APPENDIX A
HUMAN HEALTH RISK ASSESSMENT

A.1 INTRODUCTION

This appendix presents the results of the Human Health Risk Assessment (HHRA) for the non-time-critical removal actions for the Swan Pond Embayment/Dredge Cell EE/CA.

The objective of the HHRA was to develop quantitative and qualitative estimates of potential cancer risks and non-cancer hazards for human receptors exposed to environmental media impacted by ash west of Dike 2. These estimates were developed to support remediation decision-making process. Risks to current (or near-term) and potential future receptors were evaluated. The risk analysis was based on analytical data collected from ash, surface water, and groundwater sampling.

The HHRA approach follows EPA guidance including:

- *Risk Assessment Guidance for Superfund, Vol. 1: Human Health Evaluation Manual (Part A)*, EPA/540/1-89/002, (EPA 1989).
- *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors, Interim Final*, Office of Solid Waste and Emergency Response (OSWER) Directive 9285.6-03, (EPA 1991a).
- *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals),* OSWER Directive 9285.7-01B, (EPA 1991b).
- *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)*, OSWER Directive 9285.7-47, (EPA 2001a).
- *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final*, OSWER 9285.7-02EP, (EPA 2004b).
- *Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment*), OSWER 9285.7-82, (EPA 2009d).
- *Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment*, (EPA 2000a).
- *Soil Screening Guidance: Technical Background Document*, EPA/540/R-95/128, (EPA 1996).
- *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*, OSWER 9355.4-24, (EPA 2002c).
- *Exposure Factors Handbook*, EPA/600/P-95/002Fa, (EPA 1997b).
- *User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) Windows version*, OSWER Directive No. 9285.7-42, (EPA 2001c).
- *Update of the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters*, OSWER 9200.2-82, (EPA 2009f).
- *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil*, EPA-540-R-03-001, (EPA 2003a).

- *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites,* (EPA 2002a).
- *Guidance for Data Usability in Risk Assessment*, OSWER 9285.7-09, (EPA 1992a).
- *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*, OSWER Directive No. 9285.6-10, (EPA 2002b).
- *ProUCL Software Version 4.00.04 User Guide, EPA/600/R-07/038*, (EPA 2009c).
- *Human Health Toxicity Values in Superfund Risk Assessments*, OSWER Directive 9285.7-53, (EPA 2003b).
- *Health Effects Assessment Summary Tables* (HEAST), (EPA 2001b).
- *Integrated Risk Information System (IRIS) Database*, (EPA 2009a).

Risk assessment as defined in the CERCLA process consists of (1) data evaluation, (2) exposure assessment, (3) toxicity assessment, and (4) risk characterization. An uncertainty analysis was completed at the conclusion of the risk assessment.

A.1.1 Data Evaluation

Data from samples collected by TVA were used in the quantitative risk assessment. Data collected by TDEC and EPA were used to provide a qualitative evaluation of the representativeness of the TVA data (Table A-1 [Attachment A-1]). Environmental data were evaluated for use in the risk assessment as follows:

- Sample locations applicable to potential exposures were evaluated for ash remaining in the dredge cell and west of Dike 2, surface water in Swan Pond Embayment, and groundwater beneath the KIF site;
- Sample depths applicable to potential exposures were evaluated for groundwater using bedrock well data to quantify potential risks. Groundwater data from the unconsolidated zone were evaluated in the uncertainty analysis.
- The data have been validated according to the project Quality Assurance Project Plan (QAPP) or EPA's National Functional Guidelines (EPA 2004b, 2008a).

The data evaluation for data that meet the above conditions consisted of four components: (1) review of analytical data adequacy, (2) identification of site related constituents, (3) determination of exposure point concentrations (EPCs), and (4) identification of COPCs. The first three components are the same for the human health and the ecological risk assessments and are only presented once, in Sections A.1.1.1 through A.1.1.3.

A.1.1.1 Review of Analytical Data Adequacy

The primary objective for the review of analytical data is to ensure that environmental data of acceptable quality and quantity are used in the risk assessment. Guidance for evaluating the usability of environmental analytical data for risk assessments is provided by EPA in *Guidance for Data Usability in Risk Assessment* (EPA 1992a, 1992b).

The risk assessment used only data that are generated using analytical methods that unambiguously identify and confirm the presence of the compound, provide a reliable quantification of the concentration present, and are supported by a high level of quality assurance documentation. Quality checks

incorporated into the analytical methods were performed by the laboratories to generate definitive data and to document any issues that might impair the quality or usability of the resulting data, such as instrumental problems, bias in the data, or contamination introduced in the laboratory. Data were inspected further for analytical quality problems during data validation. Evaluation of data quality checks such as instrument calibrations, blank analysis, spike recoveries, etc., were reported in data validation memoranda and appropriate qualifier flags were applied to the data in accordance with the QAPP. Data adequacy was also evaluated through review of the QAPP, chain-of-custody and other inputs beyond data validation, per *Data Quality Assessment: A Reviewer's Guide* EPAQA/G-9R (EPA/240/B-06/002) [EPA 2006].

Analytical results were documented in data summary reports that discuss overall data quality and any resulting limitations on the use of the data. Data completeness was reviewed to confirm whether the available data adequately represent the site spatially (locations sampled) and statistically (sufficient number of values available to have an acceptable level of confidence in the data set). Data that were rejected by the validator for failure to pass a quality check or for noncompliance with the requirements of the QAPP were not used in the risk assessment.

Potential health effects from exposure to some constituents may occur at concentrations lower than current analytical technology can measure. In project planning, analytical methods were chosen to ensure sufficient analytical sensitivity to detect potentially harmful analytes at concentrations below the levels of concern, or, if this was not possible, at concentrations as low as can be practicably achieved. Antimony, cadmium, and molybdenum were not detected in any ash samples collected by TVA. These constituents were detected in ash samples collected by EPA and TDEC. Analysis for lithium and total uranium was not conducted on TVA ash samples. The potential impact on the risk estimates is addressed in the uncertainty analysis.

Review of analytical sensitivity in the data reported by the laboratories versus the project data quality objectives is essential because nondetect results above the levels of concern can lead to unacceptable uncertainty in the risk estimates. A higher priority was placed on preventing false negatives than false positives. These false negatives (nondetects reported when the analyte is actually present in the sample) can occur not only from elevated detection limits due to required sample dilution, but also when analytical spike or standard recoveries are extremely low. Nondetects associated with these extremely low recoveries may be rejected by the data validator, reducing not only the uncertainty due to false negatives, but also data completeness for that analyte.

One outcome of the data quality review was an assessment of the uncertainty associated with the data so that its impact on the risk assessment is understood and acceptable. Uncertainty was evaluated by reviewing such aspects as the sources of the data, consistency in data collection methods and handling, analytical methods and detection limits, data quality indicators (precision, accuracy, representativeness, comparability, and completeness), and data qualifiers.

A.1.1.2 Identification of Site Related Constituents

EPA defines COPCs as "Chemicals that are potentially site-related and whose data are of sufficient quality for use in the quantitative risk assessment" (EPA 1989). These chemicals may contribute significantly to human or ecological risk and are carried through the risk assessment process. Detected constituents were included in the risk assessment with the exception of 2-methylnaphthalene, which is discussed in the uncertainty analysis.

Coal Combustion Byproducts. The burning of coal in coal-fired power plants generates coal combustion byproducts including fly ash, bottom ash, boiler slag, and flue gas desulfurization gypsum.

EPA has identified 41 common constituents of coal combustion byproducts, including 23 metals and 14 inorganic ions, but no organic compounds (EPA 2007). The trace metals commonly found in fly ash, by relative frequency are vanadium, zinc, copper, chromium, nickel, lead, arsenic, and mercury (EPA 2008b, 1999a). Selenium and thallium were identified by the EE/CA Technical Working Group as additional constituents in fly ash that are of interest in both human health and ecological risk assessment. Additionally, ash is known to contain naturally occurring radionuclides, specifically isotopes of uranium, thorium, and potassium, and their short-lived daughter products (e.g., radium). Therefore the 10 metals and the naturally occurring radionuclides are considered constituents of interest and were carried forward in both the human health and ecological risk assessments.

Frequency-of-Detection Screen. Each constituent in each medium was evaluated to determine its frequency of detection (Tables A-2.1 through A-2.3 [Attachment A-2]). Frequency of detection is evaluated in the uncertainty analysis (Section A-1.5.1).

Use of Background Concentrations. EPA Region 4 Risk Assessment Bulletins state: "For naturally occurring inorganics and radionuclides, compare the onsite maximum detected concentration to two times the average site-specific background concentration (EPA 2000a). Eliminate the constituent as a COPC if it is less than two times the background level. It should be noted that one background sample, if elevated, is usually not acceptable for comparison or elimination purposes." For this risk assessment, background screening was not used to eliminate COPCs, rather background is used in the uncertainty analysis (Section A.1.5.1) to place the risk estimates in context with local or regional concentrations.

A.1.1.3 Determination of Exposure Point Concentrations

Quantification of exposure provides an estimate of the constituent intake for various exposure pathways identified at the site. To quantify exposure, exposure point concentrations (EPC) must be determined and constituent intakes calculated for the various exposure pathways identified for the site. Potential receptors are assumed to move randomly across the site spending equivalent amounts of time in each location. Therefore, contact with a contaminated medium over time is best represented by the average concentration of the detected analytes.

The available data for ash were collected from 52 locations (23 Geoprobe, 5 surface grab, 17 ash flow area, and 7 former private residences) as a combination of geoprobe and surface samples from the intact portion of the dredge cell and surface samples from the ash flow area including adjacent residential properties. The specific chemical composition of fly ash depends on the source of the coal. KIF burns mostly eastern bituminous coal, but has also used coal from Illinois, and blends low-sulfur Western coal to reduce emissions. This results in potential heterogeneity of the ash over time as different sources or combinations of coal are burned. The ash generated historically at KIF was mostly fly ash, but had some bottom ash mixed in. For ease of handling, water was used to flush fly ash from the hydrostatic ash collectors and bottom ash from the bottom of furnaces. The ash was carried in the resulting slurry to an onsite ash pond where the ash was allowed to settle. It was subsequently removed ("dredged") and placed in a dredge cell for long-term storage. The sluicing, dredging, and subsequent release of ash from the Dredge Cell during the ash spill resulted in a mixing of the various layers or types of ash producing a more homogeneous material.

Because of the uncertainty associated with estimating the true average concentration at a site, the representative concentration used is the UCL_{95} on the arithmetic mean (EPA 1992b). The UCL_{95} is defined as a value that, when calculated repeatedly for randomly drawn subsets of site data, equals or exceeds the true mean 95 percent of the time. When limited data are available or when the data are extremely variable, the UCL_{95} can be greater than the highest detected concentration. Therefore, the EPC represents the UCL_{95} or the maximum detected concentration whichever is smaller.

The available data for surface water were from samples collected from the clean water ditch and settling basin within the Swan Pond Embayment area. The sampling initially performed upgradient of Dike 2 during construction of the interim drainage system was not used in this EE/CA because the results are not indicative of current water quality conditions. Data collected from June 7, 2009 through September 3, 2009, which includes 24 samples from each of the two stations, were used to evaluate the potential exposures to surface water in the Swan Pond Embayment.

The available data for groundwater were from samples collected from wells screened in unconsolidated material and bedrock. Only data from bedrock groundwater wells were evaluated quantitatively in the HHRA. This evaluation is appropriate because drinking water wells are typically installed in bedrock rather than soil. Analysis of potential exposures to groundwater from unconsolidated wells is presented in the uncertainty analysis. Because of the limited number of groundwater samples only the maximum detected concentration of each constituent was used in the risk assessment. The uncertainties associated with the groundwater dataset are addressed in Section A.1.5.1.

Data of acceptable quality for use in the risk assessment were treated as follows for calculation of EPCs:

- Results from normal/field duplicate sample pairs were treated as follows:
    - The greater of the normal and field duplicate results was used if are both detects
    - The greater of the detection/quantitation-limit was used if the normal and field duplicate results are both nondetect
    - The detected value was used when either the normal or field duplicate result was a detect and the other was a nondetect
- Values for nondetects were included at the quantitation or detection limit reported by the laboratory. ProUCL was allowed to handle nondetect values according to the internal rules of the software.
- Exposure to ash was evaluated by treating ash as soil. Since the data for ash are not dependent on depth, data were not segregated by depth and a single exposure point concentration was calculated for each COPC. The calculation of single exposure point concentrations is addressed in the uncertainty analysis.
- The most current version of EPA's ProUCL software was used to the determine EPCs for each COPC in each medium. The data were tested to determine which statistical distribution (e.g., normal, lognormal, or gamma) best fit the concentrations. If the data did not fit a statistical distribution, nonparametric statistics were applied. The UCL_{95} recommended by ProUCL was generally used. Additional criteria were applied to the recommendations from the ProUCL software in cases where the calculation of the UCL_{95} was unreliable such as:
    - For data sets with fewer than 10 samples, fewer than four distinct detected values, or 50% or more nondetects, estimated UCLs are considered unreliable. ProUCL recommends a minimum of 10 to 15 samples and four or more distinct detected values for meaningful results. Data set central tendencies such as means, medians, and confidence limits on means, cannot be accurately estimated when more than half the data are censored or nondetect. Therefore, the maximum detected concentrations in ash were selected as the EPC for mercury and thallium. As previously indicated, the maximum detected concentration of all constituents in groundwater were used as EPCs.
    - For non-parametric UCL estimations, bootstrap methods were not used, even when computed, for data sets with fewer than four distinct detected values. UCLs were not estimated for data sets with fewer than two distinct detected values. The maximum detected concentration was selected as the EPC. No calculated UCLs were excluded based on this approach.

- Estimated UCLs are considered to be unrealistic if they equal or exceed the maximum detected concentration. Therefore, the maximum detected concentration was selected as the EPC in such cases. No calculated UCLs were excluded based on this approach.

EPCs for current offsite indoor and outdoor workers were multiplied by 0.7 to account for the reduction in concentrations at locations away from the ash due to tracking of ash or deposit by wind. This reduction in concentration is based on a similar factor employed in EPA's lead model and is considered conservative because of the current controls in place on the dredge cell and in the ash processing areas that minimize the potential for workers to track ash away from the area (EPA 2009e).

Tables A-3.1 through A-3.3 (Attachment A-2) summarize the EPCs for ash, surface water, and groundwater, respectively.

A.1.1.4 Identification of Constituents of Potential Concern

Ash samples have been analyzed for total metals, radioisotopes, PAHs, and BTEX. Because of the coal burning process and a review of literature results, other types of constituents were known to not be present. The analytical results showed no presence of PAHs and BTEX. Therefore, only metals and radioisotopes are COPCs. Tables A-2.1 through A-2.3 (Attachment A-2) provide the occurrence, distribution, and selection of COPCs in this assessment.

Risk-based Screen. Site-related constituents and constituents of interest were evaluated against risk-based concentration screening levels. Chemical data were compared to the most recent version of the EPA regional residential risk-based screening levels for soil or tap water as appropriate for the matrix (EPA 2009b). A target cancer risk level of 1.0E-06 was used as a screening level for carcinogens; a target HI of 0.1 was used as a screening level for non-carcinogens. Additional screening values include state and federal MCLs (http://www.epa.gov/sfewater/contaminants/index.html) for groundwater and the state and federal Ambient Water Quality Criteria (http://www.eps.gov/waterscience/criteria/wgctable) (TDEC 2009) for human consumption of water and organisms or human consumption of organisms only for surface water. The screen employed the lowest applicable value, and the maximum detected concentration of each constituent was compared to its respective screening level. As previously indicated, no constituents were eliminated as COPCs based on this screen.

Quantitation limits for constituents which did not have any detected concentrations in a given medium were compared to the appropriate risk-based screening levels to determine if the constituent should be evaluated further in the risk assessment. Antimony, cadmium, molybdenum, and silver were not detected in any ash sample collected by TVA. These constituents are evaluated qualitatively in the uncertainty analysis (Section A.1.5.4).

Essential Human Nutrient Screen. Constituents that are considered essential nutrients (i.e., calcium, chloride, iodine, magnesium, phosphorus, potassium, and sodium [EPA 2000a]) are an integral part of the human food supply and are often added to foods as supplements. EPA recommends that these constituents not be evaluated as COPCs so long as they are (1) present at low concentrations (i.e., only slightly elevated above naturally occurring levels) and (2) toxic at very high doses (i.e., much higher than those that could be associated with contact at the site). A screening process was employed whereby daily intakes (in mg/day) were estimated and compared with recommended dietary intake (RDI) values (also in mg/day).

Daily intakes were estimated from maximum detected concentrations in ash (mg/kg of constituent in ash × 0.0001 kg/day of ash = daily intake in mg/day). The intake rate used in these calculations (0.0001 kg/day of ash) represents a conservative adult ingestion rate for a residential receptor. Screening concentrations for essential nutrients were calculated so that the resulting concentration produced an

intake equal to the RDI value. RDI values were obtained online from http://www.netrition.com/rdi_page.html. No essential nutrients had maximum detected concentrations exceeding their calculated screening concentrations; therefore, essential nutrients were eliminated as COPCs. The following presents the RDIs and the resulting screening of essential human nutrients.

Essential Nutrient RDIs and Screening				
Essential Nutrient[a]	**RDI[b] (mg/day)**	**Screening Concentrations for Ash[c] (mg/kg)**	**Maximum Detected Concentration (mg/kg)**	**Screening Result**
Calcium	1,000	1,000,000	30,900	Pass
Chloride	3,400	1,000,000	NA	ND
Iodine	0.15	1,500	NA	ND
Magnesium	400	1,000,000	6,230	Pass
Phosphorus	1,000	1,000,000	NA	ND
Potassium	3,500	1,000,000	7,040	Pass
Sodium	2,400	1,000,000	1,790	Pass

Notes:

[a] Only essential human nutrients listed in *Risk Assessment Guidance for Superfund, Part A* (EPA 1989) are shown.
[b] Source of RDIs: http://www.netrition.com/rdi_page.html.
[c] Screening concentrations for ash are calculated as RDI ÷ 0.0001 kg/day, where 0.0001 kg/day is a residential adult soil ingestion rate. Resulting concentrations that exceed 1,000,000 mg/kg (the maximum possible concentration in soil) are rounded downward to the limiting value.
NA = Not analyzed
ND = Not determined

A.1.2 Exposure Assessment

The term "exposure pathway" describes the mechanism by which an individual or population may be exposed to constituents originating from an area of contamination. An exposure pathway analysis links the sources, locations, and types of environmental releases with population locations and activity patterns to determine the potential human exposure pathways. An exposure pathway generally consists of five elements: (1) a source and mechanism of chemical release, (2) transport medium (or media in cases involving media transfer of chemicals), (3) a point of potential human contact with the contaminated media, (4) an exposure route at the point of contact, and (5) a receptor. Identification of current and future exposure pathways of concern is determined by evaluating the components necessary to complete a potential exposure pathway. For an exposure pathway to be considered complete, each of these components must exist and be linked to the others. Figure A-1 (Attachment A-1), conceptual site model, illustrates the environmental pathways by which receptors could be exposed to constituents associated with the released ash.

For the HHRA potential receptors are distinguished as onsite and offsite. Onsite receptors are those who reside, work, or play on the ash, whereas, offsite receptors are those whose activities occur in areas where ash is not present but where ash may migrate through air dispersion or tracking. The exposure scenarios were also evaluated in this risk assessment for potential current and future receptors. The alternatives being evaluated for removal of ash west of Dike 2 are estimated to be completed in approximately 5 years. Therefore, the exposure duration for current receptors is assumed to be 5 years. Exposure durations for future scenarios range from 6 to 25 years. The selection of exposure pathways is summarized in Table A-1 (Attachment A-2) and described below. Exposure parameters are presented in Table A-4-1.RME (Attachment A-2).

A.1.2.1 Soil/Ash

Adult and Child Resident: Currently there are no residential properties onsite. Therefore, current offsite residential receptors may only be exposed to ash through inhalation of fugitive dust dispersed in the air away from the ash flow area. However, under the assumption that TVA abandons or releases all or part of the site and no institutional controls are implemented, future residential receptors living onsite may be exposed to ash through incidental ingestion, inhalation of fugitive dust, dermal contact, and external exposure from radionuclides. Exposure parameters for this scenario were the default values established by EPA (EPA 1991a). The residential exposure scenario is appropriate due to current use of surrounding properties.

Indoor Worker (office or light industrial worker): Under current land use scenarios offsite 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. Exposure parameters for this scenario were the default values established by EPA (EPA 1991a). Indoor workers may be exposed to ash through incidental ingestion, inhalation of particulates, and external exposure from radionuclides from material tracked indoors. Under future land use assumptions, onsite 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. The future industrial scenario assumes that TVA abandons or releases parts of the site and no institutional controls are implemented and industrial exposures occur on the ash.

Outdoor Worker: Under current land use assumptions an offsite individual involved in routine outdoor work 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. Under future land use assumptions an onsite individual involved in routine outdoor work may be exposed to ash. Exposure parameters for this scenario were the default values established by EPA (EPA 2002c). The outdoor worker may be exposed to ash through incidental ingestion, inhalation of particulates, dermal contact, and external exposure from radionuclides.

Groundskeeper (plants and maintains landscape material): Future land use scenarios may include onsite groundskeeper personnel employed to plant and maintain landscape material. Exposure parameters for this scenario were the default values established by EPA (EPA 2002c) for a construction worker with modifications for the frequency and duration of exposure as described here. The groundskeeper may be exposed to ash through incidental ingestion, inhalation of particulates, dermal contact, and external exposure from radionuclides. Inhalation of particulates would be of particular concern during activities such as mowing which cause an increase in local inhalable particulates. Based upon professional judgment, the groundskeeper is assumed to have intensive contact with ash 5 days/week for 7 months each year for an exposure frequency of 140 days per year. The exposure duration for the groundskeeper is assumed to be 25 years. Because the groundskeeper scenario as described is more conservative than a construction worker scenario, a separate assessment of a construction worker is not needed.

Onsite Trespasser: An adolescent receptor may currently trespass onto the ash spill area and subsequently be exposed to ash related constituents. Exposure parameters for this scenario were the default values established by EPA Region 4 (EPA 2000a). Exposure to ash related constituents may occur through incidental ingestion, inhalation of particulates, dermal contact, and external exposure from radionuclides. EPA Region 4 considers the typical trespasser to be an adolescent aged 7 to 16 (10 year exposure duration) with a body weight of 45 kg. Exposure frequency is assumed to be limited by the presence of TVA security personnel for most areas; however, ash in the sloughs and embayment areas are adjacent to current or former residential properties and trespassing may be harder to regulate. Therefore, based on best professional judgment, the adolescent trespasser is assumed to frequent these areas an average of 3

days per week from April through October or 84 days per year. The exposure frequency is based on the assumption that outdoor activity is likely to be more frequent when temperatures are at or above 70 °F which are common for the months identified (USDA 2009).

Recreator (adult hiker/spectator, child participant in sports or play): Onsite future recreational use of the Kingston site is a plausible scenario. In the past, part of the site was used for athletic fields. Potential receptors are 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. Exposure parameters for this scenario were a combination of default values established by EPA Region 4 and site-specific values as discussed in this section (EPA 2000a). The child recreator is assumed to be between the ages of 7 and 16 participating in organized youth athletics. These youths are assumed to participate in two practice sessions and one game per week over the course of 7 months. Game and practice sessions are assumed to last 1.5 hours each. These estimates are based on best professional judgment of schedules for organized youth athletics. The adult recreator is assumed to attend the practice sessions and games of the child recreator or is otherwise engaged in recreational activities on the site. The adult is also assumed to be onsite 1.5 hours/day, 3 days/week over the course of 7 months. Exposure to ash related constituents may occur through incidental ingestion, inhalation of particulates, dermal contact, and external exposure from radionuclides. While the younger siblings of children engaged in recreational or sporting activities would reasonably be expected to be onsite during practice or games, their potential exposures would be greater under the residential scenario and as such were not evaluated under the recreational scenario.

A.1.2.2 Surface Water

Recreator (adolescent wader): Adolescent trespassers may be exposed to ash-related constituents in surface water while wading in the Swan Pond Embayment. Incidental ingestion and dermal contact with surface water are the exposure pathways of concern. Exposure parameters for this scenario were the default values established by EPA Region 4 (EPA 2000a). The age group considered is 7 to 16 years old with a 45 kg body weight. Based on best professional judgment, the adolescent trespasser is assumed to frequent the areas an average of 3 days per week from April through October or 84 days per year and wade in the embayment on 45 of those days. The exposure frequency is based on the assumption that outdoor activity is likely to be more frequent when temperatures are at or above 70 °F which are common for the months identified (USDA 2009). An exposure time of 1.4 hours a day is assumed for this scenario based on activity pattern data by the EPA (EPA 1997b).

A.1.2.3 Groundwater

Adult and Child Resident: Exposure parameters for this scenario were the default values established by EPA (EPA 1991a). Future onsite residential receptors may be exposed to groundwater used for household water supply through ingestion, and dermal contact. The residential exposure scenario is appropriate due to current use of surrounding properties.

Indoor Worker (office or light industrial worker): Future onsite indoor workers involved in office or light industrial work may be exposed to groundwater used as a potable water supply. Exposure parameters for this scenario were the default values established by EPA (EPA 1991a). Indoor workers may be exposed to groundwater through ingestion. Dermal contact is not considered to be significant pathways of exposure for indoor workers due to the limited use of water in industrial or office settings.

A.1.2.4 Quantification of Exposure

The basic equations used to calculate cancer risk and noncancer hazard estimates for the identified exposure scenarios are taken from EPA guidance (EPA 1989, 1991b, 2000b, 2002c, 2004b, and 2009d).

Values used for daily intake calculations are summarized in Tables 4.1 through 4.3 in Attachment A.2 for ash, surface water, and groundwater, respectively.

Incidental Ingestion of Ash. The ingested dose of COPCs in ash was estimated by the following equation:

$$I_{chem} = \frac{(C_{so})(FI_{so})(IR_{so})(EF)(ED)(CF_2)}{(BW)(AT)} \qquad \textbf{Eq. A.1}$$

$$I_{rad} = (C_{so})(FI_{so})(IR_{so})(EF)(ED)(CF_3) \qquad \textbf{Eq. A.2}$$

where:

I_{chem}	= ingested dose of constituent COPC in ash (mg/kg-day, calculated)
I_{rad}	= ingested dose of radionuclide COPC in ash (pCi, calculated)
C_{so}	= concentration of COPC in ash (mg/kg or pCi/g)
FI_{so}	= fraction of exposure attributed to site ash (unitless)
IR_{so}	= ingestion rate of ash (mg/day)
EF	= exposure frequency (days/year)
ED	= exposure duration (years)
CF_2	= conversion factor (1E-6 kg/mg)
CF_3	= conversion factor (1E-3 g/mg)
BW	= body weight (kg)
AT	= averaging time (days)

Dermal Contact with Ash. Unlike the methodologies for estimating inhaled or ingested doses of COPCs, which quantify the dose at the barrier membrane (the pulmonary or gastrointestinal mucosa), dermal dose is estimated as the dose that crosses the skin and is systemically absorbed. The absorbed dose of COPCs were estimated from the following equation (EPA 2004a):

$$DAD = \frac{(DA)(SA)(EF)(ED)}{(BW)(AT)} \qquad \textbf{Eq. A.3}$$

where:

DAD	= average dermal absorbed dose of COPC (mg/kg-day, calculated)
DA	= dose absorbed per unit body surface area per day (mg/cm2-day)
SA	= surface area of the skin exposed to ash (cm2)
EF	= exposure frequency (days/year)
ED	= exposure duration (years)
BW	= body weight (kg)
AT	= averaging time (days)

Dermal uptake of constituents from ash assumes that exposure is a function of the fraction of a dermally applied constituent that is absorbed, as calculated from the following equation (EPA 2004a):

$$DA_s = (C)(FI)(CF_2)(AF)(ABS) \qquad \textbf{Eq. A.4}$$

where:

DA_s	= dose absorbed per unit body surface area per day for ash (mg/cm^2-day)
C	= concentration of COPC in ash (mg/kg)
FI	= fraction of exposure attributed to ash (unitless)
CF_2	= conversion factor (1E-6 kg/mg)

AF = ash-to-skin adherence factor (mg/cm^2-day)
ABS = absorption fraction (unitless, constituent-specific)

External Exposure to Radionuclides in Ash. External exposure to radionuclides in ash was estimated by the following equation (EPA 2000b):

$$EE_{rad} = C_s \times EF \times ED \times ACF \times [ET_o + (ET_i \times GSF)] \quad \textbf{Eq. A.5}$$

where

EE_{rad} = external exposure dose (pCi-year/g)
Cs = concentration of radionuclide in ash (pCi/g)
EF = exposure frequency (day/year)
ED = exposure duration (years)
ACF = area correction factor (unitless)
ETo = outdoor exposure time fraction (unitless)
ETi = indoor exposure time fraction (unitless)
GSF = gamma shielding factor (unitless)

Inhalation of Particulates in Air. The inhaled dose of COPCs in air was estimated by the following equation:

$$EC = \frac{(C_a)(ET_a)(EF)(ED)}{(AT)} \quad \textbf{Eq. A.6}$$

$$I_{rad} = (C_a)(I_{rad})(ET_a)(EF)(ED) \quad \textbf{Eq. A.7}$$

where:

EC = exposure concentration of constituent COPC (µg/m^3, calculated)
I_{rad} = inhaled dose of radionuclide COPC (pCi, calculated)
C_a = concentration of COPC in air (µg/m^3)
ET_a = exposure time (hours/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
AT = averaging time (days)

EPA derived a model for estimating a dust particulate emission factor based on an "unlimited reservoir" model and the assumption that the source area is square (EPA 2002c):

$$PEF = Q/C \times \frac{3600}{0.036 \times (1-V) \times \left(U_m/U_t\right)^3 \times F(x)} \quad \textbf{Eq. A.8}$$

where:

PEF = particulate emission factor (m^3/kg, calculated)
Q/C = inverse of the mean concentration at center of square source
3600 = seconds/hour
V = fraction of surface covered with vegetation (0.8, unitless, assumed)
U_m = mean annual wind speed (default, 4.69 m/second)
U_t = equivalent threshold value of wind speed at 7 m (default, 11.32 m/second)
F(x) = function dependent on U_m/U_t (default, 0.194)

EPA presents a modification to the method for calculation of the dispersion factor for wind erosion, Q/C, to reflect updated dispersion modeling (EPA 2002c). As a result of the update, Q/C values can now be derived for any source size between 0.5 and 500 acres. The equation for calculating Q/C is:

$$Q/C = A \times exp\left[\frac{(ln\ A_{site} - B)^2}{C}\right] \qquad \textbf{Eq. A.9}$$

where:

- Q/C = Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of the source or at the boundary of the source (g/m2 - s per kg/m2)
- A = Constant based on air dispersion modeling for specific climate zone
- A_{site} = Areal extent of the site (acres)
- B = Constant based on air dispersion modeling for specific climate zone
- C = Constant based on air dispersion modeling for specific climate zone

The concentrations of COPCs in air were calculated as follows:

$$C_a = \frac{C_{so}}{PEF} \qquad \textbf{Eq. A.10}$$

where:

- C_a = constituent concentration in air (mg/m^3, calculated)
- C_{so} = constituent concentration in ash (mg/kg)
- PEF = particulate emission factor (m^3/kg)

Ingestion of Groundwater or Surface Water. The ingested dose of COPCs from exposure to groundwater or surface water was estimated by the following equation:

$$I_w = \frac{(C_w)(IR_w)(ET)(EF)(ED)}{(BW)(AT)} \qquad \textbf{Eq. A.11}$$

where:

- = I_w = ingested dose of COPC in water (mg/kg-day, calculated)
- = C_w = concentration of COPC in water (mg/L)
- = IR_W = water ingestion rate (L/day)
- = ET = exposure time (hours/days)
- = EF = exposure frequency (days/year)
- = ED = exposure duration (years)
- = BW = body weight (kg)
- = AT = averaging time (days)

The exposure time factor is not used for the residential scenario.

Dermal Contact with Groundwater or Surface Water. The absorbed dose of COPC from water was estimated by the following equation (EPA 2004a):

$$DAD = \frac{(DA)(SA)(EF)(ED)}{(BW)(AT)} \qquad \textbf{Eq. A.12}$$

where:

- DAD = average dermal absorbed dose of COPC (mg/kg-day, calculated)
- DA = dose absorbed per unit body surface area per day (mg/cm^2-day).

SA = surface area of the skin exposed to the medium (cm^2)
EF = exposure frequency (days/year)
ED = exposure duration (years)
BW = body weight (kg)
AT = averaging time (days)

The absorbed dose per event from water was calculated using the spreadsheet for inorganic constituents that accompanies Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) (EPA 2004a) which employs the following equation:

$$DA_{event} = K_p \times C_w \times t_{event} \qquad \textbf{Eq. A.13}$$

where:

DA_{event} = absorbed dose per event (mg/cm-event)
K_p = dermal permeability coefficient of compound in water (cm/hr)
C_w = constituent concentration in water (mg/cm3)
t_{event} = event duration (hr/event)

A.1.2.5 Evaluation of Potential Exposure to Lead

Toxicity values are not available for the evaluation of lead. Instead, two models were employed to evaluate potential exposures to lead. The EPA IEUBK blood lead model for young children, developed for residential scenarios, was used to predict blood lead level (PbB) for children potentially exposed at the site (EPA 2009e). This model estimates the PbB in children exposed to the environmental media, and compares this estimate with the threshold level of 10 micrograms per deciliter (µg/dL). Average lead concentrations in the various media are entered into the model; default values provided by the IEUBK are used when site-specific data are not available. Arithmetic mean values, rather than conservative estimates of average, are used because the IEUBK contains a statistical module that addresses individual variation in exposure and physiological parameters. The risk assessment is considered to "pass" if the IEUBK predicts that not more than 5% of young children exposed in this manner would experience a mean PbB above the 10 µg/dL threshold. Results of the IEUBK for onsite child residential receptors are presented in Table A-2 (Attachment A-1).

The adult lead methodology was employed to examine adult exposures to lead in ash in nonresidential exposure scenarios (EPA 2009f). The method focuses on the estimation of PbB in fetuses carried by women exposed to average concentrations of lead measured in environmental media. The method is based on a probability model for PbB in adult women exposed to lead in environmental media coupled with an estimated constant of proportionality between fetal and maternal PbBs, a geometric mean fetal PbB concentration and empirically determined geometric standard deviation. The statistical terms used in the method permit an equation to be used to establish an average adult PbB such that a fetus has not more than a 5% probability of PbB exceeding 10 µg/dL. The risk assessment is considered to pass if the average adult PbB does not predict an excess of 5% probability that fetal PbB exceed 10 µg/dL. Results of the adult lead methodology for onsite worker receptors are presented in Table A-3 (Attachment A-1).

A.1.3 Toxicity Assessment

The purpose of the toxicity assessment is to weigh available evidence regarding the potential for a constituent to cause adverse effects in exposed individuals (hazard identification), and to provide an estimate of the relationship between exposure to the constituent and the likelihood of adverse effects

(dose-response assessment). Toxicity is defined as the ability of a constituent to induce adverse effects in biological systems.

The HHRA used EPA-derived toxicity values. There are two types of toxicity values: reference doses (RfDs) (Tables A-5.1 and A-5.2 [Attachment A-2]) for evaluating noncarcinogenic effects and cancer slope factors (Tables A-6.1, A-6.2, and A-6.3 [Attachment A-2]) for evaluating carcinogenic effects. Slope factors and RfDs used in the risk assessment were obtained from the latest version of the regional screening levels tables that follows EPA's three-tiered hierarchy (EPA 2003b):

- Tier 1- EPA's IRIS.
- Tier 2- EPA's Provisional Peer Reviewed Toxicity Values (PPRTV) – The Office of Research and Development/National Center for Environmental Assessment/STSC develops PPRTVs on a constituent specific basis when requested by EPA's Superfund program.
- Tier 3- Other Toxicity Values – Tier 3 includes additional EPA and non-EPA sources of toxicity information. Priority should be given to those sources of information that are the most current, the basis for which is transparent and publicly available, and which have been peer reviewed.

Cancer slope factors for radionuclides were obtained from the Health Effects Assessment Summary Tables (EPA 2001b). Cancer slope factors for external exposure from radionuclides for the current off-site exposure scenarios were obtained on-line from http://epa-sprg.ornl.gov/ (EPA 2008c). This is EPA's web-site for Preliminary Remediation Goals for Radionuclides in Outdoor Surfaces. The use of the cancer slope factors from this site is appropriate because the values in the HEAST tables (EPA 2001b) were derived based on the concept of an infinite slab. The concept of an infinite slab means that the thickness of the contaminated zone and its aerial extent are so large that it behaves as if it were infinite in its physical dimensions (EPA 1991b). Therefore, the cancer slope factors from HEAST are not applicable to the current scenario which is based on ash tracked into an office building or deposited outdoors which would be a thin layer.

A.1.3.1 Evaluation of Carcinogenicity

A few chemicals are known, and many more are suspected, to be human carcinogens. The carcinogenic slope factors (SF), inhalation unit risks, and the accompanying weight-of-evidence classification are used to evaluate potential human carcinogenic risks associated with exposures.

In defining the potential carcinogenicity of a chemical to humans, EPA first evaluates the sufficiency of evidence of carcinogenicity from available animal and human data. If there are sufficient quantitative data and adequate understanding of the carcinogenic process, a biologically based model may be developed to relate dose and response data on an agent-specific basis. Otherwise, as a default procedure, a standard model can be used to curve-fit the data. Once the data are evaluated, the chemical is assigned a weight-of-evidence classification. EPA recognizes five weight-of-evidence group classifications for carcinogenicity, which are as follows (EPA 2005):

- Carcinogenic to Humans: indicates strong evidence of human carcinogenicity.
- Likely to be Carcinogenic to Humans: weight of evidence is adequate to demonstrate carcinogenic potential to humans.
- Suggestive Evidence of Carcinogenic Potential: weight of evidence is suggestive of carcinogenicity; a concern for potential carcinogenic effects in humans is raised, but the data are judged not sufficient for a stronger conclusion.

- Inadequate Information to Assess Carcinogenic Potential: data are judged inadequate for applying one of the other descriptors.
- Not Likely to Be Carcinogenic to Humans: available data are considered robust for deciding that there is no basis for human hazard concern.

The weight of evidence narrative developed to characterize potential carcinogenic hazard summarizes results of the hazard assessment and provides a conclusion with regard to human carcinogenic potential. The weight of evidence narrative includes both a conclusion about the weight of evidence of carcinogenic potential and a summary of the data on which the conclusion rests. The narrative explains the kinds of evidence available and how they fit together in drawing conclusions, and points out significant issues/strengths/limitations of the data and conclusions.

EPA derives SF and unit risk values for carcinogens. SFs generally represent an upper bound on the average risk in a population or the risk for a randomly selected individual but not the risk for a highly susceptible individual or group. Some individuals face a higher risk and some face a lower risk as a result of variations in sensitivity. The use of upper bounds generally is considered to be a health-protective approach for covering the risk to susceptible individuals, although the calculation of upper bounds is not based on susceptibility data. The SF defines quantitatively the relationship between dose and response as the plausible upper-bound estimate of the probability of a response (i.e., development of cancer) per unit intake of a potential carcinogen over a lifetime. In general, an inhalation unit risk is developed directly from a dose response analysis using equivalent human concentrations already expressed in units of $\mu g/m^3$.

The SF is derived by EPA by selecting the most appropriate data set, extrapolating to lower doses, and determining equivalent human doses for the appropriate route of exposure. A nonlinear extrapolation method can be used for cases with sufficient data to ascertain the mode of action and to conclude that it is not linear at low doses but with insufficient data to support a toxicodynamic model that may be either nonlinear or linear at low doses. Nonlinear extrapolation having a significant biological support may be presented in addition to a linear approach when the available data and a weight of evidence evaluation support a nonlinear approach, but the data are not strong enough to ascertain the mode of action. The SF is expressed in terms of risk per unit concentration of the chemical (mg) per unit body weight (kg) per unit time (day) or $(mg/kg/day)^{-1}$. Inhalation unit risk estimates express the slope in terms of micrograms per cubic meter or parts per million air.

A.1.3.2 Evaluation of Noncarcinogenic Effects

Noncarcinogenic effects are evaluated by comparing an exposure or intake/dose with an RfD or reference air concentration (RfC). The RfDs and RfCs are determined using available dose response data for individual chemicals. Scientists determine the exposure concentration or intake/dose, below which no adverse effects are seen, and divide by a safety factor (from 10 to 1,000) to determine the RfD or RfC. RfDs and RfCs are identified by scientific committees supported by the EPA.

