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MISSOURI PUBLIC SERVICE COMMISSION

Case No. EA-2012-0281

SURREBUTTAL TESTIMONY
OF
LISA J.N. BRADLEY, Ph.D., DABT
ON
BEHALF OF
UNION ELECTRIC COMPANY
d/b/a AMEREN MISSOURI

Chelmsford, MA
September, 2013

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TABLE OF CONTENTS

SURREBUTTAL TESTIMONY

OF

LISA J.N. BRADLEY, Ph.D., DABT

CASE NO. EA-2012-0281

I. INTRODUCTION

Q. Please state your name and business address.

A. Lisa J.N. Bradley, Ph.D., DABT, AECOM, 250 Apollo Drive, Chelmsford, MA 01824.

Q. By whom are you employed and in what capacity?

A. I am Vice President and Senior Toxicologist for AECOM. AECOM is a global provider of professional, technical, and management support services to a broad range of markets, including transportation, facilities, environmental, energy, water, and government.

Q. What are your primary duties and areas of expertise?

A. I am a senior toxicologist and human health risk assessor. Human health risk assessment is a process used to estimate the risk that contact with constituents in the environment may harm people now or in the future. I conduct human health risk assessments and evaluations, provide toxicology support to my clients, conduct regulatory negotiations, and provide environmental communications support.

Q. Please outline your background, employment history, education, and training.

A. I earned a Ph.D. in Toxicology from the Massachusetts Institute of Technology in 1991, and a B.S. in Chemistry and Zoology, summa cum laude, from the University of Idaho in 1983, where I was inducted into Phi Beta Kappa. I am certified as a Diplomate by the American Board of Toxicology (DABT). I earned that certification in 1994, and have successfully recertified every five years since then. The mission of the American Board of Toxicology is to identify, maintain, and evolve a standard for professional competency in the field of toxicology. The certification of Diplomate is a globally recognized credential in toxicology representative of competency and commitment to human health and environmental sciences. A copy of my curriculum vitae is also attached hereto as Exhibit A.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to respond to local public hearing testimony, and certain exhibits submitted at the local public hearings held in this case and, in particular, to respond to various concerns and contentions that were made about coal combustion products (CCPs), which are sometimes referred to generically as coal ash. My testimony will address the following principal areas raised by the testimony of these witnesses:

- Concerns about toxicity of coal ash;
- The potential for exposure to coal ash from the proposed utility waste landfill (UWL) project;
- Putting any risks in context; and
- The so-called "damage cases."

Q. Please summarize your key conclusions.

A. The toxicity of coal ash and its risks have been grossly overstated by the local public hearing witnesses. Moreover, pathways for exposure to the coal ash to be disposed of in the proposed Ameren Missouri utility waste landfill (UWL) do not exist. In particular, the engineering of the UWL will prevent release of leachate to the environment and the extensive groundwater monitoring network that is in place will provide yet another level of protection. The proposed UWL is designed to surpass current requirements and to meet or exceed the U.S. Environmental Protection Agency's (USEPA's) expected final regulatory scheme for the handling of coal ash. UWLs of this type of design have been found by USEPA to be protective of human health and the environment. In fact, the risks for humans related to such a UWL is far, far less than the ordinary, background risk of contracting cancer or suffering a fatality from many common occurrences.

Q. Are you sponsoring any schedules?

A. Yes, I am sponsoring 16 schedules, as follows:

1. Schedule LJNB-S1 – Composition of Coal Ash and Other Natural Materials
2. Schedule LJNB-S2 – Background Levels of Arsenic in Soils
3. Schedule LJNB-S3 – Background Levels of Aluminum and Copper in Soils
4. Schedule LJNB-S4 – Background Levels of Iron and Lead in Soils
5. Schedule LJNB-S5 – Background Levels of Manganese and Mercury in Soils
6. Schedule LJNB-S6 – Background Levels of Selenium and Zinc in Soils
7. Schedule LJNB-S7 – USEPA Regional Screening Level Summary Table
8. Schedule LJNB-S8 – USEPA Regional Screening Levels for Residential Soils
9. Schedule LJNB-S9 – Comparison of USGS Data for Fly Ash to USEPA Regional Screening Levels
10. Schedule LJNB-S10 – Comparison of 10th and 90th Percentiles USGS Data for Wyoming Fly Ash to Background Levels in Soils
11. Schedule LJNB-S11 – Comparison of USGS Data for Bottom Ash to USEPA Regional Screening Levels
12. Schedule LJNB-S12 – REACH Human Health Toxicity Data for Ashes
13. Schedule LJNB-S13 – AECOM Review of Groundwater Monitoring Data – Labadie Facility
14. Schedule LJNB-S14 – USEPA Human and Ecological Risk Assessment of Coal Combustion Wastes (Table 4-1)
15. Schedule LJNB-S15 – Risks in Perspective (per USEPA Data)

16. Schedule LJNB-S16 – Pennsylvania Department of Environmental Quality Overview of Deficiencies and Errors Contained in Reports Issued by The Environmental Integrity Project Regarding Coal Combustion Waste Disposal Impoundments in Pennsylvania

Q. Did you review any testimony (filed or otherwise) submitted in this case in completing your work and arriving at your opinions?

A. Yes. I reviewed the transcripts of local public hearings held in June and July of this year in Union, Missouri, and in Washington, Missouri.

Q. To the extent you relied upon any documents, including your schedules, in forming your opinions are those documents of the type reasonably relied upon by experts in your areas of expertise and do you consider such documents reasonably reliable?

A. Yes.

Q. Are the opinions expressed in this testimony given within a reasonable degree of scientific certainty?

A. Yes.

Q. Before specifically addressing the three areas you mention above, could you please explain what coal ash consists of?

A. Yes. As the Commission is likely generally aware, coal is a sedimentary rock that is a natural component of the earth's crust. Coal contains inorganic minerals and elements in addition to its organic content. It is the organic content of coal that is burned; it is the inorganic minerals and elements that remain after combustion. This remaining material is what is referred to as coal ash. There are generally two kinds of coal ash, fly ash and bottom ash. Fly ash is coal ash that exits from a combustion chamber in the flue gas and is captured by air pollution control equipment. Fly ash has cementitious and/or pozzolanic properties that make it attractive as a building material. Fly ash with high calcium content is cementitious, meaning that it will harden like concrete when mixed with water. Cementitious ashes are typically generated from low sulfur, western coals like that burned at the Labadie facility. Bottom ash consists of agglomerated ash particles that are too large to be carried in the flue gases and instead adhere to the boiler walls or fall through open grates to an ash hopper at the bottom of the boiler.

II. TOXICITY ISSUES

Q. Various witnesses raised claims about the toxicity of coal ash, with their general point apparently being that disposing of coal ash in the UWL poses a risk to their health or the environment. Do you have an opinion regarding whether their concerns have a basis in facts and science?

A. Yes.

Q. What is that opinion?

A. My opinion is that their concerns are not grounded in facts or science, and that they reflect a fundamental misunderstanding of the issues associated with the disposal of coal ash in an engineered UWL that will hold solid, hardened coal ash.

Q. What are some of the basic facts and science relating to coal ash?

A. To answer that question, it is first helpful to understand the composition of coal ash, which I show in Schedule LJNB-S1, attached hereto. Schedule LJNB-S1 compares the relative amounts of major and minor components in coal ash and other naturally occurring materials. It is important to understand that the constituents that are the focus of many of the concerns expressed by the local public hearing witnesses about the toxicity of coal ash (e.g., lead, arsenic, mercury, cadmium, selenium, etc.) are trace elements, so called because they are present in such low concentrations (in the mg/kg or part per million (ppm) range). Together, the trace elements generally make up less than 1 percent of the total mass of these materials. To put these concentrations into context, a mg/kg or ppm is equivalent to:

- 1 penny in a large container holding $10,000 worth of pennies, or

- 1 second in 11.5 days, or
- 1 inch in 15.8 miles.

These trace elements have been referred to by witnesses at the local public hearings and even in the popular press as "toxic"—without any context provided for what this means. Moreover, witnesses have claimed that there is no safe level of exposure to any of these elements.

Q. Is that claim true?

A. No, it is not, and there are two important facts that must be understood to put my response to that question in context. The first fact that must be understood is that all of these substances occur naturally in our environment. U.S. Geological Survey (USGS) data demonstrate the presence of these constituents in the soils across the U.S., the vast majority of which have never been impacted by coal ash. Prime examples include arsenic, lead, mercury and selenium. With respect to arsenic, Schedule LJNB-S2 attached hereto shows the range of background levels of arsenic in soils across the U.S., as published by the USGS. The USGS is conducting a "national geochemical survey" to identify background levels of elements in soils in the U.S. The following schedules attached hereto provide maps prepared by the USGS demonstrating the naturally-occurring presence of other trace elements in soils in the U.S., including aluminum and copper (LJNB-S3), iron and lead (LJNB-S4), manganese and mercury (LJNB-S5), and selenium and zinc (LJNB-S6).

These soils are found in our backyards, schools, parks, etc., and because of their presence in soil, these constituents are also present in the foods we eat. Some of these constituents are present in our vitamins, such as manganese and selenium. Thus, we are exposed to these trace elements in our natural environment every day.

Q. What is the second fact that must be understood?

A. The second fact is that all constituents and materials that we encounter in our natural environment *can* be toxic, but what determines whether a toxic *effect* actually occurs is how one is exposed to the constituent, the amount of material to which one may be exposed, and the timing and duration of that exposure. Despite what witnesses such as pediatrician Dr. Jerry Friedman say, without sufficient exposure the science tells us that there are no toxic effects. Put another way, when a toxic effect is demonstrated by a particular constituent, it is caused by high levels of exposure over a long-term duration. The fundamental principles here are:

- All constituents can exert toxic effects (from aspirin[1] to table salt to water to minerals).
- For such toxic effects to occur, exposure must occur at a sufficiently high level for a sufficiently long period of time.
- If there is no exposure, there is no risk.

Q. Is this just your opinion, or is that opinion held by others charged with protecting the environment?

A. It is not just my opinion. Consider that USEPA uses information on the potential toxicity of constituents to identify concentrations of trace elements in soil in a residential setting that are considered by USEPA to be protective for humans (including sensitive groups) over a *lifetime*. Specifically, residential soil screening levels are levels that are protective of a child and adult's daily exposure to constituents present in soil or a solid matrix over a residential lifetime. In the context of regulatory decision making, at sites where constituent concentrations fall below these screening levels, no further action or study is warranted under the federal Superfund program. A copy of the USEPA regional screening levels table is attached hereto as Schedule LJNB-S7. USEPA provides screening levels for constituents in residential soil (and other media) for over 750 constituents. Schedule LJNB-S8 attached hereto shows these residential

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[1] For example, if one takes two aspirin every four hours as directed, aspirin is not toxic. If one takes the entire bottle at once, the aspirin is very toxic.

soil screening levels for the trace elements that are present in coal ash. USEPA considers it to be safe for children to be exposed to these concentrations of each of these trace elements in soils on a daily basis, throughout their lifetime. What this tells us is that by developing these residential soil screening levels, USEPA considers the presence of these levels of these constituents in soils to be safe for humans, even for exposure on a daily basis. It is, therefore, simply not true that there are no safe levels of exposure to these constituents.

Q. How do the levels of the constituents in coal ash compare to these screening levels?

A. With only a few exceptions, constituent concentrations in coal ash are below screening levels developed by the USEPA for residential soils, and are similar in concentration to background U.S. soils. My opinion is based upon a human health risk-based evaluation I conducted in 2012. This study evaluated data on constituent concentrations in a variety of coal ashes from across the U.S. published in a 2011 report by the USGS. My report addressed the potential risk to human health from direct contact pathways. Relevant to this case, this study, titled "Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants," reflects the comparison of the ranges of trace element concentrations in fly ash produced from coal from the Powder River Basin in Wyoming (the same type of coal used at Labadie). The study is available at: http://www.acaa-usa.org/associations/8003/files/ACAA_CoalAshMaterialSafety_June2012.pdf. Schedule LJNB-S9, attached hereto, is an updated chart from this study that shows the ranges of trace element concentrations in this fly ash (these ranges are shown in purple on top of the green vertical bars) to the USEPA screening levels for residential soils (which are shown as the green vertical bars). What Schedule LJNB-S9 shows is that all but one of the constituents are present in the Wyoming fly ash at concentrations that are below the USEPA residential soil screening levels; and for cobalt, the concentration range is only marginally above the screening level. As noted in detail in the report itself, the toxicity value upon which the USEPA soil screening level for cobalt is based is two levels of magnitude lower than what has been derived by other regulatory agencies; thus a much higher health protective soil screening level for cobalt exists.

The results are similar for all of the coal ashes evaluated in the report. The evaluation in the report included not only the simple comparison of constituent concentrations in coal ash to USEPA screening levels, but also provided a detailed cumulative risk screen for each coal ash data set to account for potential additive effects of combined exposures to the trace elements in coal ash. The results confirm the simple screening results, which indicate that no significant risk would be posed by direct exposure to coal ash in a residential setting.

Q. How do the levels of the constituents in fly ash compare to background levels?

Schedule LJNB-S10, attached hereto, which is also updated from the report, shows a comparison of the range of constituent concentrations in the Wyoming fly ash to background levels in soils in the U.S., and to the USEPA residential soil screening levels. What the data show is that constituent concentrations in coal ash are not that different from concentrations in soils in the U.S.

Thus, by considering the levels of trace elements in coal ash in comparison to the background levels in soils in the U.S., and in comparison to the USEPA screening levels for these constituents in residential soil, screening levels that are protective of daily exposure to soils by children and adults, including sensitive subgroups, it is concluded that even daily direct contact to trace elements in coal ash would not pose a significant risk to human health.

Q. Please address the same question regarding bottom ash?

A. The results are essentially the same for bottom ash from Wyoming coal, as shows in Schedule LJNB-S11.

Q. Are there other bases for your opinion about the relative low risk posed by these constituents?

A. Yes. Studies of coal ash with respect to various types of potential toxic effects have been conducted under the European Union (EU) REACH (Registration, Evaluation, Authorization and Restriction of Chemical substances) program. REACH enforces strict guidelines on companies that manufacture, import or use one ton of chemicals per year or more in the EU. These companies must collect information on the properties of the substances and communicate it to the European Chemical Agency (ECHA) through a registration dossier. REACH uses a weight-of-evidence approach to categorize scientifically valid information from animal and human toxicity data that are available. REACH requires the submission of information on substance identity, physicochemical properties, mammalian toxicity, ecotoxicity, environmental fate, including abiotic and biotic degradation, and information on manufacture and uses as well as risk management measures. The mammalian (human health) testing results are classified based on degrees of severity of toxicity in terms of dose response. Chemicals that have low or no toxicity at high levels of dose are "not classified," meaning that exposure is not likely to cause a hazard. While some of the information on the registrations is proprietary, the results of the toxicity testing are available.

I have compiled the data available for materials classified as "Ashes, residues" with an EC# 931-322-8 (where the EC# is a unique seven-digit identifier that is assigned to chemical substances for regulatory purposes within the EU by the regulatory authorities). The results are shown in Schedule LJNB-S12. A wide-range of mammalian toxicity tests (from seven publications and 25 study reports for a total of 34 studies) have been conducted on coal ash under the REACH program, and all of the results indicate "No Hazard." This means that the results of the toxicity tests on coal ashes either showed no toxic responses, or very mild responses at high levels of exposure; such results do not warrant classification as a hazard under the REACH system, and thus a conclusion of "No Hazard" was made.

Q. Is this kind of testing typically used for substances that are ingested by human beings?

A. Yes. This is the same kind of testing is used in medicine in the testing process for over-the-counter and prescription drugs.

Q. Please summarize your opinion regarding the toxicity of coal ash.

A. The concerns expressed regarding the toxicity of coal ash are not supported by scientific fact. The toxicity of coal ash has been grossly overstated and is not borne out by the data or by studies of the risk of harm to humans from exposure, that is, if there is exposure at all.

III. EXPOSURE

Q. You noted above that even if there were toxicity issues there must be exposure to high levels for long durations in order to pose a threat to human health. Why is this the case?

A. As noted above, if there is no exposure, there is no risk. To determine if there is a risk, we therefore have to understand the potential for exposure. For the proposed UWL, there are three potential exposure routes that have been mentioned in the local public hearing testimony: direct contact with coal ash in the landfill, the potential for off-site fugitive dust, and the potential for leaching to underlying groundwater.

Q. Please address the first route, the potential for direct contact exposure.

A. Because the property for the proposed UWL is owned by Ameren Missouri, access to the future landfill will be restricted so that members of the public will not come onto the site and be directly exposed to the coal ash. Therefore, there is no material risk posed by this potential exposure pathway.

Q. Do you have an opinion about the potential for exposure from fugitive dust and if so, what is your opinion?

A. Yes, I do. My opinion is that there is no material risk of exposure from fugitive dust. I base that opinion on studies of the issue and my knowledge of how UWLs of this type are operated, including my understanding of how Ameren Missouri will operate the proposed UWL.

