KINGSTON ASH RELEASE – HUMAN HEALTH RISK ASSESSMENT OVERVIEW

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DREDGE CELL FEATURES

Image taken August 2009

RIVER SYSTEM FEATURES

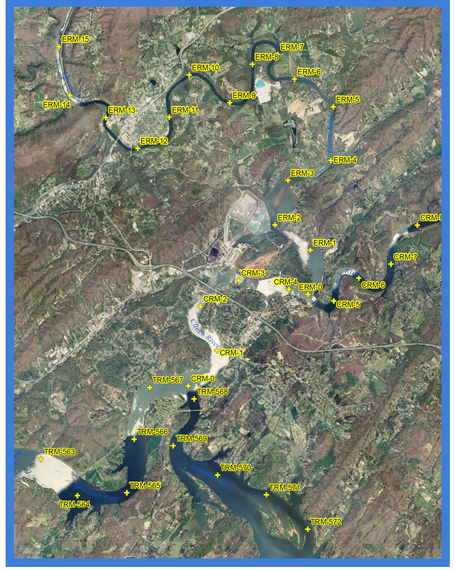


Image taken April 2008

ABSTRACT

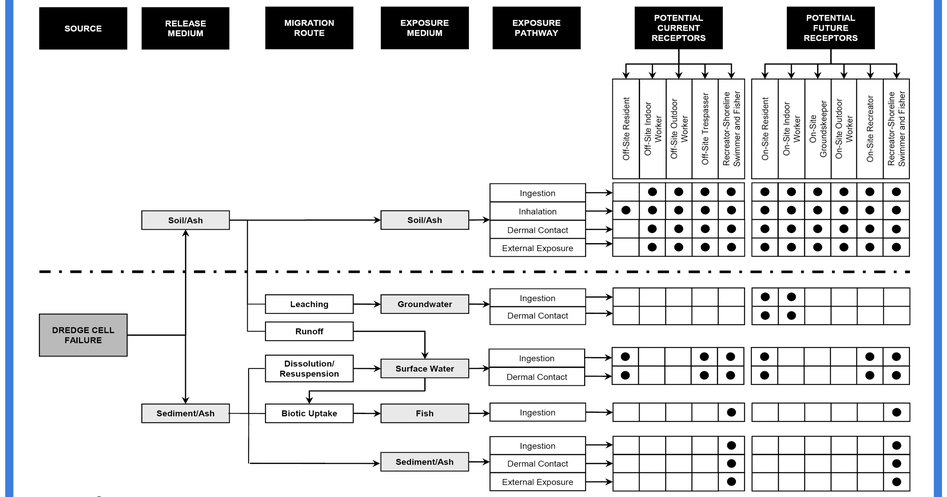
The release of fly ash at the Tennessee Valley Authority (TVA) Kingston Fossil Plant (KIF) on December 22, 2008 discharged approximately 5.4 million cubic yards of coal ash slurry into the adjacent aquatic and terrestrial systems. The initial response focused on public protection and stabilization of the released ash, but rapidly evolved to include comprehensive monitoring of ambient media and ecological receptors. Metals including arsenic and selenium are the primary constituents of potential concern in fly ash.

The KIF is located on the Emory River near the confluence of the Clinch and Tennessee Rivers. This portion of the Tennessee River Valley is bounded by ridges and impounded by Watts Bar Dam. The reach of Watts Bar Reservoir at the KIF transitions from the upstream riverine reaches of the Emory River and the Clinch River to the more lacustrine conditions found in the impounded portions of the Clinch River and Emory River backwaters of Watts Bar Reservoir. This multi-use reservoir supports a diversity of aquatic and terrestrial wildlife. The size and complexity of the potentially affected ecosystems necessitates a comprehensive environmental sampling and monitoring program, which TVA has implemented in cooperation with numerous federal, state, and academic organizations.