Chronic RfDs are developed for protection from long-term exposure to a chemical (from 7 years to a lifetime); subchronic RfDs are used to evaluate short-term exposure (from 2 weeks to 7 years) [EPA 1989]. For this HHRA all receptors (including the resident child, with an exposure duration of 6 years) were conservatively evaluated by using chronic RfDs.

Toxic effects are diverse and measured in various target body organs (e.g., they may range from eye irritation to kidney or liver damage). The EPA is currently reviewing methods for accounting for the difference in severity of effects; however, existing RfDs do not address this issue.

A.1.3.3 Dermal Toxicity Values

Dermal RfDs and SFs are derived from the corresponding oral values, provided there is no evidence to suggest that dermal exposure induces exposure route-specific effects that are not appropriately modeled by oral exposure data. In the derivation of a dermal RfD, the oral RfD is multiplied by the gastrointestinal absorption factor (GAF), expressed as a decimal fraction. The resulting dermal RfD, therefore, is based on absorbed dose. The RfD based on absorbed dose is the appropriate value with which to compare a dermal dose, because dermal doses are expressed as absorbed rather than exposure doses. The dermal SF is derived by dividing the oral SF by the GAF. The oral SF is divided, rather than multiplied, by the GAF because the SF is expressed as a reciprocal dose. The over- or under-estimation of potential cancer risks or non-cancer hazards associated with this approach is addressed in the uncertainty analysis.

A.1.3.4 Target Organ Toxicity

EPA assumes dose and effect to be additive for noncarcinogenic effects (EPA 1989). This assumption provides the justification for adding the HQs or HIs in the risk characterization for noncancer effects resulting from exposure to multiple chemicals, pathways, or media. However, EPA acknowledges that adding all HQ or HI values may overestimate hazards, because the assumption of additivity is probably appropriate only for those chemicals that exert their toxicity by the same mechanism (EPA 1989).

Mechanisms of toxicity data sufficient for predicting additivity with a high level of confidence are available for very few chemicals. In the absence of such data, EPA assumes that chemicals that act on the same target organ may do so by the same mechanism of toxicity; that is, the target organ serves as a surrogate for mechanism of toxicity (EPA 1989). When total HI for all media for a receptor exceeds 1 due to the contributions of several chemicals, it is appropriate to segregate the chemicals by route of exposure and mechanism of toxicity (i.e., target organ) and estimate separate HI values for each target organ.

As a practical matter, since human environmental exposures are likely to involve near- or sub-threshold doses, the target organ chosen for a given chemical is the one associated with the critical effect. If more than one organ is affected by a given chemical at the threshold, then the affected target organs are selected for this chemical. The target organ is also selected on the basis of duration of exposure (i.e., the target organ for chronic or subchronic exposure to low or moderate doses is selected rather than the target organ for acute exposure to high doses) and route of exposure. Because dermal RfD values are derived from oral RfD values, the oral target organ is adopted as the dermal target organ. For some chemicals, no target organ is identified. This occurs when no adverse effects are observed or when adverse effects such as reduced longevity or growth rate are not accompanied by recognized organ- or system-specific functional or morphologic alteration.

A.1.4 Risk Characterization

Risk characterization integrates the results of the exposure and toxicity assessments to estimate potential cancer risks and noncancer hazards. Carcinogenic risk estimates are expressed in terms of the probability that an individual will contract cancer over a lifetime of exposure and are referred to as the ILCR. The ILCR is the potential increased probability that an individual may develop cancer due to exposure to site-related constituents. Cancer risk attributable to exposure from a single chemical or radionuclide by a single exposure route is estimated by multiplying the exposure dose for that chemical through the exposure route by the chemical's cancer slope factor. Chemical-specific and radionuclide-specific risks are then summed to determine the total cancer risk associated with each exposure route. Risks for each exposure route of concern are then summed to estimate a total risk for an individual receptor exposed

through more than one route at a site. When appropriate, risks were summed across media. The calculated cancer risk estimates are compared to the range specified in the National Oil and Hazardous Substances Pollution Contingency Plan of 10^{-6} to 10^{-4}, or 1 in 1 million to 1 in 10,000 exposed persons developing cancer (EPA 1990). ILCRs below 10^{-6} are considered acceptable. ILCRs above 10^{-4} are considered unacceptable. The range between 10^{-6} and 10^{-4} is an area of concern, and any decisions to address ILCRs further in this range, either through additional study or engineered control measures, should account for the uncertainty in the risk estimates.

Noncarcinogenic hazards are expressed in terms of HQs and HIs. An HQ is calculated for each chemical for each exposure route by dividing the exposure dose by the chemical-specific reference dose. An HI is calculated for each exposure route by summing the HQs. HIs for each exposure route are summed to derive a total HI for each scenario. When appropriate, HIs were summed across media. An HI greater than 1 has been defined as the level of concern for potential adverse noncarcinogenic health effects (EPA 1989). This approach differs from the probabilistic approach used to evaluate carcinogens. An HQ of 0.01 does not imply a "1-in-100" chance of an adverse effect but indicates only that the estimated intake is 100 times less than the threshold level at which adverse health effects may occur. Additionally, the level of concern does not increase linearly as the reference dose is approached or exceeded because the RfDs do not have equal accuracy or precision and are not based on the same severity of effect. Moreover, hazard quotients are combined for substances with RfDs based on critical effects of varying toxicological significance. Also, RfDs of varying levels of confidence that include different uncertainty adjustments and modifying factors will often be combined (e.g., extrapolation from animals to humans, from lowest-observed-adverse-effect levels [LOAEL] to no-observed-adverse-effect levels [NOAEL], from one exposure duration to another).

Considerable uncertainty is associated with ILCR, HQ, and HI estimates; therefore, EPA recommends that they be rounded to one significant figure for presentation in an RA (EPA 1989). For example, an HI of 1.49 is rounded to 1 and interpreted to mean that the HI does not exceed the threshold level of 1 and that occurrence of adverse noncancer effects is unlikely. An HI of 14.9, for example, is rounded to 15.

Per EPA Region 4 guidance, COCs are COPCs that significantly contribute to a pathway in a exposure scenario for a receptor that either (a) exceeds a 10^{-4} cumulative site cancer risk; or (b) exceeds a noncarcinogenic HI of 1 (EPA 2000a). A 10^{-4} cumulative site risk level and an HI of 1 are used as remediation "trigger" levels. The carcinogenic "trigger" represents the summed ILCRs to a receptor when considering all pathways, media, and routes for a given land use scenario. The HI "trigger" represents the total of the HQs of all COPCs in all pathways, media, and routes to which the receptor is exposed. If the HI exceeds 1.0, then more specific HIs should be developed by summing HQs of COPCs with RfDs based on toxic effects on the same target organs; this specific target-organ based HI forms the basis for determining noncarcinogenic COCs. Chemicals are not considered to be significant contributors to risk and, therefore, are not COCs if their individual ILCR contribution is less than 10^{-6} and their noncarcinogenic HQ is less than 0.1.

Detailed calculations of cancer risk and noncancer hazard estimates are presented in Tables A-7.1-RME through A-7.12.RME (Attachment A-2). Detailed cancer risk estimates for potential exposures to naturally occurring radionuclides are presented in Tables A-8.1.RME through A-8.12.RME (Attachment A-2). Summaries of the cancer risk and noncancer hazard estimates are presented in Tables A-9.1.RME through A-9.12.RME (Attachment A-2). Tables A-10.1.RME through A-10.12.RME (Attachment A-2) summarize the cancer risk and hazard estimates for the COCs identified for potential exposures at the KIF site. Note that even though not all scenarios resulted in cancer risks greater than 10^{-4} or hazard indices greater than 1.0 for comparative purposes Tables A-10.1.RME through A-10.12.RME (Attachment A-2) list the same set of COCs based on the most conservative exposure scenario.

A.1.4.1 Current Exposure Scenarios

Potential exposures to ash related constituents were evaluated for onsite and offsite receptors. Onsite receptors are those who reside, work, or play on the ash, whereas, offsite receptors are those whose activities occur in areas where ash is not present. Cancer risk and noncancer hazard estimates were calculated for current offsite residents (adult and child), offsite indoor workers, offsite outdoor workers, and onsite adolescent trespassers as described in Section A.1.2.

Cancer risk estimates for current exposure scenarios did not exceed the target risk range for any receptor. Cancer risk estimates for current exposure scenarios ranged from 3E-08 for the offsite resident (child and adult) to 5E-05 for the onsite adolescent trespasser. This This cancer risk is driven by ingestion of arsenic and external exposure to gamma radiation from K-40, Ra-226, Ra-228, and Th-228. The uncertainties associated with these cancer risk estimates are discussed in Section A.1.5.4.

Noncancer hazard estimates for current exposure scenarios ranged from 0.009 for the offsite adult and child resident to 0.2 for the offsite outdoor worker. Therefore, the occurrence of adverse noncancer effects is unlikely.

A.1.4.2 Future Exposure Scenarios

Potential future exposures to ash related constituents were evaluated for onsite receptors. Onsite receptors are those who reside, work, or play on the ash. Cancer risk and noncancer hazard estimates were calculated for future onsite residents (adult and child), indoor workers, outdoor workers, groundskeepers, and adult and child recreational receptors as described in Section A.1.2.

Cancer risk estimates for future exposure scenarios ranged from 1E-06 for the adolescent recreator to 2E-03 for the onsite resident (adult). The cancer risk estimates are driven by ingestion of arsenic and external exposure to gamma radiation from K-40, Ra-226, Ra-228, and Th-228. The uncertainties associated with these cancer risk estimates are discussed in Section A.1.5.4.

Noncancer hazard estimates for future exposure scenarios ranged from 0.01 for the adult recreator to 8 for the child resident. The hazard estimate for adult residents is 1. The hazard estimates for all other receptors are less than the noncancer hazard threshold. Therefore, the occurrence of adverse noncancer effects is unlikely. The hazard estimates for adult and child residents are equal to or greater than the noncancer hazard threshold. The primary contributors to the HI are ingestion of arsenic, cobalt, thallium, aluminum, iron, vanadium, and chromium in ash and for the adult and child resident ingestion of arsenic in groundwater.

Lead. Results of the IEUBK for onsite child residential receptors are presented in Table A-3 (Attachment A-1). The predicted PbB range from 0.9 to 1.3 µg/dL, indicating that potential onsite exposures to lead in ash do not result in unacceptable PbB estimates.

Results of the ALM for onsite worker receptors are presented in Table A-3 (Attachment A-1). The predicted PbB and fetal PbB are 1.4 and 3.4 µg/dL, respectively, indicating that potential onsite exposures to lead in ash do not result in unacceptable PbB estimates.

A.1.5 Uncertainty Analysis

The primary purpose of the HHRA is to determine whether there is a current or potential future threat to human health or the environment that warrants remedial action. The nature of cancer risk and noncancer hazard estimates requires the use of multiple assumptions in their development, including assumptions

relative to exposure and site conditions. The information and assumptions used to derive the risk estimates are inherently uncertain. The uncertainties introduced at each stage of the risk assessment process may become magnified when they are combined with other uncertainties in the latter stages of the assessment. Reliance on a simplified numerical presentation of dose rate and risk without consideration of uncertainties, limitations, and assumptions inherent in their derivation can be misleading. The uncertainty analysis is a qualitative assessment of these assumptions and their potential impact on the risk estimates to place the numerical estimates in the proper context; namely, whether the risk assessment process may have over- or under-estimated the hazard and risk levels. The uncertainty analysis also addresses the concentrations of ash-related constituents relative to regional soil background concentrations, to place the risk estimates in the context of potential exposures to ash related constituents that are part of the natural local and regional environment.

The uncertainty analysis does not exhaustively describe all potential uncertainties but presents those that have the largest implications for the interpretation of the risk assessment results. This analysis reviews the types and, as applicable, the magnitude of the uncertainties at each stage of the risk assessment.

Various sources of uncertainty are inherent in the HHRA. Many of the uncertainties involved required the use of more conservative assumptions to estimate risks and hence are likely to result in an overestimation of potential risks. However, other uncertainties can result in the underestimation of risks. Key areas of uncertainty include:

- Data uncertainties
- Exposure scenario uncertainties
- Toxicity value uncertainties

A.1.5.1 Data Uncertainties

Although the data evaluation process used to select COPCs adheres to established procedures and guidance, it also requires making decisions and developing assumptions on the basis of historical information and best professional judgment about the data. Uncertainties are associated with all such assumptions.

Uncertainty can be introduced in the data aggregation process for estimating a representative exposure concentration in the exposure media. The available data for ash are from a combination of geoprobe and surface samples from the intact portion of the dredge cell and surface samples from the ash flow area including adjacent former residential properties. The uncertainty associated with the aggregation of data is considered to be low because of the large number of samples, the distribution of sample locations and types, and the homogeneity of the material as a result of the processing and release of ash from the dredge cell.

Because of the uncertainty associated with estimating the true average concentration at a site, the representative EPC used is the UCL_{95} on the arithmetic mean (EPA 1992b). Statistical tests were performed (using the ProUCL software) to determine which statistical distribution best fits the concentration data. Each COPC's UCL_{95} concentration was calculated using both detected values and the reported quantitation limit for samples without a detected concentration. ProUCL handled quantitation limits for nondetected analytes as appropriate for the statistical distribution of the data based on the internal rules of the software. ProUCL recommended UCLs were used for all COPCs in ash with the exception of mercury and thallium because the frequency of detection of these constituents was insufficient to allow for calculation of a valid UCL_{95}. Therefore, the maximum detected concentration was used for these two constituents. EPCs for groundwater were the maximum detected concentrations because only two rounds of data from the bedrock monitoring well were available. This method may

moderately overestimate the exposure concentration. When the resulting individual constituent risks are summed to provide a total ILCR or HI, the compounding conservatism of this method for estimating EPCs will likely result in an overestimate of the total risk.

Environmental concentrations are assumed to be constant (i.e., concentrations are not reduced by loss due to natural removal processes such as leaching, and/or biodegradation) over the duration of exposure. This assumption has low uncertainty for ash and moderate to high uncertainty for surface water and groundwater.

Low uncertainty is introduced by the exclusion of 2-methylnaphthalene. This PAH was detected in a single ash sample but not confirmed by reanalysis of the sample. The sample was collected from an area of the ash that has had substantial regrading and movement of ash by heavy equipment. Therefore, the presence of 2-methylnaphthalene is likely attributable to deposition from equipment exhaust. The detected concentration of 2-methylnaphthalene (95 µg/kg) is well below the risk-based screening level (310,000 µg/kg) and, therefore, would also be eliminated as a COPC based on this comparison.

Some unavoidable uncertainty is associated with the constituent concentrations detected and reported by the analytical laboratory. The quality of the analytical data used in the risk assessment depends on the adequacy of the set of procedures that specifies how samples are selected and handled and how strictly these procedures are followed. Quality assurance/quality control procedures within the laboratories are used to minimize uncertainties; however, sampling errors, laboratory analysis errors, and data analysis errors can occur. Low to moderate uncertainty is associated with the collection, handling, and analysis of samples. Uncertainty associated with samples collected by TVA contract personnel is minimized by the implementation and adherence to procedures established for the project, selection of analytical methods, audits conducted on the field sampling teams and laboratories, and review and validation of the analytical data packages.

There is considerable uncertainty associated with the bedrock groundwater dataset. The uncertainties are associated with the limited number of samples and the availability of data from only a single well. Therefore, the risks from potential exposure to groundwater may be overestimated or underestimated, but the magnitude of such estimation is not quantifiable. TVA is planning for the installation of addition monitoring wells which will allow for better estimates of potential risks should exposures occur in the future.

A.1.5.2 Exposure Scenario Uncertainty

The selection of exposure scenarios and parameters is a conservative process that errs on the side of overestimating rather than underestimating potential exposures. Exposure parameters are selected as combinations of average (50th percentile) and upper-bound (95th percentile) values. The selection of exposure parameters results in an estimate of the reasonable maximum exposure (RME) expected to occur under both current and future land-use scenarios. The intent of the RME is to estimate a conservative exposure case that is still within the range of possible exposures (EPA 1989).

For each exposure scenario and pathway analyzed in the HHRA, assumptions were made concerning the exposure parameters (e.g., amount of contaminated media a receptor can be exposed to and intake rates for different routes of exposure) and the routes of exposure. In the absence of EPA-approved default values for exposure parameters, site-specific parameters were used. The selection of exposure parameters is assumed to conservatively represent the potentially exposed populations. All potential constituent exposures are assumed to be from site exposure media (i.e., no other sources contribute to the receptor's health risk).

Moderate to high uncertainty is associated with current and future exposure scenarios. Potential exposures of current offsite residential receptors were assumed to occur by inhalation of dust from the ash. However, TVA has active and aggressive dust control and air monitoring programs in place. Air monitoring around the KIF confirms that the National Ambient Air Quality Standards for inhalable particulate matter (PM_{10}) and respirable particulate matter ($PM_{2.5}$) are being met, indicating that offsite releases of airborne ash are negligible. Therefore, exposures via the inhalation pathway are likely overestimated. Potential exposures to current offsite indoor and outdoor workers are also likely overestimated due to the active measures to minimize the dispersion of fly ash from the dredge cell and ash processing area including vehicle and hand washing stations, boot cleaning locations and other decontamination activities. Potential exposures to current onsite adolescent trespassers are likely overestimated due to the presence of workers on the ash and patrols by TVA security personnel. The presence of workers and security personnel are deterrents to trespassing, which by nature is most likely to occur when the possibility of being caught is minimal. This scenario further overestimates potential cancer risk and noncancer hazards because of the assumption that adolescents are on the ash for 8 hours each day they trespass. Therefore, the cancer risk and noncancer hazard estimates are likely overestimated by as much as 8 times assuming they are actually onsite for only 1 hour, which is more likely given the conditions previously mentioned.

Risks associated with potential future onsite exposure scenarios (i.e., on the ash) are considered to be overestimated because these scenarios purposefully assume that TVA abandons or releases the site without placing any cover material on the ash. Therefore, it is assumed that residences, offices, recreation areas, etc., are constructed directly on the ash and the ash becomes surface soil. However, even if TVA placed an appropriate soil cover on the ash prior to releasing the area, in the future an individual or contractor could excavate through the cover to construct a building foundation or basement in the absence of institutional controls. Such excavation and construction activities would result in a mixing of the ash with the cover material reducing the concentrations of ash related constituents. Additionally, it is a common practice for contractors to add topsoil at construction sites to ensure the establishment of lawns or landscape area, thereby, reducing or eliminating direct contact with the ash.

Potential future exposures to groundwater were evaluated using analytical data from bedrock well 13B. This is appropriate because wells installed for household use are typically installed into bedrock rather than in the overburden material. Additionally, KIF is located in an area of groundwater discharge rather than recharge. Therefore, the movement of groundwater is upward and toward the Emory River rather than downward toward bedrock. However, to evaluate the uncertainties associated with potential exposures to ash related constituents via groundwater use scenarios, analytical data from overburden monitoring wells were used to derive cancer risk and noncancer hazard estimates (Tables A-4 through A-8 [Attachment A-1]). Whereas cancer risk estimates for potential exposures to groundwater from bedrock monitoring wells ranged from 2E-05 (indoor workers) to 3E-05 (adult residents), those from overburden monitoring wells ranged from 2E-04 (indoor workers) to 4E-04 (adult residents). The cancer risk estimates are driven by ingestion of arsenic. Similarly, whereas noncancer hazard estimates for potential exposures to groundwater from bedrock monitoring wells ranged from 0.3 (indoor workers) to 2 (child residents), those from overburden monitoring wells ranged from 4 (indoor workers) to 29 (child residents). The hazard estimates are driven by ingestion of manganese and arsenic. This suggests that risks from future exposure to groundwater may be underestimated if concentrations in bedrock groundwater were to increase to concentrations measured in overburden groundwater.

Data from monitoring well 6A were not used in this evaluation because it is a non-standard environmental monitoring well, featuring simply a 4-inch diameter riser with 0.25-inch diameter holes drilled into it. Well 6A had the highest detected concentrations of boron, chromium, iron, manganese, strontium, and vanadium. Had data from well 6A been included, the noncancer hazard estimates would be higher for

iron, manganese, and vanadium. The following presents a comparison of the analytical results for KIF groundwater wells.

Comparison of KIF Groundwater Data				
		Unconsolidated		Bedrock
Analyte Name	**Units**	**Maximum Value All Wells**	**Maximum Value without Well 6A**	**Maximum Value**
Aluminum	mg/L	1.17	1.17	0.1
Arsenic	mg/L	0.0297	0.0297	0.00326
Barium	mg/L	0.101	0.101	0.485
Boron	mg/L	0.711	0.666	0.144
Chromium	mg/L	0.02	0.0029	0.002
Cobalt	mg/L	0.00372	0.00372	0.002
Iron	mg/L	1050	1.04	0.107
Manganese	mg/L	179	7.82	0.095
Strontium	mg/L	0.681	0.55	0.451
Vanadium	mg/L	0.04	0.00522	0.004

A.1.5.3 Toxicity Assessment Uncertainty

Considerable uncertainty is associated with the qualitative (hazard assessment) and quantitative (dose-response) evaluations of a toxicity assessment. Hazard assessment of carcinogenicity is evaluated as a weight-of-evidence determination (EPA 2005). Positive animal cancer test data suggest that humans also contain tissue(s) that may manifest a carcinogenic response; however, the animal data cannot necessarily be used to predict the target tissue response in humans. In the hazard assessment of noncancer effects, positive animal data suggest the nature of the effects (i.e., the target tissues and type of effects) anticipated in humans (EPA 1989).

The cancer slope factor for a chemical is a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. It is used to estimate an upper-bound lifetime probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen. The slope factor is derived by applying a mathematical model to extrapolate from a relatively high, administered dose to animals to the lower exposure levels expected for humans. For radionuclides, ingestion and inhalation cancer slope factors (CSF)] are central estimates from a linear model of the age-averaged lifetime radiation cancer incidence risk per unit of activity inhaled or ingested. For external exposure to radionuclides in soil and air, CSFs are central estimates of lifetime radiation cancer risk for each year of exposure to external radiation.

The methods used to develop noncarcinogenic toxicity values (RfD or RfC) involve identifying a threshold level below which adverse health effects are not expected to occur. The RfD and RfC values are generally based on studies of the most sensitive animal species tested (unless adequate human data are available) and the most sensitive endpoint measured. Uncertainties exist in the experimental data set for such animal studies. These studies are used to derive the experimental exposure representing the highest dose level tested at which no adverse effects are demonstrated (i.e., the NOAEL); in some cases, however, only a LOAEL is available. The RfD and/or RfC are derived from the NOAEL (or LOAEL) for the critical toxic effect by dividing the NOAEL (or LOAEL) by uncertainty factors. These factors usually are multipliers of 10, with each factor representing a specific area of uncertainty in the extrapolation of the data. For example, an uncertainty factor of 100 is typically used when extrapolating animal studies to humans. Additional uncertainty factors are sometimes necessary when other experimental data limitations are found. Because of the large uncertainty factors (10 to 10,000) associated with some RfD or RfC

toxicity values, exact safe levels of exposure for humans are not known. For noncarcinogenic effects, the amount of human variability in physical characteristics is important in determining the risks that can be expected at low exposures and in determining the NOAEL (EPA 1989).

Quantitative toxicity estimates for dermal exposures have not been developed by EPA; therefore, oral reference doses and oral cancer potency factors were used to assess systemic toxicity from dermal exposures. The dermal route of exposure can result in different patterns of distribution, metabolism, and excretion than occur from the oral route. When toxicity values for systemic effects used on oral exposures are applied to dermal exposures, uncertainty in the risk assessment is introduced because these differences are not taken into account. Since any differences between oral and dermal pathways would depend on the specific chemical, use of modified oral toxicity factors can result in the over- or underestimation of risk, depending on the chemical. It is not possible to make a general statement about the direction or magnitude of this uncertainty (EPA 2004a).

Uncertainty also arises from the presence of chemicals (e.g., lead) for which there are no EPA-approved toxicity values, and for which quantitative risk characterization is not possible. The effects of exposure to lead are well understood and PbB is recognized as a valid predictor of the potential for effects. In the absence of EPA-approved toxicity values for aluminum, cobalt, and iron provisional values have been used in the risk characterization for these COPCs. The toxicity values for these chemicals have larger uncertainties than those with approved values. Assumptions made in assigning toxicity values for COPCs for this risk assessment were as follows:

- Total chromium was evaluated using the toxicity values for mixtures of Chromium III and Chromium VI. Aluminum, cobalt, and iron were evaluated with provisional toxicity values from the National Center of Environmental Assessment; without these values, hazards could not be quantified for these metals.
- Thallium as a metal was evaluated using the toxicity values for thallium soluble salts.

In summary, the EPA methodology for both cancer and noncancer toxicity evaluation is intentionally designed to be protective. However, the extent to which toxicity values may overestimate toxic potency is not clear, and it is possible that the toxicity values for some compounds may not be adequately protective.

A.1.5.4 Risk Characterization Uncertainty

Risk assessment as a scientific activity is subject to uncertainty. This is true even though the methods used in the HHRA follow EPA guidelines. As noted previously, the risk assessment in this report is subject to uncertainty pertaining to sampling and analysis, selection of COPCs, exposure estimates, and availability and quality of toxicity data.

As stated in Section A.1.1.1, antimony, cadmium, and molybdenum were not detected in any ash samples collected by TVA. These constituents were detected in ash samples collected by EPA and TDEC. Additionally, analysis for lithium and total uranium was not conducted on EPA or TVA ash samples. These constituents were detected in samples collected by TDEC. Exclusion of these constituents from the risk assessment introduces uncertainty into the risk estimates. The maximum detected concentrations reported by EPA or TDEC of these noncarcinogenic constituents were compared to residential risk-based screening levels at a target hazard quotient level 0.1 (Table A-9 [Attachment A-1]). This comparison indicates that the maximum detected concentrations exceed their respective residential screen levels at the target hazard quotient level of 0.1. This suggests that the hazard estimates may be underestimated.

The summation of HQs and ILCRs across constituents and pathways are primary uncertainties in the risk characterization. In the absence of information on the toxicity of specific chemical mixtures, it is assumed that ILCRs and HQs are additive (i.e., cumulative) [EPA 1989]. The limitations of this approach for non-carcinogens are (1) the effects of a mixture of chemicals are generally unknown - it is possible that the interactions could be synergistic, antagonistic, or additive; (2) the RfDs have different accuracy and precision and are not based on the same severity or effect; and (3) HQ or intake summation is most properly applied to compounds that induce the same effects by the same mechanism, (4) the chemical-specific slope factors represent the upper 95th percentile estimate of potency; therefore, summing individual risks can result in an excessively conservative estimate of total lifetime cancer risk; and (5) the target organs of multiple carcinogens may be different, so the risks would not be additive. In the absence of data, additivity for ILCRs and HQs is assumed for this HHRA.

Note also that initially, no analytes were eliminated from the quantitative risk calculations based on a comparison to background concentrations, adding some uncertainty to this HHRA. This may overestimate site-related risk since some COCs may be at or below background levels. This is especially relevant for background levels of radionuclides which typically produce ILCRs close to 10^{-4}. Since the total radiological ILCR includes these isotopes, then the total radiological ILCR is likely biased on the high side. Table A-10 (Attachment A-1) presents the range and frequency of detection of inorganic constituents and radioisotopes reported for soil samples in the vicinity of KIF and throughout the state of Tennessee and compares them to the maximum detected concentration in TVA ash samples. The following constituents (excluding short-lived radionuclide daughter products) detected in TVA ash samples had maximum concentrations that exceeded the range of concentrations reported for soils in the region or in Tennessee:

- Barium
- Beryllium
- Boron
- Potassium
- Radium-226
- Selenium
- Sodium
- Thallium
- Thorium-230
- Thorium-234
- Vanadium

The maximum detected concentrations of these constituents exceed the maximum concentrations reported for regional soils by factors of 1.2 for potassium to 4.1 for barium. Arsenic concentrations reported in TVA ash samples are within the range of concentrations reported for soil. However, three samples in the Department of Energy (DOE) (1993) dataset are elevated relative to all other results. These concentrations (180, 512, and 655 mg/kg) are considered valid results based on a review of the information on the sample locations presented in DOE's report. While the concentrations do not appear to have been influenced by DOE operations (including waste disposal), they may have been influenced by past agricultural activities. Therefore, while these values are suspect due to potential anthropogenic impacts they are indicative of the range of arsenic concentrations in native and agricultural soil in the region.

A.2 REFERENCES

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ATTACHMENT A-1

Tables and Figures

Table A-1. Comparison of Detected Concentrations of Ash-related Constituents in EPA, TDEC, and TVA Samples

		Summary Statistics for EPA Ash Data			Summary Statistics for TDEC Ash Data			Summary Statistics for TVA Ash Data		
Analyte	Units	Minimum Detected Result	Maximum Detected Result	Frequency of Detect	Minimum Detected Result	Maximum Detected Result	Frequency of Detect	Minimum Detected Result	Maximum Detected Result	Frequency of Detect
Aluminum	mg/Kg	10,500	28,900	7/7	1,000	22,000	11/11	8,710	45,200	52/52
Antimony	mg/Kg	0.916	1.63	7/7	2.4	2.4	1/1	NR	NR	0/52
Arsenic	mg/Kg	44.8	81.3	7/7	26	100	12/12	2.78	166	52/52
Barium	mg/Kg	188	864	7/7	180	1,100	12/12	69.7	1,410	52/52
Beryllium	mg/Kg	0.122	6.25	7/7	1.5	7.9	12/12	1.66	9.6	47/52
Boron	mg/Kg	NR	NR	NR	NR	NR	NR	14.8	212	48/52
Cadmium	mg/Kg	0.577	1.23	7/7	0.2	0.2	2/2	NR	NR	0/52
Calcium	mg/Kg	2,190	19,500	7/7	2,000	27,000	12/12	1,460	30,900	52/52
Chromium	mg/Kg	18.2	41.3	7/7	16	43	12/12	9.64	66	52/52
Cobalt	mg/Kg	7.91	18.7	7/7	6.7	29	12/12	13.1	29.7	42/52
Copper	mg/Kg	29.9	69.4	7/7	25	76	12/12	8.49	102	52/52
Iron	mg/Kg	9,590	19,300	7/7	10,000	15,000	12/12	9,840	39,700	52/52
Lead	mg/Kg	15.3	56.9	7/7	9.8	29	12/12	10.7	46	52/52
Lithium	mg/Kg	NR	NR	NR	16	36	10/10	NR	NR	NR
Magnesium	mg/Kg	713	4,300	7/7	730	6,400	12/12	662	6,230	52/52
Manganese	mg/Kg	45.7	447	7/7	56	260	12/12	45.6	698	52/52
Mercury	mg/Kg	0.0563	0.116	7/7	NR	NR	NR	0.136	0.209	4/12
Molybdenum	mg/Kg	NR	NR	NR	1.6	5.3	6/6	NR	NR	0/52
Nickel	mg/Kg	17.1	32.3	7/7	13	37	12/12	7.37	64.4	52/52
Potassium	mg/Kg	1,340	3,280	7/7	NR	NR	NR	642	7,040	52/52
Selenium	mg/Kg	3.13	7.15	7/7	2.2	2.2	1/1	2.64	17.8	45/52
Silica	mg/Kg	40.1	1,060	6/6	NR	NR	NR	NR	NR	NR
Silver	mg/Kg	NR	NR	0/7	NR	NR	NR	NR	NR	0/52
Sodium	mg/Kg	147	725	7/7	NR	NR	NR	283	1,790	46/52
Strontium	mg/Kg	NR	NR	NR	130	260	10/10	NR	NR	NR
Thallium	mg/Kg	4.36	4.36	1/7	1.8	1.8	1/1	2.65	3.8	4/52
Uranium	mg/Kg	NR	NR	NR	2.3	4	10/10	NR	NR	NR
Vanadium	mg/Kg	44.6	121	7/7	42	150	12/12	15.6	163	52/52
Zinc	mg/Kg	24.3	55.6	7/7	25	67	12/12	23.5	94.7	52/52

Table A-2. IEUBK Results for Future Onsite Residential Child Receptor

LEAD MODEL FOR WINDOWS Version 1.1

==========
Model Version: 1.1 Build9
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research
==========

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(µg/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

****** Drinking Water ******

Water Age	Consumption: Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 28.837 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (µg Pb/g)	House Dust (µg Pb/g)
.5-1	26.910	28.837
1-2	26.910	28.837
2-3	26.910	28.837
3-4	26.910	28.837
4-5	26.910	28.837
5-6	26.910	28.837
6-7	26.910	28.837

****** Alternate Intake ******

Age	Alternate (µg Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 1.000 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.102	0.000	0.390
1-2	0.034	0.955	0.000	0.974
2-3	0.062	1.040	0.000	1.016
3-4	0.067	1.000	0.000	1.039
4-5	0.067	0.960	0.000	1.083
5-6	0.093	1.011	0.000	1.144
6-7	0.093	1.096	0.000	1.165

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	0.696	2.210	1.2
1-2	1.103	3.066	1.3
2-3	1.107	3.225	1.2
3-4	1.111	3.216	1.1
4-5	0.826	2.936	1.0
5-6	0.745	2.993	0.9
6-7	0.704	3.057	0.9

Table A-3. Results of the Adult Lead Methodology Evaluation of Blood Lead Concentrations (PbBs) for Worker Exposures at the KIF Site

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 05/19/05

Exposure Variable	Description of Exposure Variable	Units	Regional OR Ethnic GSDi and PbBo Data from HNANES III Analysis West/All Default 60% GI ABS
PbS	Soil lead concentration	ug/g or ppm	27.9
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.08
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	250
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	25
PbB_{adult}	**PbB of adult, geometric mean**	**ug/dL**	**1.4**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult	ug/dL	3.4
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	10.0
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.0%**

·ce: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead
n Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

Table A-4. Risks and Hazards from Ingestion of Uncolsolidated Groundwater for Adult Residential Receptors at TVA Kingston Fossil Plant, Harriman, TN

Chemical	Exposure Point Concentration in Groundwater (mg/L) RME	Reference Dose 1/(mg/kg-day)	Intake Values (mg/kg-day) RME	Noncarcinogenic Effects: Hazard Quotient (Intake/RfD) RME	Intake Values (mg/kg-day) RME	Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Carcinogenic Effects: Excess Lifetime Cancer Risk (Intake x sf) RME
Aluminum, total	1.17	1.00E+00	3.21E-02	0.03	1.10E-02	No toxicity value	NA
Arsenic, total	0.0297	3.00E-04	8.14E-04	3	2.79E-04	1.50E+00	4.E-04
Barium, total	0.101	2.00E-01	2.77E-03	0.01	9.49E-04	No toxicity value	NA
Boron, total	0.666	2.00E-01	1.82E-02	0.09	6.26E-03	No toxicity value	NA
Chromium, total	0.0029	3.00E-03	7.95E-05	0.03	2.72E-05	No toxicity value	NA
Cobalt, total	0.00372	3.00E-04	1.02E-04	0.3	3.49E-05	No toxicity value	NA
Iron, total	1.04	7.00E-01	2.85E-02	0.04	9.77E-03	No toxicity value	NA
Manganese, total	7.82	2.40E-02	2.14E-01	9	7.35E-02	No toxicity value	NA
Strontium, total	0.55	6.00E-01	1.51E-02	0.03	5.17E-03	No toxicity value	NA
Hazard Index				12			
Total Cancer Risk							4.E-04

RME = reasonable maximum exposure
Sf = slope factor
RfD = reference dose

Table A-5. Risks and Hazards from Dermal Contact with Unconsolidated Groundwater for Adult Residential Receptors at TVA Kingston Fossil Plant, Harriman, TN

Chemical	Exposure Point Concentration in Groundwater (mg/L) RME	Reference Dose 1/(mg/kg-day)	Dermal Absorbed Dose RME	Noncarcinogenic Effects: Hazard Quotient (Intake/RfD) RME	Dermal Absorbed Dose RME	Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Carcinogenic Effects: Excess Lifetime Cancer Risk (Intake x sf) RME
Aluminum, total	1.17	1.00E+00	1.67E-04	0.0002	5.74E-05	No toxicity value	NA
Arsenic, total	0.0297	2.85E-04	4.25E-06	0.01	1.46E-06	1.58E+00	2.E-06
Barium, total	0.101	1.40E-02	1.44E-05	0.001	4.95E-06	No toxicity value	NA
Boron, total	0.666	2.00E-01	9.52E-05	0.0005	3.27E-05	No toxicity value	NA
Chromium, total	0.0029	3.90E-05	4.15E-07	0.01	1.42E-07	No toxicity value	NA
Cobalt, total	0.00372	3.00E-04	5.32E-07	0.002	1.82E-07	No toxicity value	NA
Iron, total	1.04	7.00E-01	1.49E-04	0.0002	5.10E-05	No toxicity value	NA
Manganese, total	7.82	9.60E-04	1.12E-03	1	3.83E-04	No toxicity value	NA
Strontium, total	0.55	6.00E-01	7.87E-05	0.0001	2.70E-05	No toxicity value	NA
Hazard Index				1			
Total Cancer Risk							2.E-06

RME = reasonable maximum exposure
RfD = reference dose
Sf = slope factor

Table A-6. Risks and Hazards from Ingestion of Unconsolidated Groundwater for Child Residential Receptors at TVA Kingston Fossil Plant, Harriman, TN

Chemical	Exposure Point Concentration in Groundwater (mg/L) RME	Reference Dose 1/(mg/kg-day)	Intake Values (mg/kg-day) RME	Noncarcinogenic Effects: Hazard Quotient (Intake/RfD) RME	Intake Values (mg/kg-day) RME	Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Carcinogenic Effects: Excess Lifetime Cancer Risk (Intake x sf) RME
Aluminum, total	1.17	1.00E+00	7.48E-02	0.07	6.41E-03	No toxicity value	NA
Arsenic, total	0.0297	3.00E-04	1.90E-03	6	1.63E-04	1.50E+00	2.E-04
Barium, total	0.101	2.00E-01	6.46E-03	0.03	5.53E-04	No toxicity value	NA
Boron, total	0.666	2.00E-01	4.26E-02	0.2	3.65E-03	No toxicity value	NA
Chromium, total	0.0029	3.00E-03	1.85E-04	0.06	1.59E-05	No toxicity value	NA
Cobalt, total	0.00372	3.00E-04	2.38E-04	0.8	2.04E-05	No toxicity value	NA
Iron, total	1.04	7.00E-01	6.65E-02	0.09	5.70E-03	No toxicity value	NA
Manganese, total	7.82	2.40E-02	5.00E-01	21	4.28E-02	No toxicity value	NA
Strontium, total	0.55	6.00E-01	3.52E-02	0.06	3.01E-03	No toxicity value	NA
Hazard Index				28			
Total Cancer Risk							2.E-04

RME = reasonable maximum exposure
Sf = slope factor
RfD = reference dose

Table A-7. Risks and Hazards from Dermal Contact with Unconsolidated Groundwater for Child Residential Receptors at TVA Kingston Fossil Plant, Harriman, TN

Chemical	Exposure Point Concentration in Groundwater (mg/L) RME	Reference Dose 1/(mg/kg-day)	Dermal Absorbed Dose RME	Noncarcinogenic Effects: Hazard Quotient (Intake/RfD) RME	Dermal Absorbed Dose RME	Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Carcinogenic Effects: Excess Lifetime Cancer Risk (Intake x sf) RME
Aluminum, total	1.17	1.00E+00	4.94E-04	0.0005	4.23E-05	No toxicity value	NA
Arsenic, total	0.0297	2.85E-04	1.25E-05	0.04	1.07E-06	1.58E+00	2.E-06
Barium, total	0.101	1.40E-02	4.26E-05	0.003	3.65E-06	No toxicity value	NA
Boron, total	0.666	2.00E-01	2.81E-04	0.001	2.41E-05	No toxicity value	NA
Chromium, total	0.0029	3.90E-05	1.22E-06	0.03	1.05E-07	No toxicity value	NA
Cobalt, total	0.00372	3.00E-04	1.57E-06	0.005	1.35E-07	No toxicity value	NA
Iron, total	1.04	7.00E-01	4.39E-04	0.0006	3.76E-05	No toxicity value	NA
Manganese, total	7.82	9.60E-04	3.30E-03	3	2.83E-04	No toxicity value	NA
Strontium, total	0.55	6.00E-01	2.32E-04	0.0004	1.99E-05	No toxicity value	NA
Hazard Index				4			
Total Cancer Risk							2.E-06

RME = reasonable maximum exposure
RfD = reference dose
Sf = slope factor

Table A-8. Risks and Hazards from Ingestion of Unconsolidated Groundwater for Indoor Worker Receptors at TVA Kingston Fossil Plant, Harriman, TN