Q. Didn't USEPA conduct a study that found that such a risk does exist?

A. Yes, it did, and that study was referenced during the local public hearing testimony. However, the USEPA study contains demonstrable and significant errors that result in it greatly overestimating the potential effects of coal ash landfill management on air quality. To underscore the magnitude of the compounding of the errors in the report, the level of dust in the air predicted by USEPA at a coal ash landfill would rival the dust concentrations that resulted from the eruption of Mt. St. Helens. It is unreasonable and unrealistic to expect that dust concentrations of even a tiny fraction of the Mt. St. Helens concentrations would occur when operating a UWL. Moreover, applying even simple corrections and more realistic model factors result in air quality predictions that would meet USEPA's air quality standards.

Q. Are there other studies of this issue that you have relied upon in reaching your opinion?

A. Yes. A comprehensive public health assessment of the Tennessee Valley Authority (TVA) coal ash impoundment release was conducted by the Tennessee Department of Health in 2010 during the extensive remediation activities. Thousands of air measurements were collected by TVA, USEPA and the Tennessee Department of Environmental Conservation between December 2008 and the present. The assessment concluded that measurements of metals concentrations in the air have consistently been within background levels of metals in the U.S. or below any health comparison values. In addition, the final assessment found that with respect to risk from fugitive emissions associated with the release, "sampling and analysis of particulate matter by all agencies indicated that particulate matter [less than or equal to 2.5 microns in diameter (PM2.5) and less than or equal to 10 microns in diameter (PM10)] in ambient air surrounding the coal ash release met all National Ambient Air Quality Standards."

Q. What other facts underlie your opinion that there is no material risk of exposure from fugitive dust related to the UWL?

A. In addition to the conclusions from the TVA study, a modern UWL such as the one proposed by Ameren Missouri would be quite different from the Tennessee facility. The new UWL would be filled in stages over time, in separate areas or cells. Within each cell, operations occur within only a subset of the cell area within a given day, week or month. Thus, the area from which dust could be generated is small (in contrast, note that USEPA's draft assessment used the entire area of the landfill as a fugitive dust source term, adding to the unrealistic outcome of that model). USEPA itself noted this as a factor leading to an over-estimate of exposure in a recent regulatory publication (78 FR 110: 34432- 34543 at p. 34442), where USEPA stated as follows:

> "Similarly, these data would allow EPA to refine its analysis of the potential risks from fugitive dust at landfills. Preliminary comparisons of the Office of Water data indicate that currently active portions of landfills are significantly smaller than the landfills identified in the 1995 survey that EPA used in its assessment of the risks from fugitive dust prepared for the proposed rule. In addition, ash conditioning and dust suppression measures serve to further limit any fugitive dust emissions."

The prevailing wind direction in the general area (as determined by meteorological data from the St. Louis/Lambert International Airport) is from the south and southeast, with a lesser north northwest component. The closest residence to the proposed UWL is located on a bluff south of the UWL. During the vast majority of the time, even if there were dust, the wind would not carry dust toward those residences and, as noted, even during the limited periods when the wind might blow in that direction, there simply would not be material amount of fugitive dust that would pose a risk.

Q. The third potential exposure pathway that has been mentioned is via leaching to underlying groundwater. Do you have an opinion regarding whether exposure via this route is a legitimate concern?

A. Yes. As addressed by the Preliminary Site Investigation and Detailed Site Investigation submitted to and approved by the Missouri Department of Natural Resources (MNDR), which are discussed in the surrebuttal testimony of Ameren Missouri engineer Craig J. Giesmann, the geology and hydrology of the site is such that there is not a material risk of contamination to the groundwater from which residents would draw drinking water in the area. This opinion is shared by Ameren Missouri witness and hydrogeologist Tyler Gass who is also filing surrebuttal testimony in this case.

Q. Do you have other data that supports your opinion?

A. Yes, I do. With MDNR's approval, Ameren Missouri has installed an extensive groundwater monitoring network that rings the proposed UWL site. Two rounds of testing of the groundwater in those monitoring wells have been completed. This testing is being done now, prior to operation of the UWL, in order to establish a baseline of the groundwater conditions at the site. A baseline is necessary so that on a going-forward basis as testing is done periodically during UWL operation, one can detect UWL-related impacts to groundwater near the UWL and do so before the impact moves off-site, in the very unlikely event they occurred. I have reviewed the test results from both rounds of testing, and they demonstrate that even after 40-plus years of operation of the plant and its existing coal ash impoundments, there is no groundwater contamination at the site of the proposed UWL relating to coal ash from the plant. Given the geology and hydrology in the area, this is what one would expect. In addition, I am also aware that Ameren Missouri commissioned deep well groundwater testing near its southern boundary (toward where the nearest residents live) at depths from which residents would draw drinking well water. Those test results showed no contamination, again despite the presence of coal ash impoundments at the plant for more than 40 years. Attached hereto as Schedule LJNB-S13 is a report that I prepared that discusses the results of this groundwater testing.

Q. What do these facts suggest to you?

A. They suggest to me, and it is my opinion, that if the wet storage of coal ash at the plant for the past 40-plus years has not resulted in contamination east and south of the plant, certainly dry storage of solid, hardened coal ash in a UWL that will be a lined facility with a leachate collection system in place will not result in contamination.

Q. Is your opinion regarding the lack of a material risk of exposure to the constituents in coal ash via groundwater supplies based on anything else?

A. Yes. It is also based on the USEPA's own proposal for how coal ash is to be handled. USEPA has initiated a proposed rulemaking for coal ash disposal by electric utilities, and in that rulemaking, it has proposed two management options. The first option is to regulate coal ash management under Subtitle C of the federal Resource Conservation and Recovery Act (RCRA) or as a non-hazardous solid waste under Subtitle D of RCRA. Under both options, USEPA is proposing that coal ash be disposed of in UWLs. And, under both options, the design and construction requirements for the UWLs are exactly the same, and are consistent with design requirements for solid waste under RCRA Subtitle D. Other witnesses are addressing the design and engineering of Ameren Missouri's proposed UWL, but it is my understanding that it is designed to meet or exceed these proposed USEPA requirements.

Q. How does that relate to your opinion regarding a lack of risk of groundwater and drinking water taken from groundwater?

A. A UWL is designed to prevent and limit potential releases to the environment. For potential releases to groundwater, these engineering controls include a liner system and a leachate collection system, consistent with USEPA's proposed regulations and MDNR regulations, plus the extensive groundwater monitoring network I discussed earlier. Given that USEPA is proposing the very structure that Ameren Missouri is planning to construct, and the fact that it is USEPA's job to protect human health and the environment, I conclude for this additional reason that the proposed UWL is protective of groundwater and drinking water supplies. In fact, in April of 2010, USEPA published a draft risk assessment entitled "Human and Ecological Risk Assessment of Coal Combustion Wastes." In this risk assessment, USEPA evaluated a variety of disposal scenarios for coal ash. Only one of those scenarios, "Composite-Lined Landfill Units" (a composite liner that combines a high-density polyethylene (HDPE) membrane with either geosynthetic or natural clays), which is what I understand to be the design contemplated for the Ameren Missouri Labadie facility, is germane to the current case before the Commission.

USEPA's results indicate that there are no risks above regulatory targets for the groundwater pathway for composite-lined conventional coal ash landfills – for either human or environmental receptors. This is significant, as USEPA was *very conservative* in the development of this risk assessment, such that the results are likely to overestimate risk. In addition, in its risk assessment for composite-lined landfills (like the proposed Ameren Missouri facility), USEPA specifically used published, measured performance data for commercial landfills as an input to the risk assessment. Thus, real world data on actual behavior of composite liners were used in the USEPA's risk assessment, and as noted above, the results indicate no potential risks to human health or the environment, even when modeled for a 10,000-year period. As noted by USEPA:

> "For the groundwater-to-drinking-water pathway, composite liners, as modeled in this assessment, effectively reduced risks from all constituents to below a 10^{-5} [one in one hundred thousand] cancer risk or HQ of 1 for both landfills and surface impoundments at the 90th and 50th percentiles."
>
> [Where HQ is the noncancer hazard quotient.]

Thus, USEPA's risk assessment concluded that potential releases to groundwater from composite-lined CCP landfills would not pose a risk to human or ecological receptors above regulatory target levels, even over a *10,000 ye*ar period. This is because the amount of potential release is small, due to the liner and leachate collection system, and the resulting groundwater concentrations are too low to present a risk, even considering potential residential use of groundwater as drinking water, which is the exposure scenario evaluated in the USEPA risk assessment. The table summarizing the risk results for landfills in USEPA's risk assessment is attached hereto as schedule LJNB-S14.

IV. PUTTING RISKS IN CONTEXT

Q. Can you put the risks that were discussed by witnesses at the local public hearings in context?

A. Yes. Consider that USEPA's risk assessment results are presented as an Excess Lifetime Cancer Risk (ELCR), which is the likelihood of contracting cancer over and above the background cancer rate. The ELCR is compared to the USEPA target or acceptable risk range of one in one million (10^{-6}) to one in ten thousand (10^{-4}). By comparison, the American Cancer Society (ACS) estimates that the lifetime probability of contracting cancer in the U.S. is 1 in 2 (5×10^{-1}) for men and 1 in 3 (3×10^{-1}) for women (see: http://www.cancer.org/research/cancerfactsfigures/cancerfactsfigures/cancer-facts-figures-2013). Thus USEPA's regulatory risk range is many orders of magnitude below background cancer rates in the U.S., meaning USEPA is targeting a far, far lower range of risk than the ordinary, everyday risk we all have of contracting cancer. Schedule LJNB-S15, attached hereto, shows this relationship graphically in the context of a risk arrow. High levels of risk (e.g., 1 in 2, 1 in 10) are on the left, and range to low levels of risk (e.g., 1 in one million) towards the right. The USEPA target risk range represents the ELCR over and above background. These values, as calculated using the tools of risk assessment, are hypothetical risks, and every step of the risk assessment process is designed to result in an over-estimate, not an under-estimate, of risk. The USEPA target risk range is shown below the risk arrow. Above the risk arrow are depicted the risks of fatality in the U.S. from various events – these are risks based on measurements of incidence of fatality in the U.S. population. Also shown on the arrow is the background cancer rate in the U.S., to the far left on the risk arrow. Note that USEPA's hypothetical risk for a receptor using groundwater as drinking water downgradient from a composite-lined coal ash landfill is zero ("0"), as shown on schedule LJNB-S14. As defined by USEPA,

> "Zero results indicate that contaminant infiltration rates were too small for the contaminant plume to reach the receptor during the 10,000 year period of analysis."

Thus, this risk of zero is below background cancer risk in the U.S., and below the measured risk of fatality from many common events

Q. Does this risk context apply to the levels of arsenic in coal ash?

A. Yes. As the notation on Schedule LJNB-S2 indicates, the USEPA has calculated a soil screening level for arsenic at a target one in one million cancer risk level, which, as I have discussed, is a very low risk level. The concentration of arsenic at that level is 0.61 ppm. That same schedule demonstrates that the concentration of arsenic in the majority of the soils in the U.S. exceeds this screening level, indicating that a person's ordinary exposure to arsenic, having nothing to do with any exposure to coal ash, naturally exceeds USEPA's screening risk level. This is not necessarily a measure of the toxicity of arsenic as much as it is a demonstration of the very conservative nature of the development of the residential soil screening levels by USEPA. As shown on Schedule LJNB-S10, the arsenic concentrations in soils and, indeed, in the Wyoming coal ash are below the USEPA target risk level of one in ten thousand.

V. <u>DAMAGE CASES</u>

Q. Do you have an opinion about the validity of the concerns expressed by some witnesses at the local public hearings arising from the so-called "damage cases" involving coal ash?

A. Yes. I am familiar with these cases. First, damage cases—whether "proven" or "potential"—can only be officially defined by USEPA. The majority of the "proven" and "potential" cases identified by USEPA involve unlined facilities. However, these cases are not germane to this UWL. No damage cases have been identified by USEPA for landfills where engineering controls, as contemplated for this UWL, have been employed. Only one of USEPA's damage cases involved a lined landfill with a leachate collection system. The impacts at this location were determined to be due to a nearby unlined sedimentation pond and to mechanical issues with the leachate recovery system.

In fact, it was USEPA's regulatory conclusion based on their evaluation of the damage cases and their risk assessment that the engineering controls, such as those contemplated by the Ameren Missouri project and MDNR regulations, would be sufficiently protective of human health and the environment. In other words, these "damage" cases provide support for the design of the UWL at Labadie. I agree with USEPA's conclusion.

Q. What about cases identified by other groups?

A. In my opinion, the Commission should be extremely wary of relying upon allegations made by these other groups. These claims have not been reviewed or thoroughly vetted by USEPA, but one environmental regulator, the Pennsylvania Department of Environmental Protection (PADEP), did review the reports cited by some of the local public hearing witnesses. PADEP concluded that: "Several fundamental research flaws characterize EIP's claims, which undermine the scientific validity of these reports," and, "These assumptions show either bias or a disregard of scientific accuracy."

I have attached the entire PADEP review report to my testimony as Schedule LJNB-S16.

VI. SUMMARY

Q. Is there anything you would like to say in summary?

A. Yes. The toxicity of coal ash and its risks have been grossly overstated by the local public hearing witnesses. Moreover, pathways for exposure to the coal ash to be disposed of in the UWL do not exist. In particular, the engineering of the UWL will prevent release of leachate to the environment and the extensive groundwater monitoring network that is in place will provide yet another level of protection. UWLs of this type of design have been found by USEPA to be protective of human health and the environment. In fact, the risks for humans related to the disposal of coal ash in such a UWL is far, far less than the ordinary, background risk of contracting cancer or suffering a fatality from many common occurrences.

Q. Does this conclude your surrebuttal testimony?

A. Yes.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Union Electric)
Company d/b/a Ameren Missouri for Permission and)
Approval and a Certificate of Public)
Convenience and Necessity Authorizing)
it to Construct, Install, Own,) File No. EA-2012-0281
Operate, Maintain, and Otherwise Control and Manage)
A Utility Waste Landfill and Related Facilities at its)
Labadie Energy Center.)

AFFIDAVIT OF LISA JN BRADLEY, PH.D, DABT

STATE OF Massachusetts)
) ss
COUNTY OF WORCESTER)

Lisa JN Bradley, Ph.D, DABT, being first duly sworn on her oath, states:

1. My name is Lisa JN Bradley, Ph.D, DABT. I work in the City of Chelmsford, Massachusetts, and I am employed by AECOM, Inc. as Vice President and Senior Toxicologist.

2. Attached hereto and made a part hereof for all purposes is my Surrebuttal Testimony on behalf of Union Electric Company d/b/a Ameren Missouri consisting of 20 pages and Schedules LJNB-S1 through LJNB-S16, all of which have been prepared in written form for introduction into evidence in the above-referenced docket.

3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct.

x
Lisa JN Bradley, Ph.D, DABT

Subscribed and sworn to before me this 13 day of September, 2013.

Notary Public

My commission expires: 12/16/2016

Lisa J. N. Bradley, Ph.D., DABT
Vice President and Senior Toxicologist

Professional History

AECOM (formerly ENSR)
Massachusetts Institute of Technology
University of Idaho

Education

PhD (Toxicology) Massachusetts Institute of Technology, 1991
BS (Zoology) University of Idaho, 1983
BS (Chemistry) University of Idaho, 1983

Years of Experience 25

Technical Specialties

Toxicology
Risk Assessment
Environmental Communication
Regulatory

Dr. Lisa Bradley is a Senior Toxicologist/Risk Assessor and Vice President with AECOM. She has a Ph.D. in toxicology from the Massachusetts Institute of Technology. She has 25 years of experience in risk assessment and toxicology, and is certified by the American Board of Toxicology. She has managed risk assessments for hazardous waste sites in many EPA Regions, and under many state programs. Dr. Bradley has also served as an advisor on strategic risk assessment issues for clients in the natural gas, utility, and railroad industries. She has developed the risk assessment approach for a large multi-site program for a railroad client, for a national steel client, and developed and managed the risk evaluation component of a large multi-site, multi-state federal program for a natural gas client. Dr. Bradley is experienced in public speaking and environmental communications, and she has published articles in peer reviewed scientific journals based on both her laboratory and risk assessment work. Dr. Bradley is the global risk practice technical lead for AECOM. She is the manager and technical lead for AECOM's coal combustion product (CCP) initiative and was recently elected to the Executive Committee of the American Coal Ash Association.

Experience

PCB-Related Experience

PRP Group for Urban River Superfund Site, Region 2. Providing senior review for the human health risk assessment of an urban waterway. The risk assessment includes fish consumption as a critical exposure pathway, with dioxins, PCBs, as well as non-traditional contaminants, including pathogens and emerging contaminants as exposures of interest. Work includes agency negotiations.

Solutia, Inc., Human Health Risk Assessment, Sauget Area 1, Illinois, USEPA Region 5. Prepared a human health risk assessment work plan to follow Superfund guidelines for several abandoned landfill areas and areas downgradient of the landfills. The work plan was accepted by U.S. EPA Region V. A comprehensive human health risk assessment was prepared that evaluated the former land fill areas as well as local residential areas, a creek, and a borrow pit lake. A total of 64 receptor and area scenarios were quantitatively evaluated. Supporting risk modeling included indoor and outdoor air from subsurface soil and groundwater. Activities included site visits, meetings with personnel from USEPA Region 5 and their contractors, and preparations of responses to comments and document revisions. The human health risk assessment has been accepted by the agency, and the results have been used to guide the feasibility study and remedy selection.

