to leaching -- the process by which toxic materials in coal ash dissolve in water and percolate through the earth. The dissolved toxins, called "leachate," can endanger public health and the environment by contaminating surface water or groundwater used for drinking supplies, particularly when the disposal sites are unlined or otherwise allow the ash to mix with water.

The U.S. EPA study of the human health risks from coal ash found that people who are exposed to coal ash contaminants escaping from an unlined pond may have as high as a 1 in 50 chance of getting cancer from arsenic in their drinking water – a risk that is 2,000 times greater than the EPA's goal of reducing cancer risk to no more than 1 in 100,000 excess cancer cases. Other potential health problems from prolonged exposure to other toxic metals found in coal ash include cancer, heart damage, lung disease, respiratory distress, kidney disease, reproductive problems, gastrointestinal illness, birth defects, and nervous system impacts.

Coal ash is exempt from federal regulation as a hazardous waste, but due to mounting evidence of the health and environmental threats posed by poor coal ash disposal practices, the EPA is considering a new federal rule to regulate coal ash disposal in landfills, ponds and lagoons and must complete this new rule by December 19, 2014. The absence of federal rules has left coal ash regulation to the states, which have not acted to ensure safe disposal of coal ash. The result is that Indiana's record of spills and drinking water contamination is among the worst in the nation: 10 contaminated sites, including a Superfund site that has still not undergone cleanup, and 3 coal ash spills. What's more, the dams and embankments at Indiana's coal ash ponds have mostly escaped state safety

oversight. Dam safety assessments conducted by EPA at the state's coal ash ponds have rated five as "high hazard" meaning there is a risk to human life in the event of failure.

One of the 17 Indiana power plants where coal ash is disposed of in ash ponds is the Indianapolis Power & Light's (IPL) Harding Street Generating Station in Indianapolis. All but one of the eight ash ponds at Harding Street are unlined, and the ponds are located in the West Fork White River floodplain above a shallow sand and gravel aquifer which is also the source of drinking water for a southside neighborhood and supplies a wellfield for Citizens Water.

In 1989, IPL reported to the Marion County Health Department that its groundwater monitoring had identified several contaminants in its monitoring wells, including boron, arsenic, total dissolved solids and mercury. A HEC review of this groundwater information reveals concentrations of arsenic, mercury, and dissolved solids that exceeded national drinking water standards, and that levels of boron were three times the EPA's Child Health Advisory for drinking water.

**Conclusion and Recommendations**

In light of the widespread mismanagement of toxic coal ash and the lack of adequate regulation nationally and in Indiana, the best approach to ensuring the safety of Hoosiers and to the protection of our water is adoption of federally-enforceable rules that all states are required to adopt. Our state's laws and rules governing coal ash disposal are among the weakest in the country. In Indiana, household trash is subject to stricter oversight than is disposal of toxic coal ash, even though coal ash contains life-threatening hazardous substances, including metals like arsenic and mercury that leach from the ash when it comes into contact with water. HEC recommends that:

1. The U.S. EPA should adopt its Subtitle C option as the final federal rule for coal ash disposal.

2. The U.S. Congress should not take any action that hinders EPA's completion of its coal ash rulemaking process or that restricts EPA's authority to enforce rules governing coal ash disposal

3. Indiana's electric utilities should close and decommission their coal ash ponds and replace them with a modern dry ash handling and disposal system that allows appropriate reuse of ash, reducing the need for final disposal. If disposal is necessary, coal ash should be disposed inwell-engineered landfills that meet or exceed construction and operating standards for MSW landfills. These standards include requirements for a composite liner, leachate collection, daily cover of the waste, adequate groundwater monitoring and corrective action requirements to clean up contamination backed up by financial assurance posted by site owners.

4. In addition to stronger, more effective oversight of coal ash disposal, Indiana should adopt and broaden state policies to encourage energy efficiency, deployment of renewable energy sources, and other strategies that reduce Indiana's dependence on coal as an energy source.

## Introduction

Indiana is heavily dependent on coal for its electricity – 78% of the state's electric power is generated in coal-burning power plants.[1] But this reliance on coal comes at a high cost: forests, farmland, and wetlands bulldozed when coal is mined, nearly 35 million pounds of dangerous pollutants released to the atmosphere each year when the coal is burned, and millions of tons of toxic ash left for disposal after the electricity is produced.

It is the final stage of the coal to electricity cycle that is the subject of this report – what becomes of the huge quantity of coal ash produced in Indiana, and what consequences occur for public health, drinking water supplies, rivers and streams. ***Our Waters at Risk*** describes the status of coal ash disposal in Indiana, the threats to public health, the environmental damage that has occurred, and recommendations for reducing this potent health and environmental hazard.

*Coal ash being sluiced into the bottom ash pond at AEP Tanner's Creek power plant. Photo: Lockheed Martin, 2009*

## *Part 1*

# What is coal ash and how does it threaten public health and the environment?

"Coal ash" is the generic term for wastes that are left over after coal is burned in electric generating plants or industrial boilers. More specifically known as coal combustion wastes or residuals, they include fly ash, bottom ash, flue gas desulfurization (scrubber) sludge, and boiler slag.[2] Over 109 million tons were generated in the U.S. in 2012, down from 130 million tons in 2011.[3] The amount of coal ash generated is more than three times the annual amount of hazardous waste generated in the U.S. [4]

After combustion occurs, coal ash is collected from a combustion boiler, and/or the control equipment used to reduce air emissions from coal-burning, and transported to a disposal facility. This transport may be by truck or through pipes or other conveyances after the ash is mixed with water, known as "sluicing."[5]

**Coal Ash Disposal Practices**

Surface impoundments (ponds or lagoons) and landfills are the most common disposal facilities for coal ash.[6] Coal ash is also disposed in surface coal mines or other types of mines.