Chemical	Exposure Point Concentration in Groundwater (mg/L) RME	Reference Dose 1/(mg/kg-day)	Intake Values (mg/kg-day) RME	Noncarcinogenic Effects: Hazard Quotient (Intake/RfD) RME	Intake Values (mg/kg-day) RME	Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Carcinogenic Effects: Excess Lifetime Cancer Risk (Intake x sf) RME
Aluminum, total	1.17	1.00E+00	1.14E-02	0.01	4.09E-03	No toxicity value	NA
Arsenic, total	0.0297	3.00E-04	2.91E-04	1	1.04E-04	1.50E+00	2.E-04
Barium, total	0.101	2.00E-01	9.88E-04	0.005	3.53E-04	No toxicity value	NA
Boron, total	0.666	2.00E-01	6.52E-03	0.03	2.33E-03	No toxicity value	NA
Chromium, total	0.0029	3.00E-03	2.84E-05	0.009	1.01E-05	No toxicity value	NA
Cobalt, total	0.00372	3.00E-04	3.64E-05	0.1	1.30E-05	No toxicity value	NA
Iron, total	1.04	7.00E-01	1.02E-02	0.01	3.63E-03	No toxicity value	NA
Manganese, total	7.82	2.40E-02	7.65E-02	3	2.73E-02	No toxicity value	NA
Strontium, total	0.55	6.00E-01	5.38E-03	0.009	1.92E-03	No toxicity value	NA
Hazard Index				4			
Total Cancer Risk							2.E-04

RME = reasonable maximum exposure
Sf = slope factor
RfD = reference dose

Table A-9. Comparison of Detected Concentrations of Ash-related Constituents in EPA, TDEC, and TVA Samples to Risk Based Screening Levels

Analyte	Units	EPA Ash Data	TDEC Ash Data	TVA Ash Data	Risk-Based Screening Level
		Maximum Detected Result	Maximum Detected Result	Maximum Detected Result	
Aluminum	mg/Kg	28,900	22,000	45,200	770
Antimony	mg/Kg	1.63	2.4	NR	0.31
Arsenic	mg/Kg	81.3	100	166	
Barium	mg/Kg	864	1,100	1,410	150
Beryllium	mg/Kg	6.25	7.9	9.6	1.6
Boron	mg/Kg	NR	NR	212	160
Cadmium	mg/Kg	1.23	0.2	NR	0.7
Calcium	mg/Kg	19,500	27,000	30,900	
Chromium	mg/Kg	41.3	43	66	2.3
Cobalt	mg/Kg	18.7	29	29.7	0.23
Copper	mg/Kg	69.4	76	102	31
Iron	mg/Kg	19,300	15,000	39,700	550
Lead	mg/Kg	56.9	29	46	
Lithium	mg/Kg	NR	36	NR	1.6
Magnesium	mg/Kg	4,300	6,400	6,230	
Manganese	mg/Kg	447	260	698	
Mercury	mg/Kg	0.116	NR	0.209	0.043
Molybdenum	mg/Kg	NR	5.3	NR	3.9
Nickel	mg/Kg	32.3	37	64.4	15
Potassium	mg/Kg	3,280	NR	7,040	
Selenium	mg/Kg	7.15	2.2	17.8	3.9
Silica	mg/Kg	1,060	NR	NR	ND
Silver	mg/Kg	NR	NR	NR	3.9
Sodium	mg/Kg	725	NR	1,790	
Strontium	mg/Kg	NR	260	NR	470
Thallium	mg/Kg	4.36	1.8	3.8	0.051
Uranium	mg/Kg	NR	4	NR	2.3
Vanadium	mg/Kg	121	150	163	3.9
Zinc	mg/Kg	55.6	67	94.7	230

Table A-10. Range of Concentrations[1] of Inorganic Constituents and Radioisotopes Reported in Tennessee Soil

	TVA[2]			TDEC[2]			EPA[2]			DOE (1993)			USGS (TDEC 2001)			
Analyte	Minimum Detected Result	Maximum Detected Result	Frequency of Detection	Minimum Detected Result	Maximum Detected Result	Frequency of Detection	Minimum Detected Result	Maximum Detected Result	Frequency of Detection	Minimum Detected Result	Maximum Detected Result	Frequency of Detection	Minimum	Maximum	Number of Samples	Maximum Concentration Detected in Ash
Aluminum	6,440	34,600	25/25	1,600	15,000	15/15	2,170	14,400	9/9	7,560	46,700	108/108	NR	NR	NR	45200
Antimony	NR	NR	NR	NR	NR	NR	0.425	1.24	8/9	0.095	1.5	20/108	<1	2	8	ND
Arsenic	1.86	102	25/25	2	6.4	9/15	1.06	27.9	9/9	0.23	655	103/108	3.1	73	16	166
Barium	11.3	270	25/25	21	180	15/15	24.5	118	9/9	9.1	196	108/108	100	700	19	1410
Beryllium	1.79	2.36	2/25	0.1	1.1	13/15	0.0646	0.685	8/9	0.24	1.65	99/108	1.2	2	5	9.6
Boron	14.2	14.2	1/25	NR	NR	NR	NR	NR	NR	2.4	53	23/90	20	100	19	212
Cadmium	NR	NR	NR	0.1	0.7	4/15	0.0404	0.355	6/9	0.0095	0.155	1/108	NR	NR	NR	ND
Calcium	238	43,900	25/25	210	3,700	15/15	348	2,140	9/9	80	2,110	90/108	NR	NR	NR	30900
Chromium	5.44	48.6	25/25	8	33	15/15	4.19	54.4	9/9	0.23	80.1	106/108	30	200	19	66
Cobalt	2.87	99.6	18/25	0.9	29	15/15	3.23	33.7	9/9	0.55	51.3	92/108	5	50	18	29.7
Copper	6.21	147	25/25	1.1	120	13/15	4.26	23.2	9/9	1.35	54.2	101/108	10	50	19	102
Iron	11,000	69,100	25/25	8,800	41,000	15/15	4,880	36,700	9/9	9,365	53,900	108/108	NR	NR	NR	39700
Lead	11.9	282	25/25	4.4	33	15/15	6.57	71.8	9/9	0.115	165	105/107	15	70	18	46
Lithium	NR	NR	NR	2.8	20	15/15	NR	NR	NR	1.25	33	85/95	15	93	16	NR
Magnesium	323	27,000	25/25	300	19,000	15/15	240	2,530	9/9	276	5,410	108/108	NR	NR	NR	6230
Manganese	97.6	8,940	25/25	52	2,900	15/15	61.1	1,410	9/9	41.7	3,470	108/108	50	7,000	19	698
Mercury	0.175	0.225	4/25	NR	NR	NR	0.028	0.127	3/9	0.017	0.34	69/108	0.05	0.12	16	0.209
Molybdenum	4.06	5.29	4/25	0.6	1.1	4/15	NR	NR	NR	0.7	6.4	23/96	NR	15	1	ND
Nickel	5.42	145	25/25	1	19	13/15	6.66	23.5	8/9	2.45	50.8	91/108	5	70	19	64.4
Potassium	342	3,850	25/25	NR	NR	NR	213	2,260	9/9	133.5	5,890	98/104	NR	NR	NR	7040
Selenium	2.45	4.3	6/25	2	5.3	4/15	1.04	3.37	9/9	0.105	3.6	70/100	<1	1.1	16	17.8
Silicon	NR	NR	NR	NR	NR	NR	NR	NR	NR	185	721	81/81	NR	NR	NR	
Silica	NR	NR	NR	NR	NR	NR	192	320	9/9	NR	NR	NR	NR	NR	NR	
Silver	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.029	1.4	0/108	NR	NR	NR	ND
Sodium	266	296	2/25	NR	NR	NR	NR	NR	NR	9	463	51/63	NR	NR	NR	1790
Strontium	NR	NR	NR	2.3	18	15/15	NR	NR	NR	0.105	11.7	82/95	NR	NR	NR	
Thallium	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.1	1.4725	16/100	NR	NR	NR	3.8
Vanadium	22.4	85.8	25/25	15	28	15/15	5.01	81.5	9/9	4.8	101	108/108	30	100	19	163
Zinc	25.5	544	25/25	9.7	54	15/15	17.7	68.5	9/9	14	438	107/108	16	25	80	94.7
Potassium-40	NR	NR	NR	4.06	42.3	14/15	NR	NR	NR	1.11689	35.67	222/230	NR	NR	NR	32.4
Radium-226	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.329	6.55	123/127	NR	NR	NR	8.79
Thorium-228	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.17	3.40	125/127	NR	NR	NR	1.46
Thorium-230	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.19	2.55	127/127	NR	NR	NR	3.99
Thorium-232	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.18	3.20	241/241	NR	NR	NR	1.82
Thorium-234	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.78	3.68	73/124	NR	NR	NR	11.3
Total Uranium	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.069	6.50	54/55	NR	NR	NR	NR
Uranium-233/234	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.39	3.21	129/141	NR	NR	NR	2.51
Uranium-235	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.0175	7.72	251/350	NR	NR	NR	0.182
Uranium-238	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.44	5.74	242/316	NR	NR	NR	2.33
Uranium-235/236	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.0384	0.141	23/24	NR	NR	NR	NR
Bi-214	NR	NR	NR	0.698	1.434	15/15	NR	NR	NR	NR	NR	NR	NR	NR	NR	6.62
Ac-228	NR	NR	NR	0.704	2.45	15/15	NR	NR	NR	NR	NR	NR	NR	NR	NR	5.276
Bi-212	NR	NR	NR	0.68	1.36	7/15	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

ND = Not Detected
NR = Not Reported

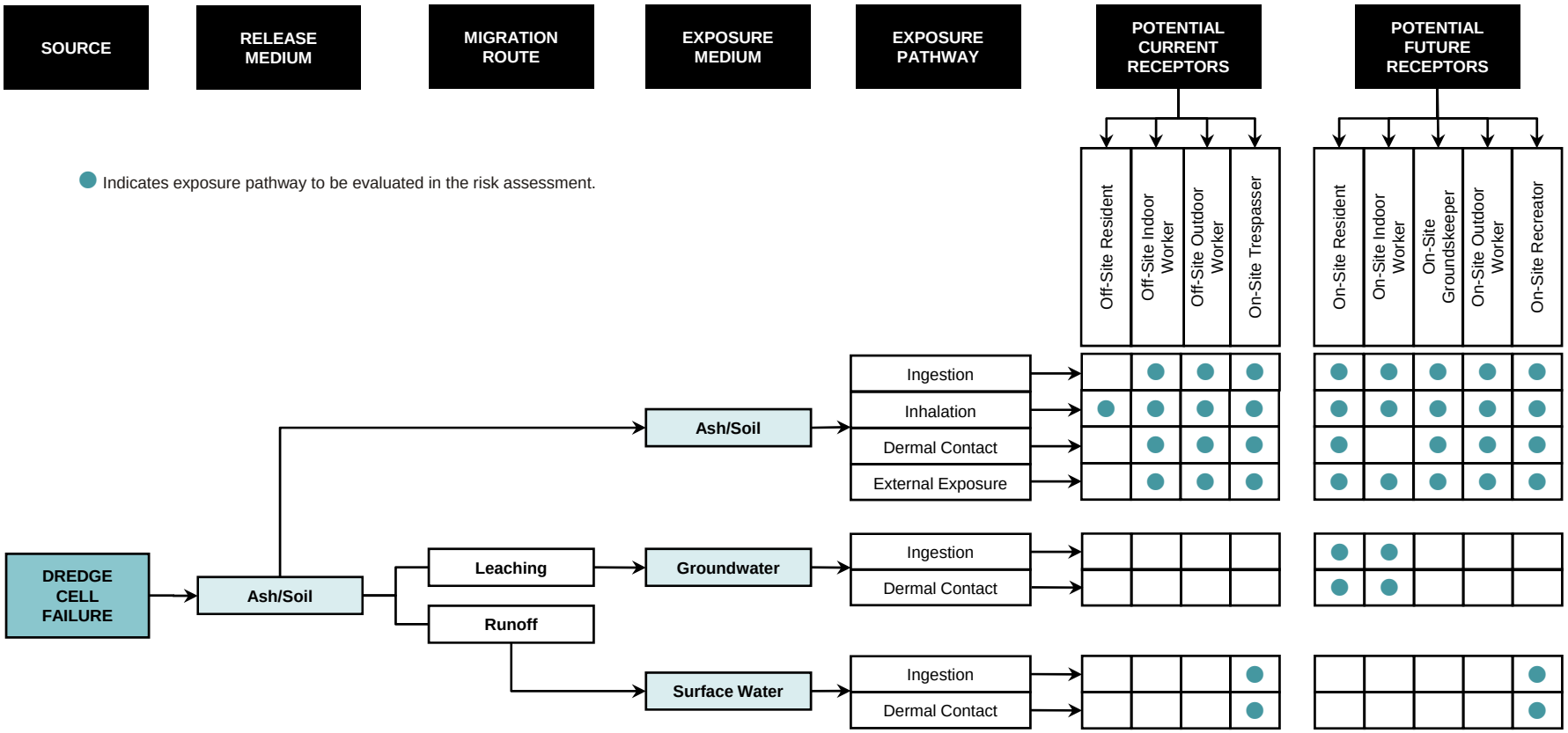
1 Units are mg/kg and pCi/g.

1 Concentrations from TVA, TDEC, and EPA are from samples collected in December 2008 - January 2009 from properties adjacent to the KIF in areas not impacted by the ash release and locations away from KIF.

DOE 1993. Final Report on the Background Soil Characterization Project at the Oak Ridge Reservation, Oak Ridge, Tennessee, Prepared by Environmental Sciences Division, Oak Ridge National Laboratory for U.S. Department of Energy (DOE/OR/01-1175/V1) October 1993.

TDEC 2001. Hazardous Trace Elements in Tennessee Soils and Other Regolith. Tennessee Department of Environment and Conservation, Division of Geology, Report of Investigations No. 49

Figure A-1. Conceptual Site Model
TVA Kingston Fly Ash Recovery Project



ATTACHMENT A-2

Risk Assessment Tables RAGS Part D Format

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

Kingston Fly Ash Recovery Project

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Ash/Soil	Air	Adjacent Residential Properties	Off-Site Residents	Child and Adult	Inhalation	Quantitative	The residential exposure scenario is appropriate due to current use of surrounding properties.
Current	Ash/Soil	Ash/Soil	Properties Adjacent to KIF or at the KIF Facility	Off-Site Indoor Workers	Adult	Ingestion, Inhalation, External Exposure to Radionuclides	Quantitative	The indoor worker exposure scenario is appropriate due to current use of the KIF Facility.
Current	Ash/Soil	Ash/Soil	Properties Adjacent to KIF or at the KIF Facility	Off-Site Outdoor Workers	Adult	Ingestion, Dermal Contact, Inhalation, External Exposure to Radionuclides	Quantitative	The outdoor worker exposure scenario is appropriate due to current use of the KIF Facility.
Current	Ash/Soil	Ash/Soil	On the Dredge Cell or Ash Flow Area	On-Site Trespasser	Adolescent	Ingestion, Dermal Contact, Inhalation, External Exposure to Radionuclides	Quantitative	An adolescent receptor may currently trespass onto the ash spill area and subsequently be exposed to ash related constituents, ash in the sloughs and embayment areas are adjacent to current or former residential properties
Current	Surface Water	Surface Water	Swan Pond Embayment	On-Site Trespasser	Adolescent	Ingestion and Dermal Contact	Quantitative	An adolescent receptor may currently trespass onto the site and subsequently be exposed to ash related constituents in the surface water of Swan Pond Embayment ash in the sloughs and embayment areas are adjacent to current or former residential properties
Future	Ash/Soil	Ash/Soil	On the Dredge Cell or Ash Flow Area	On-Site Residents	Child and Adult	Ingestion, Dermal Contact, Inhalation, External Exposure to Radionuclides	Quantitative	The residential exposure scenario is appropriate due to current use of surrounding properties.
Future	Ash/Soil	Ash/Soil	On the Dredge Cell or Ash Flow Area	On-Site Indoor Workers	Adult	Ingestion, Inhalation, External Exposure to Radionuclides	Quantitative	The indoor worker exposure scenario is appropriate due to current use of the KIF Facility.
Future	Ash/Soil	Ash/Soil	On the Dredge Cell or Ash Flow Area	On-Site Outdoor Workers	Adult	Ingestion, Dermal Contact, Inhalation, External Exposure to Radionuclides	Quantitative	The outdoor worker exposure scenario is appropriate due to current use of the KIF Facility.
Future	Ash/Soil	Ash/Soil	On the Dredge Cell or Ash Flow Area	On-Site Groundskeeper	Adult	Ingestion, Dermal Contact, Inhalation, External Exposure to Radionuclides	Quantitative	The groundskeeper exposure scenario is assumes that personnel are employed in the future to plant and maintain vegetative material on the ash spill area.
Future	Ash/Soil	Ash/Soil	On the Dredge Cell or Ash Flow Area	On-Site Recreator	Adolescent and Adult	Ingestion, Dermal Contact, Inhalation, External Exposure to Radionuclides	Quantitative	Adult and Adolescent receptors may participate in athletic activities on-site based on past use of the area.
Future	Groundwater	Groundwater	On-site	On-Site Residents	Child and Adult	Ingestion, Dermal Contact	Quantitative	Adult and Child residents may be exposed to groundwater beneath the site used as an untreated household water supply.
Future	Groundwater	Groundwater	On-site	On-Site Indoor Workers	Adult	Ingestion, Dermal Contact	Quantitative	Indoor workers may be exposed to groundwater beneath the site used as an untreated potable water supply.

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value[1] (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
Curent - Adjacent Residential Properties Future - On the Dredge Cell or Ash Flow Area		Aluminum	8710	45200	mg/Kg	GP 02-04	52/52	23.6/31.2	45200	NA	7700			Y	a
		Antimony	ND	ND	mg/Kg		0/52	11.8/15.6	ND	NA	3.1			N	b
		Arsenic	2.78	166	mg/Kg	GP 44-46	52/52	1.18/1.56	166	NA	0.39			Y	a
		Barium	69.7	1410	mg/Kg	S-2	52/52	2.36/3.12	1410	NA	1500			Y	a
		Beryllium	1.66	9.6	mg/Kg	S-4	47/52	1.18/1.56	9.6	NA	16			Y	a
		Boron	14.8	212	mg/Kg	GP 00-02	48/52	11.8/15.6	212	NA	1600			Y	a
		Cadmium	ND	ND	mg/Kg		0/52	1.18/1.56	ND	NA	7			N	b
		Calcium	1460	30900	mg/Kg	S-2	52/52	236/312	30900	NA				N	c
		Chromium	9.64	66	mg/Kg	GP 02-04	52/52	1.18/1.56	66	NA	280			Y	a
		Cobalt	13.1	29.7	mg/Kg	S-4	42/52	11.8/15.6	29.7	NA	2.3			Y	a
		Copper	8.49	102	mg/Kg	GP 46-48	52/52	2.36/3.12	102	NA	310			Y	a
		Iron	9840	39700	mg/Kg	GP 26-28	52/52	11.8/15.6	39700	NA	5500			Y	a
		Lead	10.7	46	mg/Kg	GP 46-48	52/52	1.18/1.56	46	NA	40			Y	a
		Magnesium	662	6230	mg/Kg	AFA01	52/52	236/312	6230	NA				N	c
		Manganese	45.6	698	mg/Kg	AFA19	52/52	3.53/4.68	698	NA	180			Y	a
		Mercury	0.136	0.209	mg/Kg	DREDGECELL_EECA02	3/11	0.117/0.155	0.209	NA	4.3			Y	a
		Molybdenum	ND	ND	mg/Kg		0/52	11.8/15.6	NA	NA	39			N	b
		Nickel	7.37	64.4	mg/Kg	AFA05	52/52	1.18/1.56	64.4	NA	150			Y	a
		Potassium	642	7040	mg/Kg	GP 46-48	52/52	193/312	7040	NA				N	c
		Selenium	2.64	17.8	mg/Kg	GP 48-50	45/52	2.36/3.12	17.8	NA	39			Y	a
		Silver	ND	ND	mg/Kg		0/52	1.18/1.56	ND	NA	39			N	b
		Sodium	283	1790	mg/Kg	GP 02-04	46/52	236/312	1790	NA				N	c
		Thallium	2.65	3.8	mg/Kg	GP 30-32	4/52	2.36/3.12	3.8	NA	0.51			Y	a
		Vanadium	15.6	163	mg/Kg	GP 02-04	52/52	11.8/15.6	163	NA	39			Y	a
		Zinc	23.5	94.7	mg/Kg	189 LAKESHORE DR	52/52	11.8/15.6	94.7	NA	2300			Y	a
		Actinium-228	3.63	5.28	PCI/G	DREDGECELL_EECA11	11/11	0.519/1.23	5.28	NA	732			N	e
		Bismuth-214	4.51	6.62	PCI/G	DREDGECELL_EECA09	11/11	0.284/0.668	6.62	NA	8190			N	e
		Lead-212	3.7	4.98	PCI/G	DREDGECELL_EECA08	11/11	0.196/0.438	4.98	NA	3640			N	e
		Lead-214	4.85	7.1	PCI/G	DREDGECELL_EECA09	11/11	0.266/0.591	7.1	NA	46300			N	e
		Potassium-40	20.8	32.4	PCI/G	DREDGECELL_EECA11	11/11	1.32/3.39	32.4	NA	0.108			Y	a
		Radium-226	4.6	8.79	PCI/G	DREDGECELL_EECA04	11/11	0.192/0.304	8.79	NA	0.0124			Y	a
		Radium-228	3.63	5.28	PCI/G	DREDGECELL_EECA11	11/11	0.519/1.23	5.28	NA	0.0677			Y	a
		Thallium-208	3.11	4.43	PCI/G	DREDGECELL_EECA03	10/11	0.422/1.12	4.43	NA	22600			N	e
		Thorium-228	0.41	1.46	PCI/G	DREDGECELL_EECA11	11/11	0.136/0.437	1.46	NA	0.154			Y	a
		Thorium-230	0.941	3.99	PCI/G	DREDGECELL_EECA11	11/11	0.0687/0.323	3.99	NA	3.49			N	e
		Thorium-232	0.321	1.82	PCI/G	DREDGECELL_EECA05	11/11	0.0861/0.338	1.82	NA	3.1			Y	a
		Thorium-234	5.97	11.3	PCI/G	DREDGECELL_EECA03	10/11	2.75/5.2	11.3	NA	4.01			N	e

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value[1] (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
		Uranium-234	0.816	2.51	PCI/G	DREDGECELL_EECA04	11/11	0.0359/0.0953	2.51	NA	0.195			Y	a
		Uranium-235	0.0401	0.182	PCI/G	DREDGECELL_EECA04	11/11	0.036/0.128	0.182	NA	4.46			Y	a
		Uranium-238	0.865	2.33	PCI/G	DREDGECELL_EECA10	11/11	0.0347/0.0868	2.33	NA	0.742			Y	a
		2-Methylnaphthalene	95	95	ug/Kg	DREDGECELL_EECA07	1/12	78.1/103	95	NA	310,000			N	d
		Acenaphthene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Acenaphthylene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Anthracene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Benzo(a)anthracene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Benzo(a)pyrene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Benzo(b)fluoranthene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Benzo(g,h,i)perylene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Benzo(k)fluoranthene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Chrysene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Dibenz(a,h)anthracene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Fluoranthene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Fluorene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Indeno(1,2,3-cd)pyrene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Naphthalene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Phenanthrene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b
		Pyrene	ND	ND	ug/Kg		0/11	78.1/103	ND	NA				N	b

1 Screening Toxicity Values were obtained from EPA's Risk-Based Concentration Tables.

(a) All detected inorganic constituents and radionuclides are retained as COPCs

(b) Only detected inorganic constituents and radionuclides are retained as COPCs

(c) Essential nutrients were eliminated as COPCs (See Section A.1.1.4)

(d) Elimination of 2-Methlnaphthalene as a COPC is discussed in the text.

(e) Short lived radionuclide daughter products were not retained as COPCs, but were evaluated using toxicity values for the parent radionuclide that account for the presence of these short lived radionuclides.

NA = Not available (Background concentrations for soil/ash in were not used in the selection or deletion of COPCs)

ND = Not Detected

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
Swan Pond Embayment		Alkalinity	103000	114000	ug/L	CWDITCH	2/2	10000/10000	114000	NA				N	a
		Hardness (As CaCO3)	135	143	mg/L	CWDITCH	2/2	6.62/6.62	143	NA				N	a
		Total Dissolved Solids	176	196	mg/L	SETTB	2/2	10/10	196	NA				N	a
		Total Suspended Solids	4.1	64.8	mg/L	CWDITCH	48/48	1/10	64.8	NA				N	a
		pH	7.8	7.9	PH	SETTB	4/4	0.1/0.1	7.9	NA				N	a
		Aluminum	0.106	0.565	mg/L	SETTB	38/48	0.1/0.1	0.565	NA	3.7 (N)			N	b
		Aluminum, Total	0.256	2.09	mg/L	SETTB	48/48	0.1/0.1	2.09	NA	3.7 (N)			Y	c
		Antimony	0.00204	0.00876	mg/L	SETTB	31/48	0.002/0.002	0.00876	NA	0.0015 (N)	0.006	TDWS	N	b
		Antimony, Total	0.00202	0.009	mg/L	SETTB	32/48	0.002/0.002	0.009	NA	0.0015 (N)	0.006	TDWS	Y	c
		Arsenic	0.0107	0.0755	mg/L	SETTB	48/48	0.002/0.002	0.0755	NA	.000045 (C)	0.01	TWQC	N	b
		Arsenic, Total	0.0123	0.0792	mg/L	SETTB	48/48	0.002/0.002	0.0792	NA	.000045 (C)	0.01	TWQC	Y	c
		Barium	0.0764	0.199	mg/L	SETTB	48/48	0.01/0.01	0.199	NA	0.73 (N)			N	b
		Barium, Total	0.0793	0.22	mg/L	SETTB	48/48	0.01/0.01	0.22	NA	0.73 (N)			Y	c
		Beryllium	ND	ND	mg/L		0/48	0.002/0.002	ND	NA	.0073 (N)	0.004	TDWS	N	b
		Beryllium, Total	ND	ND	mg/L		0/48	0.002/0.002	ND	NA	.0073 (N)	0.004	TDWS	N	c
		Boron	0.142	1.96	mg/L	SETTB	48/48	0.05/0.05	1.96	NA	0.73 (N)			N	b
		Boron, Total	0.154	1.93	mg/L	SETTB	48/48	0.05/0.05	1.93	NA	0.73 (N)			Y	c
		Cadmium	ND	ND	mg/L		0/48	0.001/0.001	ND	NA	0.0018 (N)	0.005	TDWS	N	b
		Cadmium, Total	ND	ND	mg/L		0/48	0.001/0.001	ND	NA	0.0018 (N)	0.005	TDWS	N	c
		Calcium	30.8	84.3	mg/L	SETTB	48/48	1/1	84.3	NA				N	b,d
		Calcium, Total	31.9	80.7	mg/L	SETTB	48/48	1/1	80.7	NA				N	d
		Chromium	ND	ND	mg/L		0/48	0.002/0.002	ND	NA		0.1	TDWS	N	b
		Chromium, Total	0.00204	0.0032	mg/L	SETTB	5/48	0.002/0.002	0.0032	NA		0.1	TDWS	Y	c
		Cobalt	ND	ND	mg/L		0/48	0.002/0.002	ND	NA	0.011 (N)			N	b
		Cobalt, Total	ND	ND	mg/L		0/48	0.002/0.002	ND	NA	0.011 (N)			N	c
		Copper	ND	ND	mg/L		0/48	0.005/0.005	ND	NA	0.15 (N)	1.3	TDWS	N	b
		Copper, Total	ND	ND	mg/L		0/48	0.005/0.005	ND	NA	0.15 (N)	1.3	TDWS	N	c
		Iron	0.0749	0.177	mg/L	CWDITCH	4/48	0.05/0.05	0.177	NA	2.6 (N)			N	b
		Iron, Total	0.0775	3.1	mg/L	CWDITCH	48/48	0.05/0.05	3.1	NA	2.6 (N)			Y	c
		Lead	ND	ND	mg/L		0/48	0.002/0.002	ND	NA		0.005	TDWS	N	b
		Lead, Total	0.00207	0.00238	mg/L	CWDITCH	4/48	0.002/0.002	0.00238	NA		0.005	TDWS	Y	c
		Magnesium	8.85	15	mg/L	CWDITCH	48/48	1/1	15	NA				N	b,d
		Magnesium, Total	9.44	15.1	mg/L	CWDITCH	48/48	1/1	15.1	NA				N	d
		Manganese	0.00602	1.16	mg/L	CWDITCH	29/48	0.005/0.025	1.16	NA	.088 (N)			N	b
		Manganese, Total	0.017	1.18	mg/L	CWDITCH	48/48	0.005/0.05	1.18	NA	.088 (N)			Y	c
		Mercury	ND	ND	mg/L		0/48	0.0002/0.0002	ND	NA	0.00005 (N)	0.00005	TWQC	N	b
		Mercury, Total	ND	ND	mg/L		0/48	0.0002/0.0002	ND	NA	0.00005 (N)	0.00005	TWQC	N	c

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
		Molybdenum	0.00917	0.164	mg/L	SETTB	48/48	0.005/0.005	0.164	NA	.018 (N)			N	b
		Molybdenum, Total	0.00948	0.161	mg/L	SETTB	48/48	0.005/0.005	0.161	NA	.018 (N)			Y	c
		Nickel	ND	ND	mg/L		0/48	0.005/0.005	ND	NA	0.073 (N)			N	b
		Nickel, Total	ND	ND	mg/L		0/48	0.005/0.005	ND	NA	0.073 (N)			N	c
		Potassium	1.74	6.5	mg/L	SETTB	48/48	1/1	6.5	NA				N	b,d
		Potassium, Total	1.74	6.65	mg/L	SETTB	48/48	1/1	6.65	NA				N	d
		Selenium	0.00221	0.0352	mg/L	SETTB	47/48	0.002/0.002	0.0352	NA	0.018 (N)	0.05	TDWS	N	b
		Selenium, Total	0.00254	0.0359	mg/L	SETTB	46/48	0.002/0.002	0.0359	NA	0.018 (N)	0.05	TDWS	Y	c
		Silver	ND	ND	mg/L		0/48	0.002/0.002	ND	NA				N	b
		Silver, Total	ND	ND	mg/L		0/48	0.002/0.002	ND	NA				N	c
		Sodium	1	3	mg/L	SETTB	48/48	1/1	3	NA				N	b,d
		Sodium, Total	1	4	mg/L	SETTB	48/48	1/1	4	NA				N	d
		Thallium	ND	ND	mg/L		0/48	0.002/0.002	ND	NA	0.00024 (N)	0.002	TDWS	N	b
		Thallium, Total	ND	ND	mg/L		0/48	0.002/0.002	ND	NA	0.00024 (N)	0.002	TDWS	N	c
		Vanadium	0.00545	0.0732	mg/L	SETTB	48/48	0.004/0.004	0.0732	NA	0.018 (N)			N	b
		Vanadium, Total	0.00668	0.0722	mg/L	SETTB	48/48	0.004/0.004	0.0722	NA	0.018 (N)			Y	c
		Zinc	ND	ND	mg/L		0/48	0.05/0.05	ND	NA	11 (N)			N	b
		Zinc, Total	ND	ND	mg/L		0/48	0.05/0.05	ND	NA	11 (N)			N	c

Footnotes:

1 Screening Toxicity Values were obtained from EPA's Risk-Based Concentration Tables.

(a) General Chemistry parameters are not retained as COPCs.

(b) Only constituents based on "total" constituent analysis with detected concentrations are retained as COPCs

(c) All constituents based on "total" constituent analysis with detected concentrations are retained as COPCs

(d) Essential nutrients were eliminated as COPCs (See Section A.1.1.4)

NA = Not available (Background concentrations for surface water in Swan Pond Embayment were not measured nor were background concentrations used in the selection or deletion of COPCs)

ND = Not Detected

TDWS = Tennessee Drinking Water Standards [Rules of Tennessee Department of Environment and Conservation Tennessee Water Quality Control Board Division of Water Pollution Control Chapter 1200-4-3-.03(1)(j)]

TWQC = Tennessee Water Quality Criteria [Rules of Tennessee Department of Environment and Conservation Tennessee Water Quality Control Board Division of Water Pollution Control Chapter 1200-4-3-.03(4)(j)]

TABLE 2.3

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwaterater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value[1] (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
On-Site		Aluminum	ND	ND	mg/L	KIF-13B	0/2	0.1/0.1	ND		3.7 (N)			N	a
		Antimony	ND	ND	mg/L	KIF-13B	0/2	0.002/0.002	ND		0.0015 (N)	0.006	TDWS	N	a
		Arsenic	0.00326	0.00326	mg/L	KIF-13B	1/2	0.002/0.002	0.00326		.000045 (C)	0.01	TDWS	Y	b
		Barium	0.485	0.485	mg/L	KIF-13B	2/2	0.01/0.01	0.485		0.73 (N)	2	TDWS	Y	b
		Beryllium	ND	ND	mg/L	KIF-13B	0/2	0.002/0.002	ND		.0073 (N)	0.004	TDWS	N	a
		Boron	0.114	0.144	mg/L	KIF-13B	2/2	0.05/0.05	0.144		0.73 (N)			Y	b
		Cadmium	ND	ND	mg/L	KIF-13B	0/2	0.001/0.001	ND		0.0018 (N)	0.005	TDWS	N	a
		Calcium	20	21.5	mg/L	KIF-13B	2/2	1/1	21.5					N	c
		Chromium	ND	ND	mg/L	KIF-13B	0/2	0.002/0.002	ND			0.1	TDWS	N	a
		Cobalt	ND	ND	mg/L	KIF-13B	0/2	0.002/0.002	ND		0.011 (N)			N	a
		Copper	ND	ND	mg/L	KIF-13B	0/2	0.005/0.005	ND		0.15 (N)	1.3	TDWS	N	a
		Iron	0.102	0.107	mg/L	KIF-13B	2/2	0.05/0.05	0.107		2.6 (N)			Y	b
		Lead	ND	ND	mg/L	KIF-13B	0/2	0.002/0.002	ND			0.005	TDWS	N	a
		Magnesium	2.68	2.85	mg/L	KIF-13B	2/2	1/1	2.85					N	c
		Manganese	0.0872	0.0872	mg/L	KIF-13B	1/2	0.005/0.005	0.0872		.088 (N)			Y	b
		Mercury	ND	ND	mg/L	KIF-13B	0/1	0.0002/0.0002	ND		0.00005 (N)	0.002	TDWS	N	a
		Molybdenum	ND	ND	mg/L	KIF-13B	0/2	0.005/0.005	ND		.018 (N)			N	a
		Nickel	ND	ND	mg/L	KIF-13B	0/2	0.005/0.005	ND		0.073 (N)			N	a
		Potassium	3.48	3.73	mg/L	KIF-13B	2/2	1/1	3.73					N	c
		Selenium	ND	ND	mg/L	KIF-13B	0/2	0.002/0.002	ND		0.018 (N)	0.05	TDWS	N	a
		Silver	ND	ND	mg/L	KIF-13B	0/2	0.002/0.002	ND					N	a
		Sodium	87.7	93.9	mg/L	KIF-13B	2/2	1/1	93.9					N	c
		Strontium	0.451	0.451	mg/L	KIF-13B	1/1	0.05/0.05	0.451					Y	b
		Thallium	ND	ND	mg/L	KIF-13B	0/2	0.002/0.002	ND		0.00024 (N)	0.002	TDWS	N	a
		Vanadium	ND	ND	mg/L	KIF-13B	0/2	0.004/0.004	ND		0.018 (N)			N	a
		Zinc	ND	ND	mg/L	KIF-13B	0/2	0.05/0.05	ND		11 (N)			N	a

Footnotes:

1 Screening Toxicity Values were obtained from EPA's Risk-Based Concentration Tables.

(a) Only constituents with detected concentrations are retained as COPCs

(b) All constituents with detected concentrations are retained as COPCs

(c) Essential nutrients were eliminated as COPCs (See Section A.1.1.4)

TDWS = Tennessee Drinking Water Standards [Rules of Tennessee Department of Environment and Conservation Tennessee Water Quality Control Board Division of Water Pollution Control Chapter 1200-4-3-.03(1)(j)]

NA = Not available (Background concentrations for groundwater were not measured nor were background concentrations used in the selection or deletion of COPCs)

ND = Not Detected

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Curent - Adjacent Residential Properties Future - On the Dredge Cell or Ash Flow Area	Aluminum	mg/Kg	25193	Normal	45200	27361	mg/Kg	Use 95% Student's-t UCL	ProUCL output
	Arsenic	mg/Kg	64.98	Normal	166	72.64	mg/Kg	Use 95% Student's-t UCL	ProUCL output
	Barium	mg/Kg	709.8	Nonparametric	1410	945.3	mg/Kg	Use 95% Chebyshev (Mean, Sd) UCL	ProUCL output
	Beryllium	mg/Kg	5.784	Nonparametric	9.6	5.913	mg/Kg	95% KM (Percentile Bootstrap) UCL	ProUCL output
	Boron	mg/Kg	99.37	Nonparametric	212	131.6	mg/Kg	95% KM (Chebyshev) UCL	ProUCL output
	Chromium	mg/Kg	42.21	Normal	66	45.18	mg/Kg	Use 95% Student's-t UCL	ProUCL output
	Cobalt	mg/Kg	20.79	Nonparametric	29.7	20.66	mg/Kg	95% KM (BCA) UCL	ProUCL output
	Copper	mg/Kg	63.84	Normal	102	69.15	mg/Kg	Use 95% Student's-t UCL	ProUCL output
	Iron	mg/Kg	19814	Lognormal	39700	21043	mg/Kg	or 95% Modified-t UCL	ProUCL output
	Manganese	mg/Kg	138.7	Nonparametric	698	226.2	mg/Kg	Use 95% Chebyshev (Mean, Sd) UCL	ProUCL output
	Nickel	mg/Kg	38.59	Normal	64.4	41.39	mg/Kg	Use 95% Student's-t UCL	ProUCL output
	Selenium	mg/Kg	6.68	Nonparametric	17.8	6.981	mg/Kg	95% KM (BCA) UCL	ProUCL output
	Thallium	mg/Kg	3.06	Maximum	3.8	3.8	mg/Kg	Maximum	Insufficeint number of detects to calculate UCL
	Vanadium	mg/Kg	103.9	Normal	163	112.9	mg/Kg	Use 95% Student's-t UCL	ProUCL output
	Zinc	mg/Kg	57.38	Normal	94.7	61.5	mg/Kg	Use 95% Student's-t UCL	ProUCL output
	Potassium-40	pCi/g	27.16	Normal	32.4	28.63	pCi/g	Use 95% Student's-t UCL	ProUCL output
	Radium-226	pCi/g	5.994	Normal	2.17	6.733	pCi/g	Use 95% Student's-t UCL	ProUCL output
	Radium-228	pCi/g	4.238	Normal	5.28	4.494	pCi/g	Use 95% Student's-t UCL	ProUCL output
	Thorium-228	pCi/g	0.779	Normal	1.46	0.958	pCi/g	Use 95% Student's-t UCL	ProUCL output
	Thorium-232	pCi/g	1.002	Normal	1.82	1.257	pCi/g	Use 95% Student's-t UCL	ProUCL output
	Uranium-234	pCi/g	1.782	Normal	2.51	2.061	pCi/g	Use 95% Student's-t UCL	ProUCL output
	Uranium-235	pCi/g	0.116	Normal	0.182	0.141	pCi/g	Use 95% Student's-t UCL	ProUCL output
	Uranium-238	pCi/g	1.759	Normal	2.33	2.021	pCi/g	Use 95% Student's-t UCL	ProUCL output

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Swan Pond Embayment	Aluminum	mg/L	0.682	Nonparametric	2.09	0.985	mg/L	Use 95% Chebyshev (Mean, Sd) UCL	ProUCL calculated value
	Antimony	mg/L	0.00407	Nonparametric	0.009	0.00384	mg/L	95% KM (Percentile Bootstrap) UCL	ProUCL calculated value
	Arsenic	mg/L	0.0341	Gamma	0.0792	0.0383	mg/L	Use 95% Approximate Gamma UCL	ProUCL calculated value
	Barium	mg/L	0.118	Gamma	0.22	0.125	mg/L	Use 95% Approximate Gamma UCL	ProUCL calculated value
	Boron	mg/L	0.649	Gamma	1.93	0.76	mg/L	Use 95% Approximate Gamma UCL	ProUCL calculated value
	Chromium	mg/L	0.00242	Maximum	0.0032	0.0032	mg/L	Maximum Detected Concentration	Insufficeint number of detects to calculate UCL
	Iron	mg/L	0.355	Nonparametric	3.1	0.648	mg/L	Use 95% Chebyshev (Mean, Sd) UCL	ProUCL calculated value
	Lead	mg/L	0.0011	Maximum	0.00238	NA	mg/L	Maximum Detected Concentration	Insufficeint number of detects to calculate UCL
	Manganese	mg/L	0.0887	Nonparametric	1.18	0.195	mg/L	Use 95% Chebyshev (Mean, Sd) UCL	ProUCL calculated value
	Molybdenum	mg/L	0.0567	Gamma	0.161	0.0673	mg/L	Use 95% Approximate Gamma UCL	ProUCL calculated value
	Selenium	mg/L	0.00949	Nonparametric	0.0359	0.0112	mg/L	95% KM (BCA) UCL	ProUCL calculated value
	Vanadium	mg/L	0.027	Gamma	0.0722	0.031	mg/L	Use 95% Approximate Gamma UCL	ProUCL calculated value

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
On-Site	Arsenic	mg/L	ND	Maximum	0.00326	0.00326	mg/L	Maximum detected value	Insufficeint number of samples to calculate UCL
	Barium	mg/L	ND	Maximum	0.485	0.485	mg/L	Maximum detected value	Insufficeint number of samples to calculate UCL
	Boron	mg/L	ND	Maximum	0.144	0.144	mg/L	Maximum detected value	Insufficeint number of samples to calculate UCL
	Iron	mg/L	ND	Maximum	0.107	0.107	mg/L	Maximum detected value	Insufficeint number of samples to calculate UCL
	Lead	mg/L	ND	Maximum	0.002	0.002	mg/L	Maximum detected value	Insufficeint number of samples to calculate UCL
	Manganese	mg/L	ND	Maximum	0.095	0.095	mg/L	Maximum detected value	Insufficeint number of samples to calculate UCL
	Mercury	mg/L	ND	Maximum	0.0002	0.0002	mg/L	Maximum detected value	Insufficeint number of samples to calculate UCL
	Strontium	mg/L	ND	Maximum	0.451	0.451	mg/L	Maximum detected value	Insufficeint number of samples to calculate UCL

ND = Not determined due to the limited number of monitoring wells and samples, the arithmetic mean was not calculated.