EXHIBIT A

Negotiation
Site Strategy Development

Professional Affiliations

Diplomate, American Board of Toxicology, 1994
Society of Toxicology
Phi Beta Kappa

Constituents of interest included PCBs in ditch sediments. The final report is available on EPA's website:
http://www.epa.gov/region5/cleanup/saugetarea1/pdfs/sauget1_deadcreek_final_remedy_200604.pdf

Columbia Gas Transmission, Strategic Risk Assessment Advisor, West Virginia, USEPA Region 3. Served as strategic risk assessment advisor to a multi-site, ten-state AOC with U.S. EPA Region III to assess environmental conditions along their pipeline system in the Mid-Atlantic States. Provided strategic risk assessment advice and technical support on the design and implementation of the program, and developed a programmatic approach to the evaluation of risk across the program. Was responsible for: review of other contractor reports, development of a common strategy for TPH and mercury to be used across the program, review and summary of risk assessment regulations and guidance for each of the states (Ohio, Pennsylvania, West Virginia, Virginia, Kentucky, North Carolina, Delaware, New Jersey, Maryland, New York, and Louisiana), conducted risk assessments, provided critical review of individual site characterization reports prepared by other contractors, and provided support in negotiations and meetings with regulators. Additional constituents of interest include PCBs, arsenic, and PAHs.

Solutia, Inc., Human Health Risk Assessment for the W.G. Krummrich Facility, Sauget, Illinois, USEPA Region 5. Developed the human health risk assessment workplan and report for the RCRA Sampling Plan for Solutia's W.G. Krummrich Facility. The workplan was designed to permit evaluation of the "Human Exposures Environmental Indicator" as well as human health risk. Used risk assessment and data visualization to identify extent of areas for remediation such that total site risk would not exceed target risk levels once remediation is complete. Also used the risk assessment to identify remedial treatment objectives for soils and groundwater. Target chemicals included PCBs and chlorinated compounds.

NiSource, Risk Assessment Issues, Columbus, Ohio. Serving as the human health risk assessment expert for NiSource's environmental programs. Have addressed issues related to PCBs (including conducting employee informational meetings), MGP-related constituents (benzene, PAHs), radon, and mercury.

Confidential Utility. Have provided PCB expert support for issues related to PCBs in natural gas pipeline systems and potential residential and commercial exposures.

Confidential Natural Gas Client, Toxicity Assessment, Ohio. Provided toxicity assessment of cleaning compounds proposed for use in the decommissioning of a natural gas pipeline laid on the bed of a reservoir that serves as the primary drinking water source for a community. Demonstrated that even should a catastrophic release of cleaning fluid and/or PCBs occur, human and ecological health would not be adversely affected and that concentrations at the drinking water intake would be much lower than health-based values or detection limits.

A. Representative Superfund Experience

Pines Area of Investigation, Indiana, USEPA Region 5. Serving as project manager for a multi-disciplinary team conducting the Remedial Investigation/Feasibility Study for the Respondents of an Administrative Order on Consent (AOC) being administered under the Superfund Alternative program in USEPA Region 5. The AOC addresses the placement of coal combustion by-products (CCBs) within a local permitted landfill and allegedly used as fill in other locations within the Area of investigation. Activities to date include agency negotiations on the AOC and scope of work; submission of a Site Management Strategy document, and subsequent approval by the Agency; submittal of the RI/FS Work Plan (including a Field Sampling Plan, Human Health and Ecological Risk Assessment Work Plans, HASP, QAPP, and a Quality Management Plan), and subsequent approval by the agency; submission of additional Sampling and Analysis Plans; and communications activities (including a website – www.pinesupdate.com - and regular mailings of information updates to the community). Regular communications with the agency is also a cornerstone of the project. As the site covers not a facility, but a town and surrounding area, executing access agreements with the land owners for sampling and well installation was a critical task. Four rounds of sampling and analysis have been successfully completed. The Final RI Report has been approved, and the Human Health Risk Assessment Report and the Ecological Risk Assessment Report have been approved and the Draft Feasibility Study has been submitted to the agency. Approved project documents to date are available on USEPA's website: http://www.epa.gov/region5/sites/pines/index.htm.

Aurora Energy, Fairbanks, AK. Providing consulting services for an EPA HRS scoring investigation of the coal-fired power plant. Activities have included fact sheet preparation, frequently asked questions and answers, document review, strategy development, and risk-based evaluation of detailed coal and coal ash data sets for the facility.

Delaware Sand & Gravel Remedial Trust, Delaware, USEPA Region 3. A human health risk assessment (HHRA) focusing on evaluation of the vapor intrusion exposure pathway was performed for the PRPs at a former drum disposal area to evaluate the effectiveness of a Bioremediation System installed as a result of an EPA Superfund Record of Decision Amendment. A tiered vapor intrusion assessment was performed consistent with USEPA guidance using groundwater and then soil gas data. It was successfully concluded, with acceptance from EPA Region 3, that no unacceptable risk to human health was posed to occupants of on-site buildings via the vapor intrusion inhalation pathway.

Sauget Area 2 Sites Group, Human Health Risk Assessment, Illinois, USEPA Region 5. Serving as the senior human health risk assessment manager for a multi-party PRP group. Prepared a human health risk assessment work plan to follow Superfund guidelines for a set of sites that include abandoned landfill areas. Conducted the multi-receptor, multi-pathway human health risk assessment, including vapor intrusion modeling for both indoor and outdoor air for the multiple multi-acre sites within the project area. Activities included a site visit, meetings and negotiations with USEPA Region 5 and their contractors, and preparation of responses to comments.

Tippecanoe Landfill, Human Health Risk Assessment, Indiana, USEPA Region 5. Conducted agency negotiations (U.S. EPA Region V) concerning the human health risk assessment for a Superfund site. Because arsenic concentrations in groundwater were of concern to the agency, researched and reviewed the toxicological information available for arsenic, and prepared a literature review and evaluation of the dose-response values developed by the U.S. EPA for arsenic.

Industri-Plex CERCLA Site, Risk Assessment Review and Strategy for PRP Group, Massachusetts, USEPA Region 1. Provided risk assessment review and strategy for PRP group, and developed risk assessment work plan to address surface water and groundwater exposure pathways.

Tennessee Valley Authority, Human Health Risk Assessment, Tennessee, USEPA Region 4. Prepared human health risk assessment and developed target cleanup levels for an abandoned battery manufacturing site. Primary constituent was lead and both child and adult lead models were used in the evaluation.

Confidential Client, Human Health Risk Assessment, New Jersey, USEPA Region 5. Conducted a human health risk assessment for a school district's baseball fields located adjacent to a potential Superfund site. Report was prepared for community distribution, and results presented at a public meeting.

Motco Superfund Site, Review of AIC for Volatile Organics, Texas, USEPA Region 6. Reviewed U.S. EPA-developed acute inhalation criteria (AIC) for volatile organics. Developed a consistent and scientifically-defensible methodology for AIC development, and applied this methodology to provide alternative AICs for use at the site.

Brio Site Task Force, Texas, USEPA Region 6. Developed acute inhalation criteria for use in a remedial program for benzene, 1,1-dichloroethane, 1,2-dichloroethane, ethyl benzene, methylene chloride, styrene, toluene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, and vinyl chloride.

B. Representative RCRA Experience

Solutia, Inc., Human Health Risk Assessment Oversight for the J.F. Queeny Facility, St. Louis, Missouri. Provided oversight for the human health risk assessment prepared for the facility under an order with USEPA Region 6. The risk assessment is designed to meet the requirements of both USEPA and the State of Missouri Risk-Based Corrective Action Program.

U.S. Steel, Human Health Risk Assessment, Gary, Indiana, USEPA Region 5. Developed the RCRA RFI Human Health Risk Assessment Workplan for the U.S. Steel Gary Works. Activities included response to regulatory comments on previous reports, site visits, review of reports generated both by USS and by local groups about the facility and its environs, development of the risk-related portions of the facility-wide RCRA RFI workplan, in addition to the HHRA workplan, and agency negotiation. Participated in strategy development for and preparation of the human health sections of the Sampling and Analysis Plans for each of the Solid Waste Management Areas being addressed at Gary Works under RCRA (13 in total). Managed and prepared the human health risk evaluation of perimeter groundwater data. Work included conducting a two tiered well-by-well screening (55 wells total). The first tier comparison was to generic and readily available standards, and the second tier took into account background and dilution into receiving water bodies, and evaluated construction worker and indoor air scenarios.

U.S. Steel, Human Health Risk Assessment, Fairless Hills, Pennsylvania, USEPA Region 3. Prepared the human health risk evaluation under RCRA Corrective Action for a parcel of property to be leased by U.S. Steel at Fairless Works. The work was conducted to satisfy Pennsylvania Department of Environmental Protection (PADEP) requirements under the Pennsylvania Act 2 program, as well as USEPA Region 3 requirements. Activities included site visit, meetings and presentations to both agencies, as well as preparation of memoranda and reports. Included in the evaluation was a sensitivity analysis of the parameters used to evaluate a construction worker scenario; site-specific parameters, parameters from the scientific literature, and parameters provided by the agency were evaluated.

U.S. Steel, Human Health Risk Assessment, Fairfield, Alabama, USEPA Region 4. Developed the RCRA RFI Human Health Risk Assessment Workplan for the U.S. Steel Fairfield Works under USEPA Region 4 and Alabama Department of Environmental Management (ADEM) requirements. Activities included site visits, preparation of strategy, review of the full RFI workplan to ensure consistency with risk objectives, and preparation of responses to agency comments. Work included a detailed evaluation of USEPA's current and proposed adult soil ingestion rates.

Hartford Working Group, Hartford Hydrocarbon Plume Site, Hartford, Illinois, USEPA Region 5. Provided toxicology and risk assessment services to the PRP group for the Hartford Hydrocarbon Plume site in Hartford, IL. Provided review of indoor air screening levels developed by the Agencies for benzene, butane, isopentane, trimethylbenzene and other petroleum-related constituents used in vapor intrusion evaluations.

C. Representative Risk Assessment Experience Under Other Programs

Confidential Client. Evaluation of Imminent and Substantial Endangerment Claim. Conducted an evaluation of surface water, sediment, and soil data used by USEPA to support an Imminent and Substantial Endangerment (ISE) claim in a draft Administrative Order on Consent. The evaluation included a review of USEPA's approach to evaluating the risks associated with the placement of fill material containing fly ash in a wetland and the potential for downstream impacts. The review concluded that the data did not support USEPA's ISE claim.

Bureau of Land Management, Environmental Impact Statement, Western States. Developed human health risk assessment to evaluate five pesticides proposed for use in BLM vegetation treatment programs. Risk assessment uses standard USEPA Office of Pesticide Policy risk assessment methods and includes use of the AgDRIFT model to evaluate off-site spray drift and deposition, and transport models to evaluate surface water impacts. Worker, public and Native American subsistence receptors were evaluated. Work has included interagency scoping meetings. Report available at: http://www.blm.gov/wo/st/en/prog/more/veg_eis.html. 2007.

Bureau of Land Management, Environmental Impact Statement, Western States. Conducting human health risk assessment for additional pesticides for the BLM vegetation treatment programs following the protocol developed for the 2007 BLM Vegetation EIS.

Confidential Client, Indiana. Evaluated groundwater and soil gas data for vapor intrusive to indoor air using the USEPA version of the Johnson and Ettinger model. Used the Johnson (2002) sensitivity analysis method to ensure that critical model parameters were within acceptable/realistic ranges. Provided deposition testimony and testimony in a court hearing on both the vapor intrusion pathway risk assessment and the toxicology of benzene.

U.S. Steel, Development of a Standardized Risk Evaluation Guidance Manual, Pennsylvania. Worked in conjunction with another firm and USS personnel to develop a standardized Risk Evaluation Guidance Manual for USS. The manual addresses important issues in human health and ecological risk assessment, provides background for the issues, USS strategy to address the issues, and examples of standard language and references to be used in future USS reports. The manual will allow for more cost-effective and consistent risk evaluations to be conducted for USS facilities and sites.

U.S. Steel, Review and Comment on Indiana's RISC Program, Indiana. Reviewed several draft versions of Indiana's "Risk Integrated System for Closure" guidance, and submitted comments to the agency. Detailed comments were provided on the following topics: construction worker soil ingestion rate, soil saturation limit, arbitrary caps for metals concentrations in soil. Have also prepared comments on Indiana's draft groundwater policy and The User's Guide that details how the RISC program will be applied to RCRA sites under state authority.

U.S. Steel, Human Health Risk Assessment, Fairfield, Alabama. Conducted a human health risk evaluation for a parcel of property to be leased by U.S. Steel at Fairfield Works. Activities included evaluation of a construction worker scenario, and use of the Johnson & Ettinger and ASTM models to evaluate indoor and outdoor air.

West Virginia Manufacturer's Association, West Virginia. Worked with the WVMA on a committee to review and provide language to the West Virginia Department of Environmental

Protection in development of their tiered site closure guidance.

Indiana Department of Environmental Management, Indiana. Served on an IDEM committee to review and provide language in the development of revisions to the "Risk Integrated System for Closure" guidance.

D. Representative Toxicology Experience

Utility Solid Waste Activities Group (USWAG), Washington, DC. Reviewed and developed comments on the risk assessment aspects of USEPA's June 2010 proposed rulemaking for the disposal of coal combustion residuals (CCRs). Comments focused on a critique of the USEPA's updated human health and ecological risk assessment, a critique of the USEPA's fugitive dust model report, and a critique of USEPA's proposed listing of CCRs as a hazardous waste under RCRA Subtitle C.

Utility Solid Waste Activities Group (USWAG), Washington, DC. Reviewed and developed comments on the USEPA's risk assessment for coal combustion wastes. The risk assessment was released in 2007, and comments were submitted under USWAG cover in January 2008. AECOM addressed all aspects of the risk assessment including human health, ecological risk and fate and transport. Provided oral comments during a national teleconference.

Utility Solid Waste Activities Group (USWAG), Washington, DC. Developed information sheet on "What is Coal Ash" for use by the USWAG membership for community relations.

Electric Power Research Institute, Palo Alto, CA. Developed the report "Comparison of Risks for Leachate from Coal Combustion Product Landfills and Impoundments with Risks for Leachate from Municipal Solid Waste Landfill Facilities," EPRI Report Number 1020555, available at www.epri.com.

Prairie State Energy Campus, Washington County, IL. Provided presentation to county board on coal ash composition and health risk issues.

We Energies, Milwaukee, WI. Reviewed the basis of the state and USEPA screening levels and toxicity values for molybdenum, and demonstrated the over-conservatism used in their derivation. Provided the review to the state agency, and developed a fact sheet on molybdenum in groundwater for communications with a local community.

We Energies, Milwaukee, WI. Reviewed the basis of the state screening levels and toxicity values for aluminum as part of review of the Wisconsin Department of Natural Resources proposed groundwater standards under NR 140. Provided testimony for a board hearing, and met with the state regulators, and demonstrated the over-conservatism used in their derivation.

Ameren UE, St. Louis, MO. Developed a human health and ecological risk assessment to support the regulatory closure under the state agency of a former ash impoundment located along a major river at the Hutsonville, IL Power Station. Boron and molybdenum were constituents of interest. Pathways evaluated in the risk assessment included use of groundwater for irrigation purposes and the migration of groundwater to the river and potential impact on the benthic community. Work included negotiation meeting with the local agency.

Ameren UE, St. Louis, MO. Serving as an expert for a landfill siting project in Missouri, for issues related to exposure, toxicity and risk assessment. Provided public testimony at a county board meeting as well as written comments that have been submitted into the record.

Ameren UE, St. Louis, MO. Providing toxicology and risk assessment support for various coal ash related projects in Illinois and Missouri.

AES, New York. Provided expert testimony on the lack of human health effects of ammonia in groundwater associated with coal ash landfills. Developed expert opinion, reviewed and critiqued opposing opinions, and testified at hearing.

AES, Puerto Rico. Provided review and synthesis of data associated with a beneficial use product, AGREMAX™ manufactured by AES Puerto Rico using bottom ash and fly ash from the coal-fired power plant. Specifically, evaluation of data on metals content, leaching of metals, and radionuclides were shown not to pose a human health or environmental risk based on the beneficial uses of AGREMAX™. Testified on AES behalf at a Puerto Rican Senate subcommittee hearing on coal ash issues.

South Carolina Electric & Gas, Columbia, SC. Provided presentation materials for use in a landfill siting and zoning process. Materials addressed the comparison of arsenic and other metals and radionuclides in coal ash and in our natural environment, and background levels of arsenic in foods and background levels of exposure to radioactivity in our natural environment.

Utility Solid Waste Activities Group (USWAG), Washington, DC. Provided oversight of comments developed on the proposed listing of naphthalene as a carcinogen by the National Toxicology Program, and on the USEPA's childhood cancer document.

Electric Power Research Institute, California. Worked with another ENSR toxicologist to develop a critique of the benzo(a)pyrene toxicity value developed by the United Kingdom for their Contaminated Lands program.