***Surface impoundments***

Alternately known as wet disposal, wastewater treatment, or waste storage, coal ash surface impoundments are constructed lagoons or ponds where the ash is mixed with water and stored.[7] Although considered a wastewater treatment system by EPA and the State of Indiana, these surface impoundments do not provide effective "treatment" for the most hazardous pollutants in coal ash and the accompanying wastewater.[8] Overflow from the lagoon or pond is usually discharged into a nearby waterway pursuant to a Clean Water Act point source discharge permit. Surface impoundments are normally located at the site of a power plant where coal is burned. Nearly all surface impoundments in Indiana are unlined and many are built within a few feet of the underlying groundwater table.[9]

***Landfills***

Coal ash is disposed of in landfills constructed for the purpose of receiving coal combustion wastes, or in a landfill that accepts a variety of wastes such as a municipal solid waste (MSW) landfill.[10] Landfills must be covered with a soil layer or other cover material in order to reduce windblown dust and water mixing with the wastes. However, for at least one ash landfill in Indiana, the Indiana Department of Environmental Management granted a variance from the daily cover requirement.[11]

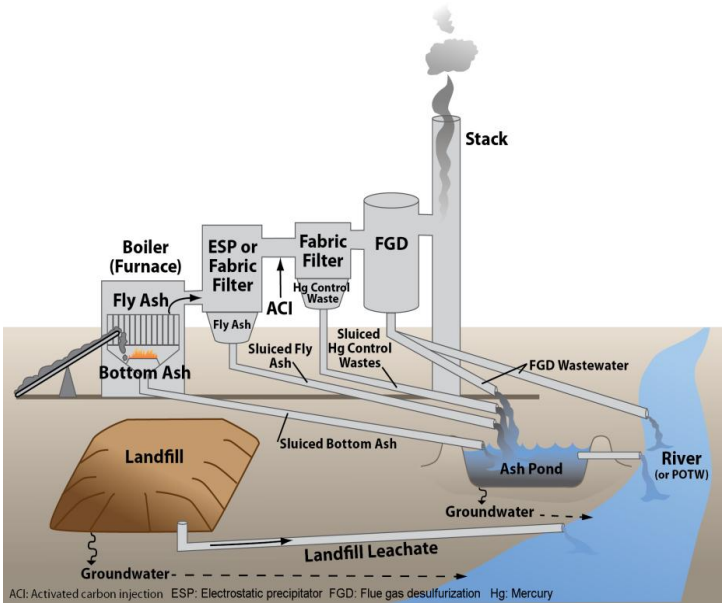
***Minefilling***

Coal ash is also disposed in surface coal mines after mining has been completed.[12] The ash is dumped in mined areas and later covered when mine reclamation occurs. There is no requirement to isolate the coal ash from the water table that forms in the coal ash as groundwater resaturates surface mined areas during and after reclamation.[13]

## HEALTH AND ENVIRONMENTAL RISKS

Coal deposits naturally contain trace elements including metals such as arsenic, selenium, lead, mercury, and chromium.[14] When the coal is burned, many of the trace elements remain in the ash and are susceptible to leaching -- the process by which toxic materials in coal ash dissolve in water and percolate through the earth. The dissolved toxins, called "leachate," can endanger public health and the environment by contaminating surface water or groundwater used for drinking supplies.[15]

Figure 2. Coal ash exposure pathways




The pathways for coal ash to reach humans include:[16]

- Drinking well water contaminated with metals and other substances contained in coal ash;
- Breathing airborne (fugitive) coal ash dust;
- Contact with contaminated surface waters or consuming contaminated fish.

An EPA study of the human health risks from coal ash found that people who are exposed to coal ash contaminants from drinking well water contaminated by leachate from an unlined pond where coal ash is disposed along with other coal wastes, have a 1 in 50 chance of getting cancer from arsenic in their drinking water – a risk that is 2,000 times greater than the EPA's goal of reducing cancer risk to no more than 1 in 100,000 excess cancer cases.[17]

Prolonged exposure to other toxic metals found in coal ash can cause several types of cancer, heart damage, lung disease, respiratory distress, kidney disease, reproductive problems, gastrointestinal illness, birth defects, impaired bone growth in children, nervous system impacts, cognitive deficits, developmental delays and behavioral problems.[18] (See Appendix C for further information.)

Coal ash is expected to become more hazardous as new air pollution control regulations go into effect. For example, the U.S. EPA's Mercury and Air Toxics Standards for Power Plants (MATS) will require new pollution controls on power plants to reduce mercury and other toxic emissions released into Indiana's air.[19] Air pollution controls do not eliminate mercury, lead and other pollutants, but rather transfer the pollution to the land and water. These toxins will end up in a power plant's waste stream that is disposed of in surface impoundments and landfills. [20]

## CONSEQUENCES OF LAX COAL ASH OVERSIGHT

Coal ash is exempt from federal regulation as a hazardous waste, pursuant to two separate U.S. EPA regulatory determinations.[21] But due to mounting evidence of the health and environmental threats posed by poor coal ash disposal practices, the EPA in June 2010 proposed two options for a new federal rule to regulate coal ash disposal in landfills and surface impoundments. This rule has not been finalized, but the EPA has agreed to complete it by December 19, 2014.[22] The absence of federal rules has left coal ash regulation to the states, which in most cases has resulted in minimal disposal standards that have not prevented groundwater contamination or catastrophic spills. There are 208 cases, in 37 states, of known groundwater contamination and surface water spills throughout the country.[23] The serious risks of poorly-regulated coal ash disposal received widespread public attention in December 2008 when a dam failed at the Tennessee Valley Authority's Kingston power plant, releasing 1 billion gallons of coal ash sludge into the Emory River.[24]

*Aftermath of TVA Kingston coal ash spill*
*December 2008 photo: Tennessee Valley Authority*

