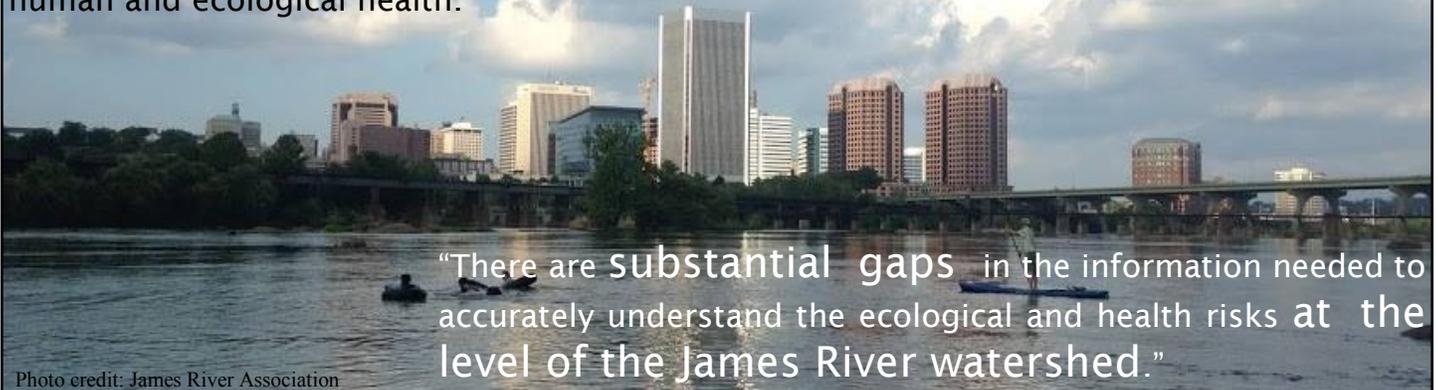




# James River Watershed Risk Analysis

Public Summary, July 2015

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“There are substantial gaps in the information needed to accurately understand the ecological and health risks at the level of the James River watershed.”

Photo credit: James River Association

**On the 40th Anniversary of the Kepone spill into the James River, we look at how far the river has come, what risks the watershed faces today, and how much protection it still needs.**

## Introduction

As the nation's founding river, the James River plays a vital role for Virginia's citizens and environment. It covers a quarter of the state and flows 340 miles from its headwaters in the Appalachian Mountains to its mouth at the Chesapeake Bay. The James was first inhabited thousands of years ago by Paleo-Indians, and several Native American tribes developed along the James. After English colonists settled at Jamestown in the early 1600s, the James became an important shipping and navigation route. The floodplains of the lower section of the river served as land for tobacco plantations, and later ironworks and flour and paper mills were developed. Today, the mouth of the river at Norfolk is home to the largest naval station in the world and one of the busiest harbors in the U.S.

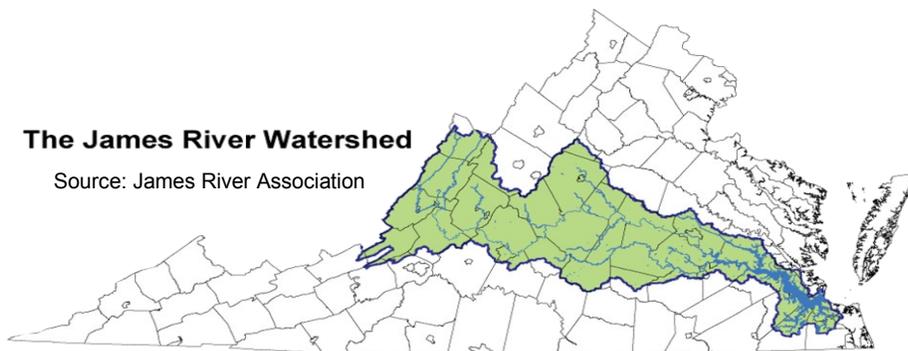
The James River watershed encompasses about 10,000 square miles and is home to one-third of all Virginians. The James and its tributaries provide drinking water to millions of Virginians across 39 counties and 19 cities. The James River is home to a biologically diverse array of species. A number of the 58 federally endangered species in Virginia are found in the James River watershed, such as the Atlantic sturgeon and the James spiny mussel.

Over the past ten years, the number of toxic spills in the Southeast has dramatically increased. In 2014 alone, the following events occurred: the spill of a coal-wash chemical in Charleston, West Virginia; the coal ash pond rupture in Eden, North Carolina; and the oil train derailment in Lynchburg, Virginia. This last event hit close to home for the James River watershed residents, shedding light on a new risk to the Commonwealth's safety. These recent events have demonstrated the fragility of our natural resources and the instantaneous impact that some human activities can exert on our aquatic resources.