Confidential Client, Toxicology Review, Indiana. Provided a review of the toxicology and potential carcinogenicity of two structurally similar proprietary industrial chemicals. Used recent data on the nongenotoxic/cytotoxic mechanism of action of a class of potential carcinogens to demonstrate that a safe level for worker exposure exists.

U.S. Environmental Protection Agency, Literature Review. Developed a strategy for evaluating absorption data in the literature and applied it to the development of absorption adjustment factors for oral and dermal exposures to soil and water for 5 metals of concern at hazardous waste sites (arsenic, cadmium, chromium III, chromium VI, inorganic mercury, organic mercury, and nickel) based on a thorough review of the literature.

Georgia Pacific, Literature Review, Georgia. Reviewed literature and summarized the current scientific knowledge of the endogenous synthesis of halogenated compounds in humans.

E. Representative MGP Experience

Natural Gas Company, Risk Assessment Advisor, Ohio. Serving as strategic risk assessment advisor to the manager of MGP sites. Work includes conducting risk assessments for MGP sites under various state programs, evaluation of program-wide vapor intrusion data, regulatory negotiations, environmental communications, and employee meetings.

Natural Gas Company, Former MGP Site Advisor, Wisconsin. Have reviewed remediation plans and fenceline monitoring plans, gave presentation at public meetings discussing the air monitoring plan, and have reviewed fenceline monitoring data for a remediation project.

Energy Company, Former MGP Site Review, Rhode Island. Provided senior review of an air monitoring program and identified where flexibility can be used in the development of fenceline air monitoring standards.

Village of Oak Park, Former MGP Site Advisor, Illinois. Provided senior review of remediation plans, and fenceline monitoring plans, and provided air monitoring data evaluation. Was involved in regulatory meetings, negotiations, and presentations to the Village council, including public meetings concerning air monitoring aspects of the project.

Committees

Leader of AECOM's Risk Assessment Technical Practice Group including practitioners internationally within AECOM with specialties in human health and ecological risk assessment and other supporting disciplines.

Leader of AECOM's Coal Combustion Product (CCP) Initiative; responsible for following regulatory developments, and keeping AECOM staff and clients updated on the issues.

Elected member of the American Coal Ash Association (ACAA) Executive Committee, and member of the Government Relations Committee, and the Women's Leadership Forum.

Publications and Presentations

"Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants." LJN Bradley. Poster presented at the Society of Toxicology Annual meeting, March 2013, San Antonio, TX. Abstract 2211, The Toxicologist, Volume 132, Issue 1. Available at: www.toxci.osfordjournals.org.

"Key Decisions in Establishing National Ambient Air Quality Standards." L Fraiser and LJN Bradley. Poster presented at the Society of Toxicology Annual meeting, March 2013, San Antonio, TX. Abstract 1567, The Toxicologist, Volume 132, Issue 1. Available at: www.toxci.osfordjournals.org.

"Coal Ash Material Safety: A Health Risk-Based Evaluation." LJN Bradley. American Coal, Issue 2, 2012. Available at: www.americancoalonlime.com.

"Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants." LJN Bradley. Ash at Work, Issue 1, 2012. Available at: www.acaa-usa.org.

"Health Hazards and Risk Issues: Sorting Fact from Fear." Invited presentation at the Coal Combustion Products Utilization & Management: A Practical Workshop. Lexington, KY. October 9-10, 2012.

"Is this Risk for Real? Putting Risk Results into Context." Invited presentation at the Midwest Energy Association meeting, Minneapolis, MN. September 2012.

"Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants." American Coal Ash Association Summer Meeting, Portsmouth, VA. June 2012.

"Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants." June 2012. Report prepared for the American Coal Ash Association. Available at: www.acaa-usa.org.

"Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants." Press Conference, National Press Club, Washington, DC. June 6, 2012.

"Health Risk of CCPs: Is Coal Ash Toxic?" Presentation at the South Carolina SWANA Meeting. Myrtle Beach, SC, May 2012.

"Health Risk of CCPs: Is Coal Ash Toxic?" Presentation at Electric Power 2012. Baltimore, MD, May 2012.

"Hexavalent Chromium in Perspective" Presentation and invited Chair – Human Health Risk Panel, MGP 2012, Chicago, IL, March 29, 2012.

"Health Risk of CCPs." Invited presentation at the Coal Ash Consortium, Scottsdale, AZ, March 28, 2012.

"Health Risk of CCPs." Presented at the EUCI conference on CCR Management: Impacts of Regulations and Technological Advances. , Nashville, TN, February 28-29, 2012.

"Coal Ash in Context: Separating Science from Sound Bites As Regulatory and News Media Debates Continue." LJN Bradley and J Ward. Ash at Work, Issue 1, 2011. Available at www.acaa-usa.org.

"Management of Coal Ash Disposal and Household Trash – Do They Need to be Different?" LJN Bradley. Energeia, Volume 22, No. 4, 2011. Available at: http://www.caer.uky.edu/energeia/enerhome.shtml.

Bradley, L.J.N., "Comparison of Risks for Leachate from Coal Combustion Product Landfills and Impoundments with Risks for Leachate from Municipal Solid Waste Landfill Facilities." EPRI Report Number 1020555, available at www.epri.com.

"Risk Assessment: How the EPA Looks at Coal Combustion Products." Presented at the ACAA Fall meeting, Indianapolis, IN, September 27, 2011.

"Risk assessment: An overview of how the U.S. Environmental Protection Agency looks at coal combustion residuals." Presented at the American Chemical Society meeting in Denver, CO, August 28, 2011.

"Is Coal Ash Toxic?" Keynote Presentation at the World of Coal Ash May 10-12, 2011, and invited presentation at The Coal Institute/NCCI meeting July 11, 2011.

"Potential Effect of Proposed Coal Combustion Residuals Regulation and Alternative Leach Testing on Beneficial Reuse." World of Coal Ash May 10-12, 2011.

"Comparison of Risks for Leachate from Coal Combustion Product Landfills and Impoundments with Risks for Leachate from Municipal Solid Waste Landfill Facilities." World of Coal Ash May 10-12, 2011, and poster at Society of Toxicology March 6-10, 2011.

"Overview of Coal Ash Regulatory Issues." NCASI Northern Regional Meeting May 18-19, 2011.

"Perspectives on Health Risks Associated with Beneficial Re-Use of Byproducts of Coal Combustion." McIlvaine Hot Topic Hour. April 28, 2011.

”Risk Assessment: How the EPA Looks at Coal Combustion Products.” EUCI March 13-14, 2011.

“Risk Assessment: How the EPA Looks at Coal Combustion Products.” Presented at the EUCI conference on Future of Coal Combustion Products (CCPs): Regulatory, Legal, Technical, and New Markets, March 2011, Denver, CO.

“Development of a Realistic Risk Assessment Conceptual Site Model for an Urban River Sediment Site.” B. Ruffle, L. Bradley, K. Durocher, and L. Fraiser. Battelle Sediment Conference February 7-10, 2011.

Press Conference with ACAA (American Coal Ash Association) , October 27, 2010, Knoxville, TN.

“USEPA’s Proposed rule for Coal Combustion Residual (CCRs): Beneficial Use Aspects.” Keynote address given at the June 2010 meeting of the American Coal Ash Association, Baltimore, MD. Bradley, L.J.N, and A. Ellis.

“Overview of a CCP Site Investigation Conducted Under the Superfund Alternative Program.” Presented at the ACAA spring meeting, March 2010, Nashville, TN.

“Coal Ash Business Planning and Management: Addressing Risks and Liabilities in a Changing Regulatory Environment.” Workshop presented at the EUCI Conference on the Future of Coal Combustion Products, March 2010, Houston, TX. L.J.N. Bradley, J. Trast, J. Matus,, and A. Kier.

“PAHs and Dioxins Not Present in Fly Ash at Levels of Concern.” World of Coal Ash, May 2009 and Society of Toxicology, March 2009.

Bradley, L.J.N., G.M. Fent, and S.W. Casteel. “In Vivo Bioavailability of Arsenic in Coal Combustion By-Products.” Poster presented at the Society of Toxicology 2008 annual meeting in Seattle, WA.

Bradley, L.J.N., K. Sullivan, and M. Garcia. “Background Levels of Benzene in Indoor and Outdoor Air.” Paper presented at the Gas Technology Institute’s Natural Gas Technologies II Conference, Phoenix, Arizona. February, 2004

Bradley, L.J.N., and K.A. Sullivan. "Risk-Based Action Levels for Remediation Project Fence-Line Air Monitoring Programs." The Toxicologist. 72(S-1): 395. March, 2003

Bradley, L.J.N., and M. Gerath. "Generic Risk and Fate Analysis for Mercury at Natural Gas Meters." Paper presented at the December 1998 Society for Risk Analysis Annual Meeting, Phoenix, AZ.

Bradley, L.J.N., K.B. Lemieux, M.C. Garcia, A.H. Parsons, and D.E. Rabbe. "Comparison of Concentrations of Selected Metals and Organics in Fish Tissue and Sediment in the Grand River, Ohio, and the Southern Lake Erie Drainage Basin." Human and Ecological Risk Assessment 4(1):57-74 (1998).

Bradley, L.J.N. "TPH Analyses Provide Means of Direct Assessment of Diesel Releases." Paper presented at the October, 1997, Contaminated Soils Conference, Amherst, MA.

Bradley, L.J.N. "Risk Assessment of Hazardous Air Pollutants in Arizona." Paper presented at the December, 1996 Society for Risk Analysis Annual Meeting, New Orleans, LA.

Bradley, L.J.N. "Cost-Effective Use of Tiered Approaches in Risk Assessment." Paper presented at the October, 1996 Annual Conference on Contaminated Soils, Amherst, MA.

Bradley, L.J.N. "Role of Risk Assessment in Environmental Management." Invited paper presented at the West Virginia Manufacturers Association Environmental Compliance Conference, May, 1996, Charleston, WV.

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Magee, B.H., and L.J.N. Bradley. "Absorption Adjustment Factors for Use in Risk Assessment." Proceedings of the International Congress on the Health Effects of Hazardous Waste. (1994).

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Magee, B.H., L.J.N. Bradley, E.L. Butler, A. Dasinger, J. Grabowski. "Risk-Based Target Clean-Up Levels for TPH in Soils." In: Hydrocarbon Contaminated Soils. Vol. 3. pp. 303-319. Edited by P.T. Kostecki and E.J. Calabrese. 1993.

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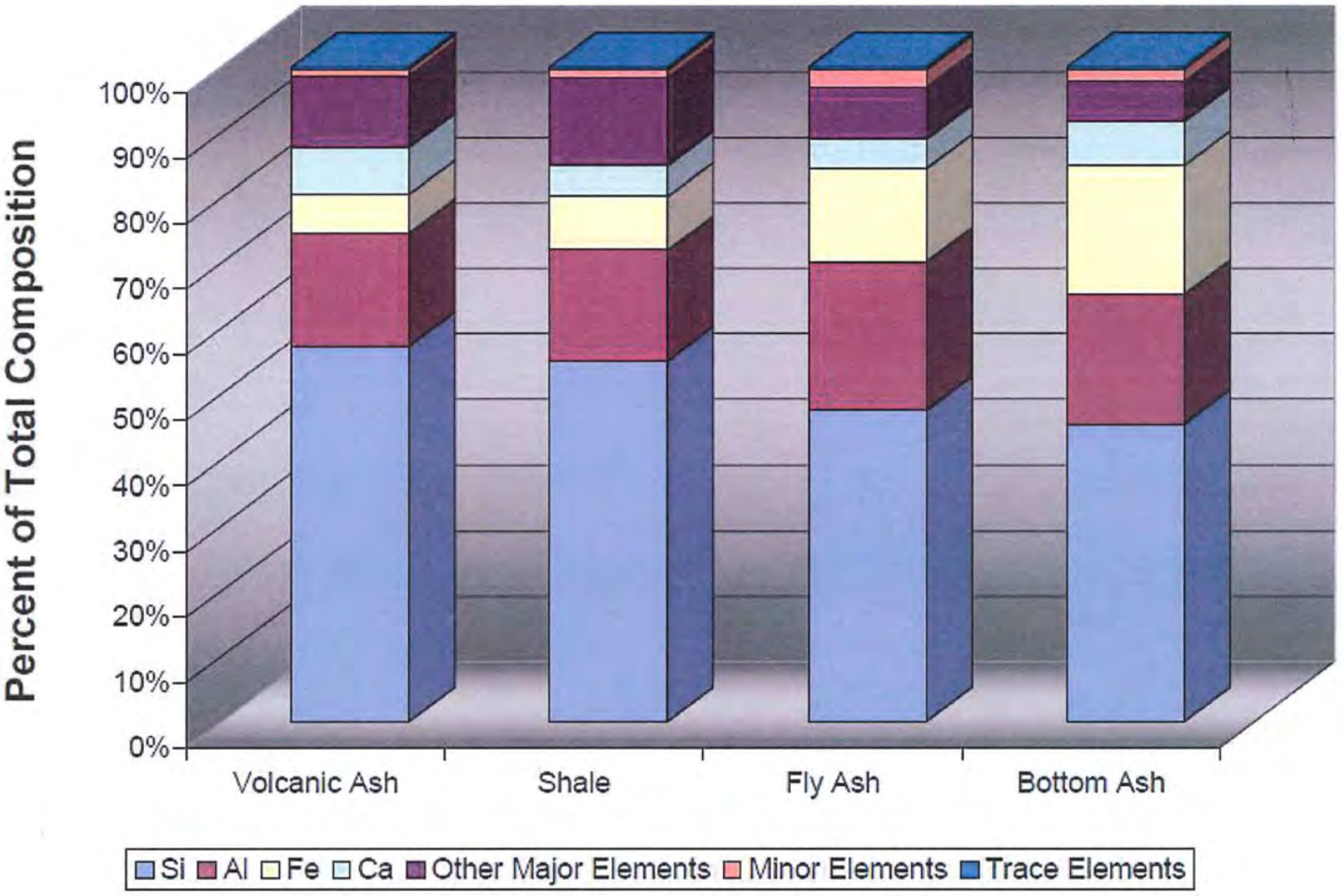
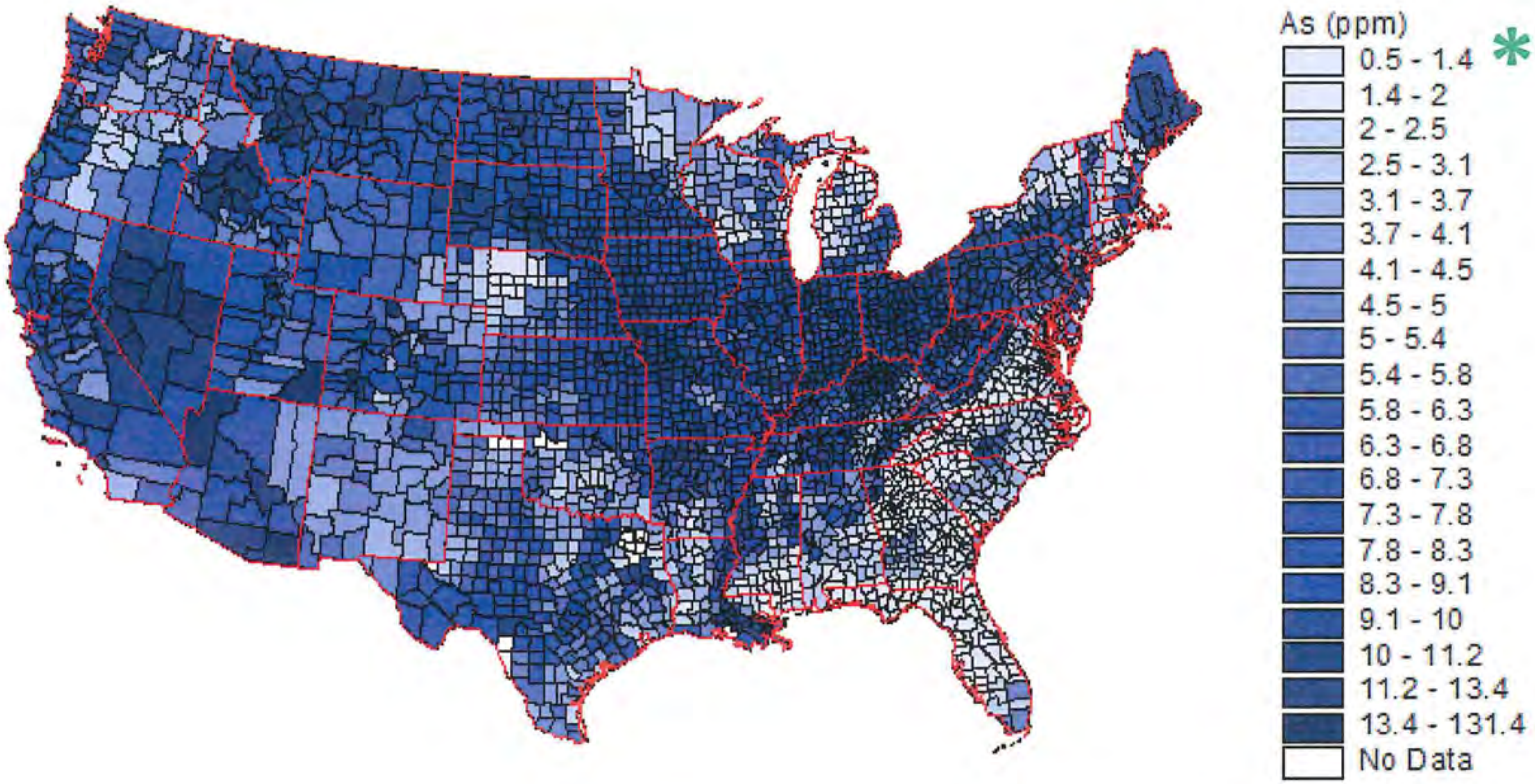
Composition of Coal Ash and Other Natural Materials



Source: EPRI. 2010. Comparison of Coal Combustion Products to Other Common Materials – Chemical Characteristics. Report No. 1020556. Available for download at www.epri.com.