Although not on the same scale, similar spills occurred at Indianapolis Power and Light's Eagle Valley power plant near Martinsville, Indiana in 2007 and 2008. Roughly 60 million gallons of coal ash sludge were released to the West Fork White River after the same pond levee failed twice.[25] None of the coal ash sludge released to the river was recovered.[26]

The most recent major coal ash spill occurred in North Carolina in February 2014. Roughly 39,000 tons of coal ash spilled into the Dan River when a stormwater pipe underneath coal ash ponds at Duke Energy's Dan River power plant failed, allowing the ash sludge to drain into the pipe and then to the river.[27]

*IPL Eagle Valley coal ash pond embankment under repair after coal ash spills.* *photo: CDM*

At Duke Energy's Wabash River power plant near Terre Haute, a seven-foot diameter corrugated metal pipe runs beneath one of the power plant's coal ash ponds.[28] This is the same type of pipe that failed at Duke Energy's Dan River plant.[29]

## COAL ASH IN INDIANA

Indiana electric utilities generated 6.6 million tons of coal ash in 2012.[30] These wastes are disposed of in surface impoundments, restricted waste landfills (RWS), surface coal mines, or sold for reuse. Table 1 lists the surface impoundments and restricted waste landfills at Indiana power plants. In 1989, several Indiana electric utilities began dumping their coal ash at active surface coal mines in Southwest Indiana, and by 2003 had disposed of more than seven million tons of coal ash at surface mines.[31] This practice created a great deal of controversy,[32] and led to several failed attempts by the Indiana Natural Resources Commission to adopt new regulations governing this practice.

**Table 1. Surface impoundments and landfills at Indiana power plants**

| Power plant | Number of ponds | RWS landfills by type | Dams/embankments hazard rating | Liners at pond(s)? | Comments |
|---|---|---|---|---|---|
| **Clifty Creek (IKEC)** | 2 | Type I | Significant | No | RWS fly ash/FGD waste landfill "constructed over hydraulically placed fly ash" |
| **AB Brown (Vectren)** | 2 | Type III | Significant | No | |
| **Culley (Vectren)** | 2 | | Significant | No | |
| **RM Schahfer (NIPSCO)** | 6 | Type I | High – 2 ponds<br>Significant – 3 ponds<br>Low – 1 pond | No – 5 ponds<br>Yes – 1 pond | |
| **Bailly (NIPSCO)** | 6 | | N/A | Yes | Ponds are built in ground, no dams |
| **Michigan City (NIPSCO)** | 6 | | Significant – 2 ponds<br>Low – 3 ponds | No | "Prior to 1973, fly ash was used as structural fill to fill in the shoreline of Lake Michigan." |
| **Mitchell (NIPSCO)** | 6 | | Less than low | No | Plant closed, ponds have no liquid |
| **Merom (Hoosier Energy)** | 4 | Type I, Type II | N/A | No – 2 ponds<br>Yes – 2 ponds | Fly ash and bottom ash disposed of in dry landfill; ponds are stormwater facilities that also contain ash – built in ground, no dams |
| **Ratts (Hoosier Energy)** | 4 | Type I | Significant – 1 pond<br>Low – 1 pond<br>Less than low – 2 ponds | No | |
| **Gibson (Duke Energy)** | 6 | Type I, Type II | Low – 1 pond<br>Less than low – 5 ponds | * | "…seepage from Ash Pond #3 had occurred in the past based on groundwater monitoring well data. This seepage was a contributing factor in the decision to close Ash Pond #3." |
| **Cayuga (Duke Energy)** | 4 | Type I | Significant – 3 ponds<br>Low – 1 pond | No – 3 ponds<br>Yes – 1 pond | |
| **Gallagher (Duke Energy)** | 3 | Type I | Significant – 1 pond<br>Low – 1 pond | No | 2 of 4 generating units retired |
| **Wabash River (Duke Energy)** | 4 | | Significant – all | No – 3 ponds<br>Yes – 1 pond | |
| **Edwardsport (Duke Energy)** | 2 | | Significant - all | No | Plant closed. New IGCC power plant built adjacent to former site. |
| **Harding Street (IPL)** | 8 | | High - 2 ponds<br>Significant – 2 ponds<br>Low – 4 ponds | No - 7 ponds<br>Yes – 1 pond | |
| **Eagle Valley (IPL)** | 5 | | High – 1 pond<br>Significant – 4 ponds | No | Plant to be retired in 2016 and replaced by natural gas-fired plant |
| **Petersburg (IPL)** | 4 | Type III | Significant – all | No | |
| **Rockport (AEP)** | 6 | Type II | Low - all | No | |
| **Tanner's Creek (AEP)** | 4 | Type I | Significant - all | No – 3 ponds<br>Yes – 1 pond | Plant to be retired in 2015 |
| **Total** | **84** | **13** | | | |

***Source: U.S. EPA Coal Ash Impoundments Assessment Reports; 104(e) Information Request responses from Electric Utilities;[33] IDEM, List of permitted solid waste facilities, March 2014[34]; Earthjustice 2014***
***Notes: Some utilities use both ponds and landfills for ash disposal. Inactive ponds at some power plants may still contain coal ash. See Appendix F for description of hazard potential ratings. *Unable to determine liner status from available information.***

Thirteen cases of groundwater contamination or spills—which occurred at more than half the power plants in Indiana-- have been documented at Indiana coal ash sites. See Table 2. Since groundwater monitoring is not required at coal ash ponds, any contamination occurring at other ash ponds may not be discovered.