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Curent - Adjacent Residential Properties Future - On the Dredge Cell or Ash Flow Area	C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg or pCi/g	-	Chronic Daily Intake (CDI) (mg/kg/day) =C_{so} x IR_{so} x EF x ED x CF1 x 1/BW x 1/AT
				IR_{so}	Ingestion Rate of Soil/Ash	100	mg/day or pCi	EPA 1991	
				EF	Exposure Frequency	350	days/yr	EPA 1991	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	24	yrs	EPA 1989	
				CF_2	Conversion Factor	1.E-06	kg/mg	-	
				CF_3	Conversion Factor	1.E-03	g/mg	-	
				BW	Body Weight	70	kg	EPA 1989	
				$AT\text{-}NC_C$	Averaging Time (noncancer - current)	1825	days	EPA 1989	AT-NC = ED*365
				$AT\text{-}NC_F$	Averaging Time (noncancer - future)	8760	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
Dermal				C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg	-	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EF x ED x 1/BW x 1/AT
				DAevent	Dose absorbed per unit area per event	Chem.-specific	mg/cm^2-event	EPA 2001b	Where DA_{event} (mg/cm^2-event) is calculated in accordance
				SA	Skin surface area available for contact	5700	cm^2	EPA 2001b	with EPA Superfund Dermal Risk Guidance (EPA, 2001)
				EF	Exposure Frequency	350	days/yr	EPA 1991	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	24	yrs	EPA 1989	
				BW	Body Weight	70	kg	EPA 1989	
				$AT\text{-}NC_C$	Averaging Time (noncancer - current)	1825	days	EPA 1989	AT-NC = ED*365
				$AT\text{-}NC_F$	Averaging Time (noncancer - future)	8760	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
External Exposure				C_{so}	Radionuclide Concentration in Soil/Ash	Chem.-specific	pCi/g	EPA 2000	EE_{rad} = C_s X EF X ED x ACF X [ET_o x(ET_i X GSF)]
				EF	Exposure Frequency	350	days/yr	EPA 2000	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	24	yrs	EPA 1989	
				ACF	Area Correction Factor	0.9	unitless	EPA 2000	
				ET_o	Exposure Time - Outdoor	0.073	unitless	EPA 2000	
				ET_i	Exposure Time - Indoor	0.683	unitless	EPA 2000	
				GSF	Gamma Shielding Factor	0.4	unitless	EPA 2000	
Inhalation				EC	Exposure Concentration	Chem.-specific	$\mu g/m^3$	EPA 2003a	Exposure Concentration (EC) = CA x ET x EF x ED x 1/AT
				C_{so}	Radionuclide Concentration in Soil/Ash	Chem.-specific	pCi/g	EPA 2000	IR_{rad} = C_{so} X IR X 1/PEF X ET X EF X ED
				PEF	Particulate Emission Factor - On-Site	1.51E+09	m^3/kg	EPA 2002	PEF = (Q/C)X[3600/(0.036x(1-V)x(U_m/U_t)xF(x))]
				PEF	Particulate Emission Factor - Off-Site	2.41E+09	m^3/kg	EPA 2002	
				ET	Exposure Time	24	hr/day	-	

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
				EF	Exposure Frequency	350	days/yr	Site-specific	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	24	yrs	EPA 1989	
				CF_3	Conversion Factor	1.E+03	ug/mg	-	
				$AT\text{-}NC_C$	Averaging Time (noncancer - current)	1825	days	EPA 1989	AT-NC = ED*365
				$AT\text{-}NC_F$	Averaging Time (noncancer - future)	8,760	hours	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	hours	EPA 1989	AT-C = 70*365

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Child	Curent - Adjacent Residential Properties	C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg or pCi/g	-	Chronic Daily Intake (CDI) (mg/kg/day) =C_{so} x IR_{so} x EF x ED x CF1 x 1/BW x 1/AT
			Future - On the Dredge Cell or Ash Flow Area						
				IR_{so}	Ingestion Rate of Soil/Ash	200	mg/day or pCi	EPA 1991	
				EF	Exposure Frequency	350	days/yr	EPA 1991	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	6	yrs	EPA 1989	
				CF_2	Conversion Factor	1.E-06	kg/mg	-	
				CF_3	Conversion Factor	1.E-03	g/mg	-	
				BW	Body Weight	15	kg	EPA 1989	
				$AT\text{-}NC_C$	Averaging Time (noncancer - current)	1825	days	EPA 1989	AT-NC = ED*365
				$AT\text{-}NC_F$	Averaging Time (noncancer - future)	2190	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
Dermal				C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg	-	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EF x ED x 1/BW x 1/AT
				DAevent	Dose absorbed per unit area per event	Chem.-specific	mg/cm^2-event	EPA 2001b	Where DA_{event} (mg/cm^2-event) is calculated in accordance
				SA	Skin surface area available for contact	2800	cm^2	EPA 2001b	with EPA Superfund Dermal Risk Guidance (EPA, 2001)
				EF	Exposure Frequency	350	days/yr	EPA 1991	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	6	yrs	EPA 1989	
				BW	Body Weight	15	kg	EPA 1989	
				$AT\text{-}NC_C$	Averaging Time (noncancer - current)	1825	days	EPA 1989	AT-NC = ED*365
				$AT\text{-}NC_F$	Averaging Time (noncancer - future)	2190	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
External Exposure				C_{so}	Radionuclide Concentration in Soil/Ash	UCL_{95} or Maximum	pCi/g	EPA 2000	EE_{rad} = C_s X EF X ED x ACF X [ET_o x(ET_i X GSF)]
				EF	Exposure Frequency	350	days/yr	EPA 2000	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	6	yrs	EPA 2000	
				ACF	Area Correction Factor	0.9	unitless	EPA 2000	
				ET_o	Exposure Time - Outdoor	0.073	unitless	EPA 2000	
				ET_i	Exposure Time - Indoor	0.683	unitless	EPA 2000	
				GSF	Gamma Shielding Factor	0.4	unitless	EPA 2000	
Inhalation				EC	Exposure Concentration	Chem.-specific	$\mu g/m^3$	EPA 2003a	Exposure Concentration (EC) = CA x ET x EF x ED x 1/AT
				C_{so}	Radionuclide Concentration in Soil/Ash	Chem.-specific	pCi/g	EPA 2000	IRrad = Cso X IR X 1/PEF X ET X EF X ED
				PEF	Particulate Emission Factor - On-Site	1.51E+09	m^3/kg	EPA 2002	PEF = (Q/C)X[3600/(0.036x(1-V)x(U_m/U_t)xF(x))]
				PEF	Particulate Emission Factor - Off-Site	2.41E+09	m^3/kg	EPA 2002	
				ET	Exposure Time	24	hr/day	-	

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
				EF	Exposure Frequency	350	days/yr	Site-specific	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	6	yrs	EPA 1989	
				CF_3	Conversion Factor	1.E+03	ug/mg	-	
				$AT\text{-}NC_C$	Averaging Time (noncancer - current)	1825	days	EPA 1989	AT-NC = ED*365
				$AT\text{-}NC_F$	Averaging Time (noncancer - future)	2,190	hours	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	hours	EPA 1989	AT-C = 70*365

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Indoor Worker	Adult	Curent - Properties Adjacent to KIF or at the KIF Facility	C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg or pCi/g	-	Chronic Daily Intake (CDI) (mg/kg/day) $=C_{so}$ x IR_{so} x EF x ED x CF1 x 1/BW x 1/AT
			Future - On the Dredge Cell or Ash Flow Area						
				IR_{so}	Ingestion Rate of Soil/Ash	50	mg/day or pCi	EPA 1991	
				EF	Exposure Frequency	250	days/yr	EPA 1991	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	25	yrs	EPA 1989	
				CF_2	Conversion Factor	1.E-06	kg/mg	-	
				CF_3	Conversion Factor	1.E-03	g/mg	-	
				BW	Body Weight	70	kg	EPA 1989	
				$AT\text{-}NC_C$	Averaging Time (noncancer - current)	1825	days	EPA 1989	AT-NC = ED*365
				$AT\text{-}NC_F$	Averaging Time (noncancer - future)	9125	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
External Exposure				C_{so}	Radionuclide Concentration in Soil/Ash	UCL_{95} or Maximum	pCi/g	EPA 2000	$EE_{rad} = C_s$ X EF X ED x ACF X [ET_o x(ET_i X GSF)]
				EF	Exposure Frequency	250	days/yr	EPA 2000	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	25	yrs	EPA 2000	
				ACF	Area Correction Factor	0.9	unitless	EPA 2000	
				ET_o	Exposure Time - Outdoor	0	unitless	EPA 2000	
				ET_i	Exposure Time - Indoor	0.333	unitless	EPA 2000	
				GSF	Gamma Shielding Factor	0.4	unitless	EPA 2000	
Inhalation				EC	Exposure Concentration	Chem.-specific	$\mu g/m^3$	EPA 2003a	Exposure Concentration (EC) = CA x ET x EF x ED x 1/AT
				C_{so}	Radionuclide Concentration in Soil/Ash	Chem.-specific	pCi/g	EPA 2000	IRrad = Cso X IR X 1/PEF X ET X EF X ED
				PEF	Particulate Emission Factor	2.41E+09	m^3/kg	EPA 2002	PEF = (Q/C)X[3600/(0.036x(1-V)x(U_m/U_t)xF(x))]
				ET	Exposure Time	8	hr/day	-	
				EF	Exposure Frequency	250	days/yr	Site-specific	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	25	yrs	EPA 1989	
				CF_3	Conversion Factor	1.E+03	ug/mg	-	
				$AT\text{-}NC_C$	Averaging Time (noncancer - current)	1825	days	EPA 1989	AT-NC = ED*365
				$AT\text{-}NC_F$	Averaging Time (noncancer - future)	9,125	hours	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	hours	EPA 1989	AT-C = 70*365

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Outdoor Worker	Adult	Curent - Properties Adjacent to KIF or at the KIF Facility	C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg or pCi/g	-	Chronic Daily Intake (CDI) (mg/kg/day) =C_{so} x IR_{so} x EF x ED x CF1 x 1/BW x 1/AT
			Future - On the Dredge Cell or Ash Flow Area						
				IR_{so}	Ingestion Rate of Soil/Ash	100	mg/day or pCi	EPA 1991	
				EF	Exposure Frequency	250	days/yr	EPA 1991	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	25	yrs	EPA 1989	
				CF_2	Conversion Factor	1.E-06	kg/mg	-	
				CF_3	Conversion Factor	1.E-03	g/mg	-	
				BW	Body Weight	70	kg	EPA 1989	
				$AT\text{-}NC_C$	Averaging Time (noncancer - current)	1825	days	EPA 1989	AT-NC = ED*365
				$AT\text{-}NC_F$	Averaging Time (noncancer - future)	9125	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
Dermal				C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg	-	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EF x ED x 1/BW x 1/AT
				DAevent	Dose absorbed per unit area per event	Chem.-specific	mg/cm^2-event	EPA 2001b	Where DA_{event} (mg/cm^2-event) is calculated in accordance
				SA	Skin surface area available for contact	3300	cm^2	EPA 2001b	with EPA Superfund Dermal Risk Guidance (EPA, 2001)
				EF	Exposure Frequency	250	days/yr	EPA 1991	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	25	yrs	EPA 1989	
				BW	Body Weight	70	kg	EPA 1989	
				$AT\text{-}NC_C$	Averaging Time (noncancer - current)	1825	days	EPA 1989	AT-NC = ED*365
				$AT\text{-}NC_F$	Averaging Time (noncancer - future)	9125	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
External Exposure				C_{so}	Radionuclide Concentration in Soil/Ash	UCL_{95} or Maximum	pCi/g	EPA 2000	EE_{rad} = C_s X EF X ED x ACF X [ET_o x(ET_i X GSF)]
				EF	Exposure Frequency	250	days/yr	EPA 2000	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	25	yrs	EPA 2000	
				ACF	Area Correction Factor	0.9	unitless	EPA 2000	
				ET_o	Exposure Time - Outdoor	0.333	unitless	EPA 2000	
				ET_i	Exposure Time - Indoor	0	unitless	EPA 2000	
				GSF	Gamma Shielding Factor	0	unitless	EPA 2000	
Inhalation				EC	Exposure Concentration	Chem.-specific	$\mu g/m^3$	EPA 2003a	Exposure Concentration (EC) = CA x ET x EF x ED x 1/AT
				C_{so}	Radionuclide Concentration in Soil/Ash	Chem.-specific	pCi/g	EPA 2000	IRrad = Cso X IR X 1/PEF X ET X EF X ED
				PEF	Particulate Emission Factor	2.41E+09	m^3/kg	EPA 2002	PEF = (Q/C)X[3600/(0.036x(1-V)x(U_m/U_t)xF(x))]
				ET	Exposure Time	8	hr/day	-	
				EF	Exposure Frequency	250	days/yr	Site-specific	

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ED_F	Exposure Duration - Future	25	yrs	EPA 1989	
				CF_3	Conversion Factor	1.E+03	ug/mg	-	
				$AT\text{-}NC_C$	Averaging Time (noncancer - current)	1825	days	EPA 1989	AT-NC = ED*365
				$AT\text{-}NC_F$	Averaging Time (noncancer - future)	9,125	hours	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	hours	EPA 1989	AT-C = 70*365

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Groundskeeper	Adult	Future - On the Dredge Cell or Ash Flow Area	C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg or pCi/g	-	Chronic Daily Intake (CDI) (mg/kg/day) =C_{so} x IR_{so} x EF x ED x CF1 x 1/BW x 1/AT
				IR_{so}	Ingestion Rate of Soil/Ash	330	mg/day or pCi	EPA 1991	
				EF	Exposure Frequency	140	days/yr	EPA 1991	
				ED	Exposure Duration	25	yrs	EPA 1989	
				CF_2	Conversion Factor	1.E-06	kg/mg	-	
				CF_3	Conversion Factor	1.E-03	g/mg	-	
				BW	Body Weight	70	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	9125	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
Dermal				C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg	-	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EF x ED x 1/BW x 1/AT
				DAevent	Dose absorbed per unit area per event	Chem.-specific	mg/cm^2-event	EPA 2001b	Where DA_{event} (mg/cm^2-event) is calculated in accordance
				SA	Skin surface area available for contact	3300	cm^2	EPA 2001b	with EPA Superfund Dermal Risk Guidance (EPA, 2001)
				EF	Exposure Frequency	140	days/yr	EPA 1991	
				ED	Exposure Duration	25	yrs	EPA 1989	
				BW	Body Weight	70	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	9125	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
External Exposure				C_{so}	Radionuclide Concentration in Soil/Ash	UCL_{95} or Maximum	pCi/g	EPA 2000	EE_{rad} = C_s X EF X ED x ACF X [ET_o x(ET_i X GSF)]
				EF	Exposure Frequency	140	days/yr	EPA 2000	
				ED	Exposure Duration	25	yrs	EPA 2000	
				ACF	Area Correction Factor	0.9	unitless	EPA 2000	
				ET_o	Exposure Time - Outdoor	0.333	unitless	EPA 2000	
				ET_i	Exposure Time - Indoor	0	unitless	EPA 2000	
				GSF	Gamma Shielding Factor	0	unitless	EPA 2000	
Inhalation				EC	Exposure Concentration	Chem.-specific	$\mu g/m^3$	EPA 2003a	Exposure Concentration (EC) = CA x ET x EF x ED x 1/AT
				C_{so}	Radionuclide Concentration in Soil/Ash	Chem.-specific	pCi/g	EPA 2000	IRrad = Cso X IR X 1/PEF X ET X EF X ED
				PEF	Particulate Emission Factor	1.51E+09	m^3/kg	EPA 2002	PEF = (Q/C)X[3600/(0.036x(1-V)x(U_m/U_t)xF(x))]
				ET	Exposure Time	8	hr/day	-	
				EF	Exposure Frequency	140	days/yr	Site-specific	
				ED	Exposure Duration	25	yrs	EPA 1989	
				CF_3	Conversion Factor	1.E+03	ug/mg	-	
				AT-NC	Averaging Time (noncancer)	9,125	hours	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	hours	EPA 1989	AT-C = 70*365

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Trespasser	Adolescent	Curent - On the Dredge Cell or Ash Flow Area	C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg or pCi/g	-	Chronic Daily Intake (CDI) (mg/kg/day) =C_{so} x IR_{so} x EF x ED x CF1 x 1/BW x 1/AT
				IR_{so}	Ingestion Rate of Soil/Ash	120	mg/day or pCi	EPA 1991	
				EF	Exposure Frequency	84	days/yr	EPA 1991	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				CF_2	Conversion Factor	1.E-06	kg/mg	-	
				CF_3	Conversion Factor	1.E-03	g/mg	-	
				BW	Body Weight	45	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	1825	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
Dermal				C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg	-	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EF x ED x 1/BW x 1/AT
				DAevent	Dose absorbed per unit area per event	Chem.-specific	mg/cm^2-event	EPA 2001b	Where DA_{event} (mg/cm^2-event) is calculated in accordance
				SA	Skin surface area available for contact	3522	cm^2	EPA 2001b	with EPA Superfund Dermal Risk Guidance (EPA, 2001)
				EF	Exposure Frequency	84	days/yr	EPA 1991	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				BW	Body Weight	45	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	1825	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
External Exposure				C_{so}	Radionuclide Concentration in Soil/Ash	UCL_{95} or Maximum	pCi/g	EPA 2000	EE_{rad} = C_s X EF X ED x ACF X [ET_o x(ET_i X GSF)]
				EF	Exposure Frequency	84	days/yr	EPA 2000	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				ACF	Area Correction Factor	0.9	unitless	EPA 2000	
				ET_o	Exposure Time - Outdoor	0.333	unitless	EPA 2000	
				ET_i	Exposure Time - Indoor	0	unitless	EPA 2000	
				GSF	Gamma Shielding Factor	0	unitless	EPA 2000	
Inhalation				EC	Exposure Concentration	Chem.-specific	$\mu g/m^3$	EPA 2003a	Exposure Concentration (EC) = CA x ET x EF x ED x 1/AT
				C_{so}	Radionuclide Concentration in Soil/Ash	Chem.-specific	pCi/g	EPA 2000	IRrad = Cso X IR X 1/PEF X ET X EF X ED
				PEF	Particulate Emission Factor - On-Site	1.51E+09	m^3/kg	EPA 2002	PEF = (Q/C)X[3600/(0.036x(1-V)x(U_m/U_t)xF(x))]
				ET	Exposure Time	8	hr/day	-	
				EF	Exposure Frequency	84	days/yr	Site-specific	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				CF_3	Conversion Factor	1.E+03	ug/mg	-	
				AT-NC	Averaging Time (noncancer)	1,825	hours	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	hours	EPA 1989	AT-C = 70*365

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Recreational	Adult	Future- On the Dredge Cell or Ash Flow Area	C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg or pCi/g	-	Chronic Daily Intake (CDI) (mg/kg/day) =C_{so} x IR_{so} x EF x ED x CF1 x 1/BW x 1/AT
				IR_{so}	Ingestion Rate of Soil/Ash	100	mg/day or pCi	EPA 1991	
				ET	Exposure Time	1.5	hr/day	BPJ	
				EF	Exposure Frequency	84	days/yr	EPA 1991	
				ED	Exposure Duration	24	yrs	EPA 1989	
				CF_2	Conversion Factor	1.E-06	kg/mg	-	
				CF_3	Conversion Factor	1.E-03	g/mg	-	
				BW	Body Weight	70	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	8760	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
Dermal				C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg	-	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EF x ED x 1/BW x 1/AT
				DAevent	Dose absorbed per unit area per event	Chem.-specific	mg/cm^2-event	EPA 2001b	Where DA_{event} (mg/cm^2-event) is calculated in accordance
				SA	Skin surface area available for contact	5700	cm^2	EPA 2001b	with EPA Superfund Dermal Risk Guidance (EPA, 2001)
				EF	Exposure Frequency	84	days/yr	EPA 1991	
				ED	Exposure Duration	24	yrs	EPA 1989	
				BW	Body Weight	70	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	8760	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
External Exposure				C_{so}	Radionuclide Concentration in Soil/Ash	UCL_{95} or Maximum	pCi/g	EPA 2000	EE_{rad} = C_s X EF X ED x ACF X [ET_o x(ET_i X GSF)]
				EF	Exposure Frequency	84	days/yr	EPA 2000	
				ED	Exposure Duration	24	yrs	EPA 2000	
				ACF	Area Correction Factor	0.9	unitless	EPA 2000	
				ET_o	Exposure Time - Outdoor	0.0625	unitless	EPA 2000	
				ET_i	Exposure Time - Indoor	0	unitless	EPA 2000	
				GSF	Gamma Shielding Factor	0	unitless	EPA 2000	
Inhalation				EC	Exposure Concentration	Chem.-specific	$\mu g/m^3$	EPA 2003a	Exposure Concentration (EC) = CA x ET x EF x ED x 1/AT
				C_{so}	Radionuclide Concentration in Soil/Ash	Chem.-specific	pCi/g	EPA 2000	IR_{rad} = C_{so} X IR X 1/PEF X ET X EF X ED
				PEF	Particulate Emission Factor - On-Site	1.51E+09	m^3/kg	EPA 2002	PEF = (Q/C)X[3600/(0.036x(1-V)x(U_m/U_t)xF(x))]
				ET	Exposure Time	1.5	hr/day	-	
				EF	Exposure Frequency	84	days/yr	Site-specific	
				ED	Exposure Duration	24	yrs	EPA 1989	
				CF_3	Conversion Factor	1.E+03	ug/mg	-	
				AT-NC	Averaging Time (noncancer)	8,760	hours	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	hours	EPA 1989	AT-C = 70*365

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe	Current/Future
Medium:	Ash
Exposure Medium:	Ash

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Recreational	Adolescent	Future- On the Dredge Cell or Ash Flow Area	C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg or pCi/g	-	Chronic Daily Intake (CDI) (mg/kg/day) =C_{so} x IR_{so} x EF x ED x CF1 x 1/BW x 1/AT
				IR_{so}	Ingestion Rate of Soil/Ash	200	mg/day or pCi	EPA 1991	
				EF	Exposure Frequency	84	days/yr	EPA 1991	
				ED	Exposure Duration	10	yrs	EPA 1989	
				CF_2	Conversion Factor	1.E-06	kg/mg	-	
				CF_3	Conversion Factor	1.E-03	g/mg	-	
				BW	Body Weight	45	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	3650	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
Dermal				C_{so}	Chemical Concentration in Soil/Ash	UCL_{95} or Maximum	mg/kg	-	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EF x ED x 1/BW x 1/AT
				DAevent	Dose absorbed per unit area per event	Chem.-specific	mg/cm^2-event	EPA 2001b	Where DA_{event} (mg/cm^2-event) is calculated in accordance
				SA	Skin surface area available for contact	2800	cm^2	EPA 2001b	with EPA Superfund Dermal Risk Guidance (EPA, 2001)
				EF	Exposure Frequency	84	days/yr	EPA 1991	
				ED	Exposure Duration	10	yrs	EPA 1989	
				BW	Body Weight	45	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	3650	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
External Exposure				C_{so}	Radionuclide Concentration in Soil/Ash	UCL_{95} or Maximum	pCi/g	EPA 2000	EE_{rad} = C_s X EF X ED x ACF X [ET_o x(ET_i X GSF)]
				EF	Exposure Frequency	84	days/yr	EPA 2000	
				ED	Exposure Duration	10	yrs	EPA 2000	
				ACF	Area Correction Factor	0.9	unitless	EPA 2000	
				ET_o	Exposure Time - Outdoor	0.0625	unitless	EPA 2000	
				ET_i	Exposure Time - Indoor	0	unitless	EPA 2000	
				GSF	Gamma Shielding Factor	0	unitless	EPA 2000	
Inhalation				EC	Exposure Concentration	Chem.-specific	$\mu g/m^3$	EPA 2003a	Exposure Concentration (EC) = CA x ET x EF x ED x 1/AT
				C_{so}	Radionuclide Concentration in Soil/Ash	Chem.-specific	pCi/g	EPA 2000	IRrad = Cso X IR X 1/PEF X ET X EF X ED
				PEF	Particulate Emission Factor - On-Site	1.51E+09	m^3/kg	EPA 2002	PEF = (Q/C)X[3600/(0.036x(1-V)x(U_m/U_t)xF(x))]
				ET	Exposure Time	1.5	hr/day	-	
				EF	Exposure Frequency	84	days/yr	Site-specific	
				ED	Exposure Duration	10	yrs	EPA 1989	
				CF_3	Conversion Factor	1.E+03	ug/mg	-	
				AT-NC	Averaging Time (noncancer)	3,650	hours	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	hours	EPA 1989	AT-C = 70*365

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	On-Site	CW	Chemical Concentration in Water	UCL_{95} or Maximum	µg/L	-	Chronic Daily Intake (CDI) (mg/kg/day) = C_W x IR_W x EF x ED x CF_1 x 1/BW x 1/AT
				IRW	Ingestion Rate of Water	2	L/day	EPA 1995a	
				EF	Exposure Frequency	350	days/yr	Site-specific	
				ED	Exposure Duration	24	yrs	EPA 1989	
				CF1	Conversion Factor	0.001	mg/µg	-	
				BW	Body Weight	70	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	8760	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
Dermal				CW	Chemical Concentration in Water	UCL_{95} or Maximum	µg/L	-	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EV x EF x ED x 1/BW x 1/AT
				DAevent	Dose absorbed per unit area per event	Chem.-specific	mg/cm^2-event	EPA 2001b	Where DA_{event} (mg/cm^2-event) is calculated in accordance
				SA	Skin surface area available for contact	18000	cm^2	EPA 2001b	with EPA Superfund Dermal Risk Guidance (EPA, 2001)
				ET	Exposure Time	0.58	hr/day	EPA 2001b	
				EV	Event	1	event/day	EPA 2001b	
				EF	Exposure Frequency	350	days/yr	Site-specific	
				ED	Exposure Duration	24	yrs	EPA 1989	
				BW	Body Weight	70	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	8760	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Child	On-Site	CW	Chemical Concentration in Water	UCL_{95} or Maximum	µg/L	-	Chronic Daily Intake (CDI) (mg/kg/day) = C_W x IR_W x EF x ED x CF_1 x 1/BW x 1/AT
				IRW	Ingestion Rate of Water	1	L/day	EPA 1995a	
				EF	Exposure Frequency	350	days/yr	Site-specific	
				ED	Exposure Duration	6	yrs	EPA 1989	
				CF1	Conversion Factor	0.001	mg/µg	-	
				BW	Body Weight	15	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	2190	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
Dermal				CW	Chemical Concentration in Water	UCL_{95} or Maximum	µg/L	-	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EV x EF x ED x 1/BW x 1/AT
				DAevent	Dose absorbed per unit area per event	Chem.-specific	mg/cm^2-event	EPA 2001b	Where DA_{event} (mg/cm^2-event) is calculated in accordance
				SA	Skin surface area available for contact	6600	cm^2	EPA 2001b	with EPA Superfund Dermal Risk Guidance (EPA, 2001)
				ET	Exposure Time	1	hr/day	EPA 2001b	
				EV	Event	1	event/day	EPA 2001b	
				EF	Exposure Frequency	350	days/yr	Site-specific	
				ED	Exposure Duration	6	yrs	EPA 1989	
				BW	Body Weight	15	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	2190	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
Ingestion	Indoor Worker	Adult	On-Site	CW	Chemical Concentration in Water	UCL_{95} or Maximum	µg/L	-	Chronic Daily Intake (CDI) (mg/kg/day) = C_W x IR_W x EF x ED x CF_1 x 1/BW x 1/AT
				IRW	Ingestion Rate of Water	1	L/day	EPA 1995a	
				EF	Exposure Frequency	250	days/yr	Site-specific	
				ED	Exposure Duration	25	yrs	EPA 1989	
				CF1	Conversion Factor	0.001	mg/µg	-	
				BW	Body Weight	70	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	9125	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365

Notes:

cm^2 = square centimeter

g = grams

hr = hours

kg = kilograms

L = liters

mg = milligrams

m^3 = cubic meter

yrs = years

µg = micrograms

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Trespasser - Wader	Adolescent	Swan Pond Embayment	C_{sw}	Chemical Concentration in Surface Water	max or 95% UCL	µg/L	Site-specific	Chronic Daily Intake (CDI) (mg/kg/day) = C_{sw} x IR_{sw} x EF x ED x CF_1 x 1/BW x 1/AT
				IR_{sw}	Ingestion Rate of Surface Water	0.05	L/day	EPA 1998	
				ET	Exposure Time	1.4	hr/day		
				EF	Exposure Frequency	45	days/yr	EPA 1998	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				CF1	Conversion Factor	0.001	mg/µg	-	
				BW	Body Weight	51	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	1825	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365
Dermal				C_{sw}	Chemical Concentration in Surface Water	max or 95% UCL	µg/L	Site-specific	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EV x EF x ED x 1/BW x 1/AT
				DA_{event}	Dose absorbed per unit area per event	Chem.-specific	mg/cm^2-event	EPA 2001b	Where DA_{event} (mg/cm^2-event) is calculated in accordance
				SAw	Skin surface area available for contact	3,522	cm^2	EPA 2001b	with Draft EPA Superfund Dermal Risk Guidance (EPA, 2001a)
				ET	Exposure Time	1.4	hr/day		
				EV	Event	1	event/day	EPA 2001b	
				EF	Exposure Frequency	45	days/yr	EPA 1998	
				ED_C	Exposure Duration - Current	5	yrs	Site-specific	
				BW	Body Weight	51	kg	EPA 1989	
				AT-NC	Averaging Time (noncancer)	1825	days	EPA 1989	AT-NC = ED*365
				AT- C	Averaging Time (cancer)	25,550	days	EPA 1989	AT-C = 70*365

Notes:

cm^2 = square centimeter

g = grams

hr = hours

kg = kilograms

L = liters

mg = milligrams

yrs = years

µg= micrograms

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Kingston Fly Ash Recovery Project

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal[1]	Absorbed RfD for Dermal[2]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Aluminum	Chronic	1.00E+00	(mg/kg/day)	100%	1.00E+00	(mg/kg/day)	CNS	100	RAIS	1990
Antimony	Chronic	4.00E-04	(mg/kg/day)	15%	6.00E-05	(mg/kg/day)	Lifespan	1000	IRIS	02/01/1991
Arsenic	Chronic	3.00E-04	(mg/kg/day)	95%	2.85E-04	(mg/kg/day)	Skin	3	IRIS	02/01/1993
Barium	Chronic	2.00E-01	(mg/kg/day)	7%	1.40E-02	(mg/kg/day)	Liver	300	IRIS	07/11/2005
Beryllium	Chronic	2.00E-03	(mg/kg/day)	0.7%	1.40E-05	(mg/kg/day)	GI	300	IRIS	04/03/1998
Boron	Chronic	2.00E-01	(mg/kg/day)	100%	2.00E-01	(mg/kg/day)	Fetus	66	IRIS	08/05/2004
Chromium	Chronic	3.00E-03	(mg/kg/day)	1.3%	3.90E-05	(mg/kg/day)	None observed	900	IRIS	09/03/1998
Cobalt	Chronic	3.00E-04	(mg/kg/day)	100%	3.00E-04	(mg/kg/day)	Blood	10	RAIS	1976
Copper	Chronic	4.00E-02	(mg/kg/day)	100%	4.00E-02	(mg/kg/day)	GI			
Iron	Chronic	7.00E-01	(mg/kg/day)	100%	7.00E-01	(mg/kg/day)	None observed		HEAST	1997
Manganese - Soil/Ash	Chronic	1.40E-01	(mg/kg/day)	4%	5.60E-03	(mg/kg/day)	CNS	1	IRIS	05/01/1996
Manganese - Water	Chronic	2.40E-02	(mg/kg/day)	4%	9.60E-04	(mg/kg/day)	CNS	1	IRIS	05/01/1996
Molybdenum	Chronic	5.00E-03	(mg/kg/day)	100%	5.00E-03	(mg/kg/day)	Blood	30	IRIS	08/01/1993
Mercury	Chronic	3.00E-04	(mg/kg/day)	74-80%	2.40E-04	(mg/kg/day)	Autoimmune	1000	IRIS	05/01/1995
Nickel	Chronic	2.00E-02	(mg/kg/day)	4%	8.00E-04	(mg/kg/day)	Weight	300	IRIS	12/01/1996
Selenium	Chronic	5.00E-03	(mg/kg/day)	30-80%	4.00E-03	(mg/kg/day)	Hair	3	IRIS	09/01/1991
Strontium	Chronic	6.00E-01	(mg/kg/day)	100%	6.00E-01	(mg/kg/day)	Bone	300	IRIS	12/01/1996
Thallium	Chronic	6.50E-05	(mg/kg/day)	100%	6.50E-05	(mg/kg/day)	Hair	3000	EPA	2009
Vanadium	Chronic	5.00E-03	(mg/kg/day)	2.6%	1.30E-04	(mg/kg/day)	Weight		ATSDR	1992
Zinc	Chronic	3.00E-01	(mg/kg/day)	highly variable	3.00E-01	(mg/kg/day)	Blood	3	IRIS	08/03/2005

1 Oral Absorption Efficiencies were obtained from EPA 2004a, Table 4-1

2 Absorbed Reference Dose for Dermal were derived from Oral Reference Dose by the following conversion [Reference Dose * Absorption Efficiency]

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

Kingston Fly Ash Recovery Project

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Aluminum	Chronic	5.00E-03	mg/m^3	1.00E-02	mg/kg/day	CNS	300	RAIS	1989
Antimony	Chronic	--	NA	NA	NA				
Arsenic	Chronic	1.50E-05	mg/m^3	3E-05	mg/kg/day	Respiratory tract		ATSDR	2007
Barium	Chronic	5.00E-04	mg/m^3	1E-03	mg/kg/day	Fetus	1000	IRIS	03/30/1998
Beryllium	Chronic	2.00E-05	mg/m^3	4E-05	mg/kg/day	Respiratory tract	10	IRIS	04/03/1998
Boron	Chronic	2.00E-02	mg/m^3	4E-02	mg/kg/day	Respiratory tract	100	HEAST	1997
Chromium	Chronic	1.00E-04	mg/m^3	2E-04	mg/kg/day	Respiratory tract	300	IRIS	09/03/1998
Cobalt	Chronic	6.00E-06	mg/m^3	1E-05	mg/kg/day	Respiratory tract	100	RAIS	1992
Copper	Chronic	--	NA	NA	NA				
Iron	Chronic	--	NA	NA	NA				
Manganese	Chronic	5.00E-05	mg/m^3	1E-04	mg/kg/day	CNS	1000	IRIS	12/01/1993
Molybdenum	Chronic	--	NA	NA	NA				
Mercury	Chronic	3.00E-04	mg/m^3	6E-04	mg/kg/day	CNS	30	IRIS	06/01/1995
Nickel	Chronic	9.00E-05	mg/m^3	2E-04	mg/kg/day				
Selenium	Chronic	2.00E-02	mg/m^3	4E-02	mg/kg/day				
Strontium	Chronic	--	NA	NA	NA				
Thallium	Chronic	--	NA	NA	NA				
Vanadium	Chronic	--	NA	NA	NA				
Zinc	Chronic	--	NA	NA	NA				

1 Inhalation Reference Dose were derived from Inhalation Reference Concentration toxicity values by the following conversion [RfC*(20/70)]

NA = Not Available

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

Kingston Fly Ash Recovery Project

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal[1]	Absorbed Cancer Slope Factor for Dermal[2]		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Aluminum	NA	NA	100%	NA	NA	D	EPA 2009	05/19/09
Antimony	NA	NA	15%	NA	NA	NA	EPA 2009	05/19/09
Arsenic	1.50E+00	$(mg/kg/day)^{-1}$	95%	1.58E+00	$(mg/kg/day)^{-1}$	A	EPA 2009	05/19/09
Barium	NA	NA	7%	NA	NA	D	EPA 2009	05/19/09
Beryllium	NA	NA	0.7%	NA	NA	B1	EPA 2009	05/19/09
Boron	NA	NA	100%	NA	NA	D	EPA 2009	05/19/09
Chromium	NA	NA	1.3%	NA	NA	D	EPA 2009	05/19/09
Cobalt	NA	NA	100%	NA	NA	B1	EPA 2009	05/19/09
Copper	NA	NA	100%	NA	NA	D	EPA 2009	05/19/09
Iron	NA	NA	100%	NA	NA	D	EPA 2009	05/19/09
Manganese	NA	NA	4%	NA	NA	D	EPA 2009	05/19/09
Molybdenum	NA	NA	100%	NA	NA	NA	EPA 2009	05/19/09
Mercury	NA	NA	74-80%	NA	NA	C	EPA 2009	05/19/09
Nickel	NA	NA	4%	NA	NA	D	EPA 2009	05/19/09
Selenium	NA	NA	30-80%	NA	NA	D	EPA 2009	05/19/09
Strontium	NA	NA	100%	NA	NA	NA	EPA 2009	05/19/09
Thallium	NA	NA	100%	NA	NA	D	EPA 2009	05/19/09
Vanadium	NA	NA	3%	NA	NA	D	EPA 2009	05/19/09
Zinc	NA	NA	highly variable	NA	NA	D	EPA 2009	05/19/09
K-40	6.18E-11	risk/pCi	NA	NA	NA	A	EPA 2001	04/16/01
RA-226	7.30E-10	risk/pCi	NA	NA	NA	A	EPA 2001	04/16/01
RA-228	2.29E-09	risk/pCi	NA	NA	NA	A	EPA 2001	04/16/01
Th-228	8.09E-10	risk/pCi	NA	NA	NA	A	EPA 2001	04/16/01
Th-232	2.31E-10	risk/pCi	NA	NA	NA	A	EPA 2001	04/16/01
U-234	1.58E-10	risk/pCi	NA	NA	NA	A	EPA 2001	04/16/01
U-235	1.63E-10	risk/pCi	NA	NA	NA	A	EPA 2001	04/16/01
U-238	2.10E-10	risk/pCi	NA	NA	NA	A	EPA 2001	04/16/01

1 Oral Absorption Efficiencies were obtained from EPA 2004a, Table 4-1

2 Absorbed Cancer Slope Factors for Dermal were derived from Oral Cancer Slope Factors by the following conversion [Cancer Slope Factor/Absorption Efficiency]

NA = Not Available

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

Kingston Fly Ash Recovery Project

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor[1]		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Aluminum	NA	NA	NA	NA	D	EPA 2009	05/19/09
Antimony	NA	NA	NA	NA	NA	EPA 2009	05/19/09
Arsenic	4.3E-03	$(ug/m^{3})^{-1}$	1.51E+01	$(mg/kg/day)^{-1}$	A	EPA 2009	05/19/09
Barium	NA	NA	NA	NA	D	EPA 2009	05/19/09
Beryllium	2.4E-03	$(ug/m^{3})^{-1}$	8.40E+00	$(mg/kg/day)^{-1}$	B1	EPA 2009	05/19/09
Boron	NA	NA	NA	NA	D	EPA 2009	05/19/09
Chromium	1.2E-02	$(ug/m^{3})^{-1}$	4.20E+01	$(mg/kg/day)^{-1}$	D	EPA 2009	05/19/09
Cobalt	9.0E-03	$(ug/m^{3})^{-1}$	3.15E+01	$(mg/kg/day)^{-1}$	B1	EPA 2009	05/19/09
Copper	NA	NA	NA	NA	D	EPA 2009	05/19/09
Iron	NA	NA	NA	NA	D	EPA 2009	05/19/09
Manganese	NA	NA	NA	NA	D	EPA 2009	05/19/09
Molybdenum	NA	NA	NA	NA	D	EPA 2009	05/19/09
Nickel	2.6E-04	$(ug/m^{3})^{-1}$	9.10E-01	$(mg/kg/day)^{-1}$	D	EPA 2009	05/19/09
Selenium	NA	NA	NA	NA	D	EPA 2009	05/19/09
Strontium	NA	NA	NA	NA	D	EPA 2009	05/19/09
Thallium	NA	NA	NA	NA	D	EPA 2009	05/19/09
Vanadium	NA	NA	NA	NA	D	EPA 2009	05/19/09
Zinc	NA	NA	NA	NA	D	EPA 2009	05/19/09
K-40	NA	NA	1.03E-11	risk/pCi	A	EPA 2001	04/16/01
RA-226	NA	NA	1.15E-08	risk/pCi	A	EPA 2001	04/16/01
RA-228	NA	NA	5.23E-09	risk/pCi	A	EPA 2001	04/16/01
Th-228	NA	NA	1.43E-07	risk/pCi	A	EPA 2001	04/16/01
Th-232	NA	NA	4.33E-08	risk/pCi	A	EPA 2001	04/16/01
U-234	NA	NA	1.14E-08	risk/pCi	A	EPA 2001	04/16/01
U-235	NA	NA	1.01E-08	risk/pCi	A	EPA 2001	04/16/01
U-238	NA	NA	9.35E-09	risk/pCi	A	EPA 2001	04/16/01

1 Inhalation Cancer Slope Factors were derived from Inhalation Unit Risk toxicity values by the following conversion [Unit Risk*(70/20)*1000]

NA = Not Available

TABLE 6.3

CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

Site Name

Chemical of Potential Concern	Parameters			Source(s)	Date(s) (MM/DD/YYYY)
	Name	Value	Units		
NA	NA	NA	NA	NA	NA

NA = Not Applicable, there were no "unusual chemicals, surrogate chemical or circumstances that are not covered by Tables 6.1 , 6.2, or 6.4. This table has been retained to maintain continuity of table numbering.