SCHEDULE LJNB-S1

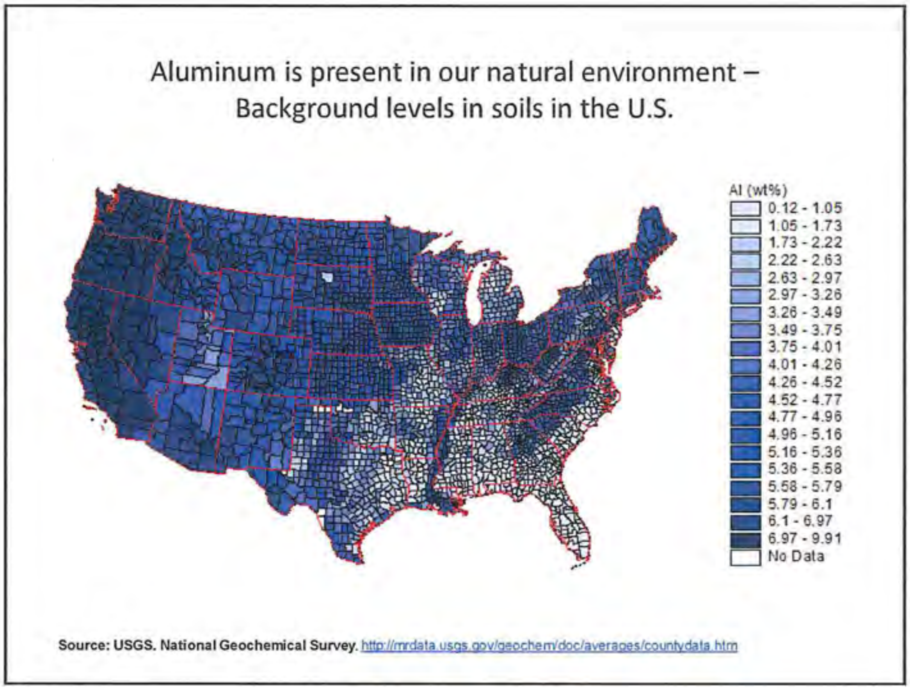
Arsenic is present in our natural environment – Background levels in soils in the U.S.



***The USEPA regional screening level for arsenic in residential soil at a one in one million risk level is 0.61 mg/kg. Thus the arsenic concentration in the majority of the soils in the U.S. are above the one in one million risk level.**

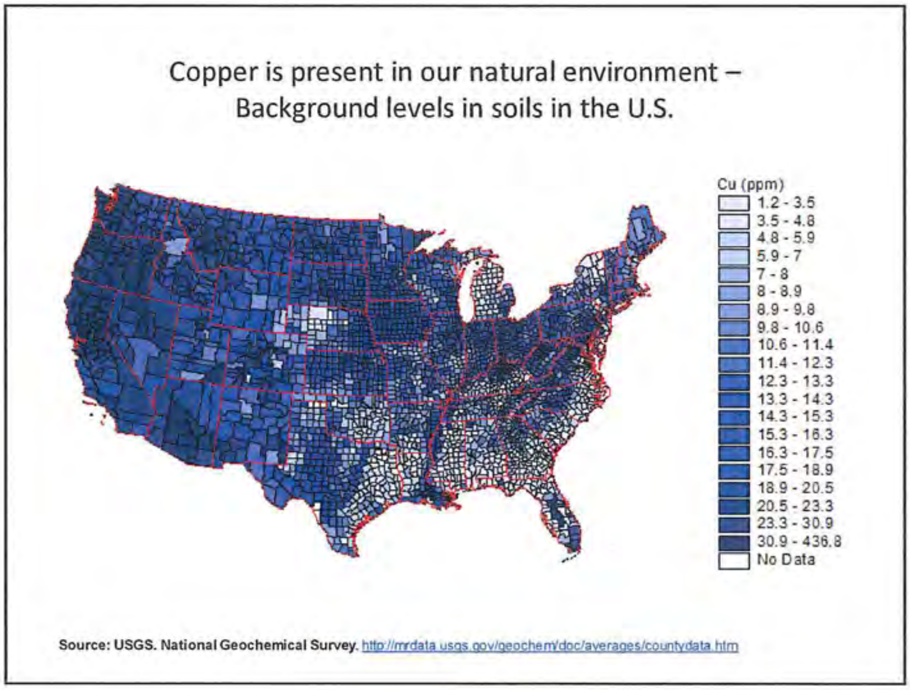
Source: USGS. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

SCHEDULE LJNB-S2



Aluminum is present in our natural environment – Background levels in soils in the U.S.

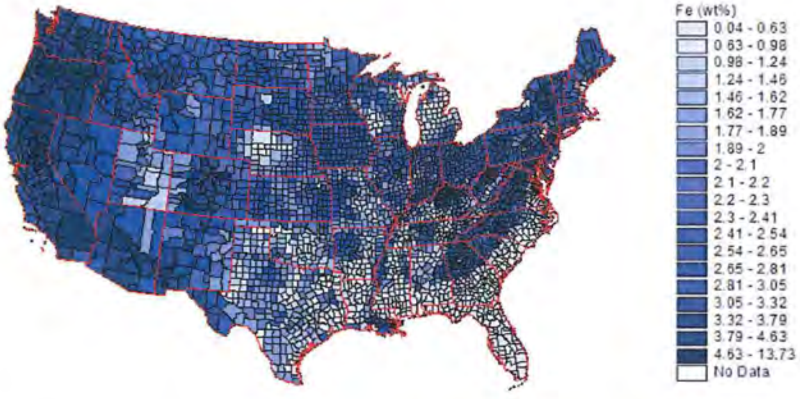
Source: USGS. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm



Copper is present in our natural environment – Background levels in soils in the U.S.

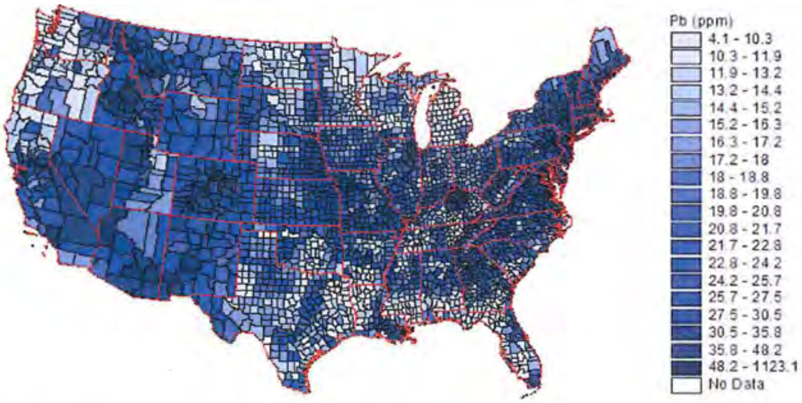
Source: USGS. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Iron is present in our natural environment – Background levels in soils in the U.S.



Source: USGS. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

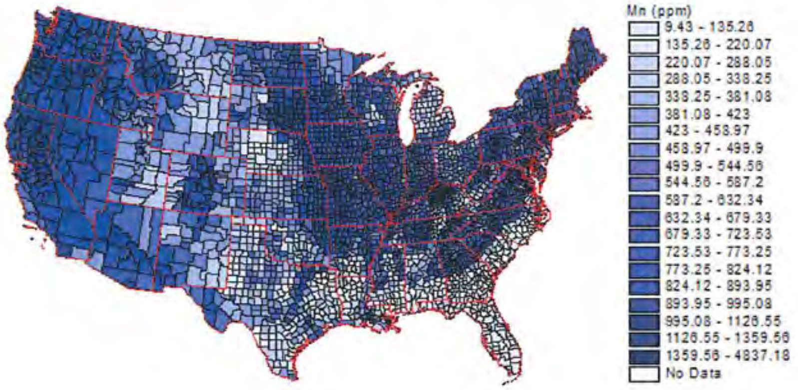
Lead is present in our natural environment – Background levels in soils in the U.S.



Source: USGS. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

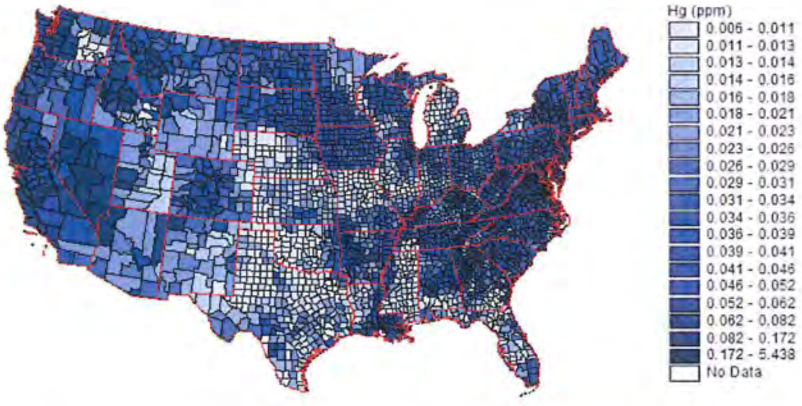
SCHEDULE LJNB-S4

Manganese is present in our natural environment – Background levels in soils in the U.S.



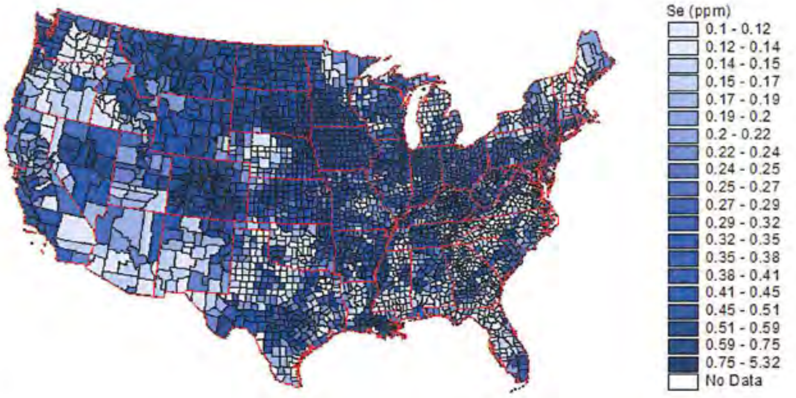
Source: USGS. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Mercury is present in our natural environment – Background levels in soils in the U.S.



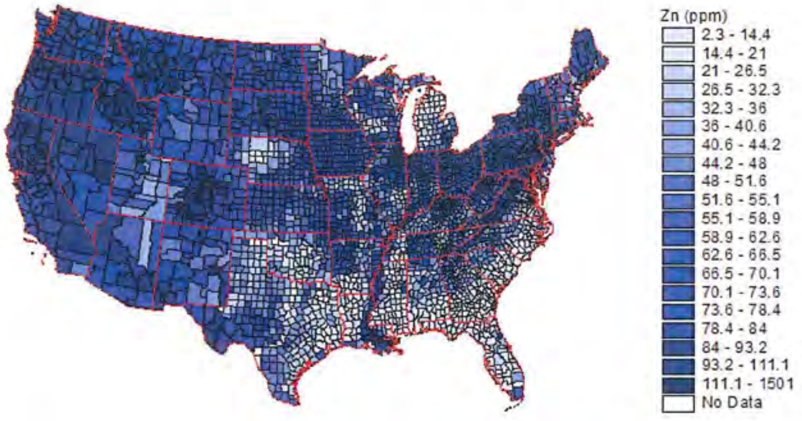
Source: USGS. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Selenium is present in our natural environment – Background levels in soils in the U.S.



Source: USGS. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Zinc is present in our natural environment – Background levels in soils in the U.S.