*Yard 520 Landfill, Town of Pines*

The most serious damage from coal ash pollution in Indiana occurred in the Town of Pines near Michigan City. For nearly a 20-year period, the Northern Indiana Public Service Company (NIPSCO) dumped over one million tons of coal ash from its Michigan City and Bailly power plants into the Yard 520 Landfill adjacent to the town. More coal ash was used as road surface material and for other fill throughout the town. The coal ash contaminated private water wells, leaving the residents' drinking water unfit to drink.[35] At least thirty wells were contaminated with hazardous substances such as boron, arsenic, lead, molybdenum, and manganese at levels as high as 118 times the level that federal standards deem safe for drinking water.[36] Over 260 homes and businesses formerly on wells have been connected to municipal water from neighboring Michigan City as a precaution.[37] The contamination in Pines is so severe that virtually the entire town was designated a Superfund site, and is now the target of a clean-up plan.[38] NIPSCO, along with the two companies, Ddalt Corp., and Brown, Inc. that owned and operated the Yard 520 landfill, and a waste hauling company, Bulk Transport Corp., have accepted responsibility for clean-up of the contamination in the Town of Pines.[39]

**Table 2. Documented cases of groundwater contamination and/or spills at Indiana coal ash sites**

| | Type of contamination | Spill | Contaminants reported |
|---|---|---|---|
| **A.B. Brown** | Groundwater | | Sulfate, total dissolved solids, chloride, pH |
| **Bailly Station** | Groundwater | | Arsenic, lead, cadmium |
| **Cayuga** | Groundwater | | Sulfates and total dissolved solids |
| **Clifty Creek** | Groundwater | | Boron, manganese, iron, sulfates |
| **Eagle Valley** | Surface water/White River | 2 | Bottom ash, fly ash, boiler slag, ash wastewater, other |
| **Gibson** | Groundwater | | Arsenic, selenium, boron, other |
| **Harding Street** | Groundwater | | Arsenic, boron, mercury, total dissolved solids |
| **Merom Station** | Groundwater | | Barium, chromium, cadmium, lead, other |
| **Michigan City** | Groundwater | | Arsenic |
| **Petersburg** | Groundwater | | Sulfate and total dissolved solids |
| **R.M. Schahfer** | Groundwater/adjacent land | 2 | Sulfate |
| **Ratts** | Surface water/White River | 1 | Fly ash and ash wastewater |
| **Yard 520/Brown's Landfill** | Groundwater | | Benzene, arsenic, manganese, boron, other |

***Source: Earthjustice, from EPA and EIP data[40]; HEC, from IPL data; U.S. EPA Report of Dam Safety Assessment of Coal Combustion Surface Impoundments, Hoosier Energy Frank E. Ratts Generating Station***

***Indiana Regulatory Oversight***

Because of the lack of federal standards, the State of Indiana regulates coal ash disposal. But this state oversight is limited or non-existent, depending on the type of disposal practice.[41]

State law allows the use of surface impoundments (ponds and lagoons) for coal ash disposal, but does not impose construction standards nor require liners or other practices to prevent wastes from contaminating groundwater beneath the ponds, if the disposal facility has a Clean Water Act discharge permit.[42] Nor is any groundwater monitoring required or inspections conducted for ash disposal ponds.[43] Without groundwater monitoring, regulatory agencies have no way to trigger corrective actions when contamination exceeds allowable levels. Surface impoundments with an overflow pipe that discharges into a waterway must obtain a Clean Water Act permit known as a National Pollutant Discharge Elimination System (NPDES) permit.[44] These permits are required to set limits on pollutants released to ensure that they do not cause or contribute to a violation of the state's water quality standards. However, for water discharge permits granted to coal ash ponds, Indiana *does not limit* many of the pollutants typically contained in coal ash ponds – such as arsenic, lead, boron, and chromium—but only requires that the utility *monitors* the amount of pollutants released.[45] For surface impoundments with no overflow permit, a state wastewater treatment facility construction permit is required but standards are minimal and do not require use of liners or groundwater monitoring.[46]

Ash disposal in landfills is regulated under the state's solid waste management rules.[47] Coal ash landfills are permitted as "restricted waste" landfills (RWS) which fall into four categories –Type I, Type II, Type III and Type IV.[48] These categories are distinguished by how stringent the requirements for monitoring and containment are.[49] There are 13 restricted waste landfills currently permitted for use by Indiana utilities. RWS landfills are subject to specific construction standards, and groundwater monitoring is required for Type I and Type II sites, but not at Type III sites.[50] However, the monitoring requirements may not be sufficient to disclose if groundwater contamination is moving away from the disposal site, and thus posing a risk to nearby drinking water supplies. This is the case at the Clifty Creek power plant near Madison, Indiana, where monitoring wells are not adequate to determine if known groundwater contamination from the coal ash disposed there is migrating toward the water supplies for the towns of Madison and Hanover.[51]

The Indiana Department of Natural Resources (DNR) is responsible for ensuring that dams and levees in the state are safe. This authority, under Indiana law, includes conducting or requiring inspections of dams and levees, and taking enforcement actions if these structures are not properly maintained or considered unsafe.[52] State law also requires that dams be ranked for their level of hazard, to people and property.[53] However, based on responses provided by Indiana's electric utilities to a U.S. EPA survey conducted in 2009 in the wake of the Kingston disaster, neither the Indiana DNR nor any other state or federal agency had conducted inspections of most of the dams or embankments at coal ash ponds at Indiana's power plants. DNR did inspect a dam at the Tanner's Creek facility in 2006, as well as dams at the AB Brown Generating Station for which the DNR had issued construction in floodway permits under Indiana's Flood Control Act.[54] This lack of state or federal inspections persisted even after levee failures at the Frank Ratts and Eagle Valley power plants in 2006, 2007, and 2008.[55] As of 2014, EPA has assigned

five coal ash ponds in Indiana with a hazard potential rating of "high", meaning a facility "...where failure or misoperation will probably cause loss of human life." These five high hazard-rated ponds are at three power plants: IPL's Harding Street Station, IPL's Eagle Valley Station, and NIPSCO's R.M. Schahfer Power Station.[56]

Other ponds with a "significant" hazard rating are at the Clifty Creek Generating Station near Madison, the Michigan City Generating Station, and the Wabash River power station near Terre Haute.[57] Thirty-three ponds have a condition rating of "poor" by the EPA.[58]