TABLE 6.4

CANCER TOXICITY DATA -- EXTERNAL (RADIATION)

Kingston Fly Ash Recovery Project

Chemical of Potential Concern	Cancer Slope Factor		Source(s)	Date(s) (MM/DD/YYYY)
	Value	Units		
On-Site				
K-40	8.0E-07	risk/yrperpCi/g	EPA 2001b	04/16/2001
RA-226	8.5E-06	risk/yrperpCi/g	EPA 2001b	04/16/2001
RA-228	4.5E-06	risk/yrperpCi/g	EPA 2001b	04/16/2001
Th-228	7.8E-06	risk/yrperpCi/g	EPA 2001b	04/16/2001
Th-232	3.4E-10	risk/yrperpCi/g	EPA 2001b	04/16/2001
U-234	2.5E-10	risk/yrperpCi/g	EPA 2001b	04/16/2001
U-235	5.4E-07	risk/yrperpCi/g	EPA 2001b	04/16/2001
U-238	1.1E-07	risk/yrperpCi/g	EPA 2001b	04/16/2001
Off-Site				
K-40	1.4E-07	risk/yrperpCi/g	EPA 2008c	07/18/2008
RA-226	1.5E-06	risk/yrperpCi/g	EPA 2008c	07/18/2008
RA-228	2.2E-06	risk/yrperpCi/g	EPA 2008c	07/18/2008
Th-228	1.3E-06	risk/yrperpCi/g	EPA 2008c	07/18/2008
Th-232	3.2E-10	risk/yrperpCi/g	EPA 2008c	07/18/2008
U-234	3.8E-10	risk/yrperpCi/g	EPA 2008c	07/18/2008
U-235	1.3E-07	risk/yrperpCi/g	EPA 2008c	07/18/2008
U-238	3.7E-08	risk/yrperpCi/g	EPA 2008c	07/18/2008

EPA 2008c Preliminary Remediation Goals for Radionuclides in Outdoor Surfaces (SPRG) on-line at http://epa-sprg.ornl.gov/

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Ingestion	Aluminum	19152.7	mg/Kg	6.69E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	9.37E-03	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.009
				Arsenic	50.848	mg/Kg	1.78E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	3.E-06	2.49E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.08
				Barium	661.71	mg/Kg	2.31E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.24E-04	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.002
				Beryllium	4.1391	mg/Kg	1.45E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.03E-06	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.001
				Boron	92.12	mg/Kg	3.22E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.51E-05	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.0002
				Chromium	31.626	mg/Kg	1.11E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.55E-05	mg/kg-day	3.0E-03	1/(mg/kg-day)	0.005
				Cobalt	14.462	mg/Kg	5.05E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	7.08E-06	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.02
				Copper	48.405	mg/Kg	1.69E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.37E-05	mg/kg-day	4.0E-02	1/(mg/kg-day)	0.0006
				Iron	14730.1	mg/Kg	5.15E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	7.21E-03	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.01
				Manganese	158.34	mg/Kg	5.53E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	7.75E-05	mg/kg-day	1.4E-01	1/(mg/kg-day)	0.0006
				Mercury	0.1463	mg/Kg	5.11E-09	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	7.16E-08	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.0002
				Nickel	28.973	mg/Kg	1.01E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.42E-05	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.0007
				Selenium	4.8867	mg/Kg	1.71E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.39E-06	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.0005
				Thallium	2.66	mg/Kg	9.30E-08	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.30E-06	mg/kg-day	6.5E-05	1/(mg/kg-day)	0.02
				Vanadium	79.03	mg/Kg	2.76E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.87E-05	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.008
				Zinc	43.05	mg/Kg	1.50E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.11E-05	mg/kg-day	3.0E-01	1/(mg/kg-day)	0.00007
			Exp. Route Total								3.E-06					0.2
		Exposure Point Total									3.E-06					0.2
	Exposure Medium Total										3.E-06					0.2
	Air	Current - Properties Adjacent to KIF or at the KIF Facility	Inhalation	Aluminum	19152.7	mg/Kg	3.89E-04	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.44E-06	mg/m^3	5.0E-03	mg/m^3	0.001
				Arsenic	50.848	mg/Kg	1.03E-06	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	4.E-09	1.45E-08	mg/m^3	1.5E-05	mg/m^3	0.001
				Barium	661.71	mg/Kg	1.34E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.88E-07	mg/m^3	5.0E-04	mg/m^3	0.0004
				Beryllium	4.1391	mg/Kg	8.40E-08	ug/m^3	2.4E-03	$(ug/m^3)^{-1}$	2.E-10	1.18E-09	mg/m^3	2.0E-05	mg/m^3	0.00006
				Boron	92.12	mg/Kg	1.87E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.62E-08	mg/m^3	2.0E-02	mg/m^3	0.000001
				Chromium	31.626	mg/Kg	6.42E-07	ug/m^3	1.2E-02	$(ug/m^3)^{-1}$	8.E-09	8.99E-09	mg/m^3	1.0E-04	mg/m^3	0.00009
				Cobalt	14.462	mg/Kg	2.94E-07	ug/m^3	9.0E-03	$(ug/m^3)^{-1}$	3.E-09	4.11E-09	mg/m^3	6.0E-06	mg/m^3	0.0007
				Copper	48.405	mg/Kg	9.83E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.38E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Iron	14730.1	mg/Kg	2.99E-04	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.19E-06	mg/m^3	No toxicity value	mg/m^3	NA
				Manganese	158.34	mg/Kg	3.21E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.50E-08	mg/m^3	5.0E-05	mg/m^3	0.0009
				Mercury	0.1463	mg/Kg	2.97E-09	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.16E-11	mg/m^3	3.0E-04	mg/m^3	0.0000001
				Nickel	28.973	mg/Kg	5.88E-07	ug/m^3	2.6E-04	$(ug/m^3)^{-1}$	2.E-10	8.23E-09	mg/m^3	9.0E-05	mg/m^3	0.00009
				Selenium	4.8867	mg/Kg	9.92E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.39E-09	mg/m^3	2.0E-02	mg/m^3	0.00000007
				Thallium	2.66	mg/Kg	5.40E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	7.56E-10	mg/m^3	No toxicity value	mg/m^3	NA
				Vanadium	79.03	mg/Kg	1.60E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.25E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Zinc	43.05	mg/Kg	8.74E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.22E-08	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								2.E-08					0.004
		Exposure Point Total									2.E-08					0.004
	Exposure Medium Total										2.E-08					0.004
Medium Total											3.E-06					0.2
									Total of Receptor Risks Across All Media		3.E-06			Total of Receptor Hazards Across All Media		0.2

TABLE 7.2.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Ingestion	Aluminum	19152.7	mg/Kg	1.34E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.87E-02	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.02
				Arsenic	50.848	mg/Kg	3.55E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	5.E-06	4.98E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.2
				Barium	661.71	mg/Kg	4.62E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	6.47E-04	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.003
				Beryllium	4.1391	mg/Kg	2.89E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.05E-06	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.002
				Boron	92.12	mg/Kg	6.44E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	9.01E-05	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.0005
				Chromium	31.626	mg/Kg	2.21E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.09E-05	mg/kg-day	3.0E-03	1/(mg/kg-day)	0.01
				Cobalt	14.462	mg/Kg	1.01E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.42E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.05
				Copper	48.405	mg/Kg	3.38E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.74E-05	mg/kg-day	4.0E-02	1/(mg/kg-day)	0.001
				Iron	14730.1	mg/Kg	1.03E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.44E-02	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.02
				Manganese	158.34	mg/Kg	1.11E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.55E-04	mg/kg-day	1.4E-01	1/(mg/kg-day)	0.001
				Mercury	0.1463	mg/Kg	1.02E-08	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.43E-07	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.0005
				Nickel	28.973	mg/Kg	2.02E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.83E-05	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.001
				Selenium	4.8867	mg/Kg	3.42E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.78E-06	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.001
				Thallium	2.66	mg/Kg	1.86E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.60E-06	mg/kg-day	6.5E-05	1/(mg/kg-day)	0.04
				Vanadium	79.03	mg/Kg	5.52E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	7.73E-05	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.02
				Zinc	43.05	mg/Kg	3.01E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.21E-05	mg/kg-day	3.0E-01	1/(mg/kg-day)	0.0001
			Exp. Route Total								5.E-06					0.3
			Dermal	Aluminum	19152.7	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.0E+00	1/(mg/kg-day)	NA
				Arsenic	50.848	mg/Kg	7.04E-07	mg/kg-day	1.6E+00	$(mg/kg\text{-}day)^{-1}$	1.E-06	9.85E-06	mg/kg-day	2.9E-04	1/(mg/kg-day)	0.03
				Barium	661.71	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-02	1/(mg/kg-day)	NA
				Beryllium	4.1391	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-05	1/(mg/kg-day)	NA
				Boron	92.12	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.0E-01	1/(mg/kg-day)	NA
				Chromium	31.626	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.9E-05	1/(mg/kg-day)	NA
				Cobalt	14.462	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-04	1/(mg/kg-day)	NA
				Copper	48.405	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-02	1/(mg/kg-day)	NA
				Iron	14730.1	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	7.0E-01	1/(mg/kg-day)	NA
				Manganese	158.34	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	5.6E-03	1/(mg/kg-day)	NA
				Mercury	0.1463	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.4E-04	1/(mg/kg-day)	NA
				Nickel	28.973	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	8.0E-04	1/(mg/kg-day)	NA
				Selenium	4.8867	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-03	1/(mg/kg-day)	NA
				Thallium	2.66	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	6.5E-05	1/(mg/kg-day)	NA
				Vanadium	79.03	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.3E-04	1/(mg/kg-day)	NA
				Zinc	43.05	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-01	1/(mg/kg-day)	NA
			Exp. Route Total								1.E-06					0.03
		Exposure Point Total									6.E-06					0
	Exposure Medium Total										6.E-06					0
	Air	Current - Properties Adjacent to KIF or at the KIF Facility	Inhalation	Aluminum	19152.7	mg/Kg	3.89E-04	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.44E-06	mg/m^3	5.0E-03	mg/m^3	0.001
				Arsenic	50.848	mg/Kg	1.03E-06	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	4.E-09	1.45E-08	mg/m^3	1.5E-05	mg/m^3	0.001
				Barium	661.71	mg/Kg	1.34E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.88E-07	mg/m^3	5.0E-04	mg/m^3	0.0004
				Beryllium	4.1391	mg/Kg	8.40E-08	ug/m^3	2.4E-03	$(ug/m^3)^{-1}$	2.E-10	1.18E-09	mg/m^3	2.0E-05	mg/m^3	0.00006
				Boron	92.12	mg/Kg	1.87E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.62E-08	mg/m^3	2.0E-02	mg/m^3	0.000001
				Chromium	31.626	mg/Kg	6.42E-07	ug/m^3	1.2E-02	$(ug/m^3)^{-1}$	8.E-09	8.99E-09	mg/m^3	1.0E-04	mg/m^3	0.00009
				Cobalt	14.462	mg/Kg	2.94E-07	ug/m^3	9.0E-03	$(ug/m^3)^{-1}$	3.E-09	4.11E-09	mg/m^3	6.0E-06	mg/m^3	0.0007
				Copper	48.405	mg/Kg	9.83E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.38E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Iron	14730.1	mg/Kg	2.99E-04	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.19E-06	mg/m^3	No toxicity value	mg/m^3	NA
				Manganese	158.34	mg/Kg	3.21E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.50E-08	mg/m^3	5.0E-05	mg/m^3	0.0009
				Mercury	0.1463	mg/Kg	2.97E-09	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.16E-11	mg/m^3	3.0E-04	mg/m^3	0.0000001
				Nickel	28.973	mg/Kg	5.88E-07	ug/m^3	2.6E-04	$(ug/m^3)^{-1}$	2.E-10	8.23E-09	mg/m^3	9.0E-05	mg/m^3	0.00009
				Selenium	4.8867	mg/Kg	9.92E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.39E-09	mg/m^3	2.0E-02	mg/m^3	0.00000007
				Thallium	2.66	mg/Kg	5.40E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	7.56E-10	mg/m^3	No toxicity value	mg/m^3	NA
				Vanadium	79.03	mg/Kg	1.60E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.25E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Zinc	43.05	mg/Kg	8.74E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.22E-08	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								2.E-08					0.004
		Exposure Point Total									2.E-08					0.004
	Exposure Medium Total										2.E-08					0.004
Medium Total											6.E-06					0.4
									Total of Receptor Risks Across All Media		6.E-06			Total of Receptor Hazards Across All Media		0.4

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
	Air	Current - Properties Adjacent to KIF or at the KIF Facility	Inhalation	Aluminum	27361	mg/Kg	7.78E-04	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.09E-05	mg/m^3	5.0E-03	mg/m^3	0.002
				Arsenic	72.64	mg/Kg	2.06E-06	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	9.E-09	2.89E-08	mg/m^3	1.5E-05	mg/m^3	0.002
				Barium	945.3	mg/Kg	2.69E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.76E-07	mg/m^3	5.0E-04	mg/m^3	0.0008
				Beryllium	5.913	mg/Kg	1.68E-07	ug/m^3	2.4E-03	$(ug/m^3)^{-1}$	4.E-10	2.35E-09	mg/m^3	2.0E-05	mg/m^3	0.0001
				Boron	131.6	mg/Kg	3.74E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.24E-08	mg/m^3	2.0E-02	mg/m^3	0.000003
				Chromium	45.18	mg/Kg	1.28E-06	ug/m^3	1.2E-02	$(ug/m^3)^{-1}$	2.E-08	1.80E-08	mg/m^3	1.0E-04	mg/m^3	0.0002
				Cobalt	20.66	mg/Kg	5.87E-07	ug/m^3	9.0E-03	$(ug/m^3)^{-1}$	5.E-09	8.22E-09	mg/m^3	6.0E-06	mg/m^3	0.001
				Copper	69.15	mg/Kg	1.97E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.75E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Iron	21043	mg/Kg	5.98E-04	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	8.37E-06	mg/m^3	No toxicity value	mg/m^3	NA
				Manganese	226.2	mg/Kg	6.43E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	9.00E-08	mg/m^3	5.0E-05	mg/m^3	0.002
				Mercury	0.209	mg/Kg	5.94E-09	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	8.32E-11	mg/m^3	3.0E-04	mg/m^3	0.0000003
				Nickel	41.39	mg/Kg	1.18E-06	ug/m^3	2.6E-04	$(ug/m^3)^{-1}$	3.E-10	1.65E-08	mg/m^3	9.0E-05	mg/m^3	0.0002
				Selenium	6.981	mg/Kg	1.98E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.78E-09	mg/m^3	2.0E-02	mg/m^3	0.0000001
				Thallium	3.8	mg/Kg	1.08E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.51E-09	mg/m^3	No toxicity value	mg/m^3	NA
				Vanadium	112.9	mg/Kg	3.21E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.49E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Zinc	61.5	mg/Kg	1.75E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.45E-08	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								3.E-08					0.009
		Exposure Point Total									3.E-08					0.009
	Exposure Medium Total										3.E-08					0.009
Medium Total											3.E-08					0.009
									Total of Receptor Risks Across All Media		3.E-08			Total of Receptor Hazards Across All Media		0.009

TABLE 7.4.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
	Air	Current - Properties Adjacent to KIF or at the KIF Facility	Inhalation	Aluminum	27361	mg/Kg	7.78E-04	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.09E-05	mg/m^3	5.0E-03	mg/m^3	0.002
				Arsenic	72.64	mg/Kg	2.06E-06	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	9.E-09	2.89E-08	mg/m^3	1.5E-05	mg/m^3	0.002
				Barium	945.3	mg/Kg	2.69E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.76E-07	mg/m^3	5.0E-04	mg/m^3	0.0008
				Beryllium	5.913	mg/Kg	1.68E-07	ug/m^3	2.4E-03	$(ug/m^3)^{-1}$	4.E-10	2.35E-09	mg/m^3	2.0E-05	mg/m^3	0.0001
				Boron	131.6	mg/Kg	3.74E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.24E-08	mg/m^3	2.0E-02	mg/m^3	0.000003
				Chromium	45.18	mg/Kg	1.28E-06	ug/m^3	1.2E-02	$(ug/m^3)^{-1}$	2.E-08	1.80E-08	mg/m^3	1.0E-04	mg/m^3	0.0002
				Cobalt	20.66	mg/Kg	5.87E-07	ug/m^3	9.0E-03	$(ug/m^3)^{-1}$	5.E-09	8.22E-09	mg/m^3	6.0E-06	mg/m^3	0.001
				Copper	69.15	mg/Kg	1.97E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.75E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Iron	21043	mg/Kg	5.98E-04	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	8.37E-06	mg/m^3	No toxicity value	mg/m^3	NA
				Manganese	226.2	mg/Kg	6.43E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	9.00E-08	mg/m^3	5.0E-05	mg/m^3	0.002
				Mercury	0.209	mg/Kg	5.94E-09	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	8.32E-11	mg/m^3	3.0E-04	mg/m^3	0.0000003
				Nickel	41.39	mg/Kg	1.18E-06	ug/m^3	2.6E-04	$(ug/m^3)^{-1}$	3.E-10	1.65E-08	mg/m^3	9.0E-05	mg/m^3	0.0002
				Selenium	6.981	mg/Kg	1.98E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.78E-09	mg/m^3	2.0E-02	mg/m^3	0.0000001
				Thallium	3.8	mg/Kg	1.08E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.51E-09	mg/m^3	No toxicity value	mg/m^3	NA
				Vanadium	112.9	mg/Kg	3.21E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.49E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Zinc	61.5	mg/Kg	1.75E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.45E-08	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								3.E-08					0.009
		Exposure Point Total									3.E-08					0.009
	Exposure Medium Total										3.E-08					0.009
Medium Total											3.E-08					0.009
										Total of Receptor Risks Across All Media	3.E-08			Total of Receptor Hazards Across All Media		0.009

TABLE 7.5.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	On-Site Trespasser
Receptor Age:	Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Ingestion	Aluminum	27361	mg/Kg	9.99E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.68E-02	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.02
				Arsenic	72.64	mg/Kg	2.65E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.E-06	4.46E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.1
				Barium	945.3	mg/Kg	3.45E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	5.80E-04	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.003
				Beryllium	5.913	mg/Kg	2.16E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.63E-06	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.002
				Boron	131.6	mg/Kg	4.81E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	8.08E-05	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.0004
				Chromium	45.18	mg/Kg	1.65E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.77E-05	mg/kg-day	3.0E-03	1/(mg/kg-day)	0.009
				Cobalt	20.66	mg/Kg	7.55E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.27E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.04
				Copper	69.15	mg/Kg	2.53E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.24E-05	mg/kg-day	4.0E-02	1/(mg/kg-day)	0.001
				Iron	21043	mg/Kg	7.69E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.29E-02	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.02
				Manganese	226.2	mg/Kg	8.26E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.39E-04	mg/kg-day	1.4E-01	1/(mg/kg-day)	0.001
				Mercury	0.209	mg/Kg	7.63E-09	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.28E-07	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.0004
				Nickel	41.39	mg/Kg	1.51E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.54E-05	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.001
				Selenium	6.981	mg/Kg	2.55E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.28E-06	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.0009
				Thallium	3.8	mg/Kg	1.39E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.33E-06	mg/kg-day	6.5E-05	1/(mg/kg-day)	0.04
				Vanadium	112.9	mg/Kg	4.12E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	6.93E-05	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.01
				Zinc	61.5	mg/Kg	2.25E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.77E-05	mg/kg-day	3.0E-01	1/(mg/kg-day)	0.0001
			Exp. Route Total								4.E-06					0.3
			Dermal	Aluminum	27361	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.0E+00	1/(mg/kg-day)	NA
				Arsenic	72.64	mg/Kg	2.24E-06	mg/kg-day	1.6E+00	$(mg/kg\text{-}day)^{-1}$	4.E-06	3.14E-05	mg/kg-day	2.9E-04	1/(mg/kg-day)	0.1
				Barium	945.3	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-02	1/(mg/kg-day)	NA
				Beryllium	5.913	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-05	1/(mg/kg-day)	NA
				Boron	131.6	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.0E-01	1/(mg/kg-day)	NA
				Chromium	45.18	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.9E-05	1/(mg/kg-day)	NA
				Cobalt	20.66	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-04	1/(mg/kg-day)	NA
				Copper	69.15	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-02	1/(mg/kg-day)	NA
				Iron	21043	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	7.0E-01	1/(mg/kg-day)	NA
				Manganese	226.2	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	5.6E-03	1/(mg/kg-day)	NA
				Mercury	0.209	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.4E-04	1/(mg/kg-day)	NA
				Nickel	41.39	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	8.0E-04	1/(mg/kg-day)	NA
				Selenium	6.981	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-03	1/(mg/kg-day)	NA
				Thallium	3.8	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	6.5E-05	1/(mg/kg-day)	NA
				Vanadium	112.9	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.3E-04	1/(mg/kg-day)	NA
				Zinc	61.5	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-01	1/(mg/kg-day)	NA
			Exp. Route Total								4.E-06					0.1
		Exposure Point Total									8.E-06					0.4
	Exposure Medium Total										8.E-06					0.4
	Air	Current - Properties Adjacent to KIF or at the KIF Facility	Inhalation	Aluminum	27361	mg/Kg	2.98E-04	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.17E-06	mg/m^3	5.0E-03	mg/m^3	0.0008
				Arsenic	72.64	mg/Kg	7.91E-07	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	3.E-09	1.11E-08	mg/m^3	1.5E-05	mg/m^3	0.0007
				Barium	945.3	mg/Kg	1.03E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.44E-07	mg/m^3	5.0E-04	mg/m^3	0.0003
				Beryllium	5.913	mg/Kg	6.44E-08	ug/m^3	2.4E-03	$(ug/m^3)^{-1}$	2.E-10	9.01E-10	mg/m^3	2.0E-05	mg/m^3	0.00005
				Boron	131.6	mg/Kg	1.43E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.01E-08	mg/m^3	2.0E-02	mg/m^3	0.000001
				Chromium	45.18	mg/Kg	4.92E-07	ug/m^3	1.2E-02	$(ug/m^3)^{-1}$	6.E-09	6.89E-09	mg/m^3	1.0E-04	mg/m^3	0.00007
				Cobalt	20.66	mg/Kg	2.25E-07	ug/m^3	9.0E-03	$(ug/m^3)^{-1}$	2.E-09	3.15E-09	mg/m^3	6.0E-06	mg/m^3	0.0005
				Copper	69.15	mg/Kg	7.53E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.05E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Iron	21043	mg/Kg	2.29E-04	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.21E-06	mg/m^3	No toxicity value	mg/m^3	NA
				Manganese	226.2	mg/Kg	2.46E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.45E-08	mg/m^3	5.0E-05	mg/m^3	0.0007
				Mercury	0.209	mg/Kg	2.28E-09	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.19E-11	mg/m^3	3.0E-04	mg/m^3	0.0000001
				Nickel	41.39	mg/Kg	4.51E-07	ug/m^3	2.6E-04	$(ug/m^3)^{-1}$	1.E-10	6.31E-09	mg/m^3	9.0E-05	mg/m^3	0.00007
				Selenium	6.981	mg/Kg	7.60E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.06E-09	mg/m^3	2.0E-02	mg/m^3	0.00000005
				Thallium	3.8	mg/Kg	4.14E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.79E-10	mg/m^3	No toxicity value	mg/m^3	NA
				Vanadium	112.9	mg/Kg	1.23E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.72E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Zinc	61.5	mg/Kg	6.70E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	9.37E-09	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								1.E-08					0.003
		Exposure Point Total									1.E-08					0.003
	Exposure Medium Total										1.E-08					0.003
Medium Total											8.E-06					0

Surface Water	Surface Water	Swan Pond Embayment	Ingestion	Aluminum, total	9.85E-01	mg/L	4.96E-07	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	6.95E-06	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.000007
				Antimony, total	3.84E-03	mg/L	1.93E-09	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	2.71E-08	mg/kg-day	4.0E-04	1/(mg/kg-day)	0.00007
				Arsenic, total	3.83E-02	mg/L	1.93E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	3.E-08	2.70E-07	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.0009
				Barium, total	1.25E-01	mg/L	6.30E-08	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	8.81E-07	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.000004
				Boron, total	7.60E-01	mg/L	3.83E-07	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	5.36E-06	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.00003
				Chromium, total	2.33E-03	mg/L	1.17E-09	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	1.64E-08	mg/kg-day	3.0E-03	1/(mg/kg-day)	0.000005
				Iron, total	6.48E-01	mg/L	3.26E-07	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	4.57E-06	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.000007
				Manganese, total	1.95E-01	mg/L	9.82E-08	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	1.37E-06	mg/kg-day	2.4E-02	1/(mg/kg-day)	0.00006
				Molybdenum, total	6.73E-02	mg/L	3.39E-08	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	4.75E-07	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.00009
				Selenium, total	1.12E-02	mg/L	5.64E-09	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	7.90E-08	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.00002
				Vanadium, total	3.10E-02	mg/L	1.56E-08	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	2.19E-07	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.00004
			Exp. Route Total								3.E-08					0.001
		Exposure Point Total									3.E-08					0.001
		Swan Pond Embayment	Dermal	Aluminum, total	9.85E-01	mg/L	1.68E-06	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	1.96E-05	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.00002
				Antimony, total	3.84E-03	mg/L	6.54E-09	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	7.63E-08	mg/kg-day	6.0E-05	1/(mg/kg-day)	0.001
				Arsenic, total	3.83E-02	mg/L	6.52E-08	mg/kg-day	1.6E+00	(mg/kg-day)$^{-1}$	1.E-07	7.61E-07	mg/kg-day	2.9E-04	1/(mg/kg-day)	0.003
				Barium, total	1.25E-01	mg/L	2.13E-07	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	2.48E-06	mg/kg-day	1.4E-02	1/(mg/kg-day)	0.0002
				Boron, total	7.60E-01	mg/L	1.29E-06	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	1.51E-05	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.00008
				Chromium, total	2.33E-03	mg/L	3.97E-09	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	4.63E-08	mg/kg-day	3.9E-05	1/(mg/kg-day)	0.001
				Iron, total	6.48E-01	mg/L	1.10E-06	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	1.29E-05	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.00002
				Manganese, total	1.95E-01	mg/L	3.32E-07	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	3.87E-06	mg/kg-day	9.6E-04	1/(mg/kg-day)	0.004
				Molybdenum, total	6.73E-02	mg/L	1.15E-07	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	1.34E-06	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.0003
				Selenium, total	1.12E-02	mg/L	1.91E-08	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	2.23E-07	mg/kg-day	4.0E-03	1/(mg/kg-day)	0.00006
				Vanadium, total	3.10E-02	mg/L	5.28E-08	mg/kg-day	No toxicity value	(mg/kg-day)$^{-1}$	NA	6.16E-07	mg/kg-day	1.3E-04	1/(mg/kg-day)	0.005
			Exp. Route Total								1.E-07					0.01
		Exposure Point Total									1.E-07					0.01
	Exposure Medium Total										1.E-07					0.02
Medium Total											1.E-07					0.02
									Total of Receptor Risks Across All Media		8.E-06	Total of Receptor Hazards Across All Media				0.4

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	Aluminum	27361	mg/Kg	4.78E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.34E-02	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.01
				Arsenic	72.64	mg/Kg	1.27E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.E-05	3.55E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.1
				Barium	945.3	mg/Kg	1.65E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.62E-04	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.002
				Beryllium	5.913	mg/Kg	1.03E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.89E-06	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.001
				Boron	131.6	mg/Kg	2.30E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	6.44E-05	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.0003
				Chromium	45.18	mg/Kg	7.89E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.21E-05	mg/kg-day	3.0E-03	1/(mg/kg-day)	0.007
				Cobalt	20.66	mg/Kg	3.61E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.01E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.03
				Copper	69.15	mg/Kg	1.21E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.38E-05	mg/kg-day	4.0E-02	1/(mg/kg-day)	0.0008
				Iron	21043	mg/Kg	3.68E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.03E-02	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.01
				Manganese	226.2	mg/Kg	3.95E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.11E-04	mg/kg-day	1.4E-01	1/(mg/kg-day)	0.0008
				Mercury	0.209	mg/Kg	3.65E-08	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.02E-07	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.0003
				Nickel	41.39	mg/Kg	7.23E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.02E-05	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.001
				Selenium	6.981	mg/Kg	1.22E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.42E-06	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.0007
				Thallium	3.8	mg/Kg	6.64E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.86E-06	mg/kg-day	6.5E-05	1/(mg/kg-day)	0.03
				Vanadium	112.9	mg/Kg	1.97E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	5.52E-05	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.01
				Zinc	61.5	mg/Kg	1.07E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.01E-05	mg/kg-day	3.0E-01	1/(mg/kg-day)	0.0001
			Exp. Route Total								2.E-05					0.2
		Exposure Point Total									2.E-05					0.2
	Exposure Medium Total										2.E-05					0.2
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	Aluminum	27361	mg/Kg	2.78E-03	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	7.78E-06	mg/m^3	5.0E-03	mg/m^3	0.002
				Arsenic	72.64	mg/Kg	7.37E-06	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	3.E-08	2.06E-08	mg/m^3	1.5E-05	mg/m^3	0.001
				Barium	945.3	mg/Kg	9.59E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.69E-07	mg/m^3	5.0E-04	mg/m^3	0.0005
				Beryllium	5.913	mg/Kg	6.00E-07	ug/m^3	2.4E-03	$(ug/m^3)^{-1}$	1.E-09	1.68E-09	mg/m^3	2.0E-05	mg/m^3	0.00008
				Boron	131.6	mg/Kg	1.34E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.74E-08	mg/m^3	2.0E-02	mg/m^3	0.000002
				Chromium	45.18	mg/Kg	4.59E-06	ug/m^3	1.2E-02	$(ug/m^3)^{-1}$	6.E-08	1.28E-08	mg/m^3	1.0E-04	mg/m^3	0.0001
				Cobalt	20.66	mg/Kg	2.10E-06	ug/m^3	9.0E-03	$(ug/m^3)^{-1}$	2.E-08	5.87E-09	mg/m^3	6.0E-06	mg/m^3	0.001
				Copper	69.15	mg/Kg	7.02E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.97E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Iron	21043	mg/Kg	2.14E-03	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.98E-06	mg/m^3	No toxicity value	mg/m^3	NA
				Manganese	226.2	mg/Kg	2.30E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	6.43E-08	mg/m^3	5.0E-05	mg/m^3	0.001
				Mercury	0.209	mg/Kg	2.12E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.94E-11	mg/m^3	3.0E-04	mg/m^3	0.0000002
				Nickel	41.39	mg/Kg	4.20E-06	ug/m^3	2.6E-04	$(ug/m^3)^{-1}$	1.E-09	1.18E-08	mg/m^3	9.0E-05	mg/m^3	0.0001
				Selenium	6.981	mg/Kg	7.09E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.98E-09	mg/m^3	2.0E-02	mg/m^3	0.0000001
				Thallium	3.8	mg/Kg	3.86E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.08E-09	mg/m^3	No toxicity value	mg/m^3	NA
				Vanadium	112.9	mg/Kg	1.15E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.21E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Zinc	61.5	mg/Kg	6.24E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.75E-08	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								1.E-07					0.006
		Exposure Point Total									1.E-07					0.006
	Exposure Medium Total										1.E-07					0.006
Medium Total											2.E-05					0.2

Bedrock Groundwater	Bedrock Groundwater	On-Site	Ingestion	Arsenic, total	3.26E-03	mg/L	1.14E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.E-05	3.19E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.1
				Barium, total	4.85E-01	mg/L	1.69E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.75E-03	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.02
				Boron, total	1.44E-01	mg/L	5.03E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.41E-03	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.01
				Iron, total	1.07E-01	mg/L	3.74E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.05E-03	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.001
				Manganese, total	9.50E-02	mg/L	3.32E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	9.30E-04	mg/kg-day	2.4E-02	1/(mg/kg-day)	0.04
				Strontium, total	4.51E-01	mg/L	1.58E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.41E-03	mg/kg-day	6.0E-01	1/(mg/kg-day)	0.01
			Exp. Route Total								2.E-05					0.2
		Exposure Point Total									2.E-05					0.2
Medium Total											2.E-05					0.2
										Total of Receptor Risks Across All Media	4.E-05				Total of Receptor Hazards Across All Media	0.4

TABLE 7.7.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	Aluminum	27361	mg/Kg	9.56E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.68E-02	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.03
				Arsenic	72.64	mg/Kg	2.54E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.E-05	7.11E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.2
				Barium	945.3	mg/Kg	3.30E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	9.25E-04	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.005
				Beryllium	5.913	mg/Kg	2.07E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	5.79E-06	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.003
				Boron	131.6	mg/Kg	4.60E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.29E-04	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.0006
				Chromium	45.18	mg/Kg	1.58E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.42E-05	mg/kg-day	3.0E-03	1/(mg/kg-day)	0.01
				Cobalt	20.66	mg/Kg	7.22E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.02E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.07
				Copper	69.15	mg/Kg	2.42E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	6.77E-05	mg/kg-day	4.0E-02	1/(mg/kg-day)	0.002
				Iron	21043	mg/Kg	7.35E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.06E-02	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.03
				Manganese	226.2	mg/Kg	7.90E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.21E-04	mg/kg-day	1.4E-01	1/(mg/kg-day)	0.002
				Mercury	0.209	mg/Kg	7.30E-08	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.05E-07	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.0007
				Nickel	41.39	mg/Kg	1.45E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.05E-05	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.002
				Selenium	6.981	mg/Kg	2.44E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	6.83E-06	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.001
				Thallium	3.8	mg/Kg	1.33E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.72E-06	mg/kg-day	6.5E-05	1/(mg/kg-day)	0.06
				Vanadium	112.9	mg/Kg	3.95E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.10E-04	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.02
				Zinc	61.5	mg/Kg	2.15E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	6.02E-05	mg/kg-day	3.0E-01	1/(mg/kg-day)	0.0002
			Exp. Route Total								4.E-05					0.5
			Dermal	Aluminum	27361	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.0E+00	1/(mg/kg-day)	NA
				Arsenic	72.64	mg/Kg	5.03E-06	mg/kg-day	1.6E+00	$(mg/kg\text{-}day)^{-1}$	8.E-06	1.41E-05	mg/kg-day	2.9E-04	1/(mg/kg-day)	0.05
				Barium	945.3	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-02	1/(mg/kg-day)	NA
				Beryllium	5.913	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-05	1/(mg/kg-day)	NA
				Boron	131.6	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.0E-01	1/(mg/kg-day)	NA
				Chromium	45.18	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.9E-05	1/(mg/kg-day)	NA
				Cobalt	20.66	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-04	1/(mg/kg-day)	NA
				Copper	69.15	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-02	1/(mg/kg-day)	NA
				Iron	21043	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	7.0E-01	1/(mg/kg-day)	NA
				Manganese	226.2	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	5.6E-03	1/(mg/kg-day)	NA
				Mercury	0.209	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.4E-04	1/(mg/kg-day)	NA
				Nickel	41.39	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	8.0E-04	1/(mg/kg-day)	NA
				Selenium	6.981	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-03	1/(mg/kg-day)	NA
				Thallium	3.8	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	6.5E-05	1/(mg/kg-day)	NA
				Vanadium	112.9	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.3E-04	1/(mg/kg-day)	NA
				Zinc	61.5	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-01	1/(mg/kg-day)	NA
			Exp. Route Total								8.E-06					0.05
		Exposure Point Total									5.E-05					0.5
	Exposure Medium Total										5.E-05					0.5
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	Aluminum	27361	mg/Kg	2.78E-03	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	7.78E-06	mg/m^3	5.0E-03	mg/m^3	0.002
				Arsenic	72.64	mg/Kg	7.37E-06	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	3.E-08	2.06E-08	mg/m^3	1.5E-05	mg/m^3	0.001
				Barium	945.3	mg/Kg	9.59E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.69E-07	mg/m^3	5.0E-04	mg/m^3	0.0005
				Beryllium	5.913	mg/Kg	6.00E-07	ug/m^3	2.4E-03	$(ug/m^3)^{-1}$	1.E-09	1.68E-09	mg/m^3	2.0E-05	mg/m^3	0.00008
				Boron	131.6	mg/Kg	1.34E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.74E-08	mg/m^3	2.0E-02	mg/m^3	0.000002
				Chromium	45.18	mg/Kg	4.59E-06	ug/m^3	1.2E-02	$(ug/m^3)^{-1}$	6.E-08	1.28E-08	mg/m^3	1.0E-04	mg/m^3	0.0001
				Cobalt	20.66	mg/Kg	2.10E-06	ug/m^3	9.0E-03	$(ug/m^3)^{-1}$	2.E-08	5.87E-09	mg/m^3	6.0E-06	mg/m^3	0.001
				Copper	69.15	mg/Kg	7.02E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.97E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Iron	21043	mg/Kg	2.14E-03	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.98E-06	mg/m^3	No toxicity value	mg/m^3	NA
				Manganese	226.2	mg/Kg	2.30E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	6.43E-08	mg/m^3	5.0E-05	mg/m^3	0.001
				Mercury	0.209	mg/Kg	2.12E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.94E-11	mg/m^3	3.0E-04	mg/m^3	0.0000002
				Nickel	41.39	mg/Kg	4.20E-06	ug/m^3	2.6E-04	$(ug/m^3)^{-1}$	1.E-09	1.18E-08	mg/m^3	9.0E-05	mg/m^3	0.0001
				Selenium	6.981	mg/Kg	7.09E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.98E-09	mg/m^3	2.0E-02	mg/m^3	0.0000001
				Thallium	3.8	mg/Kg	3.86E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.08E-09	mg/m^3	No toxicity value	mg/m^3	NA
				Vanadium	112.9	mg/Kg	1.15E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.21E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Zinc	61.5	mg/Kg	6.24E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.75E-08	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								1.E-07					0.006
		Exposure Point Total									1.E-07					0.006
	Exposure Medium Total										1.E-07					0.006
Medium Total											5.E-05					0.5
									Total of Receptor Risks Across All Media		5.E-05			Total of Receptor Hazards Across All Media		0.5