Source: USGS. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

SCHEDULE LJNB-S6

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs	
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	voc	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
1.8E-02	C	5.1E-06	C	1.5E-01	I					1	0.1		ALAR	1596-84-5	2.7E+01	c	9.6E+01	c	4.8E-01	c	2.4E+00	c	3.7E+00	c		8.2E-04	
8.7E-03	I			4.0E-03	I					1	0.1		Acephate	30560-19-1	5.6E+01	c**	2.0E+02	c*					7.7E+00	c**		1.7E-03	
		2.2E-06	I			9.0E-03	I	V		1		1.1E+05	Acetaldehyde	75-07-0	1.0E+01	c**	5.2E+01	c**	1.1E+00	c**	5.6E+00	c**	2.2E+00	c**		4.5E-04	
				2.0E-02	I					1	0.1		Acetochlor	34256-82-1	1.2E+03	n	1.2E+04	n					2.7E+02	n		2.2E-01	
				9.0E-01	I	3.1E+01	A	V		1		1.1E+05	Acetone	67-64-1	6.1E+04	n	6.3E+05	nms	3.2E+04	n	1.4E+05	n	1.2E+04	n		2.4E+00	
						2.0E-03	X	V		1		1.1E+05	Acetone Cyanohydrin	75-86-5	5.3E+01	n	2.2E+02	n	2.1E+00	n	8.8E+00	n	4.2E+00	n		8.4E-04	
						6.0E-02	I	V		1		1.3E+05	Acetonitrile	75-05-8	8.7E+02	n	3.7E+03	n	6.3E+01	n	2.6E+02	n	1.3E+02	n		2.6E-02	
				1.0E-01	I			V		1		2.5E+03	Acetophenone	98-86-2	7.8E+03	ns	1.0E+05	nms					1.5E+03	n		4.5E-01	
3.8E+00	C	1.3E-03	C							1	0.1		Acetylaminofluorene, 2-	53-96-3	1.3E-01	c	4.5E-01	c	1.9E-03	c	9.4E-03	c	1.3E-02	c		6.2E-05	
				5.0E-04	I	2.0E-05	I	V		1		2.3E+04	Acrolein	107-02-8	1.5E-01	n	6.5E-01	n	2.1E-02	n	8.8E-02	n	4.1E-02	n		8.4E-06	
5.0E-01	I	1.0E-04	I	2.0E-03	I	6.0E-03	I		M	1	0.1		Acrylamide	79-06-1	2.3E-01	c	3.4E+00	c	9.6E-03	c	1.2E-01	c	4.3E-02	c		9.1E-06	
				5.0E-01	I	1.0E-03	I			1	0.1		Acrylic Acid	79-10-7	3.0E+04	n	2.9E+05	nm	1.0E+00	n	4.4E+00	n	7.7E+03	n		1.6E+00	
5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V		1		1.1E+04	Acrylonitrile	107-13-1	2.4E-01	c*	1.2E+00	c*	3.6E-02	c*	1.8E-01	c*	4.5E-02	c*		9.8E-06	
						6.0E-03	P			1	0.1		Adiponitrile	111-69-3	8.5E+06	nm	3.6E+07	nm	6.3E+00	n	2.6E+01	n					
5.6E-02	C			1.0E-02	I					1	0.1		Alachlor	15972-60-8	8.7E+00	c*	3.1E+01	c					9.1E-01	c	2.0E+00	7.5E-04	1.6E-03
				1.0E-03	I					1	0.1		Aldicarb	116-06-3	6.1E+01	n	6.2E+02	n					1.5E+01	n	3.0E+00	3.8E-03	7.5E-04
				1.0E-03	I					1	0.1		Aldicarb Sulfone	1646-88-4	6.1E+01	n	6.2E+02	n					1.6E+01	n	2.0E+00	3.4E-03	4.4E-04
										1	0.1		Aldicarb sulfoxide	1646-87-3											4.0E+00		8.8E-04
1.7E+01	I	4.9E-03	I	3.0E-05	I					1	0.1		Aldrin	309-00-2	2.9E-02	c*	1.0E-01	c	5.0E-04	c	2.5E-03	c	4.0E-03	c		6.5E-04	
				2.5E-01	I					1	0.1		Ally	74223-64-6	1.5E+04	n	1.5E+05	nm					3.8E+03	n		1.5E+00	
				5.0E-03	I	1.0E-04	X			1	0.1		Allyl Alcohol	107-18-6	3.0E+02	n	3.1E+03	n	1.0E-01	n	4.4E-01	n	7.8E+01	n		1.6E-02	
2.1E-02	C	6.0E-06	C			1.0E-03	I	V		1		1.4E+03	Allyl Chloride	107-05-1	6.8E-01	c**	3.4E+00	c**	4.1E-01	c**	2.0E+00	c**	6.3E-01	c**		2.0E-04	
				1.0E+00	P	5.0E-03	P			1			Aluminum	7429-90-5	7.7E+04	n	9.9E+05	nm	5.2E+00	n	2.2E+01	n	1.6E+04	n		2.3E+04	
				4.0E-04	I					1			Aluminum Phosphide	20859-73-8	3.1E+01	n	4.1E+02	n					6.2E+00	n			
				3.0E-04	I					1	0.1		Amdro	67485-29-4	1.8E+01	n	1.8E+02	n					4.6E+00	n		1.7E+03	
				9.0E-03	I					1	0.1		Ametryn	834-12-8	5.5E+02	n	5.5E+03	n					1.2E+02	n		1.2E-01	
2.1E+01	C	6.0E-03	C							1	0.1		Aminobiphenyl, 4-	92-67-1	2.3E-02	c	8.2E-02	c	4.1E-04	c	2.0E-03	c	2.6E-03	c		1.3E-05	
				8.0E-02	P					1	0.1		Aminophenol, m-	591-27-5	4.9E+03	n	4.9E+04	n					1.2E+03	n		4.7E-01	
				2.0E-02	P					1	0.1		Aminophenol, p-	123-30-8	1.2E+03	n	1.2E+04	n					3.1E+02	n		1.2E-01	
				2.5E-03	I					1	0.1		Amitraz	33089-61-1	1.5E+02	n	1.5E+03	n					5.9E+00	n		3.0E+00	
						1.0E-01	I			1			Ammonia	7664-41-7					1.0E+02	n	4.4E+02	n					
				2.0E-01	I					1			Ammonium Sulfamate	7773-06-0	1.6E+04	n	2.0E+05	nm					3.1E+03	n			
5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I			1	0.1		Aniline	62-53-3	8.5E+01	c**	3.0E+02	c*	1.0E+00	n	4.4E+00	n	1.2E+01	c**		3.9E-03	
4.0E-02	P			2.0E-03	X					1	0.1		Anthraquinone, 9,10-	84-65-1	1.2E+01	c*	4.3E+01	c*					1.2E+00	c*		1.2E-02	
				4.0E-04	I					0.15			Antimony (metallic)	7440-36-0	3.1E+01	n	4.1E+02	n					6.0E+00	n	6.0E+00	2.7E-01	2.7E-01
				5.0E-04	H					0.15			Antimony Pentoxide	1314-60-9	3.9E+01	n	5.1E+02	n					7.5E+00	n			
				9.0E-04	H					0.15			Antimony Potassium Tartrate	11071-15-1	7.0E+01	n	9.2E+02	n					1.3E+01	n			
				4.0E-04	H					0.15			Antimony Tetroxide	1332-81-6	3.1E+01	n	4.1E+02	n					6.0E+00	n			
						2.0E-04	I			0.15			Antimony Trioxide	1309-64-4	2.8E+05	nm	1.2E+06	nm	2.1E-01	n	8.8E-01	n					
				1.3E-02	I					1	0.1		Apollo	74115-24-5	7.9E+02	n	8.0E+03	n					1.8E+02	n		1.1E+01	
2.5E-02	I	7.1E-06	I	5.0E-02	H					1	0.1		Aramite	140-57-8	1.9E+01	c	6.9E+01	c	3.4E-01	c	1.7E+00	c	1.1E+00	c		1.3E-02	
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C			1	0.03		Arsenic, Inorganic	7440-38-2	6.1E-01	c*R	2.4E+00	cR	5.7E-04	c*	2.9E-03	c*	4.5E-02	c	1.0E+01	1.3E-03	2.9E-01
				3.5E-06	C	5.0E-05	I			1			Arsine	7784-42-1	2.7E-01	n	3.6E+00	n	5.2E-02	n	2.2E-01	n	5.4E-02	n			
				9.0E-03	I					1	0.1		Assure	76578-14-8	5.5E+02	n	5.5E+03	n					9.3E+01	n		1.4E+00	
				5.0E-02	I					1	0.1		Asulam	3337-71-1	3.1E+03	n	3.1E+04	n					7.8E+02	n		2.0E-01	
2.3E-01	C			3.5E-02	I					1	0.1		Atrazine	1912-24-9	2.1E+00	c	7.5E+00	c					2.6E-01	c	3.0E+00	1.7E-04	1.9E-03
8.8E-01	C	2.5E-04	C							1	0.1		Auramine	492-80-8	5.5E-01	c	2.0E+00	c	9.7E-03	c	4.9E-02	c	5.7E-02	c		5.2E-04	
				4.0E-04	I					1	0.1		Avermectin B1	65195-55-3	2.4E+01	n	2.5E+02	n					6.3E+00	n		1.1E+01	
1.1E-01	I	3.1E-05	I					V		1			Azobenzene	103-33-3	5.1E+00	c	2.3E+01	c	7.8E-02	c	4.0E-01	c	1.0E-01	c		8.0E-04	
				2.0E-01	I	5.0E-04	H			0.07			Barium	7440-39-3	1.5E+04	n	1.9E+05	nm	5.2E-01	n	2.2E+00	n	2.9E+03	n	2.0E+03	1.2E+02	8.2E+01
				4.0E-03	I					1	0.1		Baygon	114-26-1	2.4E+02	n	2.5E+03	n					6.1E+01	n		2.0E-02	
				3.0E-02	I					1	0.1		Bayleton	43121-43-3	1.8E+03	n	1.8E+04	n					4.3E+02	n		3.4E-01	
				2.5E-02	I					1	0.1		Baythroid	68359-37-5	1.5E+03	n	1.5E+04	n					8.7E+01	n		2.3E+01	
				3.0E-01	I					1	0.1		Benefin	1861-40-1	1.8E+04	n	1.8E+05	nm					1.2E+03	n		4.1E+01	
				5.0E-02	I					1	0.1		Benomyl	17804-35-2	3.1E+03	n	3.1E+04	n					7.5E+02	n		6.6E-01	
				3.0E-02	I					1	0.1		Bentazon	25057-89-0	1.8E+03	n	1.8E+04	n					4.4E+02	n		9.6E-02	
				1.0E-01	I			V		1		1.2E+03	Benzaldehyde	100-52-7	7.8E+03	ns	1.0E+05	nms					1.5E+03	n		3.3E-01	
5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	V		1		1.8E+03	Benzene	71-43-2	1.1E+00	c*	5.4E+00	c*	3.1E-01	c	1.6E+00	c*	3.9E-01	c*	5.0E+00	2.0E-04	2.6E-03
1.0E-01	X			3.0E-04	X					1	0.1		Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1	4.9E+00	c**	1.7E+01	c*					6.7E-01	c**		1.9E-04	
				1.0E-03	P			V		1		1.3E+03	Benzenethiol	108-98-5	7.8E+01	n	1.0E+03	n					1.3E+01	n		8.6E-03	
2.3E+02	I	6.7E-02	I	3.0E-03	I				M	1	0.1		Benzidine	92-87-5	5.0E-04	c	7.5E-03	c	1.4E-05	c	1.8E-04	c	9.2E-05	c		2.4E-07	
				4.0E+00	I					1	0.1		Benzoic Acid	65-85-0	2.4E+05	nm	2.5E+06	nm					5.8E+04	n		1.4E+01	
1.3E+01	I							V		1		3.2E+02	Benzotrichloride	98-07-7	4.9E-02	c	2.2E-01	c					2.6E-03	c		5.6E-06	
				1.0E-01	P					1	0.1		Benzyl Alcohol	100-51-6	6.1E+03	n	6.2E+04	n					1.5E+03	n		3.7E-01	
1.7E-01	I	4.9E-05	C	2.0E-03	P	1.0E-03	P	V		1		1.5E+03	Benzyl Chloride	100-44-7	1.0E+00	c*	4.9E+00	c*	5.0E-02	c*	2.5E-01	c*	7.7E-02	c*		8.4E-05	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs	
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	voc	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
		2.4E-03	I	2.0E-03	I	2.0E-05	I			0.007			Beryllium and compounds	7440-41-7	1.6E+02	n	2.0E+03	n	1.0E-03	c*	5.1E-03	c*	1.6E+01	n	4.0E+00	1.3E+01	3.2E+00
				1.0E-04	I					1	0.1		Bidrin	141-66-2	6.1E+00	n	6.2E+01	n					1.6E+00	n		3.6E-04	
				9.0E-03	P					1	0.1		Bifenox	42576-02-3	5.5E+02	n	5.5E+03	n					7.5E+01	n		5.7E-01	
				1.5E-02	I					1	0.1		Biphenthrin	82657-04-3	9.2E+02	n	9.2E+03	n					2.3E+02	n		1.1E+03	
8.0E-03	X			5.0E-02	I	4.0E-04	X	V		1			Biphenyl, 1,1'-	92-52-4	5.1E+01	n	2.1E+02	n	4.2E-01	n	1.8E+00	n	8.3E-01	n		8.7E-03	
7.0E-02	H	1.0E-05	H	4.0E-02	I			V		1		1.0E+03	Bis(2-chloro-1-methylethyl) ether	108-60-1	4.6E+00	c	2.2E+01	c	2.4E-01	c	1.2E+00	c	3.1E-01	c		1.1E-04	
				3.0E-03	P					1	0.1		Bis(2-chloroethoxy)methane	111-91-1	1.8E+02	n	1.8E+03	n					4.6E+01	n		1.1E-02	
1.1E+00	I	3.3E-04	I					V		1		5.1E+03	Bis(2-chloroethyl)ether	111-44-4	2.1E-01	c	1.0E+00	c	7.4E-03	c	3.7E-02	c	1.2E-02	c		3.1E-06	
1.4E-02	I	2.4E-06	C	2.0E-02	I					1	0.1		Bis(2-ethylhexyl)phthalate	117-81-7	3.5E+01	c*	1.2E+02	c	1.0E+00	c	5.1E+00	c	4.8E+00	c*	6.0E+00	1.1E+00	1.4E+00
2.2E+02	I	6.2E-02	I					V		1		4.2E+03	Bis(chloromethyl)ether	542-88-1	7.7E-05	c	3.9E-04	c	3.9E-05	c	2.0E-04	c	6.2E-05	c		1.5E-08	
				5.0E-02	I					1	0.1		Bisphenol A	80-05-7	3.1E+03	n	3.1E+04	n					5.8E+02	n		4.4E+01	
				2.0E-01	I	2.0E-02	H			1			Boron And Borates Only	7440-42-8	1.6E+04	n	2.0E+05	nm	2.1E+01	n	8.8E+01	n	3.1E+03	n		9.9E+00	
				2.0E+00	P	2.0E-02	P			1			Boron Trichloride	10294-34-5	1.6E+05	nm	2.0E+06	nm	2.1E+01	n	8.8E+01	n	3.1E+04	n			
				4.0E-02	C	1.3E-02	C			1			Boron Trifluoride	7637-07-2	3.1E+03	n	4.1E+04	n	1.4E+01	n	5.7E+01	n	6.2E+02	n			
7.0E-01	I			4.0E-03	I					1			Bromate	15541-45-4	9.1E-01	c	4.1E+00	c					9.6E-02	c	1.0E+01	7.4E-04	7.7E-02
2.0E+00	X	6.0E-04	X					V		1		2.4E+03	Bromo-2-chloroethane, 1-	107-04-0	2.4E-02	c	1.2E-01	c	4.1E-03	c	2.0E-02	c	6.4E-03	c		1.8E-06	
				8.0E-03	I	6.0E-02	I	V		1		6.8E+02	Bromobenzene	108-86-1	3.0E+02	n	1.8E+03	ns	6.3E+01	n	2.6E+02	n	5.4E+01	n		3.6E-02	
						4.0E-02	X	V		1		4.0E+03	Bromochloromethane	74-97-5	1.6E+02	n	6.8E+02	n	4.2E+01	n	1.8E+02	n	8.3E+01	n		2.1E-02	
6.2E-02	I	3.7E-05	C	2.0E-02	I			V		1		9.3E+02	Bromodichloromethane	75-27-4	2.7E-01	c	1.4E+00	c	6.6E-02	c	3.3E-01	c	1.2E-01	c	8.0E+01(F)	3.2E-05	2.2E-02
7.9E-03	I	1.1E-06	I	2.0E-02	I					1	0.1		Bromoform	75-25-2	6.2E+01	c*	2.2E+02	c*	2.2E+00	c	1.1E+01	c	7.9E+00	c*	8.0E+01(F)	2.1E-03	2.1E-02
				1.4E-03	I	5.0E-03	I	V		1		3.6E+03	Bromomethane	74-83-9	7.3E+00	n	3.2E+01	n	5.2E+00	n	2.2E+01	n	7.0E+00	n		1.8E-03	
				5.0E-03	H					1	0.1		Bromophos	2104-96-3	3.1E+02	n	3.1E+03	n					2.6E+01	n		1.1E-01	
				2.0E-02	I					1	0.1		Bromoxynil	1689-84-5	1.2E+03	n	1.2E+04	n					2.5E+02	n		2.2E-01	
				2.0E-02	I					1	0.1		Bromoxynil Octanoate	1689-99-2	1.2E+03	n	1.2E+04	n					1.0E+02	n		8.7E-01	
3.4E+00	C	3.0E-05	I			2.0E-03	I	V		1		6.7E+02	Butadiene, 1,3-	106-99-0	5.4E-02	c*	2.6E-01	c*	8.1E-02	c*	4.1E-01	c*	1.6E-02	c		8.6E-06	
				1.0E-01	I					1	0.1		Butanol, N-	71-36-3	6.1E+03	n	6.2E+04	n					1.5E+03	n		3.2E-01	
1.9E-03	P			2.0E-01	I					1	0.1		Butyl Benzyl Phthlate	85-68-7	2.6E+02	c*	9.1E+02	c					1.4E+01	c*		2.0E-01	
				2.0E+00	P	3.0E+01	P			1	0.1		Butyl alcohol, sec-	78-92-2	1.2E+05	nm	1.2E+06	nm	3.1E+04	n	1.3E+05	n	3.1E+04	n		6.3E+00	
				5.0E-02	I					1	0.1		Butylate	2008-41-5	3.1E+03	n	3.1E+04	n					3.4E+02	n		3.3E-01	
2.0E-04	C	5.7E-08	C							1	0.1		Butylated hydroxyanisole	25013-16-5	2.4E+03	c	8.6E+03	c	4.3E+01	c	2.2E+02	c	2.1E+02	c		3.9E-01	
				5.0E-02	P			V		1		1.1E+02	Butylbenzene, n-	104-51-8	3.9E+03	ns	5.1E+04	ns					7.8E+02	n		2.5E+00	
				1.0E-01	X			V		1		1.5E+02	Butylbenzene, sec-	135-98-8	7.8E+03	ns	1.0E+05	nms					1.6E+03	n		4.6E+00	
				1.0E-01	X			V		1		1.8E+02	Butylbenzene, tert-	98-06-6	7.8E+03	ns	1.0E+05	nms					5.1E+02	n		1.1E+00	
				1.0E+00	I					1	0.1		Butylphthalyl Butylglycolate	85-70-1	6.1E+04	n	6.2E+05	nm					1.0E+04	n		2.3E+02	
				2.0E-02	A					1	0.1		Cacodylic Acid	75-60-5	1.2E+03	n	1.2E+04	n					3.1E+02	n			
		1.8E-03	I	1.0E-03	I	1.0E-05	A			0.025	0.001		Cadmium (Diet)	7440-43-9	7.0E+01	n	8.0E+02	n									
		1.8E-03	I	5.0E-04	I	1.0E-05	A			0.05	0.001		Cadmium (Water)	7440-43-9					1.4E-03	c**	6.8E-03	c**	6.9E+00	n	5.0E+00	5.2E-01	3.8E-01
				5.0E-01	I					1	0.1		Caprolactam	105-60-2	3.1E+04	n	3.1E+05	nm					7.7E+03	n		1.9E+00	
1.5E-01	C	4.3E-05	C	2.0E-03	I					1	0.1		Captafol	2425-06-1	3.2E+00	c*	1.1E+01	c	5.7E-02	c	2.9E-01	c	3.5E-01	c*		6.1E-04	
2.3E-03	C	6.6E-07	C	1.3E-01	I					1	0.1		Captan	133-06-2	2.1E+02	c*	7.5E+02	c	3.7E+00	c	1.9E+01	c	2.7E+01	c*		1.9E-02	
				1.0E-01	I					1	0.1		Carbaryl	63-25-2	6.1E+03	n	6.2E+04	n					1.4E+03	n		1.3E+00	
				5.0E-03	I					1	0.1		Carbofuran	1563-66-2	3.1E+02	n	3.1E+03	n					7.3E+01	n	4.0E+01	2.8E-02	1.6E-02
				1.0E-01	I	7.0E-01	I	V		1		7.4E+02	Carbon Disulfide	75-15-0	8.2E+02	ns	3.7E+03	ns	7.3E+02	n	3.1E+03	n	7.2E+02	n		2.1E-01	
7.0E-02	I	6.0E-06	I	4.0E-03	I	1.0E-01	I	V		1		4.6E+02	Carbon Tetrachloride	56-23-5	6.1E-01	c	3.0E+00	c	4.1E-01	c	2.0E+00	c	3.9E-01	c	5.0E+00	1.5E-04	1.9E-03
				1.0E-02	I					1	0.1		Carbosulfan	55285-14-8	6.1E+02	n	6.2E+03	n					3.7E+01	n		9.0E-01	
				1.0E-01	I					1	0.1		Carboxin	5234-68-4	6.1E+03	n	6.2E+04	n					1.5E+03	n		8.0E-01	
						9.0E-04	I			1			Ceric oxide	1306-38-3	1.3E+06	nm	5.4E+06	nm	9.4E-01	n	3.9E+00	n					
				1.0E-01	I					1	0.1		Chloral Hydrate	302-17-0	6.1E+03	n	6.2E+04	n					1.5E+03	n		3.1E-01	
				1.5E-02	I					1	0.1		Chloramben	133-90-4	9.2E+02	n	9.2E+03	n					2.2E+02	n		5.5E-02	
4.0E-01	H									1	0.1		Chloranil	118-75-2	1.2E+00	c	4.3E+00	c					1.6E-01	c		1.3E-04	
3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I			1	0.04		Chlordane	12789-03-6	1.6E+00	c*	6.5E+00	c*	2.4E-02	c*	1.2E-01	c*	1.9E-01	c*	2.0E+00	1.3E-02	1.4E-01
1.0E+01	I	4.6E-03	C	3.0E-04	I					1	0.1		Chlordecone (Kepone)	143-50-0	4.9E-02	c	1.7E-01	c	5.3E-04	c	2.7E-03	c	3.0E-03	c		1.1E-04	
				7.0E-04	A					1	0.1		Chlorfenvinphos	470-90-6	4.3E+01	n	4.3E+02	n					8.6E+00	n		2.3E-02	
				2.0E-02	I					1	0.1		Chlorimuron, Ethyl-	90982-32-4	1.2E+03	n	1.2E+04	n					3.0E+02	n		1.0E-01	
				1.0E-01	I	1.5E-04	A			1			Chlorine	7782-50-5	7.5E+03	n	9.1E+04	n	1.5E-01	n	6.4E-01	n	1.6E+03	n		7.0E-01	
				3.0E-02	I	2.0E-04	I			1			Chlorine Dioxide	10049-04-4	2.3E+03	n	3.0E+04	n	2.1E-01	n	8.8E-01	n	4.7E+02	n			
				3.0E-02	I					1			Chlorite (Sodium Salt)	7758-19-2	2.3E+03	n	3.1E+04	n					4.7E+02	n	1.0E+03		
						5.0E+01	I	V		1		1.2E+03	Chloro-1,1-difluoroethane, 1-	75-68-3	5.8E+04	ns	2.4E+05	nms	5.2E+04	n	2.2E+05	n	1.0E+05	n		5.2E+01	
		3.0E-04	I	2.0E-02	H	2.0E-02	I	V		1		7.5E+02	Chloro-1,3-butadiene, 2-	126-99-8	9.4E-03	c	4.7E-02	c	8.1E-03	c	4.1E-02	c	1.6E-02	c		8.5E-06	
4.6E-01	H									1	0.1		Chloro-2-methylaniline HCl, 4-	3165-93-3	1.1E+00	c	3.7E+00	c					1.5E-01	c		1.3E-04	
1.0E-01	P	7.7E-05	C	3.0E-03	X					1	0.1		Chloro-2-methylaniline, 4-	95-69-2	4.9E+00	c*	1.7E+01	c	3.2E-02	c	1.6E-01	c	6.0E-01	c*		3.4E-04	
2.7E-01	X							V		1	0.1	2.8E+04	Chloroacetaldehyde, 2-	107-20-0	1.8E+00	c	6.4E+00	c					2.5E-01	c		5.0E-05	
				2.0E-03	H					1	0.1		Chloroacetic Acid	79-11-8	1.2E+02	n	1.2E+03	n					3.1E+01	n	6.0E+01	6.3E-03	1.2E-02
						3.0E-05	I			1	0.1		Chloroacetophenone, 2-	532-27-4	4.3E+04	n	1.8E+05	nm	3.1E-02	n	1.3E-01	n					
2.0E-01	P			4.0E-03	I					1	0.1		Chloroaniline, p-	106-47-8	2.4E+00	c	8.6E+00	c					3.2E-01	c		1.3E-04	