Toxic chemicals and other pollutants that are stored, spilled, and discharged into the river and its tributaries threaten the watershed and impact human and ecological health. Three of the most significant sources of risk to the James River watershed are 1) the storage of toxic chemicals within the watershed, 2) coal-fired power plants and their associated coal ash ponds, and 3) crude oil spills during rail transport.

## The James River Watershed

Source: James River Association



This assessment of risks to the watershed begins with a review of the data on the toxic chemicals stored and released from the three major sources. The contaminants from these sources make their way into the water through a variety of pathways. Permitted releases discharged directly into the river, accidental spills, and seepage onto land and into groundwater all present risks to the resources of the river. This report describes the risks posed to both the environment and the humans living in the watershed by being exposed to these types of contaminants. We also review the toxicological effects of these types of chemicals on key ecological resources, termed assessment endpoints, and on human health.

### Storage of toxic chemicals in the watershed

Virginia has a large number of storage tanks with chemicals ranging from highly toxic to unknown toxicity. Thousands of these tanks are located in the James River watershed, clumped around city centers, such as Richmond and the Hampton Roads area. These storage tanks are both aboveground and underground and associated with a wide range of industrial and municipal facilities. Assessing the risks of releases and spills from such storage facilities poses a challenge because the data are often incomplete or not up-to-date. The experiences in other states indicate that a range of factors affects the likelihood of a spill, including the age and condition of the tanks, inspections, operator behavior and susceptibility to risk factors such as floods, hurricanes and tornadoes. Spills or leaks from these types of storage tanks have the potential to contaminate surface and groundwater. Other spills occur both sporadically and continuously in the James River watershed. Approximately 19 incidents occurred in 2014 that directly impacted the James River or the James in combination with another river and that threatened human health in some capacity.

### Chemical Storage in the James River Watershed

Location	≈ # Chemicals Stored	≈ # of Facilities	Chemicals Stored in Largest Quantities
Watershed-wide	>1400*	>1,100	coal ash (11), 12.5% sodium hypochlorite (10), calcium carbonate (10), automotive diesel fuel (9), MPC fuel oil/diesel/kerosene (7); MPC gasoline (7); aviation gasoline (6), various oils (6), petroleum hydrocarbons (6); others
City of Richmond	>250*	>30	calcium carbonate (10); automotive diesel fuel (9); lead acid batteries (4); diesel fuel, aviation gasoline (6); coal ash (6); plasticizers, motor oils, paint (flammable), natural gas, denatured ethanol (6), "withheld" (6) and (7)
Hopewell	>200*	19	coal, ammonium carbonate/bicarbonate, ammonium sulfate crystals, black liquor, caprolactam (8); #2 diesel fuel, ammonia, green liquor, sulfur (7); ; bottom ash, fly ash/recycle, used oil (5); others
Lynchburg	>80*	>40	#2 diesel fuel, #4 recycled diesel, diesel fuel, fuel oil #2, toluene, brine solution (5); lead acid batteries, locomotive lubricating oil (4); diesel fuel oil (3); others
Hampton	>64*	36	diesel fuel, lead acid batteries, diesel fuel No. 2, nickel, potassium hydroxide, aluminum oxide (5); antifreeze, diesel fuel, automotive gasolines (4); others

Source: VDEQ "Stored Toxics with Lat. Long."

\* Includes those not assigned CAS#s and those with "N/A" CAS#s

## Coal ash in the watershed

Coal combustion residues are collectively a variety of materials generated from the combustion of coal. Coal ash commonly contains an assortment of chemicals and metals and is usually stored in three primary ways: dry disposal in landfills, wet disposal in “ponds” or “lagoons,” and surface or underground mine filling. Coal ash contaminants are transported through the environment in several different ways: aerial routes (e.g. dust resuspension), emanation of radioactivity, mercury volatilization, phytoaccumulation and plant toxicity, and effluent discharge and percolation to groundwater and rivers.

Virginia’s coal-fired power plants produce about 2.73 million tons of coal ash annually. In Virginia, there are minimal regulations regarding the storage of coal ash. Virginia dam safety regulations, enforced by the Virginia Department of Conservation and Recreation (VDCR), do not require stricter safety standards for coal ash ponds than for regular dams, and many of the impoundments are not regulated as dams, meaning that inspections by state personnel do not routinely occur. Also, a number of coal ash ponds are unlined, allowing contaminants to leach into sediment and groundwater. The EPA national effort to understand the risks from coal ash storage ponds provided some important insight into the risks, indicating that at least two major facilities are significant risks in the James River watershed. As such, the appropriate approach is addressing the deficiencies identified by EPA.