*NIPSCO Michigan City Generating Station coal ash ponds discharge channel to Lake Michigan*
*photo: GZA GeoEnvironmental*

## *Part 2*

# A closer look at IPL's Harding Street Station coal ash ponds

**Site Description**

The Harding Street Station is a coal-fired electricity generating station owned and operated by Indianapolis Power & Light (IPL) Company, located on Indianapolis' southwest side, in Marion County, Indiana, with a production capacity of 1,094 megawatts (MW).[59] The power plant and ash ponds are located approximately 1.5 miles upstream (north) of the nearest residential areas on the east bank of the White River in the river's floodplain. Harding Street Station began operation in September 1941, and has relied on eight coal ash ponds for its waste disposal. The total surface area of the ponds is 75.29 acres, and the total storage capacity is 1,535,639 cubic yards (CY).[60] An aerial view of the coal ash ponds is shown in Figure 3. The construction history of the ash ponds is reported in Appendix B.

*Coal ash pond #4 at IPL Harding Street power plant photo: CDM*

**Oversight and Reports**

According to responses submitted by IPL to the U.S. EPA Information Request in 2009, none of the coal ash ponds at the Harding Street Station had ever been inspected by state or federal regulatory agencies.[61] Moreover, none of the ash ponds had ever been rated for hazard potential by any state or federal agency, prior to the EPA ratings.[62]

As a follow up to the EPA's 2009 information survey of electric utilities, EPA commissioned assessments of the structural integrity of coal ash impoundments in 2009 and 2010. In the report prepared for the Harding Street Station, entitled "Assessment of Dam Safety of Coal Combustion Surface Impoundments",[63] coal ash ponds at Harding Street Station were rated for their potential hazard based on the U.S. EPA classification system. Two of the ash ponds were assigned a "high hazard" potential rating. All of the coal ash ponds were rated "poor" for their structural condition.[64] EPA's assessment found no records of state or federal inspections of the ponds, no operations or maintenance plan, and no emergency plan providing response procedures in the event the ponds' embankments failed and leaked ash or contaminated water.[65]

After the coal ash ponds at Harding Street Station were assessed by EPA contractor CDM, IPL committed to the following action plan to address the structural issues identified in the CDM report.[66]

The Action Plan consists of three tasks:

- Task 1 – Preparation of a Set of "As-Built" Plans for the CCW [coal ash]Ponds
  There are two main steps of Task 1. The first step is to compile all existing information and data and then prepare a set of initial Plans for the CCW facilities, and the second step is to review the initial Plans and decide where existing data must be supplemented with new data in order to complete the Plans.
- Task 2 – Perform Hydraulic and Stability Analyses of Each CCW Pond
  Divided into two sub-tasks; Task 2a includes the hydraulic analyses of each of the CCW ponds and all of the hydraulic structures [such as the connecting pipes and gates] between the connection at the plant and the discharge point from the CCW ponds to the downstream receiving point; Task 2b includes the static and seismic stability analyses of typical cross sections for each of the CCW ponds.
- Task 3 – Operation and Maintenance Plan
  Divided into three sub-tasks; Task 3a includes the operation and maintenance plan; Task 3b includes the instrumentation and monitoring plan to describe procedures for measuring and recording data; Task 3c includes the emergency action plan.

*Figure 3. Coal ash ponds at IPL Harding Street generating station*

IPL completed its required Ash Pond Operations and Maintenance Plan in April 2012.[67] The Operations and Maintenance Plan contains no provisions for monitoring groundwater, installing liners, or otherwise ensuring that the coal ash ponds are not leaching contaminants into the underlying aquifer.[68] The Emergency Action Plan was completed in October 2012. It contains no detailed action steps for clean-up or remediation of coal ash or fluids mixed with ash that leak or spill from the ponds.[69]

**Wastes stored in coal ash ponds and environmental releases**

The Harding Street Station ponds contain Coal Combustion Residuals (CCRs) and other types of plant wastes. CCRs include bottom ash, fly ash, boiler slag, flue gas emission control residuals. Other wastes include cooling tower blowdown, ash and pyrite system waste, boiler blowdown, flue gas desulfurization (FGD) system blowdown, stormwater, metal cleaning wastes, and river dredging materials. [70] This mixing of wastes increases the health risks from coal ash contamination, as noted in U.S. EPA's Human and Ecological Risk Assessment of Coal Combustion wastes, which reported, "…..for surface impoundments, codisposal of CCW [coal ash] with coal refuse results in significantly higher risks from arsenic and certain other constituents than CCW disposed alone."[71]

According to the U.S. EPA Toxic Release Inventory (TRI) database, IPL's Harding Street power plant released 1.6 million pounds of toxic substances to the environment in 2012.[72] Most of this pollution was emitted through the plant's smokestacks as air emissions, some of which are deposited in surface waters and affect water quality. Over 475,000 pounds were disposed of in surface impoundments at the plant, and 959 pounds were released as fugitive air emissions, including fugitive dust from the coal ash ponds.[73]

In a March 2014 presentation at a coal combustion residuals conference, IPL reported that it disposes of approximately half of its total coal ash produced at surface mines. The remainder is sold either as an ash product –for use in cement or concrete -- or as synthetic gypsum. IPL's presentation indicated that all but one of the ash ponds at its three coal-fired power plants are full.[74]

The following section evaluates the exposure pathways to the coal ash disposed in the ash ponds.

*Pond 3 discharge pipe to Lick Creek. photo: CDM*

**Exposure Pathways**

Three main pathways exist for the release of coal ash or its contaminants to humans and the environment: [75]

1. Coal ash and its constituents pose a health hazard through inhalation as airborne particles.

2. Coal ash and ash pond wastewater are directly released to surface water, through overflows or dam/levee breaches potentially resulting in contaminated fish that are consumed by humans.