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Toxicity and Chemical-specific Information													Contaminant		Screening Levels												Protection of Ground Water SSLs	
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	voc	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
				2.0E-02	I	5.0E-02	P	V		1		7.6E+02	Chlorobenzene	108-90-7	2.9E+02	n	1.4E+03	ns	5.2E+01	n	2.2E+02	n	7.2E+01	n	1.0E+02	4.9E-02	6.8E-02
1.1E-01	C	3.1E-05	C	2.0E-02	I					1	0.1		Chlorobenzilate	510-15-6	4.4E+00	c	1.6E+01	c	7.8E-02	c	4.0E-01	c	2.7E-01	c		8.8E-04	
				3.0E-02	X					1	0.1		Chlorobenzoic Acid, p-	74-11-3	1.8E+03	n	1.8E+04	n					3.9E+02	n		9.9E-02	
				3.0E-03	P	3.0E-01	P	V		1		1.2E+02	Chlorobenzotrifluoride, 4-	98-56-6	2.1E+02	ns	2.3E+03	ns	3.1E+02	n	1.3E+03	n	2.6E+01	n		9.3E-02	
				4.0E-02	P			V		1		7.3E+02	Chlorobutane, 1-	109-69-3	3.1E+03	ns	4.1E+04	ns					4.8E+02	n		2.0E-01	
						5.0E+01	I	V		1		1.7E+03	Chlorodifluoromethane	75-45-6	5.3E+04	ns	2.2E+05	nms	5.2E+04	n	2.2E+05	n	1.0E+05	n		4.3E+01	
				2.0E-02	P					1	0.1		Chloroethanol, 2-	107-07-3	1.2E+03	n	1.2E+04	n					3.1E+02	n		6.3E-02	
3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V		1		2.5E+03	Chloroform	67-66-3	2.9E-01	c	1.5E+00	c	1.1E-01	c	5.3E-01	c	1.9E-01	c	8.0E+01(F)	5.3E-05	2.2E-02
						9.0E-02	I	V		1		1.3E+03	Chloromethane	74-87-3	1.2E+02	n	5.0E+02	n	9.4E+01	n	3.9E+02	n	1.9E+02	n		4.9E-02	
2.4E+00	C	6.9E-04	C					V		1		2.6E+04	Chloromethyl Methyl Ether	107-30-2	1.9E-02	c	9.4E-02	c	3.5E-03	c	1.8E-02	c	5.6E-03	c		1.2E-06	
				8.0E-02	I			V		1			Chloronaphthalene, Beta-	91-58-7	6.3E+03	n	8.2E+04	n					5.5E+02	n		2.9E+00	
3.0E-01	P			3.0E-03	P	1.0E-05	X			1	0.1		Chloronitrobenzene, o-	88-73-3	1.6E+00	c	5.7E+00	c	1.0E-02	n	4.4E-02	n	2.0E-01	c		1.9E-04	
6.3E-03	P			1.0E-03	P	6.0E-04	P			1	0.1		Chloronitrobenzene, p-	100-00-5	6.1E+01	n	2.7E+02	c**	6.3E-01	n	2.6E+00	n	9.4E+00	c**		8.7E-03	
				5.0E-03	I			V		1		2.2E+04	Chlorophenol, 2-	95-57-8	3.9E+02	n	5.1E+03	n					7.1E+01	n		5.7E-02	
						4.0E-04	C	V		1		6.2E+02	Chloropicrin	76-06-2	2.1E+00	n	8.8E+00	n	4.2E-01	n	1.8E+00	n	8.3E-01	n		2.5E-04	
3.1E-03	C	8.9E-07	C	1.5E-02	I					1	0.1		Chlorothalonil	1897-45-6	1.6E+02	c**	5.6E+02	c*	2.7E+00	c	1.4E+01	c	1.9E+01	c*		4.3E-02	
				2.0E-02	I			V		1		9.1E+02	Chlorotoluene, o-	95-49-8	1.6E+03	ns	2.0E+04	ns					1.8E+02	n		1.7E-01	
				2.0E-02	X			V		1		2.5E+02	Chlorotoluene, p-	106-43-4	1.6E+03	ns	2.0E+04	ns					1.9E+02	n		1.8E-01	
2.4E+02	C	6.9E-02	C							1	0.1		Chlorozotocin	54749-90-5	2.0E-03	c	7.2E-03	c	3.5E-05	c	1.8E-04	c	2.8E-04	c		6.2E-08	
				2.0E-01	I					1	0.1		Chlorpropham	101-21-3	1.2E+04	n	1.2E+05	nm					2.2E+03	n		1.9E+00	
				1.0E-03	A					1	0.1		Chlorpyrifos	2921-88-2	6.1E+01	n	6.2E+02	n					6.2E+00	n		9.2E-02	
				1.0E-02	H					1	0.1		Chlorpyrifos Methyl	5598-13-0	6.1E+02	n	6.2E+03	n					8.9E+01	n		4.1E-01	
				5.0E-02	I					1	0.1		Chlorsulfuron	64902-72-3	3.1E+03	n	3.1E+04	n					7.7E+02	n		6.5E-01	
				8.0E-04	H					1	0.1		Chlorthiophos	60238-56-4	4.9E+01	n	4.9E+02	n					2.0E+00	n		5.2E-02	
				1.5E+00	I					0.013			Chromium(III), Insoluble Salts	16065-83-1	1.2E+05	nm	1.5E+06	nm					1.6E+04	n		2.8E+07	
5.0E-01	J	8.4E-02	S	3.0E-03	I	1.0E-04	I		M	0.025			Chromium(VI)	18540-29-9	2.9E-01	c	5.6E+00	c	1.1E-05	c	1.5E-04	c	3.1E-02	c		5.9E-04	
										0.013			Chromium, Total	7440-47-3											1.0E+02		1.8E+05
		9.0E-03	P	3.0E-04	P	6.0E-06	P			1			Cobalt	7440-48-4	2.3E+01	n	3.0E+02	n	2.7E-04	c*	1.4E-03	c*	4.7E+00	n		2.1E-01	
		6.2E-04	I						M	1	0.1		Coke Oven Emissions	8007-45-2					1.5E-03	c	2.0E-02	c					
				4.0E-02	H					1			Copper	7440-50-8	3.1E+03	n	4.1E+04	n					6.2E+02	n	1.3E+03	2.2E+01	4.6E+01
				5.0E-02	I	6.0E-01	C			1	0.1		Cresol, m-	108-39-4	3.1E+03	n	3.1E+04	n	6.3E+02	n	2.6E+03	n	7.2E+02	n		5.7E-01	
				5.0E-02	I	6.0E-01	C			1	0.1		Cresol, o-	95-48-7	3.1E+03	n	3.1E+04	n	6.3E+02	n	2.6E+03	n	7.2E+02	n		5.8E-01	
				1.0E-01	A	6.0E-01	C			1	0.1		Cresol, p-	106-44-5	6.1E+03	n	6.2E+04	n	6.3E+02	n	2.6E+03	n	1.4E+03	n		1.1E+00	
				1.0E-01	A					1	0.1		Cresol, p-chloro-m-	59-50-7	6.1E+03	n	6.2E+04	n					1.1E+03	n		1.3E+00	
				1.0E-01	A	6.0E-01	C			1	0.1		Cresols	1319-77-3	6.1E+03	n	6.2E+04	n	6.3E+02	n	2.6E+03	n	1.4E+03	n		1.2E+00	
1.9E+00	H			1.0E-03	P			V		1		1.7E+04	Crotonaldehyde, trans-	123-73-9	3.4E-01	c	1.5E+00	c					3.5E-02	c		7.1E-06	
				1.0E-01	I	4.0E-01	I	V		1		2.7E+02	Cumene	98-82-8	2.1E+03	ns	1.1E+04	ns	4.2E+02	n	1.8E+03	n	3.9E+02	n		6.4E-01	
2.2E-01	C	6.3E-05	C							1	0.1		Cupferron	135-20-6	2.2E+00	c	7.8E+00	c	3.9E-02	c	1.9E-01	c	3.1E-01	c		5.3E-04	
8.4E-01	H			2.0E-03	H					1	0.1		Cyanazine	21725-46-2	5.8E-01	c	2.1E+00	c					7.6E-02	c		3.5E-05	
													Cyanides														
				1.0E-03	I					1			~Calcium Cyanide	592-01-8	7.8E+01	n	1.0E+03	n					1.6E+01	n			
				5.0E-03	I					1			~Copper Cyanide	544-92-3	3.9E+02	n	5.1E+03	n					7.8E+01	n			
				6.0E-04	I	8.0E-04	S	V		1		1.0E+07	~Cyanide (CN-)	57-12-5	2.2E+01	n	1.4E+02	n	8.3E-01	n	3.5E+00	n	1.4E+00	n	2.0E+02	1.4E-02	2.0E+00
				1.0E-03	I			V		1			~Cyanogen	460-19-5	7.8E+01	n	1.0E+03	n					1.6E+01	n			
				9.0E-02	I			V		1			~Cyanogen Bromide	506-68-3	7.0E+03	n	9.2E+04	n					1.4E+03	n			
				5.0E-02	I			V		1			~Cyanogen Chloride	506-77-4	3.9E+03	n	5.1E+04	n					7.8E+02	n			
				6.0E-04	I	8.0E-04	I	V		1		1.0E+07	~Hydrogen Cyanide	74-90-8	2.3E+01	n	1.5E+02	n	8.3E-01	n	3.5E+00	n	1.4E+00	n		1.4E-02	
				2.0E-03	I					1			~Potassium Cyanide	151-50-8	1.6E+02	n	2.0E+03	n					3.1E+01	n			
				5.0E-03	I					0.04			~Potassium Silver Cyanide	506-61-6	3.9E+02	n	5.1E+03	n					5.9E+01	n			
				1.0E-01	I					0.04			~Silver Cyanide	506-64-9	7.8E+03	n	1.0E+05	nm					1.3E+03	n			
				1.0E-03	I					1			~Sodium Cyanide	143-33-9	7.8E+01	n	1.0E+03	n					1.6E+01	n	2.0E+02		
				2.0E-04	P					1			~Thiocyanates	NA	1.6E+01	n	2.0E+02	n					3.1E+00	n			
				2.0E-04	X					1			~Thiocyanic Acid	463-56-9									3.1E+00	n			
				5.0E-02	I					1			~Zinc Cyanide	557-21-1	3.9E+03	n	5.1E+04	n					7.8E+02	n			
						6.0E+00	I	V		1		1.2E+02	Cyclohexane	110-82-7	7.0E+03	ns	2.9E+04	ns	6.3E+03	n	2.6E+04	n	1.3E+04	n		1.3E+01	
2.3E-02	H									1	0.1		Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	2.1E+01	c	7.5E+01	c					2.1E+00	c		1.2E-02	
				5.0E+00	I	7.0E-01	P			1	0.1		Cyclohexanone	108-94-1	3.1E+05	nm	3.1E+06	nm	7.3E+02	n	3.1E+03	n	7.7E+04	n		1.8E+01	
				5.0E-03	P	1.0E+00	X	V		1		2.8E+02	Cyclohexene	110-83-8	3.1E+02	ns	2.8E+03	ns	1.0E+03	n	4.4E+03	n	5.3E+01	n		3.5E-02	
				2.0E-01	I					1	0.1		Cyclohexylamine	108-91-8	1.2E+04	n	1.2E+05	nm					3.0E+03	n		7.9E-01	
				5.0E-03	I					1	0.1		Cyhalothrin/karate	68085-85-8	3.1E+02	n	3.1E+03	n					7.8E+01	n		5.3E+01	
				1.0E-02	I					1	0.1		Cypermethrin	52315-07-8	6.1E+02	n	6.2E+03	n					1.6E+02	n		2.5E+01	
				7.5E-03	I					1	0.1		Cyromazine	66215-27-8	4.6E+02	n	4.6E+03	n					1.2E+02	n		3.0E-02	
2.4E-01	I	6.9E-05	C							1	0.1		DDD	72-54-8	2.0E+00	c	7.2E+00	c	3.5E-02	c	1.8E-01	c	2.7E-02	c		6.4E-03	
3.4E-01	I	9.7E-05	C							1	0.1		DDE, p,p'-	72-55-9	1.4E+00	c	5.1E+00	c	2.5E-02	c	1.3E-01	c	2.0E-01	c		4.6E-02	
3.4E-01	I	9.7E-05	I	5.0E-04	I					1	0.03		DDT	50-29-3	1.7E+00	c*	7.0E+00	c*	2.5E-02	c	1.3E-01	c	2.0E-01	c*		6.7E-02	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs	
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	voc	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
				1.0E-02	I					1	0.1		Dacthal	1861-32-1	6.1E+02	n	6.2E+03	n					9.3E+01	n		1.1E-01	
				3.0E-02	I					1	0.1		Dalapon	75-99-0	1.8E+03	n	1.8E+04	n					4.6E+02	n	2.0E+02	9.6E-02	4.1E-02
7.0E-04	I			7.0E-03	I					1	0.1		Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	4.3E+02	n	2.5E+03	c**					9.6E+01	c**		5.3E+01	
				4.0E-05	I					1	0.1		Demeton	8065-48-3	2.4E+00	n	2.5E+01	n					5.2E-01	n			
1.2E-03	I			6.0E-01	I					1	0.1		Di(2-ethylhexyl)adipate	103-23-1	4.1E+02	c*	1.4E+03	c					5.6E+01	c	4.0E+02	4.0E+00	2.9E+01
6.1E-02	H									1	0.1		Diallate	2303-16-4	8.0E+00	c	2.8E+01	c					4.6E-01	c		6.8E-04	
				7.0E-04	A					1	0.1		Diazinon	333-41-5	4.3E+01	n	4.3E+02	n					7.9E+00	n		4.9E-02	
8.0E-01	P	6.0E-03	P	2.0E-04	P	2.0E-04	I	V	M	1		9.8E+02	Dibromo-3-chloropropane, 1,2-	96-12-8	5.4E-03	c	6.9E-02	c	1.6E-04	c	2.0E-03	c	3.2E-04	c	2.0E-01	1.4E-07	8.6E-05
				1.0E-02	I					1	0.1		Dibromobenzene, 1,4-	106-37-6	6.1E+02	n	6.2E+03	n					9.8E+01	n		9.3E-02	
8.4E-02	I	2.7E-05	C	2.0E-02	I			V		1	0.1	8.0E+02	Dibromochloromethane	124-48-1	6.8E-01	c	3.3E+00	c	9.0E-02	c	4.5E-01	c	1.5E-01	c	8.0E+01(F)	3.9E-05	2.1E-02
2.0E+00	I	6.0E-04	I	9.0E-03	I	9.0E-03	I	V		1		1.3E+03	Dibromoethane, 1,2-	106-93-4	3.4E-02	c	1.7E-01	c	4.1E-03	c	2.0E-02	c	6.5E-03	c	5.0E-02	1.8E-06	1.4E-05
				1.0E-02	H	4.0E-03	X	V		1		2.8E+03	Dibromomethane (Methylene Bromide)	74-95-3	2.5E+01	n	1.1E+02	n	4.2E+00	n	1.8E+01	n	7.9E+00	n		1.9E-03	
				1.0E-01	I					1	0.1		Dibutyl Phthalate	84-74-2	6.1E+03	n	6.2E+04	n					6.7E+02	n		1.7E+00	
				3.0E-04	P					1	0.1		Dibutyltin Compounds	NA	1.8E+01	n	1.8E+02	n					4.7E+00	n			
				3.0E-02	I					1	0.1		Dicamba	1918-00-9	1.8E+03	n	1.8E+04	n					4.4E+02	n		1.1E-01	
		4.2E-03	P					V		1		5.2E+02	Dichloro-2-butene, 1,4-	764-41-0	6.9E-03	c	3.5E-02	c	5.8E-04	c	2.9E-03	c	1.2E-03	c		5.4E-07	
		4.2E-03	P					V		1	0.1	5.2E+02	Dichloro-2-butene, cis-1,4-	1476-11-5	6.9E-03	c	3.5E-02	c	5.8E-04	c	2.9E-03	c	1.2E-03	c		5.4E-07	
		4.2E-03	P					V		1	0.1	7.6E+02	Dichloro-2-butene, trans-1,4-	110-57-6	6.9E-03	c	3.5E-02	c	5.8E-04	c	2.9E-03	c	1.2E-03	c		5.4E-07	
5.0E-02	I			4.0E-03	I					1	0.1		Dichloroacetic Acid	79-43-6	9.7E+00	c*	3.4E+01	c*					1.3E+00	c*	6.0E+01	2.7E-04	1.2E-02
				9.0E-02	I	2.0E-01	H	V		1		3.8E+02	Dichlorobenzene, 1,2-	95-50-1	1.9E+03	ns	9.8E+03	ns	2.1E+02	n	8.8E+02	n	2.8E+02	n	6.0E+02	2.7E-01	5.8E-01
5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I	V		1			Dichlorobenzene, 1,4-	106-46-7	2.4E+00	c	1.2E+01	c	2.2E-01	c	1.1E+00	c	4.2E-01	c	7.5E+01	4.0E-04	7.2E-02
4.5E-01	I	3.4E-04	C							1	0.1		Dichlorobenzidine, 3,3'-	91-94-1	1.1E+00	c	3.8E+00	c	7.2E-03	c	3.6E-02	c	1.1E-01	c		7.1E-04	
				9.0E-03	X					1	0.1		Dichlorobenzophenone, 4,4'-	90-98-2	5.5E+02	n	5.5E+03	n					5.7E+01	n		3.5E-01	
				2.0E-01	I	1.0E-01	X	V		1		8.5E+02	Dichlorodifluoromethane	75-71-8	9.4E+01	n	4.0E+02	n	1.0E+02	n	4.4E+02	n	1.9E+02	n		3.0E-01	
5.7E-03	C	1.6E-06	C	2.0E-01	P			V		1		1.7E+03	Dichloroethane, 1,1-	75-34-3	3.3E+00	c	1.7E+01	c	1.5E+00	c	7.7E+00	c	2.4E+00	c		6.8E-04	
9.1E-02	I	2.6E-05	I	6.0E-03	X	7.0E-03	P	V		1		3.0E+03	Dichloroethane, 1,2-	107-06-2	4.3E-01	c*	2.2E+00	c*	9.4E-02	c*	4.7E-01	c*	1.5E-01	c*	5.0E+00	4.2E-05	1.4E-03
				5.0E-02	I	2.0E-01	I	V		1		1.2E+03	Dichloroethylene, 1,1-	75-35-4	2.4E+02	n	1.1E+03	n	2.1E+02	n	8.8E+02	n	2.6E+02	n	7.0E+00	9.3E-02	2.5E-03
				9.0E-03	H			V		1		1.3E+03	Dichloroethylene, 1,2- (Mixed Isomers)	540-59-0	7.0E+02	n	9.2E+03	ns					1.3E+02	n		3.7E-02	
				2.0E-03	I			V		1		2.4E+03	Dichloroethylene, 1,2-cis-	156-59-2	1.6E+02	n	2.0E+03	n					2.8E+01	n	7.0E+01	8.2E-03	2.1E-02
				2.0E-02	I	6.0E-02	P	V		1		1.7E+03	Dichloroethylene, 1,2-trans-	156-60-5	1.5E+02	n	6.9E+02	n	6.3E+01	n	2.6E+02	n	8.6E+01	n	1.0E+02	2.5E-02	2.9E-02
				3.0E-03	I					1	0.1		Dichlorophenol, 2,4-	120-83-2	1.8E+02	n	1.8E+03	n					3.5E+01	n		4.1E-02	
				1.0E-02	I					1	0.05		Dichlorophenoxy Acetic Acid, 2,4-	94-75-7	6.9E+02	n	7.7E+03	n					1.3E+02	n	7.0E+01	3.5E-02	1.8E-02
				8.0E-03	I					1	0.1		Dichlorophenoxy)butyric Acid, 4-(2,4-	94-82-6	4.9E+02	n	4.9E+03	n					9.1E+01	n		3.6E-02	
3.6E-02	C	1.0E-05	C	9.0E-02	A	4.0E-03	I	V		1		1.4E+03	Dichloropropane, 1,2-	78-87-5	9.4E-01	c*	4.7E+00	c*	2.4E-01	c*	1.2E+00	c*	3.8E-01	c*	5.0E+00	1.3E-04	1.7E-03
				2.0E-02	P			V		1		1.5E+03	Dichloropropane, 1,3-	142-28-9	1.6E+03	ns	2.0E+04	ns					2.9E+02	n		9.9E-02	
				3.0E-03	I					1	0.1		Dichloropropanol, 2,3-	616-23-9	1.8E+02	n	1.8E+03	n					4.6E+01	n		9.8E-03	
1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	V		1		1.6E+03	Dichloropropene, 1,3-	542-75-6	1.7E+00	c*	8.3E+00	c*	6.1E-01	c*	3.1E+00	c*	4.1E-01	c*		1.5E-04	
2.9E-01	I	8.3E-05	C	5.0E-04	I	5.0E-04	I			1	0.1		Dichlorvos	62-73-7	1.7E+00	c*	5.9E+00	c*	2.9E-02	c*	1.5E-01	c*	2.3E-01	c*		7.0E-05	
				8.0E-03	P	7.0E-03	P	V		1			Dicyclopentadiene	77-73-6	3.1E+01	n	1.3E+02	n	7.3E+00	n	3.1E+01	n	1.2E+01	n		4.3E-02	
1.6E+01	I	4.6E-03	I	5.0E-05	I					1	0.1		Dieldrin	60-57-1	3.0E-02	c	1.1E-01	c	5.3E-04	c	2.7E-03	c	1.5E-03	c		6.1E-05	
		3.0E-04	C			5.0E-03	I			1	0.1		Diesel Engine Exhaust	NA					8.1E-03	c	4.1E-02	c					
				2.0E-03	P	2.0E-04	P			1	0.1		Diethanolamine	111-42-2	1.2E+02	n	1.2E+03	n	2.1E-01	n	8.8E-01	n	3.1E+01	n		6.3E-03	
				8.0E-01	I					1	0.1		Diethyl Phthalate	84-66-2	4.9E+04	n	4.9E+05	nm					1.1E+04	n		4.7E+00	
				3.0E-02	P	1.0E-04	P			1	0.1		Diethylene Glycol Monobutyl Ether	112-34-5	1.8E+03	n	1.8E+04	n	1.0E-01	n	4.4E-01	n	4.7E+02	n		1.0E-01	
				6.0E-02	P	3.0E-04	P			1	0.1		Diethylene Glycol Monoethyl Ether	111-90-0	3.6E+03	n	3.6E+04	n	3.1E-01	n	1.3E+00	n	9.4E+02	n		1.9E-01	
				1.0E-03	P					1	0.1		Diethylformamide	617-84-5	6.1E+01	n	6.2E+02	n					1.6E+01	n		3.2E-03	
3.5E+02	C	1.0E-01	C							1	0.1		Diethylstilbestrol	56-53-1	1.4E-03	c	4.9E-03	c	2.4E-05	c	1.2E-04	c	4.3E-05	c		2.4E-05	
				8.0E-02	I					1	0.1		Difenzoquat	43222-48-6	4.9E+03	n	4.9E+04	n					1.2E+03	n			
				2.0E-02	I					1	0.1		Diflubenzuron	35367-38-5	1.2E+03	n	1.2E+04	n					2.2E+02	n		2.5E-01	
						4.0E+01	I	V		1		1.4E+03	Difluoroethane, 1,1-	75-37-6	5.2E+04	ns	2.2E+05	nms	4.2E+04	n	1.8E+05	n	8.3E+04	n		2.8E+01	
4.4E-02	C	1.3E-05	C					V		1	0.1		Dihydrosafrole	94-58-6	2.4E-01	c	1.2E+00	c	1.9E-01	c	9.4E-01	c	2.6E-01	c		3.2E-04	
						7.0E-01	P	V		1		2.3E+03	Diisopropyl Ether	108-20-3	2.4E+03	ns	1.0E+04	ns	7.3E+02	n	3.1E+03	n	1.5E+03	n		3.7E-01	
				8.0E-02	I			V		1		5.3E+02	Diisopropyl Methylphosphonate	1445-75-6	6.3E+03	ns	8.2E+04	ns					1.2E+03	n		3.5E-01	
				2.0E-02	I					1	0.1		Dimethipin	55290-64-7	1.2E+03	n	1.2E+04	n					3.1E+02	n		6.9E-02	
				2.0E-04	I					1	0.1		Dimethoate	60-51-5	1.2E+01	n	1.2E+02	n					3.1E+00	n		7.0E-04	
1.4E-02	H									1	0.1		Dimethoxybenzidine, 3,3'-	119-90-4	3.5E+01	c	1.2E+02	c					4.7E+00	c		5.7E-03	
1.7E-03	P			6.0E-02	P					1	0.1		Dimethyl methylphosphonate	756-79-6	2.9E+02	c*	1.0E+03	c*					3.9E+01	c*		8.3E-03	
4.6E+00	C	1.3E-03	C							1	0.1		Dimethylamino azobenzene [p-]	60-11-7	1.1E-01	c	3.7E-01	c	1.9E-03	c	9.4E-03	c	4.3E-03	c		1.8E-05	
5.8E-01	H									1	0.1		Dimethylaniline HCl, 2,4-	21436-96-4	8.4E-01	c	3.0E+00	c					1.2E-01	c		1.0E-04	
2.0E-01	P			2.0E-03	X					1	0.1		Dimethylaniline, 2,4-	95-68-1	2.4E+00	c*	8.6E+00	c					3.2E-01	c*		1.8E-04	
				2.0E-03	I			V		1		8.3E+02	Dimethylaniline, N,N-	121-69-7	1.6E+02	n	2.0E+03	ns					2.7E+01	n		9.8E-03	
1.1E+01	P									1	0.1		Dimethylbenzidine, 3,3'-	119-93-7	4.4E-02	c	1.6E-01	c					5.6E-03	c		3.7E-05	
				1.0E-01	P	3.0E-02	I			1	0.1		Dimethylformamide	68-12-2	6.1E+03	n	6.2E+04	n	3.1E+01	n	1.3E+02	n	1.6E+03	n		3.2E-01	
				1.0E-04	X	2.0E-06	X			1	0.1		Dimethylhydrazine, 1,1-	57-14-7	6.1E+00	n	6.1E+01	n	2.1E-03	n	8.8E-03	n	1.6E+00	n		3.5E-04	
5.5E+02	C	1.6E-01	C							1	0.1		Dimethylhydrazine, 1,2-	540-73-8	8.8E-04	c	3.1E-03	c	1.5E-05	c	7.7E-05	c	1.2E-04	c		2.8E-08	