TABLE 7.8.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Groundskeeper
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	Aluminum	27361	mg/Kg	1.77E-02	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.95E-02	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.05
				Arsenic	72.64	mg/Kg	4.69E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	7.E-05	1.31E-04	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.4
				Barium	945.3	mg/Kg	6.10E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.71E-03	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.009
				Beryllium	5.913	mg/Kg	3.82E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.07E-05	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.005
				Boron	131.6	mg/Kg	8.50E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.38E-04	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.001
				Chromium	45.18	mg/Kg	2.92E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	8.17E-05	mg/kg-day	3.0E-03	1/(mg/kg-day)	0.03
				Cobalt	20.66	mg/Kg	1.33E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.74E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.1
				Copper	69.15	mg/Kg	4.47E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.25E-04	mg/kg-day	4.0E-02	1/(mg/kg-day)	0.003
				Iron	21043	mg/Kg	1.36E-02	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.81E-02	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.05
				Manganese	226.2	mg/Kg	1.46E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.09E-04	mg/kg-day	1.4E-01	1/(mg/kg-day)	0.003
				Mercury	0.209	mg/Kg	1.35E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.78E-07	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.001
				Nickel	41.39	mg/Kg	2.67E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	7.48E-05	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.004
				Selenium	6.981	mg/Kg	4.51E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.26E-05	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.003
				Thallium	3.8	mg/Kg	2.45E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	6.87E-06	mg/kg-day	6.5E-05	1/(mg/kg-day)	0.1
				Vanadium	112.9	mg/Kg	7.29E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.04E-04	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.04
				Zinc	61.5	mg/Kg	3.97E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.11E-04	mg/kg-day	3.0E-01	1/(mg/kg-day)	0.0004
			Exp. Route Total								7.E-05					0.9
			Dermal	Aluminum	27361	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.0E+00	1/(mg/kg-day)	NA
				Arsenic	72.64	mg/Kg	2.81E-06	mg/kg-day	1.6E+00	$(mg/kg\text{-}day)^{-1}$	4.E-06	7.88E-06	mg/kg-day	2.9E-04	1/(mg/kg-day)	0.03
				Barium	945.3	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-02	1/(mg/kg-day)	NA
				Beryllium	5.913	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-05	1/(mg/kg-day)	NA
				Boron	131.6	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.0E-01	1/(mg/kg-day)	NA
				Chromium	45.18	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.9E-05	1/(mg/kg-day)	NA
				Cobalt	20.66	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-04	1/(mg/kg-day)	NA
				Copper	69.15	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-02	1/(mg/kg-day)	NA
				Iron	21043	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	7.0E-01	1/(mg/kg-day)	NA
				Manganese	226.2	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	5.6E-03	1/(mg/kg-day)	NA
				Mercury	0.209	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.4E-04	1/(mg/kg-day)	NA
				Nickel	41.39	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	8.0E-04	1/(mg/kg-day)	NA
				Selenium	6.981	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-03	1/(mg/kg-day)	NA
				Thallium	3.8	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	6.5E-05	1/(mg/kg-day)	NA
				Vanadium	112.9	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.3E-04	1/(mg/kg-day)	NA
				Zinc	61.5	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-01	1/(mg/kg-day)	NA
			Exp. Route Total								4.E-06					0.03
		Exposure Point Total									7.E-05					0.9
	Exposure Medium Total										7.E-05					0.9
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	Aluminum	27361	mg/Kg	2.48E-03	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	6.95E-06	mg/m^3	5.0E-03	mg/m^3	0.001
				Arsenic	72.64	mg/Kg	6.59E-06	ug/m3	4.3E-03	$(ug/m^3)^{-1}$	3.E-08	1.85E-08	mg/m3	1.5E-05	mg/m3	0.001
				Barium	945.3	mg/Kg	8.58E-05	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.40E-07	mg/m3	5.0E-04	mg/m3	0.0005
				Beryllium	5.913	mg/Kg	5.36E-07	ug/m3	2.4E-03	$(ug/m^3)^{-1}$	1.E-09	1.50E-09	mg/m3	2.0E-05	mg/m3	0.00008
				Boron	131.6	mg/Kg	1.19E-05	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.34E-08	mg/m3	2.0E-02	mg/m3	0.000002
				Chromium	45.18	mg/Kg	4.10E-06	ug/m3	1.2E-02	$(ug/m^3)^{-1}$	5.E-08	1.15E-08	mg/m3	1.0E-04	mg/m3	0.0001
				Cobalt	20.66	mg/Kg	1.87E-06	ug/m3	9.0E-03	$(ug/m^3)^{-1}$	2.E-08	5.25E-09	mg/m3	6.0E-06	mg/m3	0.0009
				Copper	69.15	mg/Kg	6.27E-06	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.76E-08	mg/m3	No toxicity value	mg/m3	NA
				Iron	21043	mg/Kg	1.91E-03	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.35E-06	mg/m3	No toxicity value	mg/m3	NA
				Manganese	226.2	mg/Kg	2.05E-05	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.75E-08	mg/m3	5.0E-05	mg/m3	0.001
				Mercury	0.209	mg/Kg	1.90E-08	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.31E-11	mg/m3	3.0E-04	mg/m3	0.0000002
				Nickel	41.39	mg/Kg	3.75E-06	ug/m3	2.6E-04	$(ug/m^3)^{-1}$	1.E-09	1.05E-08	mg/m3	9.0E-05	mg/m3	0.0001
				Selenium	6.981	mg/Kg	6.33E-07	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.77E-09	mg/m3	2.0E-02	mg/m3	0.00000009
				Thallium	3.8	mg/Kg	3.45E-07	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	9.65E-10	mg/m3	No toxicity value	mg/m3	NA
				Vanadium	112.9	mg/Kg	1.02E-05	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.87E-08	mg/m3	No toxicity value	mg/m3	NA
				Zinc	61.5	mg/Kg	5.58E-06	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.56E-08	mg/m3	No toxicity value	mg/m3	NA
			Exp. Route Total								1.E-07					0.005
		Exposure Point Total									1.E-07					0.005
	Exposure Medium Total										1.E-07					0.005
Medium Total											7.E-05					0.9
									Total of Receptor Risks Across All Media		7.E-05			Total of Receptor Hazards Across All Media		0.9

TABLE 7.9.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	Aluminum	27361	mg/Kg	1.29E-02	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.75E-02	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.04
				Arsenic	72.64	mg/Kg	3.41E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	5.E-05	9.95E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.3
				Barium	945.3	mg/Kg	4.44E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.29E-03	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.006
				Beryllium	5.913	mg/Kg	2.78E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	8.10E-06	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.004
				Boron	131.6	mg/Kg	6.18E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.80E-04	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.0009
				Chromium	45.18	mg/Kg	2.12E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	6.19E-05	mg/kg-day	3.0E-03	1/(mg/kg-day)	0.02
				Cobalt	20.66	mg/Kg	9.70E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.83E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.09
				Copper	69.15	mg/Kg	3.25E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	9.47E-05	mg/kg-day	4.0E-02	1/(mg/kg-day)	0.002
				Iron	21043	mg/Kg	9.88E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.88E-02	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.04
				Manganese	226.2	mg/Kg	1.06E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.10E-04	mg/kg-day	1.4E-01	1/(mg/kg-day)	0.002
				Mercury	0.209	mg/Kg	9.82E-08	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.86E-07	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.001
				Nickel	41.39	mg/Kg	1.94E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	5.67E-05	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.003
				Selenium	6.981	mg/Kg	3.28E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	9.56E-06	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.002
				Thallium	3.8	mg/Kg	1.78E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	5.21E-06	mg/kg-day	6.5E-05	1/(mg/kg-day)	0.08
				Vanadium	112.9	mg/Kg	5.30E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.55E-04	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.03
				Zinc	61.5	mg/Kg	2.89E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	8.42E-05	mg/kg-day	3.0E-01	1/(mg/kg-day)	0.0003
			Exp. Route Total								5.E-05					0.7
			Dermal	Aluminum	27361	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.0E+00	1/(mg/kg-day)	NA
				Arsenic	72.64	mg/Kg	1.17E-05	mg/kg-day	1.6E+00	$(mg/kg\text{-}day)^{-1}$	2.E-05	3.40E-05	mg/kg-day	2.9E-04	1/(mg/kg-day)	0.1
				Barium	945.3	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-02	1/(mg/kg-day)	NA
				Beryllium	5.913	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-05	1/(mg/kg-day)	NA
				Boron	131.6	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.0E-01	1/(mg/kg-day)	NA
				Chromium	45.18	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.9E-05	1/(mg/kg-day)	NA
				Cobalt	20.66	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-04	1/(mg/kg-day)	NA
				Copper	69.15	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-02	1/(mg/kg-day)	NA
				Iron	21043	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	7.0E-01	1/(mg/kg-day)	NA
				Manganese	226.2	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	5.6E-03	1/(mg/kg-day)	NA
				Mercury	0.209	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.4E-04	1/(mg/kg-day)	NA
				Nickel	41.39	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	8.0E-04	1/(mg/kg-day)	NA
				Selenium	6.981	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-03	1/(mg/kg-day)	NA
				Thallium	3.8	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	6.5E-05	1/(mg/kg-day)	NA
				Vanadium	112.9	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.3E-04	1/(mg/kg-day)	NA
				Zinc	61.5	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-01	1/(mg/kg-day)	NA
			Exp. Route Total								2.E-05					0.1
		Exposure Point Total									7.E-05					0.8
	Exposure Medium Total										7.E-05					0.8
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	Aluminum	27361	mg/Kg	5.96E-03	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.74E-05	mg/m^3	5.0E-03	mg/m^3	0.003
				Arsenic	72.64	mg/Kg	1.58E-05	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	7.E-08	4.61E-08	mg/m^3	1.5E-05	mg/m^3	0.003
				Barium	945.3	mg/Kg	2.06E-04	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	6.00E-07	mg/m^3	5.0E-04	mg/m^3	0.001
				Beryllium	5.913	mg/Kg	1.29E-06	ug/m^3	2.4E-03	$(ug/m^3)^{-1}$	3.E-09	3.75E-09	mg/m^3	2.0E-05	mg/m^3	0.0002
				Boron	131.6	mg/Kg	2.87E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	8.36E-08	mg/m^3	2.0E-02	mg/m^3	0.000004
				Chromium	45.18	mg/Kg	9.84E-06	ug/m^3	1.2E-02	$(ug/m^3)^{-1}$	1.E-07	2.87E-08	mg/m^3	1.0E-04	mg/m^3	0.0003
				Cobalt	20.66	mg/Kg	4.50E-06	ug/m^3	9.0E-03	$(ug/m^3)^{-1}$	4.E-08	1.31E-08	mg/m^3	6.0E-06	mg/m^3	0.002
				Copper	69.15	mg/Kg	1.51E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.39E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Iron	21043	mg/Kg	4.58E-03	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.34E-05	mg/m^3	No toxicity value	mg/m^3	NA
				Manganese	226.2	mg/Kg	4.92E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.44E-07	mg/m^3	5.0E-05	mg/m^3	0.003
				Mercury	0.209	mg/Kg	4.55E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.33E-10	mg/m^3	3.0E-04	mg/m^3	0.0000004
				Nickel	41.39	mg/Kg	9.01E-06	ug/m^3	2.6E-04	$(ug/m^3)^{-1}$	2.E-09	2.63E-08	mg/m^3	9.0E-05	mg/m^3	0.0003
				Selenium	6.981	mg/Kg	1.52E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.43E-09	mg/m^3	2.0E-02	mg/m^3	0.0000002
				Thallium	3.8	mg/Kg	8.27E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.41E-09	mg/m^3	No toxicity value	mg/m^3	NA
				Vanadium	112.9	mg/Kg	2.46E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	7.17E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Zinc	61.5	mg/Kg	1.34E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.91E-08	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								2.E-07					0.01
		Exposure Point Total									2.E-07					0.01
	Exposure Medium Total										2.E-07					0.01
Medium Total											7.E-05					0.8

Bedrock Groundwater	Bedrock Groundwater	On-Site	Ingestion	Arsenic, total	3.26E-03	mg/L	3.06E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	5.E-05	8.93E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.3
				Barium, total	4.85E-01	mg/L	4.56E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.33E-02	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.1
				Boron, total	1.44E-01	mg/L	1.35E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.95E-03	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.02
				Iron, total	1.07E-01	mg/L	1.01E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.93E-03	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.004
				Manganese, total	9.50E-02	mg/L	8.92E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.60E-03	mg/kg-day	2.4E-02	1/(mg/kg-day)	0.11
				Strontium, total	4.51E-01	mg/L	4.24E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.24E-02	mg/kg-day	6.0E-01	1/(mg/kg-day)	0.02
			Exp. Route Total								5.E-05					0.5
		Exposure Point Total									5.E-05					0.5
		On-Site	Dermal	Arsenic, total	3.26E-03	mg/L	1.60E-07	mg/kg-day	1.6E+00	$(mg/kg\text{-}day)^{-1}$	3.E-07	4.66E-07	mg/kg-day	2.9E-04	1/(mg/kg-day)	0.002
				Barium, total	4.85E-01	mg/L	2.38E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	6.94E-05	mg/kg-day	1.4E-02	1/(mg/kg-day)	0.005
				Boron, total	1.44E-01	mg/L	7.06E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.06E-05	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.0001
				Iron, total	1.07E-01	mg/L	5.25E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.53E-05	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.0000
				Manganese, total	9.50E-02	mg/L	4.66E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.36E-05	mg/kg-day	9.6E-04	1/(mg/kg-day)	0.0142
				Strontium, total	4.51E-01	mg/L	2.21E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	6.45E-05	mg/kg-day	6.0E-01	1/(mg/kg-day)	0.000
			Exp. Route Total								3.E-07					0.021
		Exposure Point Total									5.E-05					0.5
	Exposure Medium Total										5.E-05					0.5
Medium Total											5.E-05					0.5
										Total of Receptor Risks Across All Media	1.E-04	Total of Receptor Hazards Across All Media				1

TABLE 7.10.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	Aluminum	27361	mg/Kg	3.00E-02	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.50E-01	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.3
				Arsenic	72.64	mg/Kg	7.96E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.E-04	9.29E-04	mg/kg-day	3.0E-04	1/(mg/kg-day)	3
				Barium	945.3	mg/Kg	1.04E-03	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.21E-02	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.06
				Beryllium	5.913	mg/Kg	6.48E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	7.56E-05	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.04
				Boron	131.6	mg/Kg	1.44E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.68E-03	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.008
				Chromium	45.18	mg/Kg	4.95E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	5.78E-04	mg/kg-day	3.0E-03	1/(mg/kg-day)	0.2
				Cobalt	20.66	mg/Kg	2.26E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.64E-04	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.9
				Copper	69.15	mg/Kg	7.58E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	8.84E-04	mg/kg-day	4.0E-02	1/(mg/kg-day)	0.02
				Iron	21043	mg/Kg	2.31E-02	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.69E-01	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.4
				Manganese	226.2	mg/Kg	2.48E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.89E-03	mg/kg-day	1.4E-01	1/(mg/kg-day)	0.02
				Mercury	0.209	mg/Kg	2.29E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.67E-06	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.009
				Nickel	41.39	mg/Kg	4.54E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	5.29E-04	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.03
				Selenium	6.981	mg/Kg	7.65E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	8.93E-05	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.02
				Thallium	3.8	mg/Kg	4.16E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.86E-05	mg/kg-day	6.5E-05	1/(mg/kg-day)	0.7
				Vanadium	112.9	mg/Kg	1.24E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.44E-03	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.3
				Zinc	61.5	mg/Kg	6.74E-05	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	7.86E-04	mg/kg-day	3.0E-01	1/(mg/kg-day)	0.003
			Exp. Route Total								1.E-04					6
			Dermal	Aluminum	27361	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.0E+00	1/(mg/kg-day)	NA
				Arsenic	72.64	mg/Kg	6.69E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.E-05	7.80E-05	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.3
				Barium	945.3	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.0E-01	1/(mg/kg-day)	NA
				Beryllium	5.913	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.0E-03	1/(mg/kg-day)	NA
				Boron	131.6	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.0E-01	1/(mg/kg-day)	NA
				Chromium	45.18	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-03	1/(mg/kg-day)	NA
				Cobalt	20.66	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-04	1/(mg/kg-day)	NA
				Copper	69.15	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-02	1/(mg/kg-day)	NA
				Iron	21043	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	7.0E-01	1/(mg/kg-day)	NA
				Manganese	226.2	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-01	1/(mg/kg-day)	NA
				Mercury	0.209	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-04	1/(mg/kg-day)	NA
				Nickel	41.39	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.0E-02	1/(mg/kg-day)	NA
				Selenium	6.981	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	5.0E-03	1/(mg/kg-day)	NA
				Thallium	3.8	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	6.5E-05	1/(mg/kg-day)	NA
				Vanadium	112.9	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	5.0E-03	1/(mg/kg-day)	NA
				Zinc	61.5	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-01	1/(mg/kg-day)	NA
			Exp. Route Total								1.E-05					0.3
		Exposure Point Total									1.E-04					6
	Exposure Medium Total										1.E-04					6
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	Aluminum	27361	mg/Kg	1.49E-03	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.74E-05	mg/m^3	5.0E-03	mg/m^3	0.003
				Arsenic	72.64	mg/Kg	3.95E-06	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	2.E-08	4.61E-08	mg/m^3	1.5E-05	mg/m^3	0.003
				Barium	945.3	mg/Kg	5.15E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	6.00E-07	mg/m^3	5.0E-04	mg/m^3	0.001
				Beryllium	5.913	mg/Kg	3.22E-07	ug/m^3	2.4E-03	$(ug/m^3)^{-1}$	8.E-10	3.75E-09	mg/m^3	2.0E-05	mg/m^3	0.0002
				Boron	131.6	mg/Kg	7.16E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	8.36E-08	mg/m^3	2.0E-02	mg/m^3	0.000004
				Chromium	45.18	mg/Kg	2.46E-06	ug/m^3	1.2E-02	$(ug/m^3)^{-1}$	3.E-08	2.87E-08	mg/m^3	1.0E-04	mg/m^3	0.0003
				Cobalt	20.66	mg/Kg	1.12E-06	ug/m^3	9.0E-03	$(ug/m^3)^{-1}$	1.E-08	1.31E-08	mg/m^3	6.0E-06	mg/m^3	0.002
				Copper	69.15	mg/Kg	3.76E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.39E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Iron	21043	mg/Kg	1.15E-03	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.34E-05	mg/m^3	No toxicity value	mg/m^3	NA
				Manganese	226.2	mg/Kg	1.23E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.44E-07	mg/m^3	5.0E-05	mg/m^3	0.003
				Mercury	0.209	mg/Kg	1.14E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.33E-10	mg/m^3	3.0E-04	mg/m^3	0.0000004
				Nickel	41.39	mg/Kg	2.25E-06	ug/m^3	2.6E-04	$(ug/m^3)^{-1}$	6.E-10	2.63E-08	mg/m^3	9.0E-05	mg/m^3	0.0003
				Selenium	6.981	mg/Kg	3.80E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	4.43E-09	mg/m^3	2.0E-02	mg/m^3	0.0000002
				Thallium	3.8	mg/Kg	2.07E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.41E-09	mg/m^3	No toxicity value	mg/m^3	NA
				Vanadium	112.9	mg/Kg	6.15E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	7.17E-08	mg/m^3	No toxicity value	mg/m^3	NA
				Zinc	61.5	mg/Kg	3.35E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.91E-08	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								6.E-08					0.01
		Exposure Point Total									6.E-08					0.01
	Exposure Medium Total										6.E-08					0.01
Medium Total											1.E-04					6

Bedrock Groundwater	Bedrock Groundwater	On-Site	Ingestion	Arsenic, total	3.26E-03	mg/L	1.79E-05		1.5E+00	(mg/kg-day)$^{-1}$	3.E-05	2.08E-04		3.0E-04	1/(mg/kg-day)	0.7
				Barium, total	4.85E-01	mg/L	2.66E-03		No toxicity value	(mg/kg-day)$^{-1}$	NA	3.10E-02		2.0E-01	1/(mg/kg-day)	0.2
				Boron, total	1.44E-01	mg/L	7.89E-04		No toxicity value	(mg/kg-day)$^{-1}$	NA	9.21E-03		2.0E-01	1/(mg/kg-day)	0.05
				Iron, total	1.07E-01	mg/L	5.86E-04		No toxicity value	(mg/kg-day)$^{-1}$	NA	6.84E-03		7.0E-01	1/(mg/kg-day)	0.01
				Manganese, total	9.50E-02	mg/L	5.21E-04		No toxicity value	(mg/kg-day)$^{-1}$	NA	6.07E-03		2.4E-02	1/(mg/kg-day)	0.3
				Strontium, total	4.51E-01	mg/L	2.47E-03		No toxicity value	(mg/kg-day)$^{-1}$	NA	2.88E-02		6.0E-01	1/(mg/kg-day)	0.05
			Exp. Route Total								3.E-05					1
		Exposure Point Total									3.E-05					1
		On-Site	Dermal	Arsenic, total	3.26E-03	mg/L	1.18E-07		1.6E+00	(mg/kg-day)$^{-1}$	2.E-07	1.38E-06		2.9E-04	1/(mg/kg-day)	0.00483
				Barium, total	4.85E-01	mg/L	1.75E-05		No toxicity value	(mg/kg-day)$^{-1}$	NA	2.05E-04		1.4E-02	1/(mg/kg-day)	0.015
				Boron, total	1.44E-01	mg/L	5.21E-06		No toxicity value	(mg/kg-day)$^{-1}$	NA	6.08E-05		2.0E-01	1/(mg/kg-day)	0.0003
				Iron, total	1.07E-01	mg/L	3.87E-06		No toxicity value	(mg/kg-day)$^{-1}$	NA	4.51E-05		7.0E-01	1/(mg/kg-day)	0.0001
				Manganese, total	9.50E-02	mg/L	3.44E-06		No toxicity value	(mg/kg-day)$^{-1}$	NA	4.01E-05		9.6E-04	1/(mg/kg-day)	0.042
				Strontium, total	4.51E-01	mg/L	1.63E-05		No toxicity value	(mg/kg-day)$^{-1}$	NA	1.90E-04		6.0E-01	1/(mg/kg-day)	0.0003
			Exp. Route Total								2.E-07					0.06
		Exposure Point Total									3.E-05					1
	Exposure Medium Total										3.E-05					1
Medium Total											3.E-05					1
										Total of Receptor Risks Across All Media	2.E-04	Total of Receptor Hazards Across All Media				8

TABLE 7.11.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Recreator
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	Aluminum	27361	mg/Kg	1.93E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	5.62E-04	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.0006
				Arsenic	72.64	mg/Kg	5.12E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	8.E-07	1.49E-06	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.005
				Barium	945.3	mg/Kg	6.66E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.94E-05	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.0001
				Beryllium	5.913	mg/Kg	4.17E-08	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.22E-07	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.00006
				Boron	131.6	mg/Kg	9.27E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.70E-06	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.00001
				Chromium	45.18	mg/Kg	3.18E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	9.28E-07	mg/kg-day	3.0E-03	1/(mg/kg-day)	0.0003
				Cobalt	20.66	mg/Kg	1.46E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.25E-07	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.001
				Copper	69.15	mg/Kg	4.87E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.42E-06	mg/kg-day	4.0E-02	1/(mg/kg-day)	0.00004
				Iron	21043	mg/Kg	1.48E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.32E-04	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.0006
				Manganese	226.2	mg/Kg	1.59E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.65E-06	mg/kg-day	1.4E-01	1/(mg/kg-day)	0.00003
				Mercury	0.209	mg/Kg	1.47E-09	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.29E-09	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.00001
				Nickel	41.39	mg/Kg	2.92E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	8.50E-07	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.00004
				Selenium	6.981	mg/Kg	4.92E-08	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.43E-07	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.00003
				Thallium	3.8	mg/Kg	2.68E-08	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	7.81E-08	mg/kg-day	6.5E-05	1/(mg/kg-day)	0.001
				Vanadium	112.9	mg/Kg	7.95E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.32E-06	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.0005
				Zinc	61.5	mg/Kg	4.33E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.26E-06	mg/kg-day	3.0E-01	1/(mg/kg-day)	0.000004
			Exp. Route Total								8.E-07					0.01
			Dermal	Aluminum	27361	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.0E+00	1/(mg/kg-day)	NA
				Arsenic	72.64	mg/Kg	1.75E-07	mg/kg-day	1.6E+00	$(mg/kg\text{-}day)^{-1}$	3.E-07	5.10E-07	mg/kg-day	2.9E-04	1/(mg/kg-day)	0.002
				Barium	945.3	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-02	1/(mg/kg-day)	NA
				Beryllium	5.913	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-05	1/(mg/kg-day)	NA
				Boron	131.6	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.0E-01	1/(mg/kg-day)	NA
				Chromium	45.18	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.9E-05	1/(mg/kg-day)	NA
				Cobalt	20.66	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-04	1/(mg/kg-day)	NA
				Copper	69.15	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-02	1/(mg/kg-day)	NA
				Iron	21043	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	7.0E-01	1/(mg/kg-day)	NA
				Manganese	226.2	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	5.6E-03	1/(mg/kg-day)	NA
				Mercury	0.209	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.4E-04	1/(mg/kg-day)	NA
				Nickel	41.39	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	8.0E-04	1/(mg/kg-day)	NA
				Selenium	6.981	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-03	1/(mg/kg-day)	NA
				Thallium	3.8	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	6.5E-05	1/(mg/kg-day)	NA
				Vanadium	112.9	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.3E-04	1/(mg/kg-day)	NA
				Zinc	61.5	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-01	1/(mg/kg-day)	NA
			Exp. Route Total								3.E-07					0.002
		Exposure Point Total									1.E-06					0.01
	Exposure Medium Total										1.E-06					0.01
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	Aluminum	27361	mg/Kg	8.94E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.61E-07	mg/m^3	5.0E-03	mg/m^3	0.00005
				Arsenic	72.64	mg/Kg	2.37E-07	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	1.E-09	6.92E-10	mg/m^3	1.5E-05	mg/m^3	0.00005
				Barium	945.3	mg/Kg	3.09E-06	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	9.00E-09	mg/m^3	5.0E-04	mg/m^3	0.00002
				Beryllium	5.913	mg/Kg	1.93E-08	ug/m^3	2.4E-03	$(ug/m^3)^{-1}$	5.E-11	5.63E-11	mg/m^3	2.0E-05	mg/m^3	0.000003
				Boron	131.6	mg/Kg	4.30E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.25E-09	mg/m^3	2.0E-02	mg/m^3	0.00000006
				Chromium	45.18	mg/Kg	1.48E-07	ug/m^3	1.2E-02	$(ug/m^3)^{-1}$	2.E-09	4.30E-10	mg/m^3	1.0E-04	mg/m^3	0.000004
				Cobalt	20.66	mg/Kg	6.75E-08	ug/m^3	9.0E-03	$(ug/m^3)^{-1}$	6.E-10	1.97E-10	mg/m^3	6.0E-06	mg/m^3	0.00003
				Copper	69.15	mg/Kg	2.26E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	6.59E-10	mg/m^3	No toxicity value	mg/m^3	NA
				Iron	21043	mg/Kg	6.87E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.00E-07	mg/m^3	No toxicity value	mg/m^3	NA
				Manganese	226.2	mg/Kg	7.39E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.15E-09	mg/m^3	5.0E-05	mg/m^3	0.00004
				Mercury	0.209	mg/Kg	6.83E-10	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.99E-12	mg/m^3	3.0E-04	mg/m^3	0.000000007
				Nickel	41.39	mg/Kg	1.35E-07	ug/m^3	2.6E-04	$(ug/m^3)^{-1}$	4.E-11	3.94E-10	mg/m^3	9.0E-05	mg/m^3	0.000004
				Selenium	6.981	mg/Kg	2.28E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	6.65E-11	mg/m^3	2.0E-02	mg/m^3	0.000000003
				Thallium	3.8	mg/Kg	1.24E-08	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.62E-11	mg/m^3	No toxicity value	mg/m^3	NA
				Vanadium	112.9	mg/Kg	3.69E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.08E-09	mg/m^3	No toxicity value	mg/m^3	NA
				Zinc	61.5	mg/Kg	2.01E-07	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.86E-10	mg/m^3	No toxicity value	mg/m^3	NA
			Exp. Route Total								3.E-09					0.0002
		Exposure Point Total									3.E-09					0.0002
	Exposure Medium Total										3.E-09					0.0002
Medium Total											1.E-06					0.01
									Total of Receptor Risks Across All Media		1.E-06			Total of Receptor Hazards Across All Media		0.01

TABLE 7.12.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Recreator
Receptor Age:	Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	Aluminum	27361	mg/Kg	2.50E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.75E-03	mg/kg-day	1.0E+00	1/(mg/kg-day)	0.002
				Arsenic	72.64	mg/Kg	6.63E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.E-06	4.64E-06	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.02
				Barium	945.3	mg/Kg	8.63E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	6.04E-05	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.0003
				Beryllium	5.913	mg/Kg	5.40E-08	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.78E-07	mg/kg-day	2.0E-03	1/(mg/kg-day)	0.0002
				Boron	131.6	mg/Kg	1.20E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	8.41E-06	mg/kg-day	2.0E-01	1/(mg/kg-day)	0.00004
				Chromium	45.18	mg/Kg	4.13E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.89E-06	mg/kg-day	3.0E-03	1/(mg/kg-day)	0.001
				Cobalt	20.66	mg/Kg	1.89E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.32E-06	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.004
				Copper	69.15	mg/Kg	6.32E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.42E-06	mg/kg-day	4.0E-02	1/(mg/kg-day)	0.0001
				Iron	21043	mg/Kg	1.92E-04	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.35E-03	mg/kg-day	7.0E-01	1/(mg/kg-day)	0.002
				Manganese	226.2	mg/Kg	2.07E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.45E-05	mg/kg-day	1.4E-01	1/(mg/kg-day)	0.0001
				Mercury	0.209	mg/Kg	1.91E-09	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	1.34E-08	mg/kg-day	3.0E-04	1/(mg/kg-day)	0.00004
				Nickel	41.39	mg/Kg	3.78E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.65E-06	mg/kg-day	2.0E-02	1/(mg/kg-day)	0.0001
				Selenium	6.981	mg/Kg	6.38E-08	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	4.46E-07	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.00009
				Thallium	3.8	mg/Kg	3.47E-08	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	2.43E-07	mg/kg-day	6.5E-05	1/(mg/kg-day)	0.004
				Vanadium	112.9	mg/Kg	1.03E-06	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	7.22E-06	mg/kg-day	5.0E-03	1/(mg/kg-day)	0.001
				Zinc	61.5	mg/Kg	5.62E-07	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	3.93E-06	mg/kg-day	3.0E-01	1/(mg/kg-day)	0.00001
			Exp. Route Total								1.E-06					0.03
			Dermal	Aluminum	27361	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.0E+00	1/(mg/kg-day)	NA
				Arsenic	72.64	mg/Kg	5.57E-08	mg/kg-day	1.6E+00	$(mg/kg\text{-}day)^{-1}$	9.E-08	3.90E-07	mg/kg-day	2.9E-04	1/(mg/kg-day)	0.001
				Barium	945.3	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-02	1/(mg/kg-day)	NA
				Beryllium	5.913	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.4E-05	1/(mg/kg-day)	NA
				Boron	131.6	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.0E-01	1/(mg/kg-day)	NA
				Chromium	45.18	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.9E-05	1/(mg/kg-day)	NA
				Cobalt	20.66	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-04	1/(mg/kg-day)	NA
				Copper	69.15	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-02	1/(mg/kg-day)	NA
				Iron	21043	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	7.0E-01	1/(mg/kg-day)	NA
				Manganese	226.2	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	5.6E-03	1/(mg/kg-day)	NA
				Mercury	0.209	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	2.4E-04	1/(mg/kg-day)	NA
				Nickel	41.39	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	8.0E-04	1/(mg/kg-day)	NA
				Selenium	6.981	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	4.0E-03	1/(mg/kg-day)	NA
				Thallium	3.8	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	6.5E-05	1/(mg/kg-day)	NA
				Vanadium	112.9	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	1.3E-04	1/(mg/kg-day)	NA
				Zinc	61.5	mg/Kg	ND	mg/kg-day	No toxicity value	$(mg/kg\text{-}day)^{-1}$	NA	ND	mg/kg-day	3.0E-01	1/(mg/kg-day)	NA
			Exp. Route Total								9.E-08					0.001
		Exposure Point Total									1.E-06					0.03
	Exposure Medium Total										1.E-06					0.03
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	Aluminum	27361	mg/Kg	3.72E-05	ug/m^3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.61E-07	mg/m^3	5.0E-03	mg/m^3	0.00005
				Arsenic	72.64	mg/Kg	9.88E-08	ug/m3	4.3E-03	$(ug/m^3)^{-1}$	4.E-10	6.92E-10	mg/m3	1.5E-05	mg/m3	0.00005
				Barium	945.3	mg/Kg	1.29E-06	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	9.00E-09	mg/m3	5.0E-04	mg/m3	0.00002
				Beryllium	5.913	mg/Kg	8.05E-09	ug/m3	2.4E-03	$(ug/m^3)^{-1}$	2.E-11	5.63E-11	mg/m3	2.0E-05	mg/m3	0.000003
				Boron	131.6	mg/Kg	1.79E-07	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.25E-09	mg/m3	2.0E-02	mg/m3	0.00000006
				Chromium	45.18	mg/Kg	6.15E-08	ug/m3	1.2E-02	$(ug/m^3)^{-1}$	7.E-10	4.30E-10	mg/m3	1.0E-04	mg/m3	0.000004
				Cobalt	20.66	mg/Kg	2.81E-08	ug/m3	9.0E-03	$(ug/m^3)^{-1}$	3.E-10	1.97E-10	mg/m3	6.0E-06	mg/m3	0.00003
				Copper	69.15	mg/Kg	9.41E-08	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	6.59E-10	mg/m3	No toxicity value	mg/m3	NA
				Iron	21043	mg/Kg	2.86E-05	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.00E-07	mg/m3	No toxicity value	mg/m3	NA
				Manganese	226.2	mg/Kg	3.08E-07	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	2.15E-09	mg/m3	5.0E-05	mg/m3	0.00004
				Mercury	0.209	mg/Kg	2.84E-10	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.99E-12	mg/m3	3.0E-04	mg/m3	0.000000007
				Nickel	41.39	mg/Kg	5.63E-08	ug/m3	2.6E-04	$(ug/m^3)^{-1}$	1.E-11	3.94E-10	mg/m3	9.0E-05	mg/m3	0.000004
				Selenium	6.981	mg/Kg	9.50E-09	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	6.65E-11	mg/m3	2.0E-02	mg/m3	0.000000003
				Thallium	3.8	mg/Kg	5.17E-09	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	3.62E-11	mg/m3	No toxicity value	mg/m3	NA
				Vanadium	112.9	mg/Kg	1.54E-07	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	1.08E-09	mg/m3	No toxicity value	mg/m3	NA
				Zinc	61.5	mg/Kg	8.37E-08	ug/m3	No toxicity value	$(ug/m^3)^{-1}$	NA	5.86E-10	mg/m3	No toxicity value	mg/m3	NA
			Exp. Route Total								1.E-09					0.0002
		Exposure Point Total									1.E-09					0.0002
	Exposure Medium Total										1.E-09					0.0002
Medium Total											1.E-06					0.03
									Total of Receptor Risks Across All Media		1.E-06			Total of Receptor Hazards Across All Media		0.03

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Ingestion	K-40	20.041	pCi/g	US EPA RAGS Part A	1.25E+03	pCi	6.18E-11	risk/pCi	8.E-08
				Ra-226	4.7131	pCi/g	US EPA RAGS Part A	2.95E+02	pCi	7.30E-10	risk/pCi	2.E-07
				Ra-228	3.1458	pCi/g	US EPA RAGS Part A	1.97E+02	pCi	2.29E-09	risk/pCi	5.E-07
				TH-228	0.6706	pCi/g	US EPA RAGS Part A	4.19E+01	pCi	8.09E-10	risk/pCi	3.E-08
				TH-232	0.8799	pCi/g	US EPA RAGS Part A	5.50E+01	pCi	2.31E-10	risk/pCi	1.E-08
				U-234	1.4427	pCi/g	US EPA RAGS Part A	9.02E+01	pCi	1.58E-10	risk/pCi	1.E-08
				U-235	0.0987	pCi/g	US EPA RAGS Part A	6.17E+00	pCi	1.63E-10	risk/pCi	1.E-09
				U-238	1.4147	pCi/g	US EPA RAGS Part A	8.84E+01	pCi	2.10E-10	risk/pCi	2.E-08
			Exp. Route Total									8.E-07
			External Exposure	K-40	20.041	pCi/g	US EPA RAGS Part A	3.66E+00	pCi	1.42E-07	risk/yr per pCi/g	5.E-07
				Ra-226	4.7131	pCi/g	US EPA RAGS Part A	8.60E-01	pCi	1.54E-06	risk/yr per pCi/g	1.E-06
				Ra-228	3.1458	pCi/g	US EPA RAGS Part A	5.74E-01	pCi	2.16E-06	risk/yr per pCi/g	1.E-06
				TH-228	0.6706	pCi/g	US EPA RAGS Part A	1.22E-01	pCi	1.30E-06	risk/yr per pCi/g	2.E-07
				TH-232	0.8799	pCi/g	US EPA RAGS Part A	1.61E-01	pCi	3.20E-10	risk/yr per pCi/g	5.E-11
				U-234	1.4427	pCi/g	US EPA RAGS Part A	2.63E-01	pCi	3.84E-10	risk/yr per pCi/g	1.E-10
				U-235	0.0987	pCi/g	US EPA RAGS Part A	1.80E-02	pCi	1.31E-07	risk/yr per pCi/g	2.E-09
				U-238	1.4147	pCi/g	US EPA RAGS Part A	2.58E-01	pCi	3.71E-08	risk/yr per pCi/g	1.E-08
			Exp. Route Total									3.E-06
		Exposure Point Total										4.E-06
	Exposure Medium Total											
	Air	Current - Properties Adjacent to KIF or at the KIF Facility	Inhalation	K-40	20.041	pCi/g	US EPA RAGS Part A	2.08E-07	pCi	1.03E-11	risk/pCi	2.E-18
				Ra-226	4.7131	pCi/g	US EPA RAGS Part A	4.89E-08	pCi	1.15E-08	risk/pCi	6.E-16
				Ra-228	3.1458	pCi/g	US EPA RAGS Part A	3.26E-08	pCi	5.23E-09	risk/pCi	2.E-16
				TH-228	0.6706	pCi/g	US EPA RAGS Part A	6.96E-09	pCi	1.43E-07	risk/pCi	1.E-15
				TH-232	0.8799	pCi/g	US EPA RAGS Part A	9.13E-09	pCi	4.33E-08	risk/pCi	4.E-16
				U-234	1.4427	pCi/g	US EPA RAGS Part A	1.50E-08	pCi	1.14E-08	risk/pCi	2.E-16
				U-235	0.0987	pCi/g	US EPA RAGS Part A	1.02E-09	pCi	1.01E-08	risk/pCi	1.E-17
				U-238	1.4147	pCi/g	US EPA RAGS Part A	1.47E-08	pCi	9.35E-09	risk/pCi	1.E-16
			Exp. Route Total									2.E-15
		Exposure Point Total										2.E-15
	Exposure Medium Total											4.E-06
Medium Total												4.E-06