3. Leachate from coal ash in unlined ponds can infiltrate groundwater that is used as drinking water.

The ash ponds are constructed in the White River's floodplain.[76] According to IPL documents, the company has raised the elevation of the pond levees as the ponds were reconstructed or reconfigured, with the current levee heights ranging from 685 to 718 feet above sea level in elevation.[77] The bottom elevation of the ash ponds is 670 feet.[78]

The U.S. Geological Survey maintains a stream gauge on the West Fork White River across from the Harding Street Station. Flood stage at this gauge is 673.4 feet.[79] The record flood level (1913) at this location was nearly 29 feet above the gauge, an elevation of 692.3 feet,[80] above the levee heights of all but one of the Harding Street ash ponds.

Any breaches or failures of the ash pond levees could result in a release to Lick Creek and the West Fork White River. Also, a major flood of the West Fork White River could overflow the ash pond levees, resulting in flood waters carrying coal ash into the river.

Overflow from the coal ash ponds ultimately is collected in Pond 3, and then discharged to Lick Creek, a tributary of the West Fork White River.[81] Lick Creek flows from east to west through the Harding Street Station property, with the power plant buildings north of the creek, and the ash ponds south of the creek. See Figure 3.

As noted in Part 1, many NPDES surface water discharge permits for coal ash ponds do not impose limits on the metals typically discharged from coal ash surface impoundments, since these ponds are considered a treatment technology for solids and grease, but not the metals that are present in the ash pond wastewater.[82] Table 3 lists the quantity of chemicals and metals discharged from the Harding Street Station surface water discharge pipe, according to IPL's TRI report. Harding Street's NPDES permit does not limit the release of several of these pollutants as noted in the table.[83] Another common pollutant in coal ash, boron, also is not limited by the permit.[84]

**Table 3. Chemicals released from Harding Street ash ponds surface water discharge (2012)**

| Chemicals | Surface water discharge (lbs) | Discharge limited by permit? |
|---|---|---|
| **ammonia** | 3,298 | No |
| **arsenic** | 2,808.4 | No |
| **chromium** | 159 | No |
| **copper** | 16,621 | Yes |
| **lead** | 22.5 | No |
| **manganese** | 9,293 | No |
| **mercury**[85] | 3.02 | Yes |
| **nickel** | 1,063 | No |
| **zinc** | 1,152 | No |

***Source: U.S. EPA, TRI (Toxic Release Inventory) Explorer online database, for Harding Street Station, IPL***

Table 3 shows copper and mercury discharges are limited by IPL's wastewater discharge permit. Until September 2012, however, IPL's wastewater permit did not place limits on mercury or copper. Under the terms of the 2012 permit, IPL had three years (until 2015) to install pollution control equipment to meet the new requirements. However, in April 2013 IDEM granted IPL an additional two years to install equipment that would protect Lick Creek and the White River from these pollutants. IDEM fined IPL only $1,500 for its failure to meet the 3-year deadline. As a result, the controls do not have to be in place until September 2017. [86]

Concerns about water pollution are compounded by the loose sand and gravel soils underneath the ash ponds. The Harding Street Station coal ash ponds are constructed directly above the shallow sand and gravel aquifer that adjoins the White River, spreading as far as two miles from each bank of the river.[87] According to IPL, "the ponds were created by berms constructed of native site soils including clay and sand and ash."[88] Pond 2 has a geosynthetic clay liner, but there are no other linings or engineering treatments to control or collect leachate from the ash stored in the other seven ponds.[89] The White River Outwash Aquifer System, over which the Harding Street Station power plant and coal ash ponds are located, is "highly susceptible to surface contamination where sand and gravel deposits are near the surface and have little or no clay deposits."[90] Well records for this area reveal that clay deposits above the aquifer, which include sandy clays, diminish in thickness as they near the river, eventually disappearing completely.[91] Coal ash pond number 2 is located roughly 500 feet from the river, and pond 1 is about 110 feet from Lick Creek.[92] Static water levels (the distance between the ground surface and water level in a well) for wells in the immediate vicinity of the coal ash ponds may be as little as 4 feet; IPL's own water wells, used for power plant operations, have water levels as little as 9 feet below the surface.[93] Ash Pond 4 was constructed in a former gravel borrow pit, meaning coal ash has apparently been dumped directly in the sand and gravel deposits that are part of the aquifer.[94]

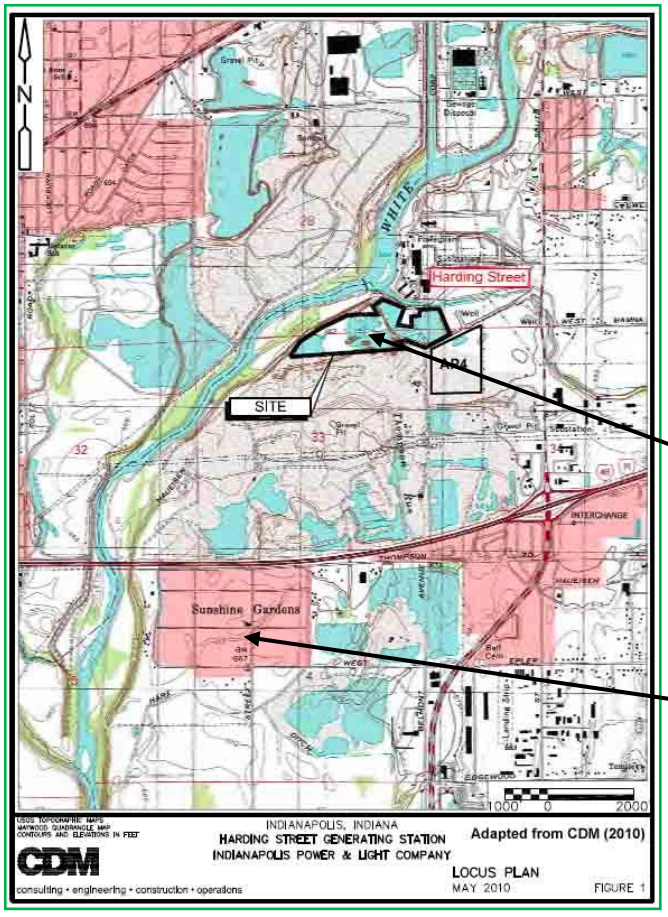
In 1986, IPL installed 13 groundwater monitoring wells adjacent to its coal ash ponds.[95] IPL reported monitoring results for levels of volatile organic compounds (VOCs) quarterly to the Marion County Health Department, but later reduced its frequency of reporting since the monitoring detected no exceedances of standards for VOCs, and was eventually discontinued.[96] IPL's quarterly monitoring reports did not contain any monitoring results for metals or other contaminants typically found in coal ash leachate.[97] However, in an August 1989 response to a Health Department questionnaire, IPL reported background and typical concentrations of chemical constituents in its monitoring wells, including boron, arsenic, total dissolved solids and mercury.[98] In a March 2014 report (Appendix D) prepared for HEC, J. Russell Boulding, a consulting geologist, analyzed the available groundwater monitoring information provided to the MCHD, and stated:

> *The overall conclusion of this preliminary analysis is that toxic concentrations of coal ash contaminants have been migrating in all directions from the ponds since the 1980s and probably much longer. Specific conclusions concerning concentrations of coal ash contaminants in groundwater monitoring wells include the following (see Table 1):*
>
> - *Typical concentrations of arsenic in monitoring wells were 20 ug/L, twice the EPA Maximum Contaminant Level (MCL) for drinking water.*
> - *Typical concentrations of mercury were 20 ug/L, twenty times the MCL for drinking water.*
> - *Typical concentrations of boron were 9,630 ug/L, more than three times EPA's Child Health Advisory for drinking water.*
> - *Typical concentrations of lead were significantly elevated at 10 ug/L, and two thirds of EPA's lead Advisory Level for drinking water.*
> - *Typical concentrations of Total Dissolved Solids (TDS) were 1,233 mg/L, two-and-a-half times EPA's Secondary Drinking Water Standard (SDWS).*
> - *Elevated concentrations of boron and iron in groundwater reported as "background" suggest that the background wells are also contaminated by water that has infiltrated through the unlined coal ash ponds. The reported "background" boron concentration (1,044 ug/L) is more than 6.5 times higher than the 90$^{th}$ percentile concentration for boron in groundwater in the eastern U.S. reported by the U.S. Geological Survey (Ayotte, et al. 2011). The reported background concentration of iron (3.04 mg/L) is 1.4 times the 90th percentile concentration for iron in groundwater in the eastern U.S reported by the U.S. Geological Survey.*

Despite groundwater monitoring results that revealed significant exceedances of drinking water standards, no monitoring is currently taking place to determine the extent and magnitude of contamination in the groundwater beneath and nearby the coal ash ponds. The Boulding report identifies potential pathways for groundwater contamination to reach drinking water wells south of the ash ponds, and recommends new and expanded monitoring at the Harding Street coal ash ponds and in nearby wells. The report also states that the potential

clearly exists for migration of contaminants from the Harding Street ash ponds is all directions from the ponds except to the north.

Two Indianapolis Wellfield Protection Districts are located south of the ash ponds and east of the White River downstream of the Harding Street Station. The northern limit of the 5-year Wellfield Protection District begins just south of the Sunshine Gardens neighborhood, the closest residential area south of the Harding Street Station.[99] The 1-year Wellfield Protection District northern boundary begins at Edgewood Avenue and State Road 37. Several high capacity water wells for Indianapolis' water supplier, Citizens Water – the Perry Wellfield -- are located in this Wellfield Protection District.[100] In comments submitted to the U.S. EPA on the agency's proposed Steam Electric Power Generating Effluents Guidelines, the Citizens Coal Council identified 949 private water wells on record within a three-mile radius of the Harding Street coal ash ponds.[101] Forty-five of these wells are considered significant water withdrawal facilities, meaning they have the capability to withdraw 100,000 gallons or more per day.[102]




As noted above, the nearest residential area, a small neighborhood of roughly 200 homes known as Sunshine Gardens, is located only 1.5 miles south of the Harding Street Station coal ash ponds.[103] Many residents of this neighborhood rely on groundwater wells for their drinking and household water.[104] The water wells used by residents of this neighborhood are located in the same White River outwash aquifer that lies immediately below the unlined coal ash ponds at Harding Street Station.[105]

Harding Street generating station coal ash ponds

## *Part 3*

## Reducing the health and environmental risks from coal ash disposal

The legacy of contamination resulting from coal ash disposed in surface impoundments, along with the poor record of states in preventing this contamination and protecting human health and water resources, are compelling arguments for enforceable federal standards to govern the disposal of coal ash.

The principal federal law governing waste management is the Resource Conservation and Recovery Act (RCRA).[106] Hazardous wastes are regulated by Subtitle C of RCRA, which establishes a uniform set of federal standards that control hazardous waste from its generation to final disposal, including permitting for hazardous waste landfills. Every state must comply with these federal standards for hazardous waste.[107]

Subtitle D of RCRA establishes criteria for managing non-hazardous wastes, but such standards cannot be enforced by EPA, nor are states required to adopt the federal standards in state programs. Subtitle D standards are primarily enforced by citizens through citizen suits.[108]

In 2010, the U.S. EPA proposed new federal rules – but took an unusual approach by proposing two alternative rule versions. One version – the Subtitle C option-- would classify coal ash as a "special waste" and require that coal ash be managed according to federally-enforceable hazardous waste standards. It would require all states to adopt standards for storage, transport, and disposal of coal ash at least as stringent as the federal standards. The method of disposing of coal ash in ponds and lagoons would be phased out, and disposal facilities would be required to provide financial assurance, such as a bond, to guarantee that clean-up of contamination can occur if needed.[109]