## Coal Ash Impoundments and Landfills in the James River Watershed

COMPANY	FACILITY	LOCALITY	# UNITS	AREA* (acres)	STATUS*	AGE* (years)	EPA HAZARD EVALUATION*
Dominion	Bremo Bluff	Fluvanna	3 ponds	96, 17, unknown	2 active, 1 inactive	32, 37, unknown	2 significant risk, 1 unrated
Dominion	Chesapeake Energy	Chesapeake	1 pond, 1 landfill	9.7, unknown	active	65, 30	significant risk, not rated
Dominion	Chesterfield	Chesterfield	2 ponds, 1 landfill	49, 112, unknown	2 active, landfill proposed for 2018	51, 32, landfill proposed for 2018	significant, low, unknown
Dominion	Hopewell	Hopewell	1 pond	unknown	closed	23	not rated
Mead Westvaco	Covington	Covington	1 pond	unknown**	unknown**	unknown**	not rated

ADAPTED FROM: VDEQ, Southeastcoalash.org, EPA

\*Commas separate respective ponds/landfills; \*\*All “unknowns” provided by Southeastcoalash.org except for these

The EPA study was not intended to be a comprehensive evaluation of all coal ash storage facilities in the US, and Virginia has the responsibility to insure the integrity of the state’s waters. Not all of the coal ash storage facilities are inspected, meaning the level of risk of a dam breach is unknown for these, and all but one are unlined, presenting at least the potential for groundwater contamination. Virginia should inspect all the facilities across the state and take appropriate action to insure none present a risk to human health and the environment.

## Rail transport of crude oil in the watershed

Bakken crude oil is the most common form of crude oil shipped through Virginia by train in tanker cars. CSX transports Bakken crude oil in 20 counties of Virginia, and estimates its weekly average for trains carrying 1,000,000 gallons or more of oil to be four to six times per week through each of these counties. The CSX route runs parallel to the James for most of its stretch. Because the CSX train route runs parallel to the James River for most of its stretch, crude oil from spills has a high likelihood of going directly into the river or into tributaries of the James. Crude oil is a mixture of many compounds, so a number of chemical, physical, and biological processes can change its composition depending upon where it is spilled. Weathering of crude oil can involve evaporation, volatilization, emulsification, dissolution, and oxidation.

While rail is the main form of crude oil transport in Virginia, crude oil can also be transported by barge and truck. In Richmond, oil is also transported via ship and barge by a number of operators from the Port of Richmond, which is located along the west bank of the James River on approximately 121 acres. Aside from spills, explosions due to train derailment are also of grave concern. In Virginia, many city centers and highly populated areas are included within the one mile crude oil train blast zone, including downtown Lynchburg, Richmond, Williamsburg, and Newport News. In Virginia in 2014, 629 incidents were reported through the ERNS, resulting in 10 casualties, 12 hospitalizations, and over \$1 million in property damages. The top city for numbers of incidents was Norfolk, VA, where 134 (21.3%) of the spills were reported. Factors that could affect the situation are likely the condition of the equipment and tracks, experience and training of personnel, inspections, and proximity to resources and risk factors. According to analysts, the nation can expect more oil spills, and there are no reasons to exclude Virginia from that expectation.

### Other exposure sources

In the James River watershed, other exposure sources include wastewater and stormwater discharges and large-scale natural disturbances. Wastewater and stormwater discharges represent a high frequency, low magnitude risk to the watershed. While wastewater is treated to remove solids, the treatment process does little to prevent many non-solid contaminants from entering our waterways. Among the many chemicals in wastewater, one of the most dangerous categories is emerging contaminants. Large-scale natural disturbances represent a low-frequency, high magnitude risk to the watershed. Natural disturbances can exacerbate toxic contamination issues. Hurricanes and floods can cause overflow and damage to coal ash ponds and other storage basins. Earthquakes can induce similar damage.

### Conclusions

The results of this watershed assessment indicate that there are significant risks from three major sources of chemical contamination. Many of these large scale events may be infrequent, but they have serious effects. Consistent with national assessments, the dramatic increase in crude oil production and transport can be expected to increase the amount of oil spilled into the environment. The spills and accidental releases do not take place in a vacuum but in a river system that already experiences permitted discharges from hundreds of facilities, the effects of which are not well described or understood.

There are substantial gaps in the information needed to accurately understand the ecological and health risks at the level of the James River watershed. The gaps include the condition of the infrastructure, the status of facilities, and the equipment used to transport toxic chemicals. There is also a lack of basic toxicological data on many chemicals stored in the watershed and released into the river. In order for managers to make the policy decisions that will protect the James River watershed, information needs to be collected with the express purpose of examining these risks cumulatively.

## Likelihood of effects on James River resources from toxic chemical releases

Source Type	Event		Impact		Total Risk
	Frequency	Magnitude	Likelihood	Magnitude	
Storage Tank Release	Low	Variable	High	Variable	Variable
Coal Ash Spill	Low	High	High	Variable	Variable
Oil Spill (Large)	Low	High	High	High	High
All	Low	High	High	High	High
Baseline Contamination	High	Low	Med	Variable	Unknown