The objective of the human health risk assessment for the TVA Kingston Fly Ash Recovery Project is to develop quantitative and qualitative estimates of potential cancer risks and noncancer hazards for human receptors exposed to environmental media impacted by the ash following completion of the time-critical removal action. These estimates will be developed to support remediation decision making. Risks to both current (or near-term) and potential future receptors will be evaluated. The risk analysis will be based on analytical data collected from ash, surface water, sediment, and fish sampling.

This poster presents an overview of the human health risk assessment process as it is being applied at the TVA Kingston Fly Ash Recovery Project.

CONCEPTUAL SITE MODEL: FLOWCHART



HUMAN HEALTH RISK ASSESSMENT PROCESS

DATA EVALUATION

Identifies site-related constituents and the data that are of acceptable quality for use in the quantitative risk assessment. Consists of:

1. Review of analytical data adequacy
2. Identification of site related contaminants
3. Determination of exposure point concentrations
4. Identification of constituents of potential concern (COPCs)

EXPOSURE ASSESSMENT

Evaluates the links between the sources, locations, and types of environmental releases with populations and activities to determine the potential human exposure pathways. An exposure pathway generally consists of five elements:

1. Source and mechanism of constituent release
2. Transport medium (or media in cases involving media transfer of constituents)
3. Point of potential human contact with the contaminated media
4. Exposure route at the point of contact
5. Receptor – Potential receptors are distinguished as on-site and off-site
   - On-site receptors are those who reside, work, or play on the ash
   - Off-site receptors are those whose activities occur in areas where ash is not present

TOXICITY ASSESSMENT

Weighs available evidence regarding the potential for adverse effects and provides an estimate of the relationship between the extent of exposure and the increased likelihood and/or severity of adverse effects. Toxicity Assessment consists of:

1. **Hazard identification –** process of determining whether exposure to an agent can cause an increase in the incidence of a particular adverse health effect (e.g., cancer, birth defect) and whether the adverse health effect is likely to occur in humans.
2. **Dose-response assessment –** process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the contaminant administered or received and the incidence of adverse health effects in the exposed population.

RISK CHARACTERIZATION

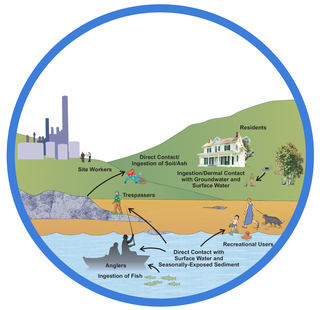
Integrates the results of the exposure and toxicity assessments to estimate potential cancer risks and noncancer hazards. Risk characterization consists of:

Carcinogenic risk – expressed in terms of the probability that an individual will contract cancer over a lifetime of exposure.

Noncarcinogenic hazards – expressed in terms of hazard quotients and hazard indices.

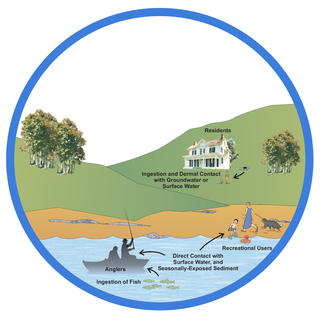
DREDGE CELL COPCs

ASH-RELATED CONSTITUENTS	
Aluminum	Potassium-40
Antimony	Radium-226
Arsenic	Radium-228
Barium	Thorium-228
Beryllium	Thorium-230
Boron	Thorium-232
Cadmium	Thorium-234
Chromium	Uranium-234
Cobalt	Uranium-235
Copper	Uranium-238
Iron	
Lead	
Manganese	
Mercury	
Molybdenum	
Nickel	
Selenium	
Silver	
Thallium	
Vanadium	
Zinc	