Total of Receptor Risks Across All Media 4.E-06

TABLE 8.2.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Ingestion	K-40	20.041	pCi/g	US EPA RAGS Part A	2.51E+03	pCi	6.18E-11	risk/pCi	2.E-07
				Ra-226	4.7131	pCi/g	US EPA RAGS Part A	5.89E+02	pCi	7.30E-10	risk/pCi	4.E-07
				Ra-228	3.1458	pCi/g	US EPA RAGS Part A	3.93E+02	pCi	2.29E-09	risk/pCi	9.E-07
				TH-228	0.6706	pCi/g	US EPA RAGS Part A	8.38E+01	pCi	8.09E-10	risk/pCi	7.E-08
				TH-232	0.8799	pCi/g	US EPA RAGS Part A	1.10E+02	pCi	2.31E-10	risk/pCi	3.E-08
				U-234	1.4427	pCi/g	US EPA RAGS Part A	1.80E+02	pCi	1.58E-10	risk/pCi	3.E-08
				U-235	0.0987	pCi/g	US EPA RAGS Part A	1.23E+01	pCi	1.63E-10	risk/pCi	2.E-09
				U-238	1.4147	pCi/g	US EPA RAGS Part A	1.77E+02	pCi	2.10E-10	risk/pCi	4.E-08
			Exp. Route Total									2.E-06
			External Exposure	K-40	20.041	pCi/g	US EPA RAGS Part A	9.14E+00	pCi	1.42E-07	risk/yr per pCi/g	1.E-06
				Ra-226	4.7131	pCi/g	US EPA RAGS Part A	2.15E+00	pCi	1.54E-06	risk/yr per pCi/g	3.E-06
				Ra-228	3.1458	pCi/g	US EPA RAGS Part A	1.44E+00	pCi	2.16E-06	risk/yr per pCi/g	3.E-06
				TH-228	0.6706	pCi/g	US EPA RAGS Part A	3.06E-01	pCi	1.30E-06	risk/yr per pCi/g	4.E-07
				TH-232	0.8799	pCi/g	US EPA RAGS Part A	4.01E-01	pCi	3.20E-10	risk/yr per pCi/g	1.E-10
				U-234	1.4427	pCi/g	US EPA RAGS Part A	6.58E-01	pCi	3.84E-10	risk/yr per pCi/g	3.E-10
				U-235	0.0987	pCi/g	US EPA RAGS Part A	4.50E-02	pCi	1.31E-07	risk/yr per pCi/g	6.E-09
				U-238	1.4147	pCi/g	US EPA RAGS Part A	6.45E-01	pCi	3.71E-08	risk/yr per pCi/g	2.E-08
			Exp. Route Total									8.E-06
		Exposure Point Total										1.E-05
	Exposure Medium Total											
	Air	Current - Properties Adjacent to KIF or at the KIF Facility	Inhalation	K-40	20.041	pCi/g	US EPA RAGS Part A	2.08E-07	pCi	1.03E-11	risk/pCi	2.E-18
				Ra-226	4.7131	pCi/g	US EPA RAGS Part A	4.89E-08	pCi	1.15E-08	risk/pCi	6.E-16
				Ra-228	3.1458	pCi/g	US EPA RAGS Part A	3.26E-08	pCi	5.23E-09	risk/pCi	2.E-16
				TH-228	0.6706	pCi/g	US EPA RAGS Part A	6.96E-09	pCi	1.43E-07	risk/pCi	1.E-15
				TH-232	0.8799	pCi/g	US EPA RAGS Part A	9.13E-09	pCi	4.33E-08	risk/pCi	4.E-16
				U-234	1.4427	pCi/g	US EPA RAGS Part A	1.50E-08	pCi	1.14E-08	risk/pCi	2.E-16
				U-235	0.0987	pCi/g	US EPA RAGS Part A	1.02E-09	pCi	1.01E-08	risk/pCi	1.E-17
				U-238	1.4147	pCi/g	US EPA RAGS Part A	1.47E-08	pCi	9.35E-09	risk/pCi	1.E-16
			Exp. Route Total									2.E-15
		Exposure Point Total										2.E-15
	Exposure Medium Total											1.E-05
Medium Total												1.E-05

Total of Receptor Risks Across All Media	1.E-05

TABLE 8.3.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
	Air	Current - Properties Adjacent to KIF or at the KIF Facility	Inhalation	K-40	28.63	pCi/g	US EPA RAGS Part A	4.16E-07	pCi	1.03E-11	risk/pCi	4.E-18
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	9.78E-08	pCi	1.15E-08	risk/pCi	1.E-15
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	6.53E-08	pCi	5.23E-09	risk/pCi	3.E-16
				TH-228	0.958	pCi/g	US EPA RAGS Part A	1.39E-08	pCi	1.43E-07	risk/pCi	2.E-15
				TH-232	1.257	pCi/g	US EPA RAGS Part A	1.83E-08	pCi	4.33E-08	risk/pCi	8.E-16
				U-234	2.061	pCi/g	US EPA RAGS Part A	2.99E-08	pCi	1.14E-08	risk/pCi	3.E-16
				U-235	0.141	pCi/g	US EPA RAGS Part A	2.05E-09	pCi	1.01E-08	risk/pCi	2.E-17
				U-238	2.021	pCi/g	US EPA RAGS Part A	2.94E-08	pCi	9.35E-09	risk/pCi	3.E-16
			Exp. Route Total									5.E-15
		Exposure Point Total										5.E-15
	Exposure Medium Total											5.E-15
Medium Total												5.E-15

Total of Receptor Risks Across All Media	5.E-15

TABLE 8.4.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
	Air	Current - Properties Adjacent to KIF or at the KIF Facility	Inhalation	K-40	28.63	pCi/g	US EPA RAGS Part A	4.16E-07	pCi	1.03E-11	risk/pCi	4.E-18
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	9.78E-08	pCi	1.15E-08	risk/pCi	1.E-15
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	6.53E-08	pCi	5.23E-09	risk/pCi	3.E-16
				TH-228	0.958	pCi/g	US EPA RAGS Part A	1.39E-08	pCi	1.43E-07	risk/pCi	2.E-15
				TH-232	1.257	pCi/g	US EPA RAGS Part A	1.83E-08	pCi	4.33E-08	risk/pCi	8.E-16
				U-234	2.061	pCi/g	US EPA RAGS Part A	2.99E-08	pCi	1.14E-08	risk/pCi	3.E-16
				U-235	0.141	pCi/g	US EPA RAGS Part A	2.05E-09	pCi	1.01E-08	risk/pCi	2.E-17
				U-238	2.021	pCi/g	US EPA RAGS Part A	2.94E-08	pCi	9.35E-09	risk/pCi	3.E-16
			Exp. Route Total									5.E-15
		Exposure Point Total										5.E-15
	Exposure Medium Total											5.E-15
Medium Total												5.E-15

Total of Receptor Risks Across All Media 5.E-15

TABLE 8.5.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	On-Site Trespasser
Receptor Age:	Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Ingestion	K-40	28.63	pCi/g	US EPA RAGS Part A	1.44E+03	pCi	6.18E-11	risk/pCi	9.E-08
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	3.39E+02	pCi	7.30E-10	risk/pCi	2.E-07
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	2.26E+02	pCi	2.29E-09	risk/pCi	5.E-07
				TH-228	0.958	pCi/g	US EPA RAGS Part A	4.83E+01	pCi	8.09E-10	risk/pCi	4.E-08
				TH-232	1.257	pCi/g	US EPA RAGS Part A	6.34E+01	pCi	2.31E-10	risk/pCi	1.E-08
				U-234	2.061	pCi/g	US EPA RAGS Part A	1.04E+02	pCi	1.58E-10	risk/pCi	2.E-08
				U-235	0.141	pCi/g	US EPA RAGS Part A	7.11E+00	pCi	1.63E-10	risk/pCi	1.E-09
				U-238	2.021	pCi/g	US EPA RAGS Part A	1.02E+02	pCi	2.10E-10	risk/pCi	2.E-08
			Exp. Route Total									9.E-07
			External Exposure	K-40	28.63	pCi/g	US EPA RAGS Part A	9.87E+00	pCi	7.97E-07	risk/yr per pCi/g	8.E-06
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	2.32E+00	pCi	8.49E-06	risk/yr per pCi/g	2.E-05
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	1.55E+00	pCi	4.53E-06	risk/yr per pCi/g	7.E-06
				TH-228	0.958	pCi/g	US EPA RAGS Part A	3.30E-01	pCi	7.76E-06	risk/yr per pCi/g	3.E-06
				TH-232	1.257	pCi/g	US EPA RAGS Part A	4.33E-01	pCi	3.42E-10	risk/yr per pCi/g	1.E-10
				U-234	2.061	pCi/g	US EPA RAGS Part A	7.11E-01	pCi	2.52E-10	risk/yr per pCi/g	2.E-10
				U-235	0.141	pCi/g	US EPA RAGS Part A	4.86E-02	pCi	5.43E-07	risk/yr per pCi/g	3.E-08
				U-238	2.021	pCi/g	US EPA RAGS Part A	6.97E-01	pCi	1.14E-07	risk/yr per pCi/g	8.E-08
			Exp. Route Total									4.E-05
		Exposure Point Total										4.E-05
	Exposure Medium Total											
	Air	Current - Properties Adjacent to KIF or at the KIF Facility	Inhalation	K-40	28.63	pCi/g	US EPA RAGS Part A	1.59E-07	pCi	1.03E-11	risk/pCi	2.E-18
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	3.75E-08	pCi	1.15E-08	risk/pCi	4.E-16
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	2.50E-08	pCi	5.23E-09	risk/pCi	1.E-16
				TH-228	0.958	pCi/g	US EPA RAGS Part A	5.33E-09	pCi	1.43E-07	risk/pCi	8.E-16
				TH-232	1.257	pCi/g	US EPA RAGS Part A	6.99E-09	pCi	4.33E-08	risk/pCi	3.E-16
				U-234	2.061	pCi/g	US EPA RAGS Part A	1.15E-08	pCi	1.14E-08	risk/pCi	1.E-16
				U-235	0.141	pCi/g	US EPA RAGS Part A	7.84E-10	pCi	1.01E-08	risk/pCi	8.E-18
				U-238	2.021	pCi/g	US EPA RAGS Part A	1.12E-08	pCi	9.35E-09	risk/pCi	1.E-16
			Exp. Route Total									2.E-15
		Exposure Point Total										2.E-15
	Exposure Medium Total											4.E-05
Medium Total												4.E-05

Total of Receptor Risks Across All Media 4.E-05

TABLE 8.6.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	K-40	28.63	pCi/g	US EPA RAGS Part A	8.95E+03	pCi	6.18E-11	risk/pCi	6.E-07
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	2.10E+03	pCi	7.30E-10	risk/pCi	2.E-06
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	1.40E+03	pCi	2.29E-09	risk/pCi	3.E-06
				TH-228	0.958	pCi/g	US EPA RAGS Part A	2.99E+02	pCi	8.09E-10	risk/pCi	2.E-07
				TH-232	1.257	pCi/g	US EPA RAGS Part A	3.93E+02	pCi	2.31E-10	risk/pCi	9.E-08
				U-234	2.061	pCi/g	US EPA RAGS Part A	6.44E+02	pCi	1.58E-10	risk/pCi	1.E-07
				U-235	0.141	pCi/g	US EPA RAGS Part A	4.41E+01	pCi	4.52E-11	risk/pCi	2.E-09
				U-238	2.021	pCi/g	US EPA RAGS Part A	6.32E+02	pCi	2.10E-10	risk/pCi	1.E-07
			Exp. Route Total									6.E-06
			External Exposure	K-40	28.63	pCi/g	US EPA RAGS Part A	5.88E+01	pCi	7.97E-07	risk/yr per pCi/g	5.E-05
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	1.38E+01	pCi	8.49E-06	risk/yr per pCi/g	1.E-04
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	9.23E+00	pCi	4.53E-06	risk/yr per pCi/g	4.E-05
				TH-228	0.958	pCi/g	US EPA RAGS Part A	1.97E+00	pCi	7.76E-06	risk/yr per pCi/g	2.E-05
				TH-232	1.257	pCi/g	US EPA RAGS Part A	2.58E+00	pCi	3.42E-10	risk/yr per pCi/g	9.E-10
				U-234	2.061	pCi/g	US EPA RAGS Part A	4.23E+00	pCi	2.52E-10	risk/yr per pCi/g	1.E-09
				U-235	0.141	pCi/g	US EPA RAGS Part A	2.89E-01	pCi	2.63E-07	risk/yr per pCi/g	8.E-08
				U-238	2.021	pCi/g	US EPA RAGS Part A	4.15E+00	pCi	1.14E-07	risk/yr per pCi/g	5.E-07
			Exp. Route Total									2.E-04
		Exposure Point Total										2.E-04
	Exposure Medium Total											
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	K-40	28.63	pCi/g	US EPA RAGS Part A	1.48E-06	pCi	1.03E-11	risk/pCi	2.E-17
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	3.49E-07	pCi	1.15E-08	risk/pCi	4.E-15
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	2.33E-07	pCi	5.23E-09	risk/pCi	1.E-15
				TH-228	0.958	pCi/g	US EPA RAGS Part A	4.97E-08	pCi	1.43E-07	risk/pCi	7.E-15
				TH-232	1.257	pCi/g	US EPA RAGS Part A	6.52E-08	pCi	4.33E-08	risk/pCi	3.E-15
				U-234	2.061	pCi/g	US EPA RAGS Part A	1.07E-07	pCi	1.14E-08	risk/pCi	1.E-15
				U-235	0.141	pCi/g	US EPA RAGS Part A	7.31E-09	pCi	1.30E-08	risk/pCi	1.E-16
				U-238	2.021	pCi/g	US EPA RAGS Part A	1.05E-07	pCi	9.35E-09	risk/pCi	1.E-15
			Exp. Route Total									2.E-14
		Exposure Point Total										2.E-14
	Exposure Medium Total											2.E-04
Medium Total												2.E-04

Total of Receptor Risks Across All Media 2.E-04

TABLE 8.7.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	K-40	28.63	pCi/g	US EPA RAGS Part A	1.79E+04	pCi	6.18E-11	risk/pCi	1.E-06
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	4.21E+03	pCi	7.30E-10	risk/pCi	3.E-06
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	2.81E+03	pCi	2.29E-09	risk/pCi	6.E-06
				TH-228	0.958	pCi/g	US EPA RAGS Part A	5.99E+02	pCi	8.09E-10	risk/pCi	5.E-07
				TH-232	1.257	pCi/g	US EPA RAGS Part A	7.86E+02	pCi	2.31E-10	risk/pCi	2.E-07
				U-234	2.061	pCi/g	US EPA RAGS Part A	1.29E+03	pCi	1.58E-10	risk/pCi	2.E-07
				U-235	0.141	pCi/g	US EPA RAGS Part A	8.81E+01	pCi	4.52E-11	risk/pCi	4.E-09
				U-238	2.021	pCi/g	US EPA RAGS Part A	1.26E+03	pCi	2.10E-10	risk/pCi	3.E-07
			Exp. Route Total									1.E-05
			External Exposure	K-40	28.63	pCi/g	US EPA RAGS Part A	1.47E+02	pCi	7.97E-07	risk/yr per pCi/g	1.E-04
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	3.46E+01	pCi	8.49E-06	risk/yr per pCi/g	3.E-04
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	2.31E+01	pCi	4.53E-06	risk/yr per pCi/g	1.E-04
				TH-228	0.958	pCi/g	US EPA RAGS Part A	4.92E+00	pCi	7.76E-06	risk/yr per pCi/g	4.E-05
				TH-232	1.257	pCi/g	US EPA RAGS Part A	6.45E+00	pCi	3.42E-10	risk/yr per pCi/g	2.E-09
				U-234	2.061	pCi/g	US EPA RAGS Part A	1.06E+01	pCi	2.52E-10	risk/yr per pCi/g	3.E-09
				U-235	0.141	pCi/g	US EPA RAGS Part A	7.24E-01	pCi	2.63E-07	risk/yr per pCi/g	2.E-07
				U-238	2.021	pCi/g	US EPA RAGS Part A	1.04E+01	pCi	1.14E-07	risk/yr per pCi/g	1.E-06
			Exp. Route Total									6.E-04
		Exposure Point Total										6.E-04
	Exposure Medium Total											
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	K-40	28.63	pCi/g	US EPA RAGS Part A	1.48E-06	pCi	1.03E-11	risk/pCi	2.E-17
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	3.49E-07	pCi	1.15E-08	risk/pCi	4.E-15
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	2.33E-07	pCi	5.23E-09	risk/pCi	1.E-15
				TH-228	0.958	pCi/g	US EPA RAGS Part A	4.97E-08	pCi	1.43E-07	risk/pCi	7.E-15
				TH-232	1.257	pCi/g	US EPA RAGS Part A	6.52E-08	pCi	4.33E-08	risk/pCi	3.E-15
				U-234	2.061	pCi/g	US EPA RAGS Part A	1.07E-07	pCi	1.14E-08	risk/pCi	1.E-15
				U-235	0.141	pCi/g	US EPA RAGS Part A	7.31E-09	pCi	1.30E-08	risk/pCi	1.E-16
				U-238	2.021	pCi/g	US EPA RAGS Part A	1.05E-07	pCi	9.35E-09	risk/pCi	1.E-15
			Exp. Route Total									2.E-14
		Exposure Point Total										2.E-14
	Exposure Medium Total											6.E-04
Medium Total												6.E-04

Total of Receptor Risks Across All Media 6.E-04

TABLE 8.8.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Groundskeeper
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	K-40	28.63	pCi/g	US EPA RAGS Part A	3.31E+04	pCi	6.18E-11	risk/pCi	2.E-06
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	7.78E+03	pCi	7.30E-10	risk/pCi	6.E-06
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	5.19E+03	pCi	2.29E-09	risk/pCi	1.E-05
				TH-228	0.958	pCi/g	US EPA RAGS Part A	1.11E+03	pCi	8.09E-10	risk/pCi	9.E-07
				TH-232	1.257	pCi/g	US EPA RAGS Part A	1.45E+03	pCi	2.31E-10	risk/pCi	3.E-07
				U-234	2.061	pCi/g	US EPA RAGS Part A	2.38E+03	pCi	1.58E-10	risk/pCi	4.E-07
				U-235	0.141	pCi/g	US EPA RAGS Part A	1.63E+02	pCi	4.52E-11	risk/pCi	7.E-09
				U-238	2.021	pCi/g	US EPA RAGS Part A	2.33E+03	pCi	2.10E-10	risk/pCi	5.E-07
			Exp. Route Total									2.E-05
			External Exposure	K-40	28.63	pCi/g	US EPA RAGS Part A	8.23E+01	pCi	7.97E-07	risk/yr per pCi/g	7.E-05
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	1.93E+01	pCi	8.49E-06	risk/yr per pCi/g	2.E-04
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	1.29E+01	pCi	4.53E-06	risk/yr per pCi/g	6.E-05
				TH-228	0.958	pCi/g	US EPA RAGS Part A	2.75E+00	pCi	7.76E-06	risk/yr per pCi/g	2.E-05
				TH-232	1.257	pCi/g	US EPA RAGS Part A	3.61E+00	pCi	3.42E-10	risk/yr per pCi/g	1.E-09
				U-234	2.061	pCi/g	US EPA RAGS Part A	5.92E+00	pCi	2.52E-10	risk/yr per pCi/g	1.E-09
				U-235	0.141	pCi/g	US EPA RAGS Part A	4.05E-01	pCi	2.63E-07	risk/yr per pCi/g	1.E-07
				U-238	2.021	pCi/g	US EPA RAGS Part A	5.81E+00	pCi	1.14E-07	risk/yr per pCi/g	7.E-07
			Exp. Route Total									3.E-04
		Exposure Point Total										3.E-04
	Exposure Medium Total											
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	K-40	28.63	pCi/g	US EPA RAGS Part A	4.68E-07	pCi	1.03E-11	risk/pCi	5.E-18
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	1.10E-07	pCi	1.15E-08	risk/pCi	1.E-15
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	7.35E-08	pCi	5.23E-09	risk/pCi	4.E-16
				TH-228	0.958	pCi/g	US EPA RAGS Part A	1.57E-08	pCi	1.43E-07	risk/pCi	2.E-15
				TH-232	1.257	pCi/g	US EPA RAGS Part A	2.06E-08	pCi	4.33E-08	risk/pCi	9.E-16
				U-234	2.061	pCi/g	US EPA RAGS Part A	3.37E-08	pCi	1.14E-08	risk/pCi	4.E-16
				U-235	0.141	pCi/g	US EPA RAGS Part A	2.31E-09	pCi	1.30E-08	risk/pCi	3.E-17
				U-238	2.021	pCi/g	US EPA RAGS Part A	3.31E-08	pCi	9.35E-09	risk/pCi	3.E-16
			Exp. Route Total									6.E-15
		Exposure Point Total										6.E-15
	Exposure Medium Total											3.E-04
Medium Total												3.E-04

Total of Receptor Risks Across All Media 3.E-04

TABLE 8.9.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	K-40	28.63	pCi/g	US EPA RAGS Part A	2.40E+04	pCi	6.18E-11	risk/pCi	1.E-06
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	5.66E+03	pCi	7.30E-10	risk/pCi	4.E-06
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	3.77E+03	pCi	2.29E-09	risk/pCi	9.E-06
				TH-228	0.958	pCi/g	US EPA RAGS Part A	8.05E+02	pCi	8.09E-10	risk/pCi	7.E-07
				TH-232	1.257	pCi/g	US EPA RAGS Part A	1.06E+03	pCi	2.31E-10	risk/pCi	2.E-07
				U-234	2.061	pCi/g	US EPA RAGS Part A	1.73E+03	pCi	1.58E-10	risk/pCi	3.E-07
				U-235	0.141	pCi/g	US EPA RAGS Part A	1.18E+02	pCi	4.52E-11	risk/pCi	5.E-09
				U-238	2.021	pCi/g	US EPA RAGS Part A	1.70E+03	pCi	2.10E-10	risk/pCi	4.E-07
			Exp. Route Total									2.E-05
			External Exposure	K-40	28.63	pCi/g	US EPA RAGS Part A	4.22E+02	pCi	7.97E-07	risk/yr per pCi/g	3.E-04
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	9.93E+01	pCi	8.49E-06	risk/yr per pCi/g	8.E-04
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	6.63E+01	pCi	4.53E-06	risk/yr per pCi/g	3.E-04
				TH-228	0.958	pCi/g	US EPA RAGS Part A	1.41E+01	pCi	7.76E-06	risk/yr per pCi/g	1.E-04
				TH-232	1.257	pCi/g	US EPA RAGS Part A	1.85E+01	pCi	3.42E-10	risk/yr per pCi/g	6.E-09
				U-234	2.061	pCi/g	US EPA RAGS Part A	3.04E+01	pCi	2.52E-10	risk/yr per pCi/g	8.E-09
				U-235	0.141	pCi/g	US EPA RAGS Part A	2.08E+00	pCi	2.63E-07	risk/yr per pCi/g	5.E-07
				U-238	2.021	pCi/g	US EPA RAGS Part A	2.98E+01	pCi	1.14E-07	risk/yr per pCi/g	3.E-06
			Exp. Route Total									2.E-03
		Exposure Point Total										2.E-03
	Exposure Medium Total											
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	K-40	28.63	pCi/g	US EPA RAGS Part A	3.19E-06	pCi	1.03E-11	risk/pCi	3.E-17
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	7.49E-07	pCi	1.15E-08	risk/pCi	9.E-15
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	5.00E-07	pCi	5.23E-09	risk/pCi	3.E-15
				TH-228	0.958	pCi/g	US EPA RAGS Part A	1.07E-07	pCi	1.43E-07	risk/pCi	2.E-14
				TH-232	1.257	pCi/g	US EPA RAGS Part A	1.40E-07	pCi	4.33E-08	risk/pCi	6.E-15
				U-234	2.061	pCi/g	US EPA RAGS Part A	2.29E-07	pCi	1.14E-08	risk/pCi	3.E-15
				U-235	0.141	pCi/g	US EPA RAGS Part A	1.57E-08	pCi	1.30E-08	risk/pCi	2.E-16
				U-238	2.021	pCi/g	US EPA RAGS Part A	2.25E-07	pCi	9.35E-09	risk/pCi	2.E-15
			Exp. Route Total									4.E-14
		Exposure Point Total										4.E-14
	Exposure Medium Total											2.E-03
Medium Total												2.E-03

Total of Receptor Risks Across All Media 2.E-03

TABLE 8.10.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
Ash	Ash	Future - Adjacent Residential Properties	Ingestion	K-40	28.63	pCi/g	US EPA RAGS Part A	1.20E+04	pCi	6.18E-11	risk/pCi	7.E-07
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	2.83E+03	pCi	7.30E-10	risk/pCi	2.E-06
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	1.89E+03	pCi	2.29E-09	risk/pCi	4.E-06
				TH-228	0.958	pCi/g	US EPA RAGS Part A	4.02E+02	pCi	8.09E-10	risk/pCi	3.E-07
				TH-232	1.257	pCi/g	US EPA RAGS Part A	5.28E+02	pCi	2.31E-10	risk/pCi	1.E-07
				U-234	2.061	pCi/g	US EPA RAGS Part A	8.66E+02	pCi	1.58E-10	risk/pCi	1.E-07
				U-235	0.141	pCi/g	US EPA RAGS Part A	5.92E+01	pCi	4.52E-11	risk/pCi	3.E-09
				U-238	2.021	pCi/g	US EPA RAGS Part A	8.49E+02	pCi	2.10E-10	risk/pCi	2.E-07
			Exp. Route Total									8.E-06
			External Exposure	K-40	28.63	pCi/g	US EPA RAGS Part A	1.06E+02	pCi	7.97E-07	risk/yr per pCi/g	8.E-05
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	2.48E+01	pCi	8.49E-06	risk/yr per pCi/g	2.E-04
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	1.66E+01	pCi	4.53E-06	risk/yr per pCi/g	8.E-05
				TH-228	0.958	pCi/g	US EPA RAGS Part A	3.53E+00	pCi	7.76E-06	risk/yr per pCi/g	3.E-05
				TH-232	1.257	pCi/g	US EPA RAGS Part A	4.64E+00	pCi	3.42E-10	risk/yr per pCi/g	2.E-09
				U-234	2.061	pCi/g	US EPA RAGS Part A	7.60E+00	pCi	2.52E-10	risk/yr per pCi/g	2.E-09
				U-235	0.141	pCi/g	US EPA RAGS Part A	5.20E-01	pCi	2.63E-07	risk/yr per pCi/g	1.E-07
				U-238	2.021	pCi/g	US EPA RAGS Part A	7.45E+00	pCi	1.14E-07	risk/yr per pCi/g	8.E-07
			Exp. Route Total									4.E-04
		Exposure Point Total										4.E-04
	Exposure Medium Total											
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	K-40	28.63	pCi/g	US EPA RAGS Part A	7.96E-07	pCi	1.03E-11	risk/pCi	8.E-18
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	1.87E-07	pCi	1.15E-08	risk/pCi	2.E-15
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	1.25E-07	pCi	5.23E-09	risk/pCi	7.E-16
				TH-228	0.958	pCi/g	US EPA RAGS Part A	2.66E-08	pCi	1.43E-07	risk/pCi	4.E-15
				TH-232	1.257	pCi/g	US EPA RAGS Part A	3.50E-08	pCi	4.33E-08	risk/pCi	2.E-15
				U-234	2.061	pCi/g	US EPA RAGS Part A	5.73E-08	pCi	1.14E-08	risk/pCi	7.E-16
				U-235	0.141	pCi/g	US EPA RAGS Part A	3.92E-09	pCi	1.30E-08	risk/pCi	5.E-17
				U-238	2.021	pCi/g	US EPA RAGS Part A	5.62E-08	pCi	9.35E-09	risk/pCi	5.E-16
			Exp. Route Total									9.E-15
		Exposure Point Total										9.E-15
	Exposure Medium Total											4.E-04
Medium Total												4.E-04

Total of Receptor Risks Across All Media	4.E-04

TABLE 8.11.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Recreator
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	K-40	28.63	pCi/g	US EPA RAGS Part A	3.61E+02	pCi	6.18E-11	risk/pCi	2.E-08
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	8.48E+01	pCi	7.30E-10	risk/pCi	6.E-08
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	5.66E+01	pCi	2.29E-09	risk/pCi	1.E-07
				TH-228	0.958	pCi/g	US EPA RAGS Part A	1.21E+01	pCi	8.09E-10	risk/pCi	1.E-08
				TH-232	1.257	pCi/g	US EPA RAGS Part A	1.58E+01	pCi	2.31E-10	risk/pCi	4.E-09
				U-234	2.061	pCi/g	US EPA RAGS Part A	2.60E+01	pCi	1.58E-10	risk/pCi	4.E-09
				U-235	0.141	pCi/g	US EPA RAGS Part A	1.78E+00	pCi	4.52E-11	risk/pCi	8.E-11
				U-238	2.021	pCi/g	US EPA RAGS Part A	2.55E+01	pCi	2.10E-10	risk/pCi	5.E-09
			Exp. Route Total									2.E-07
			External Exposure	K-40	28.63	pCi/g	US EPA RAGS Part A	1.59E-01	pCi	7.97E-07	risk/yr per pCi/g	1.E-07
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	3.74E-02	pCi	8.49E-06	risk/yr per pCi/g	3.E-07
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	2.49E-02	pCi	4.53E-06	risk/yr per pCi/g	1.E-07
				TH-228	0.958	pCi/g	US EPA RAGS Part A	5.31E-03	pCi	7.76E-06	risk/yr per pCi/g	4.E-08
				TH-232	1.257	pCi/g	US EPA RAGS Part A	6.97E-03	pCi	3.42E-10	risk/yr per pCi/g	2.E-12
				U-234	2.061	pCi/g	US EPA RAGS Part A	1.14E-02	pCi	2.52E-10	risk/yr per pCi/g	3.E-12
				U-235	0.141	pCi/g	US EPA RAGS Part A	7.82E-04	pCi	2.63E-07	risk/yr per pCi/g	2.E-10
				U-238	2.021	pCi/g	US EPA RAGS Part A	1.12E-02	pCi	1.14E-07	risk/yr per pCi/g	1.E-09
			Exp. Route Total									6.E-07
		Exposure Point Total										8.E-07
	Exposure Medium Total											
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	K-40	28.63	pCi/g	US EPA RAGS Part A	4.78E-08	pCi	1.03E-11	risk/pCi	5.E-19
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	1.12E-08	pCi	1.15E-08	risk/pCi	1.E-16
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	7.50E-09	pCi	5.23E-09	risk/pCi	4.E-17
				TH-228	0.958	pCi/g	US EPA RAGS Part A	1.60E-09	pCi	1.43E-07	risk/pCi	2.E-16
				TH-232	1.257	pCi/g	US EPA RAGS Part A	2.10E-09	pCi	4.33E-08	risk/pCi	9.E-17
				U-234	2.061	pCi/g	US EPA RAGS Part A	3.44E-09	pCi	1.14E-08	risk/pCi	4.E-17
				U-235	0.141	pCi/g	US EPA RAGS Part A	2.35E-10	pCi	1.30E-08	risk/pCi	3.E-18
				U-238	2.021	pCi/g	US EPA RAGS Part A	3.37E-09	pCi	9.35E-09	risk/pCi	3.E-17
			Exp. Route Total									6.E-16
		Exposure Point Total										6.E-16
	Exposure Medium Total											8.E-07
Medium Total												8.E-07

Total of Receptor Risks Across All Media: 8.E-07

TABLE 8.12.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Recreator
Receptor Age:	Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Ingestion	K-40	28.63	pCi/g	US EPA RAGS Part A	1.80E+02	pCi	6.18E-11	risk/pCi	1.E-08
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	4.24E+01	pCi	7.30E-10	risk/pCi	3.E-08
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	2.83E+01	pCi	2.29E-09	risk/pCi	6.E-08
				TH-228	0.958	pCi/g	US EPA RAGS Part A	6.04E+00	pCi	8.09E-10	risk/pCi	5.E-09
				TH-232	1.257	pCi/g	US EPA RAGS Part A	7.92E+00	pCi	2.31E-10	risk/pCi	2.E-09
				U-234	2.061	pCi/g	US EPA RAGS Part A	1.30E+01	pCi	1.58E-10	risk/pCi	2.E-09
				U-235	0.141	pCi/g	US EPA RAGS Part A	8.88E-01	pCi	4.52E-11	risk/pCi	4.E-11
				U-238	2.021	pCi/g	US EPA RAGS Part A	1.27E+01	pCi	2.10E-10	risk/pCi	3.E-09
			Exp. Route Total									1.E-07
			External Exposure	K-40	28.63	pCi/g	US EPA RAGS Part A	3.97E-02	pCi	7.97E-07	risk/yr per pCi/g	3.E-08
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	9.34E-03	pCi	8.49E-06	risk/yr per pCi/g	8.E-08
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	6.23E-03	pCi	4.53E-06	risk/yr per pCi/g	3.E-08
				TH-228	0.958	pCi/g	US EPA RAGS Part A	1.33E-03	pCi	7.76E-06	risk/yr per pCi/g	1.E-08
				TH-232	1.257	pCi/g	US EPA RAGS Part A	1.74E-03	pCi	3.42E-10	risk/yr per pCi/g	6.E-13
				U-234	2.061	pCi/g	US EPA RAGS Part A	2.86E-03	pCi	2.52E-10	risk/yr per pCi/g	7.E-13
				U-235	0.141	pCi/g	US EPA RAGS Part A	1.96E-04	pCi	2.63E-07	risk/yr per pCi/g	5.E-11
				U-238	2.021	pCi/g	US EPA RAGS Part A	2.80E-03	pCi	1.14E-07	risk/yr per pCi/g	3.E-10
			Exp. Route Total									1.E-07
		Exposure Point Total										3.E-07
	Exposure Medium Total											
	Air	Future - On the Dredge Cell or Ash Flow Area	Inhalation	K-40	28.63	pCi/g	US EPA RAGS Part A	1.19E-08	pCi	1.03E-11	risk/pCi	1.E-19
				Ra-226	6.733	pCi/g	US EPA RAGS Part A	2.81E-09	pCi	1.15E-08	risk/pCi	3.E-17
				Ra-228	4.494	pCi/g	US EPA RAGS Part A	1.87E-09	pCi	5.23E-09	risk/pCi	1.E-17
				TH-228	0.958	pCi/g	US EPA RAGS Part A	4.00E-10	pCi	1.43E-07	risk/pCi	6.E-17
				TH-232	1.257	pCi/g	US EPA RAGS Part A	5.24E-10	pCi	4.33E-08	risk/pCi	2.E-17
				U-234	2.061	pCi/g	US EPA RAGS Part A	8.60E-10	pCi	1.14E-08	risk/pCi	1.E-17
				U-235	0.141	pCi/g	US EPA RAGS Part A	5.88E-11	pCi	1.30E-08	risk/pCi	8.E-19
				U-238	2.021	pCi/g	US EPA RAGS Part A	8.43E-10	pCi	9.35E-09	risk/pCi	8.E-18
			Exp. Route Total									1.E-16
		Exposure Point Total										1.E-16
	Exposure Medium Total											3.E-07
Medium Total												3.E-07

Total of Receptor Risks Across All Media 3.E-07

TABLE 9.1.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Aluminum	NA	NA			NA	CNS	0.009	0.001		0.01
			Arsenic	3.E-06	4.E-09			3.E-06	Skin	0.08	0.001		0.08
			Barium	NA	NA			NA	Liver	0.002	0.0004		0.002
			Beryllium	NA	2.E-10			2.E-10	GI	0.001	0.00006		0.001
			Boron	NA	NA			NA	Fetus	0.0002	0.000001		0.0002
			Chromium	NA	8.E-09			8.E-09	None observed	0.005	0.00009		0.005
			Cobalt	NA	3.E-09			3.E-09	Blood	0.02	0.0007		0.02
			Copper	NA	NA			NA	GI	0.0006	NA		0.0006
			Iron	NA	NA			NA	None observed	0.01	NA		0.01
			Manganese	NA	NA			NA	Autoimmune	0.0006	0.0009		0.001
			Mercury	NA	NA			NA	CNS	0.0002	0.0000001		0.0002
			Nickel	NA	2.E-10			2.E-10	Weight	0.0007	0.00009		0.0008
			Selenium	NA	NA			NA	Hair	0.0005	0.00000007		0.0005
			Thallium	NA	NA			NA	Hair	0.02	NA		0.02
			Vanadium	NA	NA			NA	Weight	0.008	NA		0.008
			Zinc	NA	NA			NA	Blood	0.00007	NA		0.00007
			K-40	8.E-08	2.E-18		5.E-07	6.E-07					
			Ra-226	2.E-07	6.E-16		1.E-06	2.E-06					
			Ra-228	5.E-07	2.E-16		1.E-06	2.E-06					
			TH-228	3.E-08	1.E-15		2.E-07	2.E-07					
			TH-232	1.E-08	4.E-16		5.E-11	1.E-08					
			U-234	1.E-08	2.E-16		1.E-10	1.E-08					
			U-235	1.E-09	1.E-17		2.E-09	3.E-09					
			U-238	2.E-08	1.E-16		1.E-08	3.E-08					
			Chemical Total					7.E-06					0.2
		Exposure Point Total						7.E-06					0.2
	Exposure Medium Total							7.E-06					0.2
Medium Total													0.2
Receptor Total							Receptor Risk Total	7.E-06				Receptor HI Total	0.2

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Aluminum	NA	NA	NA		NA	CNS	0.02	0.001	NA	0.02
			Arsenic	5.E-06	4.E-09	1.E-06		6.E-06	Skin	0.2	0.001	0.03	0.2
			Barium	NA	NA	NA		NA	Liver	0.003	0.0004	NA	0.004
			Beryllium	NA	2.E-10	NA		2.E-10	GI	0.002	0.00006	NA	0.002
			Boron	NA	NA	NA		NA	Fetus	0.0005	0.000001	NA	0.0005
			Chromium	NA	8.E-09	NA		8.E-09	None observed	0.01	0.00009	NA	0.01
			Cobalt	NA	3.E-09	NA		3.E-09	Blood	0.05	0.0007	NA	0.05
			Copper	NA	NA	NA		NA	GI	0.001	NA	NA	0.001
			Iron	NA	NA	NA		NA	None observed	0.02	NA	NA	0.02
			Manganese	NA	NA	NA		NA	CNS	0.001	0.0009	NA	0.002
			Mercury	NA	NA	NA		NA	Autoimmune	0.0005	0.0000001	NA	0.0005
			Nickel	NA	2.E-10	NA		2.E-10	Weight	0.001	0.00009	NA	0.002
			Selenium	NA	NA	NA		NA	Hair	0.001	0.00000007	NA	0.001
			Thallium	NA	NA	NA		NA	Hair	0.04	NA	NA	0.04
			Vanadium	NA	NA	NA		NA	Weight	0.02	NA	NA	0.02
			Zinc	NA	NA	NA		NA	Blood	0.0001	NA	NA	0.0001
			K-40	2.E-07	2.E-18		1.E-06	1.E-06					
			Ra-226	4.E-07	6.E-16		3.E-06	4.E-06					
			Ra-228	9.E-07	2.E-16		3.E-06	4.E-06					
			TH-228	7.E-08	1.E-15		4.E-07	5.E-07					
			TH-232	3.E-08	4.E-16		1.E-10	3.E-08					
			U-234	3.E-08	2.E-16		3.E-10	3.E-08					
			U-235	2.E-09	1.E-17		6.E-09	8.E-09					
			U-238	4.E-08	1.E-16		2.E-08	6.E-08					
			Chemical Total					2.E-05					0.4
		Exposure Point Total						2.E-05					0.4
	Exposure Medium Total							2.E-05					0.4
Medium Total								2.E-05					0.4
Receptor Total							Receptor Risk Total	2.E-05				Receptor HI Total	0.4

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.3.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Aluminum		NA			NA	CNS		0.002		0.002
			Arsenic		9.E-09			9.E-09	Skin		0.002		0.002
			Barium		NA			NA	Liver		0.0008		0.0008
			Beryllium		4.E-10			4.E-10	GI		0.0001		0.0001
			Boron		NA			NA	Fetus		0.000003		0.000003
			Chromium		2.E-08			2.E-08	None observed		0.0002		0.0002
			Cobalt		5.E-09			5.E-09	Blood		0.001		0.001
			Copper		NA			NA	GI		NA		NA
			Iron		NA			NA	None observed		NA		NA
			Manganese		NA			NA	CNS		0.002		0.002
			Mercury		NA			NA	Autoimmune		0.0000003		0.0000003
			Nickel		3.E-10			3.E-10	Weight		0.0002		0.0002
			Selenium		NA			NA	Hair		0.0000001		0.0000001
			Thallium		NA			NA	Hair		NA		NA
			Vanadium		NA			NA	Weight		NA		NA
			Zinc		NA			NA	Blood		NA		NA
			K-40		4.E-18			4.E-18					
			Ra-226		1.E-15			1.E-15					
			Ra-228		3.E-16			3.E-16					
			TH-228		2.E-15			2.E-15					
			TH-232		8.E-16			8.E-16					
			U-234		3.E-16			3.E-16					
			U-235		2.E-17			2.E-17					
			U-238		3.E-16			3.E-16					
			Chemical Total					3.E-08					0.009
		Exposure Point Total						3.E-08					0.009
	Exposure Medium Total							3.E-08					0.009
Medium Total								3.E-08					0.009
Receptor Total							Receptor Risk Total	3.E-08				Receptor HI Total	0.009