The other rule alternative is the Subtitle D option. This version would classify coal ash as a "solid waste" and provide that national standards for managing coal ash are only guidelines for states to follow. EPA would have no enforcement role under this option. Coal ash disposal sites would not be required to obtain permits, nor provide financial assurance, unless required by the state.[110]

The EPA's Subtitle C option proposes to continue the regulatory exemption for certain "beneficial uses" of coal ash. Coal ash is widely used as a strengthening agent in concrete and asphalt, and as a fill material.[111] Synthetic gypsum from flue gas desulfurization equipment (scrubbers) is used in wallboard, and as a soil additive.[112] Use of coal ash in concrete and asphalt (known as "encapsulated" use), has a lower risk that the coal ash will come into contact with water, and EPA proposes to exempt such uses from the proposed coal ash rule's requirements. However, its use as a fill material or soil additive ("unencapsulated"), would allow the ash to come into contact with water, resulting in leachate that may contaminate streams, lakes or aquifers.[113]

Since publishing its proposed Coal Combustion Residuals rule in 2010, the EPA has yet to produce a final rule. During that time, some members of Congress have sought to have Congress decide the issue by introducing bills that dictate the content of federal coal ash regulations, removing EPA authority to regulate coal ash, prohibiting adoption of enforceable federal rules and allowing legacy coal ash sites – such as surface impoundments that stop receiving waste prior to the bill's passage – to remain in place without cleanup or environmental safeguards.[114]

Hundreds of public health and environmental organizations, health professionals, and other organizations support the Subtitle C option as the best approach, given the ineffectiveness of states in regulating this major toxic waste stream.[115] In a legal action brought by Appalachian Voices and nine other environmental and public health plaintiffs, as well as an Indian tribe, a U.S. District Court ruled in October 2013 that EPA has a mandatory duty to review and revise its RCRA regulations every three years.[116] The resulting Consent Decree in this case provides that EPA will issue a final rule by December 19, 2014.[117]

Weak regulation of coal ash disposal by the Indiana Department of Environmental Management and the Indiana Department of Natural Resources has failed to prevent groundwater contamination, or spills, or reduced the likelihood of future environmental and public health disasters.[118] As noted earlier, construction standards, liners, inspections, groundwater monitoring, and effective controls on toxic metals discharged to surface waters are virtually non-existent for coal ash surface impoundments in Indiana. Restricted waste landfills are required to obtain a state permit, but monitoring requirements are not sufficient to reveal if underground contamination is threatening drinking water supplies. The Indiana DNR has failed to exercise its authority to inspect all the dams and embankments that enclose coal ash ponds.[119] Indiana has never adopted regulations setting standards for disposal of coal ash in mines.

Nor has the state made any effort to improve its oversight of coal ash disposal. In 1996, the Indiana General Assembly passed a law directing the Indiana Water Pollution Control Board to "adopt rules for the construction and monitoring of surface impoundments for non-hazardous waste and wastewater."[120] Since that time, no new Indiana rules governing surface impoundments have been adopted.

**Conclusion and Recommendations**

Indiana's streams, lakes and underground drinking water supplies face a considerable risk due to the lack of comprehensive and effective state or federal standards that control coal ash disposal. In Indiana, household trash is subject to stricter oversight than is disposal of toxic coal ash, even though coal ash waste contains life-threatening hazardous substances, including metals like arsenic and mercury that leach from the ash when it comes into contact with water. In fact, including the contamination divulged from past monitoring at the Harding Street Station, there are at least thirteen instances in Indiana of documented coal ash-related groundwater contamination or spills to surface waters resulting from the lack of proper oversight and dangerous dumping. Furthermore many more cases of groundwater contamination from coal ash are likely but unknown given the lack of monitoring at most coal ash disposal sites in the state.

In light of the widespread mismanagement of toxic coal ash and the lack of adequate regulation nationally, the best approach to ensuring the safety of Hoosiers and to the protection of our water is adoption of federally-enforceable rules that all states are required to adopt. This is the Subtitle C option proposed by U.S. EPA in June 2010.[121] Among the many positive aspects of the Subtitle C option is the requirement that "wet disposal" in coal ash ponds be discontinued. The most fundamental principle of proper coal ash management and disposal is to prevent contact with water. Subtitle C embraces this concept and thus provides the best approach for preventing water contamination and resulting public health impacts.

*RECOMMENDATIONS*

1. The U.S. EPA should adopt its Subtitle C option as the final federal rule for coal ash disposal.

2. The U.S. Congress should not take any action that hinders EPA's completion of its coal ash rulemaking process or that restricts EPA's authority to enforce rules governing coal ash disposal

3. Indiana's electric utilities should close and decommission their coal ash ponds and replace them with a modern dry ash handling and disposal system that allows appropriate reuse of ash, reducing the need for final disposal. If disposal is necessary, coal ash should be disposed in well-engineered landfills that meet or exceed construction and operating standards for MSW landfills. These standards include requirements for a composite liner, leachate collection, daily cover of the waste, adequate groundwater monitoring and corrective action requirements to clean up contamination backed up by financial assurance posted by site owners. Rather than being left in place, decommissioned ash ponds that are upgradient of public or private water supplies should be excavated entirely and the ash removed to a safe dry handling and disposal system. Phasing out wet disposal in favor of responsible dry ash handling and disposal that meets these standards will greatly encourage legitimate encapsulated forms of coal ash recycling that pose far lower risks to Hoosiers and their environment.

4. In addition to stronger, more effective oversight of coal ash disposal, Indiana should adopt and broaden state policies to encourage energy efficiency, deployment of renewable energy sources, and other strategies that reduce Indiana's dependence on coal as an energy source.

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