RIVER SYSTEM COPCs

ASH-RELATED CONSTITUENTS		LEGACY CONSTITUENTS
Aluminum	Potassium-40	Polycholorinated Biphenyls (PCBs)
Antimony	Radium-226	Polycyclic Aromatic Hydrocarbons (PAHs)
Arsenic	Radium-228	Pesticides (chlordane)
Barium	Thorium-228	Mercury
Beryllium	Thorium-230	Cesium-137
Boron	Thorium-232	Cobalt-60
Cadmium	Thorium-234	
Chromium	Uranium-234	
Cobalt	Uranium-235	
Copper	Uranium-238	
Iron		
Lead		
Manganese		
Mercury		
Molybdenum		
Nickel		
Selenium		
Silver		
Thallium		
Vanadium		
Zinc		



DREDGE CELL EXPOSURE SCENARIOS

SOIL/ASH

- Residents: Current off-site residential receptors (adults and children) may only be exposed to ash through inhalation of fugitive dust dispersed in the air away from the ash.
  - Future residential receptors living on-site may be exposed to ash through incidental ingestion, inhalation of fugitive dust, dermal contact, and external exposure from radionuclides.
- Indoor Worker: Current off-site indoor workers involved in office or light industrial work may be exposed to ash that has been deposited by wind or tracked by human or vehicle traffic to a point of exposure away from the ash flow area through incidental ingestion, inhalation of particulates, and external exposure from radionuclides from material tracked indoors.
  - Future On-site indoor workers may be exposed to ash through incidental ingestion, inhalation of particulates, and external exposure from radionuclides from material tracked indoors from unpaved and unvegetated portions of the ash.
- Outdoor Worker: Current Off-site outdoor worker not associated with removal or management of ash may be exposed to ash that has been deposited by wind or tracked by human or vehicle traffic to a point of exposure off the ash flow area.
  - Future On-site outdoor worker may be exposed to ash through incidental ingestion, inhalation of particulates, dermal contact, and external exposure from radionuclides.
- Future Groundskeeper personnel employed to plant and maintain landscape material may be exposed to ash through incidental ingestion, inhalation of particulates, dermal contact, and external exposure from radionuclides.
- Current On-site trespasser: An adolescent receptor trespassing onto the ash spill area may be exposed to ash related constituents through incidental ingestion, inhalation of particulates, dermal contact, and external exposure from radionuclides.
- Future On-site Recreator: Children involved in sports such as baseball, soccer, or football and their parents who attend their practices and games or use the site for recreational activity may be exposed through incidental ingestion, inhalation of particulates, dermal contact, and external exposure from radionuclides.

GROUNDWATER

- Residents: Future on-site residential receptors (adults and children) may be exposed to groundwater used for household water supply through ingestion, inhalation of water vapor, and dermal contact.
- Indoor Worker: Future on-site indoor workers involved in office or light industrial work may be exposed to groundwater used as a potable water supply through ingestion.

RIVER SYSTEM EXPOSURE SCENARIOS

SEASONALLY-EXPOSED SEDIMENT/ASH

- Recreators: Adolescent or adult recreators may be exposed to seasonally exposed sediment during the winter when Watts Bar Reservoir is lowered to winter pool potentially exposing ash impacted sediment in the Emory, Clinch, and Tennessee Rivers. Recreational receptors may be exposed to residual ash and sediment via incidental ingestion, dermal contact, and external exposure to radionuclides.

SURFACE WATER

- Recreators: Adolescent or adult swimmers may be exposed to ash related constituents in surface water. Exposure may occur via incidental ingestion and dermal contact with surface water during swimming.
- Residents: Future residential receptors may be exposed to surface water drawn from the river for household use without filtration or treatment. Exposure may occur via ingestion and dermal contact.

FISH INGESTION

- Recreators: Recreational fishing is known to occur in the Emory River; therefore, ingestion of recreationally caught fish from the Emory River will be evaluated.

GROUNDWATER

- Residents: Future on-site residential receptors (adults and children) may be exposed to groundwater used for household water supply through ingestion, inhalation of water vapor, and dermal contact.
- Indoor Worker: Future on-site indoor workers involved in office or light industrial work may be exposed to groundwater used as a potable water supply through ingestion.