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Aluminum		NA			NA	CNS		0.002		0.002
			Arsenic		9.E-09			9.E-09	Skin		0.002		0.002
			Barium		NA			NA	Liver		0.0008		0.0008
			Beryllium		4.E-10			4.E-10	GI		0.0001		0.0001
			Boron		NA			NA	Fetus		0.000003		0.000003
			Chromium		2.E-08			2.E-08	None observed		0.0002		0.0002
			Cobalt		5.E-09			5.E-09	Blood		0.001		0.001
			Copper		NA			NA	GI		NA		NA
			Iron		NA			NA	None observed		NA		NA
			Manganese		NA			NA	CNS		0.002		0.002
			Mercury		NA			NA	Autoimmune		0.0000003		0.0000003
			Nickel		3.E-10			3.E-10	Weight		0.0002		0.0002
			Selenium		NA			NA	Hair		0.0000001		0.0000001
			Thallium		NA			NA	Hair		NA		NA
			Vanadium		NA			NA	Weight		NA		NA
			Zinc		NA			NA	Blood		NA		NA
			K-40		4.E-18			4.E-18					
			Ra-226		1.E-15			1.E-15					
			Ra-228		3.E-16			3.E-16					
			TH-228		2.E-15			2.E-15					
			TH-232		8.E-16			8.E-16					
			U-234		3.E-16			3.E-16					
			U-235		2.E-17			2.E-17					
			U-238		3.E-16			3.E-16					
			Chemical Total					3.E-08					0.009
		Exposure Point Total						3.E-08					0.009
	Exposure Medium Total							3.E-08					0.009
Medium Total								3.E-08					0.009
Receptor Total							Receptor Risk Total	3.E-08				Receptor HI Total	0.009

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	On-Site Trespasser
Receptor Age:	Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.02	0.0008	NA	0.02
			Arsenic	4.E-06	3.E-09	4.E-06		8.E-06	Skin	0.1	0.0007	0.1	0.3
			Barium	NA	NA	NA		NA	Liver	0.003	0.0003	NA	0.003
			Beryllium	NA	2.E-10	NA		2.E-10	GI	0.002	0.00005	NA	0.002
			Boron	NA	NA	NA		NA	Fetus	0.0004	0.000001	NA	0.0004
			Chromium	NA	6.E-09	NA		6.E-09	None observed	0.009	0.00007	NA	0.009
			Cobalt	NA	2.E-09	NA		2.E-09	Blood	0.04	0.0005	NA	0.04
			Copper	NA	NA	NA		NA	GI	0.001	NA	NA	0.001
			Iron	NA	NA	NA		NA	None observed	0.02	NA	NA	0.02
			Manganese	NA	NA	NA		NA	CNS	0.001	0.0007	NA	0.002
			Mercury	NA	NA	NA		NA	Autoimmune	0.0004	0.0000001	NA	0.0004
			Nickel	NA	1.E-10	NA		1.E-10	Weight	0.001	0.00007	NA	0.001
			Selenium	NA	NA	NA		NA	Hair	0.0009	0.00000005	NA	0.0009
			Thallium	NA	NA	NA		NA	Hair	0.04	NA	NA	0.04
			Vanadium	NA	NA	NA		NA	Weight	0.01	NA	NA	0.01
			Zinc	NA	NA	NA		NA	Blood	0.0001	NA	NA	0.0001
			K-40	9.E-08	2.E-18	8.E-06		8.E-06					
			Ra-226	2.E-07	4.E-16	2.E-05		2.E-05					
			Ra-228	5.E-07	1.E-16	7.E-06		8.E-06					
			TH-228	4.E-08	8.E-16	3.E-06		3.E-06					
			TH-232	1.E-08	3.E-16	1.E-10		1.E-08					
			U-234	2.E-08	1.E-16	2.E-10		2.E-08					
			U-235	1.E-09	8.E-18	3.E-08		3.E-08					
			U-238	2.E-08	1.E-16	8.E-08		1.E-07					
			Chemical Total					5.E-05					0.4
		Exposure Point Total						5.E-05					0.4
	Exposure Medium Total							5.E-05					0.4
Medium Total								5.E-05					0.4

Surface Water	Surface Water	Swan Pond Embayment	Aluminum, total	NA		NA		NA	CNS	0.000007		0.00002	0.00003
			Antimony, total	NA		NA		NA	Lifespan	0.00007		0.0013	0.001
			Arsenic, total	3.E-08		1.E-07		1.E-07	Skin	0.0009		0.003	0.004
			Barium, total	NA		NA		NA	Liver	0.000004		0.00018	0.0002
			Boron, total	NA		NA		NA	Fetus	0.00003		0.00008	0.0001
			Chromium, total	NA		NA		NA	None observed	0.000005		0.00119	0.001
			Iron, total	NA		NA		NA	None observed	0.000007		0.00002	0.00002
			Manganese, total	NA		NA		NA	CNS	0.00006		0.0040	0.004
			Molybdenum, total	NA		NA		NA	Blood	0.00009		0.0003	0.0004
			Selenium, total	NA		NA		NA	Hair	0.00002		0.00006	0.00007
			Vanadium, total	NA		NA		NA	Weight	0.00004		0.0047	0.005
			Chemical Total					1.E-07					0.02
Medium Total								1.E-07					0.02
Receptor Total							Receptor Risk Total	5.E-05				Receptor HI Total	0.4

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.6.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA			NA	CNS	0.01	0.002		0.01
			Arsenic	2.E-05	3.E-08			2.E-05	Skin	0.1	0.001		0.1
			Barium	NA	NA			NA	Liver	0.002	0.0005		0.003
			Beryllium	NA	1.E-09			1.E-09	GI	0.001	0.00008		0.002
			Boron	NA	NA			NA	Fetus	0.0003	0.000002		0.0003
			Chromium	NA	6.E-08			6.E-08	None observed	0.007	0.0001		0.007
			Cobalt	NA	2.E-08			2.E-08	Blood	0.03	0.001		0.03
			Copper	NA	NA			NA	GI	0.0008	NA		0.0008
			Iron	NA	NA			NA	None observed	0.01	NA		0.01
			Manganese	NA	NA			NA	CNS	0.0008	0.001		0.002
			Mercury	NA	NA			NA	Autoimmune	0.0003	0.0000002		0.0003
			Nickel	NA	1.E-09			1.E-09	Weight	0.001	0.0001		0.001
			Selenium	NA	NA			NA	Hair	0.0007	0.0000001		0.0007
			Thallium	NA	NA			NA	Hair	0.03	NA		0.03
			Vanadium	NA	NA			NA	Weight	0.01	NA		0.01
			Zinc	NA	NA			NA	Blood	0.0001	NA		0.0001
			K-40	6.E-07	2.E-17		5.E-05	5.E-05					
			Ra-226	2.E-06	4.E-15		1.E-04	1.E-04					
			Ra-228	3.E-06	1.E-15		4.E-05	5.E-05					
			TH-228	2.E-07	7.E-15		2.E-05	2.E-05					
			TH-232	9.E-08	3.E-15		9.E-10	9.E-08					
			U-234	1.E-07	1.E-15		1.E-09	1.E-07					
			U-235	2.E-09	1.E-16		8.E-08	8.E-08					
			U-238	1.E-07	1.E-15		5.E-07	6.E-07					
			Chemical Total					2.E-04					0.2
		Exposure Point Total						2.E-04					0.2
	Exposure Medium Total							2.E-04					0.2
Medium Total								2.E-04					0.2

Bedrock Groundwater	Bedrock Groundwater	On-Site	Arsenic, total	2.E-05				2.E-05	CNS	0.1			0.1
			Barium, total	NA				NA	Skin	0.02			0.02
			Boron, total	NA				NA	Liver	0.01			0.01
			Iron, total	NA				NA	Skin	0.001			0.001
			Manganese, total	NA				NA	Fetus	0.04			0.04
			Strontium, total	NA				NA	Blood	0.01			0.01
			Chemical Total					2.E-05					0.2
			Radionuclide Total										
		Exposure Point Total						2.E-05					0.2
	Exposure Medium Total							2.E-05					0.2
Medium Total								2.E-05					0.2
Receptor Total							Receptor Risk Total	3.E-04				Receptor HI Total	0.4

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.7.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.03	0.002	NA	0.03
			Arsenic	4.E-05	3.E-08	8.E-06		5.E-05	Skin	0.2	0.001	0.05	0.3
			Barium	NA	NA	NA		NA	Liver	0.005	0.0005	NA	0.005
			Beryllium	NA	1.E-09	NA		1.E-09	GI	0.003	0.00008	NA	0.003
			Boron	NA	NA	NA		NA	Fetus	0.0006	0.000002	NA	0.0006
			Chromium	NA	6.E-08	NA		6.E-08	None observed	0.01	0.0001	NA	0.01
			Cobalt	NA	2.E-08	NA		2.E-08	Blood	0.07	0.001	NA	0.07
			Copper	NA	NA	NA		NA	GI	0.002	NA	NA	0.002
			Iron	NA	NA	NA		NA	None observed	0.03	NA	NA	0.03
			Manganese	NA	NA	NA		NA	CNS	0.002	0.001	NA	0.003
			Mercury	NA	NA	NA		NA	Autoimmune	0.0007	0.0000002	NA	0.0007
			Nickel	NA	1.E-09	NA		1.E-09	Weight	0.002	0.0001	NA	0.002
			Selenium	NA	NA	NA		NA	Hair	0.001	0.0000001	NA	0.001
			Thallium	NA	NA	NA		NA	Hair	0.06	NA	NA	0.06
			Vanadium	NA	NA	NA		NA	Weight	0.02	NA	NA	0.02
			Zinc	NA	NA	NA		NA	Blood	0.0002	NA	NA	0.0002
			K-40	1.E-06	2.E-17		1.E-04	1.E-04					
			Ra-226	3.E-06	4.E-15		3.E-04	3.E-04					
			Ra-228	6.E-06	1.E-15		1.E-04	1.E-04					
			TH-228	5.E-07	7.E-15		4.E-05	4.E-05					
			TH-232	2.E-07	3.E-15		2.E-09	2.E-07					
			U-234	2.E-07	1.E-15		3.E-09	2.E-07					
			U-235	4.E-09	1.E-16		2.E-07	2.E-07					
			U-238	3.E-07	1.E-15		1.E-06	1.E-06					
			Chemical Total					6.E-04					0.5
		Exposure Point Total						6.E-04					0.5
	Exposure Medium Total							6.E-04					0.5
Medium Total								6.E-04					0.5
Receptor Total							Receptor Risk To	6.E-04				Receptor HI Total	0.5

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.8.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Groundskeeper
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.05	0.001	NA	0.05
			Arsenic	7.E-05	3.E-08	4.E-06		7.E-05	Skin	0.4	0.001	0.03	0.5
			Barium	NA	NA	NA		NA	Liver	0.009	0.0005	NA	0.009
			Beryllium	NA	1.E-09	NA		1.E-09	GI	0.005	0.00008	NA	0.005
			Boron	NA	NA	NA		NA	Fetus	0.001	0.000002	NA	0.001
			Chromium	NA	5.E-08	NA		5.E-08	None observed	0.03	0.0001	NA	0.03
			Cobalt	NA	2.E-08	NA		2.E-08	Blood	0.1	0.0009	NA	0.1
			Copper	NA	NA	NA		NA	GI	0.003	NA	NA	0.003
			Iron	NA	NA	NA		NA	None observed	0.05	NA	NA	0.05
			Manganese	NA	NA	NA		NA	CNS	0.003	0.001	NA	0.004
			Mercury	NA	NA	NA		NA	Autoimmune	0.001	0.0000002	NA	0.001
			Nickel	NA	1.E-09	NA		1.E-09	Weight	0.004	0.0001	NA	0.004
			Selenium	NA	NA	NA		NA	Hair	0.003	0.00000009	NA	0.003
			Thallium	NA	NA	NA		NA	Hair	0.1	NA	NA	0.1
			Vanadium	NA	NA	NA		NA	Weight	0.04	NA	NA	0.04
			Zinc	NA	NA	NA		NA	Blood	0.0004	NA	NA	0.0004
			K-40	2.E-06	5.E-18		7.E-05	7.E-05					
			Ra-226	6.E-06	1.E-15		2.E-04	2.E-04					
			Ra-228	1.E-05	4.E-16		6.E-05	7.E-05					
			TH-228	9.E-07	2.E-15		2.E-05	2.E-05					
			TH-232	3.E-07	9.E-16		1.E-09	3.E-07					
			U-234	4.E-07	4.E-16		1.E-09	4.E-07					
			U-235	7.E-09	3.E-17		1.E-07	1.E-07					
			U-238	5.E-07	3.E-16		7.E-07	1.E-06					
			Chemical Total					4.E-04					0.9
		Exposure Point Total						4.E-04					0.9
	Exposure Medium Total							4.E-04					0.9
Medium Total								4.E-04					0.9
Receptor Total							Receptor Risk To	4.E-04				Receptor HI Total	0.9

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.9.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.04	0.003	NA	0.04
			Arsenic	5.E-05	7.E-08	2.E-05		7.E-05	Skin	0.3	0.003	0.1	0.5
			Barium	NA	NA	NA		NA	Liver	0.006	0.001	NA	0.008
			Beryllium	NA	3.E-09	NA		3.E-09	GI	0.004	0.0002	NA	0.004
			Boron	NA	NA	NA		NA	Fetus	0.0009	0.000004	NA	0.001
			Chromium	NA	1.E-07	NA		1.E-07	None observed	0.02	0.0003	NA	0.02
			Cobalt	NA	4.E-08	NA		4.E-08	Blood	0.09	0.002	NA	0.1
			Copper	NA	NA	NA		NA	GI	0.002	NA	NA	0.002
			Iron	NA	NA	NA		NA	None observed	0.04	NA	NA	0.04
			Manganese	NA	NA	NA		NA	CNS	0.002	0.003	NA	0.005
			Mercury	NA	NA	NA		NA	Autoimmune	0.001	0.0000004	NA	0.001
			Nickel	NA	2.E-09	NA		2.E-09	Weight	0.003	0.0003	NA	0.003
			Selenium	NA	NA	NA		NA	Hair	0.002	0.0000002	NA	0.002
			Thallium	NA	NA	NA		NA	Hair	0.08	NA	NA	0.08
			Vanadium	NA	NA	NA		NA	Weight	0.03	NA	NA	0.03
			Zinc	NA	NA	NA		NA	Blood	0.0003	NA	NA	0.0003
			K-40	1.E-06	3.E-17		3.E-04	3.E-04					
			Ra-226	4.E-06	9.E-15		8.E-04	8.E-04					
			Ra-228	9.E-06	3.E-15		3.E-04	3.E-04					
			TH-228	7.E-07	2.E-14		1.E-04	1.E-04					
			TH-232	2.E-07	6.E-15		6.E-09	3.E-07					
			U-234	3.E-07	3.E-15		8.E-09	3.E-07					
			U-235	5.E-09	2.E-16		5.E-07	6.E-07					
			U-238	4.E-07	2.E-15		3.E-06	4.E-06					
			Chemical Total					2.E-03					0.8
		Exposure Point Total						2.E-03					0.8
	Exposure Medium Total							2.E-03					0.8
Medium Total								2.E-03					0.8

Bedrock Groundwater	Bedrock Groundwater	On-Site	Aluminum, total	5.E-05		3.E-07		5.E-05	CNS	0.3		0.002	0.3
			Arsenic, total	NA		NA		NA	Skin	0.1		0.005	0.1
			Barium, total	NA		NA		NA	Liver	0.02		0.0001	0.02
			Boron, total	NA		NA		NA	Fetus	0.004		0.0000	0.004
			Chromium, total	NA		NA		NA	None Observed	0.1		0.0142	0.1
			Cobalt, total	NA		NA		NA	Blood	0.02		0.000	0.02
			Chemical Total					5.E-05					0.5
		Exposure Point Total						5.E-05					0.5
Medium Total								5.E-05					0.5
Receptor Total							Receptor Risk Total	2.E-03				Receptor HI Total	1

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.10.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.3	0.003	NA	0.4
			Arsenic	1.E-04	2.E-08	1.E-05		1.E-04	Skin	3	0.003	0.3	3
			Barium	NA	NA	NA		NA	Liver	0.06	0.001	NA	0.06
			Beryllium	NA	8.E-10	NA		8.E-10	GI	0.04	0.0002	NA	0.04
			Boron	NA	NA	NA		NA	Fetus	0.008	0.000004	NA	0.008
			Chromium	NA	3.E-08	NA		3.E-08	None observed	0.2	0.0003	NA	0.2
			Cobalt	NA	1.E-08	NA		1.E-08	Blood	0.9	0.002	NA	0.9
			Copper	NA	NA	NA		NA	GI	0.02	NA	NA	0.02
			Iron	NA	NA	NA		NA	None observed	0.4	NA	NA	0.4
			Manganese	NA	NA	NA		NA	CNS	0.02	0.003	NA	0.02
			Mercury	NA	NA	NA		NA	Autoimmune	0.009	0.0000004	NA	0.009
			Nickel	NA	6.E-10	NA		6.E-10	Weight	0.03	0.0003	NA	0.03
			Selenium	NA	NA	NA		NA	Hair	0.02	0.0000002	NA	0.02
			Thallium	NA	NA	NA		NA	Hair	0.7	NA	NA	0.7
			Vanadium	NA	NA	NA		NA	Weight	0.3	NA	NA	0.3
			Zinc	NA	NA	NA		NA	Blood	0.003	NA	NA	0.003
			K-40	7.E-07	8.E-18		8.E-05	8.E-05					
			Ra-226	2.E-06	2.E-15		2.E-04	2.E-04					
			Ra-228	4.E-06	7.E-16		8.E-05	8.E-05					
			TH-228	3.E-07	4.E-15		3.E-05	3.E-05					
			TH-232	1.E-07	2.E-15		2.E-09	1.E-07					
			U-234	1.E-07	7.E-16		2.E-09	1.E-07					
			U-235	3.E-09	5.E-17		1.E-07	1.E-07					
			U-238	2.E-07	5.E-16		8.E-07	1.E-06					
			Chemical Total					5.E-04					6
		Exposure Point Total						5.E-04					6
	Exposure Medium Total							5.E-04					6
Medium Total								5.E-04					6

Bedrock Groundwater	Bedrock Groundwater	On-Site	Aluminum, total	3.E-05		2.E-07		3.E-05	CNS	0.7		0.00483	0.7
			Arsenic, total	NA		NA		NA	Skin	0.2		0.015	0.2
			Barium, total	NA		NA		NA	Liver	0.05		0.000	0.05
			Boron, total	NA		NA		NA	Fetus	0.01		0.0001	0.01
			Chromium, total	NA		NA		NA	None Observed	0.3		0.0418	0.3
			Cobalt, total	NA		NA		NA	Blood	0.05		0.000	0.05
			Chemical Total					3.E-05					1
		Exposure Point Total						3.E-05					1
Medium Total								3.E-05					1
Receptor Total							Receptor Risk Total	6.E-04				Receptor HI Total	8

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.11.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Recreator
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.0006	0.00005	NA	0.0006
			Arsenic	8.E-07	1.E-09	3.E-07		1.E-06	Skin	0.005	0.00005	0.002	0.007
			Barium	NA	NA	NA		NA	Liver	0.0001	0.00002	NA	0.0001
			Beryllium	NA	5.E-11	NA		5.E-11	GI	0.00006	0.000003	NA	0.00006
			Boron	NA	NA	NA		NA	Fetus	0.00001	0.00000006	NA	0.00001
			Chromium	NA	2.E-09	NA		2.E-09	None observed	0.0003	0.000004	NA	0.0003
			Cobalt	NA	6.E-10	NA		6.E-10	Blood	0.001	0.00003	NA	0.001
			Copper	NA	NA	NA		NA	GI	0.00004	NA	NA	0.00004
			Iron	NA	NA	NA		NA	None observed	0.0006	NA	NA	0.0006
			Manganese	NA	NA	NA		NA	CNS	0.00003	0.00004	NA	0.00008
			Mercury	NA	NA	NA		NA	Autoimmune	0.00001	0.000000007	NA	0.00001
			Nickel	NA	4.E-11	NA		4.E-11	Weight	0.00004	0.000004	NA	0.00005
			Selenium	NA	NA	NA		NA	Hair	0.00003	0.000000003	NA	0.00003
			Thallium	NA	NA	NA		NA	Hair	0.001	NA	NA	0.001
			Vanadium	NA	NA	NA		NA	Weight	0.0005	NA	NA	0.0005
			Zinc	NA	NA	NA		NA	Blood	0.000004	NA	NA	0.000004
			K-40	2.E-08	5.E-19		1.E-07	1.E-07					
			Ra-226	6.E-08	1.E-16		3.E-07	4.E-07					
			Ra-228	1.E-07	4.E-17		1.E-07	2.E-07					
			TH-228	1.E-08	2.E-16		4.E-08	5.E-08					
			TH-232	4.E-09	9.E-17		2.E-12	4.E-09					
			U-234	4.E-09	4.E-17		3.E-12	4.E-09					
			U-235	8.E-11	3.E-18		2.E-10	3.E-10					
			U-238	5.E-09	3.E-17		1.E-09	7.E-09					
			Chemical Total					2.E-06					0.01
		Exposure Point Total						2.E-06					0.01
	Exposure Medium Total							2.E-06					0.01
Medium Total													0.01
Receptor Total							Receptor Risk Total	2.E-06				Receptor HI Total	0.01

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.12.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Recreator
Receptor Age:	Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.002	0.00005	NA	0.002
			Arsenic	1.E-06	4.E-10	9.E-08		1.E-06	Skin	0.02	0.00005	0.001	0.02
			Barium	NA	NA	NA		NA	Liver	0.0003	0.00002	NA	0.0003
			Beryllium	NA	2.E-11	NA		2.E-11	GI	0.0002	0.000003	NA	0.0002
			Boron	NA	NA	NA		NA	Fetus	0.00004	0.00000006	NA	0.00004
			Chromium	NA	7.E-10	NA		7.E-10	None observed	0.001	0.000004	NA	0.001
			Cobalt	NA	3.E-10	NA		3.E-10	Blood	0.004	0.00003	NA	0.004
			Copper	NA	NA	NA		NA	GI	0.0001	NA	NA	0.0001
			Iron	NA	NA	NA		NA	None observed	0.002	NA	NA	0.002
			Manganese	NA	NA	NA		NA	CNS	0.0001	0.00004	NA	0.0001
			Mercury	NA	NA	NA		NA	Autoimmune	0.00004	0.000000007	NA	0.00004
			Nickel	NA	1.E-11	NA		1.E-11	Weight	0.0001	0.000004	NA	0.0001
			Selenium	NA	NA	NA		NA	Hair	0.00009	0.000000003	NA	0.00009
			Thallium	NA	NA	NA		NA	Hair	0.004	NA	NA	0.004
			Vanadium	NA	NA	NA		NA	Weight	0.001	NA	NA	0.001
			Zinc	NA	NA	NA		NA	Blood	0.00001	NA	NA	0.00001
			K-40	1.E-08	1.E-19		3.E-08	4.E-08					
			Ra-226	3.E-08	3.E-17		8.E-08	1.E-07					
			Ra-228	6.E-08	1.E-17		3.E-08	9.E-08					
			TH-228	5.E-09	6.E-17		1.E-08	2.E-08					
			TH-232	2.E-09	2.E-17		6.E-13	2.E-09					
			U-234	2.E-09	1.E-17		7.E-13	2.E-09					
			U-235	4.E-11	8.E-19		5.E-11	9.E-11					
			U-238	3.E-09	8.E-18		3.E-10	3.E-09					
			Chemical Total					1.E-06					0.03
		Exposure Point Total						1.E-06					0.03
	Exposure Medium Total							1.E-06					0.03
Medium Total								1.E-06					0.03
Receptor Total							Receptor Risk Total	1.E-06				Receptor HI Total	0.03

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.1.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Aluminum	NA	NA			NA	CNS	0.009	0.001		0.01
			Arsenic	3.E-06	4.E-09			3.E-06	Skin	0.08	0.001		0.08
			Chromium	NA	8.E-09			8.E-09	Liver	0.005	0.00009		0.005
			Cobalt	NA	3.E-09			3.E-09	GI	0.02	0.0007		0.02
			Iron	NA	NA			NA	Fetus	0.01	NA		0.01
			Thallium	NA	NA			NA	None observed	0.02	NA		0.02
			Vanadium	NA	NA			NA	Blood	0.008	NA		0.008
			K-40	8.E-08	2.E-18		5.E-07	6.E-07					
			Ra-226	2.E-07	6.E-16		1.E-06	2.E-06					
			Ra-228	5.E-07	2.E-16		1.E-06	2.E-06					
			TH-228	3.E-08	1.E-15		2.E-07	2.E-07					
			TH-232	1.E-08	4.E-16		5.E-11	1.E-08					
			U-234	1.E-08	2.E-16		1.E-10	1.E-08					
			U-238	2.E-08	1.E-16		1.E-08	3.E-08					
			Chemical Total					7.E-06					0.2
		Exposure Point Total						7.E-06					0.2
	Exposure Medium Total							7.E-06					0.2
Medium Total								7.E-06					0.2
Receptor Total							Receptor Risk Total	7.E-06				Receptor HI Total	0.2

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.2.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Aluminum	NA	NA	NA		NA	CNS	0.02	0.001	NA	0.02
			Arsenic	5.E-06	4.E-09	1.E-06		6.E-06	Skin	0.2	0.001	0.03	0.2
			Chromium	NA	8.E-09	NA		8.E-09	Liver	0.01	0.00009	NA	0.01
			Cobalt	NA	3.E-09	NA		3.E-09	GI	0.05	0.0007	NA	0.05
			Iron	NA	NA	NA		NA	Fetus	0.02	NA	NA	0.02
			Thallium	NA	NA	NA		NA	None observed	0.04	NA	NA	0.04
			Vanadium	NA	NA	NA		NA	Blood	0.02	NA	NA	0.02
			K-40	2.E-07	2.E-18		1.E-06	1.E-06					
			Ra-226	4.E-07	6.E-16		3.E-06	4.E-06					
			Ra-228	9.E-07	2.E-16		3.E-06	4.E-06					
			TH-228	7.E-08	1.E-15		4.E-07	5.E-07					
			TH-232	3.E-08	4.E-16		1.E-10	3.E-08					
			U-234	3.E-08	2.E-16		3.E-10	3.E-08					
			U-238	4.E-08	1.E-16		2.E-08	6.E-08					
			Chemical Total					2.E-05					0.4
		Exposure Point Total						2.E-05					0.4
	Exposure Medium Total							2.E-05					0.4
Medium Total								2.E-05					0.4
Receptor Total							Receptor Risk Total	2.E-05				Receptor HI Total	0.4

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.3.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Aluminum		NA			NA	CNS		0.002		0.002
			Arsenic		9.E-09			9.E-09	Skin		0.002		0.002
			Chromium		2.E-08			2.E-08	None observed		0.0002		0.0002
			Cobalt		5.E-09			5.E-09	Blood		0.001		0.001
			Iron		NA			NA	None observed		NA		NA
			Thallium		NA			NA	Hair		NA		NA
			Vanadium		NA			NA	Weight		NA		NA
			K-40		4.E-18			4.E-18					
			Ra-226		1.E-15			1.E-15					
			Ra-228		3.E-16			3.E-16					
			TH-228		2.E-15			2.E-15					
			TH-232		8.E-16			8.E-16					
			U-234		3.E-16			3.E-16					
			U-238		3.E-16			3.E-16					
			Chemical Total					3.E-08					0.009
		Exposure Point Total						3.E-08					0.009
	Exposure Medium Total							3.E-08					0.009
Medium Total								3.E-08					0.009
Receptor Total							Receptor Risk Total	3.E-08				Receptor HI Total	0.009

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.4.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	Off-Site Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Current - Properties Adjacent to KIF or at the KIF Facility	Aluminum		NA			NA	CNS		0.002		0.002
			Arsenic		9.E-09			9.E-09	Skin		0.002		0.002
			Chromium		2.E-08			2.E-08	None observed		0.0002		0.0002
			Cobalt		5.E-09			5.E-09	Blood		0.001		0.001
			Iron		NA			NA	None observed		NA		NA
			Thallium		NA			NA	Hair		NA		NA
			Vanadium		NA			NA	Weight		NA		NA
			K-40		4.E-18			4.E-18					
			Ra-226		1.E-15			1.E-15					
			Ra-228		3.E-16			3.E-16					
			TH-228		2.E-15			2.E-15					
			TH-232		8.E-16			8.E-16					
			U-234		3.E-16			3.E-16					
			U-238		3.E-16			3.E-16					
			Chemical Total					3.E-08					0.009
		Exposure Point Total						3.E-08					0.009
	Exposure Medium Total							3.E-08					0.009
Medium Total								3.E-08					0.009
Receptor Total							Receptor Risk Total	3.E-08				Receptor HI Total	0.009

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.5.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Current
Receptor Population:	On-Site Trespasser
Receptor Age:	Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.02	0.0008	NA	0.02
			Arsenic	4.E-06	3.E-09	4.E-06		8.E-06	Skin	0.1	0.0007	0.1	0.3
			Chromium	NA	6.E-09	NA		6.E-09	None observed	0.009	0.00007	NA	0.009
			Cobalt	NA	2.E-09	NA		2.E-09	Blood	0.04	0.0005	NA	0.04
			Iron	NA	NA	NA		NA	None observed	0.02	NA	NA	0.02
			Thallium	NA	NA	NA		NA	Hair	0.04	NA	NA	0.04
			Vanadium	NA	NA	NA		NA	Weight	0.01	NA	NA	0.01
			K-40	9.E-08	2.E-18		8.E-06	8.E-06					
			Ra-226	2.E-07	4.E-16		2.E-05	2.E-05					
			Ra-228	5.E-07	1.E-16		7.E-06	8.E-06					
			TH-228	4.E-08	8.E-16		3.E-06	3.E-06					
			TH-232	1.E-08	3.E-16		1.E-10	1.E-08					
			U-234	2.E-08	1.E-16		2.E-10	2.E-08					
			U-238	2.E-08	1.E-16		3.E-08	1.E-07					
			Chemical Total					5.E-05					0.4
		Exposure Point Total						5.E-05					0.4
	Exposure Medium Total							5.E-05					0.4
Medium Total								5.E-05					0.4
Receptor Total							Receptor Risk Total	5.E-05				Receptor HI Total	0.4

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.6.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA			NA	CNS	0.01	0.002		0.01
			Arsenic	2.E-05	3.E-08			2.E-05	Skin	0.1	0.001		0.1
			Chromium	NA	6.E-08			6.E-08	None observed	0.007	0.0001		0.01
			Cobalt	NA	2.E-08			2.E-08	Blood	0.03	0.001		0.03
			Iron	NA	NA			NA	None observed	0.01	NA		0.01
			Thallium	NA	NA			NA	Hair	0.03	NA		0.03
			Vanadium	NA	NA			NA	Weight	0.01	NA		0.01
			K-40	6.E-07	2.E-17		5.E-05	5.E-05					
			Ra-226	2.E-06	4.E-15		1.E-04	1.E-04					
			Ra-228	3.E-06	1.E-15		4.E-05	5.E-05					
			TH-228	2.E-07	7.E-15		2.E-05	2.E-05					
			U-238	1.E-07	1.E-15		5.E-07	6.E-07					
			Chemical Total					2.E-04					0.2
		Exposure Point Total						2.E-04					0.2
	Exposure Medium Total							2.E-04					0.2
Medium Total								2.E-04					0.2
Bedrock Groundwater	Bedrock Groundwater	On-Site	Barium, total	NA				NA	Skin	0.02			0.02
			Iron, total	NA				NA	Skin	0.001			0.001
			Strontium, total	NA				NA	Blood	0.007			0.007
			Chemical Total					2.E-05					0.2
		Exposure Point Total						2.E-05					0.2
Receptor Total							Receptor Risk Total	2.E-05				Receptor HI Total	0.2

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.7.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.03	0.002	NA	0.03
			Arsenic	4.E-05	3.E-08	8.E-06		5.E-05	Skin	0.2	0.001	0.05	0.3
			Chromium	NA	6.E-08	NA		6.E-08	None observed	0.01	0.0001	NA	0.01
			Cobalt	NA	2.E-08	NA		2.E-08	Blood	0.07	0.001	NA	0.07
			Iron	NA	NA	NA		NA	None observed	0.03	NA	NA	0.03
			Thallium	NA	NA	NA		NA	Hair	0.06	NA	NA	0.06
			Vanadium	NA	NA	NA		NA	Weight	0.02	NA	NA	0.02
			K-40	1.E-06	2.E-17		1.E-04	1.E-04					
			Ra-226	3.E-06	4.E-15		3.E-04	3.E-04					
			Ra-228	6.E-06	1.E-15		1.E-04	1.E-04					
			TH-228	5.E-07	7.E-15		4.E-05	4.E-05					
			U-238	3.E-07	1.E-15		1.E-06	1.E-06					
			Chemical Total					6.E-04					0.5
	Exposure Medium Total							6.E-04					0.5
Medium Total								6.E-04					0.5
Receptor Total							Receptor Risk Total	6.E-04				Receptor HI Total	0.5

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.8.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Groundskeeper
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.05	0.001	NA	0.05
			Arsenic	7.E-05	3.E-08	4.E-06		7.E-05	Skin	0.4	0.001	0.03	0.5
			Chromium	NA	5.E-08	NA		5.E-08	None observed	0.03	0.0001	NA	0.03
			Cobalt	NA	2.E-08	NA		2.E-08	Blood	0.1	0.0009	NA	0.1
			Iron	NA	NA	NA		NA	None observed	0.05	NA	NA	0.05
			Thallium	NA	NA	NA		NA	Hair	0.1	NA	NA	0.1
			Vanadium	NA	NA	NA		NA	Weight	0.04	NA	NA	0.04
			K-40	2.E-06	5.E-18		7.E-05	7.E-05					
			Ra-226	6.E-06	1.E-15		2.E-04	2.E-04					
			Ra-228	1.E-05	4.E-16		6.E-05	7.E-05					
			TH-228	9.E-07	2.E-15		2.E-05	2.E-05					
			U-238	5.E-07	3.E-16		7.E-07	1.E-06					
			Chemical Total					4.E-04					0.9
		Exposure Point Total						4.E-04					0.9
	Exposure Medium Total							4.E-04					0.9
Medium Total								4.E-04					0.9
Receptor Total							Receptor Risk Total	4.E-04				Receptor HI Total	0.9

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.9.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.04	0.003	NA	0.04
			Arsenic	5.E-05	7.E-08	2.E-05		7.E-05	Skin	0.3	0.003	0.1	0.5
			Chromium	NA	1.E-07	NA		1.E-07	None observed	0.02	0.0003	NA	0.02
			Cobalt	NA	4.E-08	NA		4.E-08	Blood	0.09	0.002	NA	0.1
			Iron	NA	NA	NA		NA	None observed	0.04	NA	NA	0.04
			Thallium	NA	NA	NA		NA	Hair	0.08	NA	NA	0.08
			Vanadium	NA	NA	NA		NA	Weight	0.03	NA	NA	0.03
			K-40	1.E-06	3.E-17		3.E-04	3.E-04					
			Ra-226	4.E-06	9.E-15		8.E-04	8.E-04					
			Ra-228	9.E-06	3.E-15		3.E-04	3.E-04					
			TH-228	7.E-07	2.E-14		1.E-04	1.E-04					
			U-238	4.E-07	2.E-15		3.E-06	4.E-06					
			Chemical Total					2.E-03					0.8
		Exposure Point Total											
	Exposure Medium Total							2.E-03					0.8
Medium Total								2.E-03					0.8
Bedrock Groundwater	Bedrock Groundwater	On-Site	Arsenic, total	NA		NA		NA	Skin	0.07		0.0050	0.07
			Barium, total	NA		NA		NA	Liver	0.02		0.0001	0.02
			Cobalt, total	NA		NA		NA	Blood	0.02		0.0001	0.02
			Chemical Total					5.E-05					0.5
		Exposure Point Total						5.E-05					0.5
	Exposure Medium Total							5.E-05					0.5
Medium Total								5.E-05					0.5
Receptor Total							Receptor Risk Total	2.E-03				Receptor HI Total	1

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.10.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.3	0.003	NA	0.4
			Arsenic	1.E-04	2.E-08	1.E-05		1.E-04	Skin	3	0.003	0.3	3
			Chromium	NA	3.E-08	NA		3.E-08	None observed	0.2	0.0003	NA	0.2
			Cobalt	NA	1.E-08	NA		1.E-08	Blood	0.9	0.002	NA	0.9
			Iron	NA	NA	NA		NA	None observed	0.4	NA	NA	0.4
			Thallium	NA	NA	NA		NA	Hair	0.7	NA	NA	0.7
			Vanadium	NA	NA	NA		NA	Weight	0.3	NA	NA	0.3
			K-40	7.E-07	8.E-18		8.E-05	8.E-05					
			Ra-226	2.E-06	2.E-15		2.E-04	2.E-04					
			Ra-228	4.E-06	7.E-16		8.E-05	8.E-05					
			TH-228	3.E-07	4.E-15		3.E-05	3.E-05					
			U-238	2.E-07	5.E-16		8.E-07	1.E-06					
			Chemical Total					5.E-04					6
		Exposure Point Total						5.E-04					6
	Exposure Medium Total							5.E-04					6
	Exposure Medium Total							5.E-04					6
Medium Total													
Bedrock Groundwater	Bedrock Groundwater	On-Site	Arsenic, total	NA		NA		NA	Skin	0.2		0.015	0.2
			Barium, total	NA		NA		NA	Liver	0.05		0.0003	0.05
			Cobalt, total	NA		NA		NA	Blood	0.05		0.0003	0.05
			Chemical Total					3.E-05					1
		Exposure Point Total						3.E-05					1
	Exposure Medium Total							3.E-05					1
Medium Total								3.E-05					1
Receptor Total							Receptor Risk Total	6.E-04				Receptor HI Total	8

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.11.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Recreator
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.0006	0.00005	NA	0.0006
			Arsenic	8.E-07	1.E-09	3.E-07		1.E-06	Skin	0.005	0.00005	0.002	0.007
			Chromium	NA	2.E-09	NA		2.E-09	None observed	0.0003	0.000004	NA	0.0003
			Cobalt	NA	6.E-10	NA		6.E-10	Blood	0.001	0.00003	NA	0.001
			Iron	NA	NA	NA		NA	None observed	0.0006	NA	NA	0.0006
			Thallium	NA	NA	NA		NA	Hair	0.001	NA	NA	0.001
			Vanadium	NA	NA	NA		NA	Weight	0.0005	NA	NA	0.0005
			K-40	2.E-08	5.E-19		1.E-07	1.E-07					
			Ra-226	6.E-08	1.E-16		3.E-07	4.E-07					
			Ra-228	1.E-07	4.E-17		1.E-07	2.E-07					
			TH-228	1.E-08	2.E-16		4.E-08	5.E-08					
			U-238	5.E-09	3.E-17		1.E-09	7.E-09					
			Chemical Total					2.E-06					0.01
		Exposure Point Total						2.E-06					0.01
	Exposure Medium Total							2.E-06					0.01
Medium Total								2.E-06					0.01
Receptor Total							Receptor Risk Total	2.E-06					0.01

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.12.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Kingston Fly Ash Recovery Project

Scenario Timeframe:	Future
Receptor Population:	On-Site Recreator
Receptor Age:	Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ash	Ash	Future - On the Dredge Cell or Ash Flow Area	Aluminum	NA	NA	NA		NA	CNS	0.002	0.00005	NA	0.002
			Arsenic	1.E-06	4.E-10	9.E-08		1.E-06	Skin	0.02	0.00005	0.001	0.02
			Chromium	NA	7.E-10	NA		7.E-10	None observed	0.001	0.000004	NA	0.001
			Cobalt	NA	3.E-10	NA		3.E-10	Blood	0.004	0.00003	NA	0.004
			Iron	NA	NA	NA		NA	None observed	0.002	NA	NA	0.002
			Thallium	NA	NA	NA		NA	Hair	0.004	NA	NA	0.004
			Vanadium	NA	NA	NA		NA	Weight	0.001	NA	NA	0.001
			K-40	1.E-08	1.E-19		3.E-08	4.E-08					
			Ra-226	3.E-08	3.E-17		8.E-08	1.E-07					
			Ra-228	6.E-08	1.E-17		3.E-08	9.E-08					
			TH-228	5.E-09	6.E-17		1.E-08	2.E-08					
			U-238	3.E-09	8.E-18		3.E-10	3.E-09					
			Chemical Total					1.E-06					0.03
		Exposure Point Total						1.E-06					0.03
	Exposure Medium Total							1.E-06					0.03
Medium Total								1.E-06					0.03
Medium Total													
Receptor Total							Receptor Risk Total	1.E-06					0.03

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	