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Toxicity and Chemical-specific Information													Contaminant		Screening Levels												Protection of Ground Water SSLs	
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	voc	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
				2.0E-02	I					1	0.1		Dimethylphenol, 2,4-	105-67-9	1.2E+03	n	1.2E+04	n					2.7E+02	n		3.2E-01	
				6.0E-04	I					1	0.1		Dimethylphenol, 2,6-	576-26-1	3.7E+01	n	3.7E+02	n					8.1E+00	n		9.8E-03	
				1.0E-03	I					1	0.1		Dimethylphenol, 3,4-	95-65-8	6.1E+01	n	6.2E+02	n					1.4E+01	n		1.6E-02	
				1.0E-01	I			V		1			Dimethylterephthalate	120-61-6	7.8E+03	n	1.0E+05	nm					1.4E+03	n		3.8E-01	
4.5E-02	C	1.3E-05	C					V		1	0.1	1.1E+03	Dimethylvinylchloride	513-37-1	2.0E-01	c	1.0E+00	c	1.9E-01	c	9.4E-01	c	2.8E-01	c		1.8E-04	
				8.0E-05	X					1	0.1		Dinitro-o-cresol, 4,6-	534-52-1	4.9E+00	n	4.9E+01	n					1.2E+00	n		2.0E-03	
				2.0E-03	I					1	0.1		Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5	1.2E+02	n	1.2E+03	n					1.7E+01	n		5.7E-01	
				1.0E-04	P					1	0.1		Dinitrobenzene, 1,2-	528-29-0	6.1E+00	n	6.2E+01	n					1.5E+00	n		1.4E-03	
				1.0E-04	I					1	0.1		Dinitrobenzene, 1,3-	99-65-0	6.1E+00	n	6.2E+01	n					1.5E+00	n		1.4E-03	
				1.0E-04	P					1	0.1		Dinitrobenzene, 1,4-	100-25-4	6.1E+00	n	6.2E+01	n					1.5E+00	n		1.4E-03	
				2.0E-03	I					1	0.1		Dinitrophenol, 2,4-	51-28-5	1.2E+02	n	1.2E+03	n					3.0E+01	n		3.4E-02	
6.8E-01	I									1	0.1		Dinitrotoluene Mixture, 2,4/2,6-	NA	7.2E-01	c	2.5E+00	c					9.2E-02	c		1.3E-04	
3.1E-01	C	8.9E-05	C	2.0E-03	I					1	0.102		Dinitrotoluene, 2,4-	121-14-2	1.6E+00	c*	5.5E+00	c	2.7E-02	c	1.4E-01	c	2.0E-01	c		2.8E-04	
1.5E+00	P			3.0E-04	X					1	0.099		Dinitrotoluene, 2,6-	606-20-2	3.3E-01	c*	1.2E+00	c					4.2E-02	c		5.8E-05	
				2.0E-03	S					1	0.006		Dinitrotoluene, 2-Amino-4,6-	35572-78-2	1.5E+02	n	2.0E+03	n					3.0E+01	n		2.3E-02	
				2.0E-03	S					1	0.009		Dinitrotoluene, 4-Amino-2,6-	19406-51-0	1.5E+02	n	1.9E+03	n					3.0E+01	n		2.3E-02	
4.5E-01	X			9.0E-04	X					1	0.1		Dinitrotoluene, Technical grade	25321-14-6	1.1E+00	c	3.8E+00	c					1.4E-01	c		1.9E-04	
				1.0E-03	I					1	0.1		Dinoseb	88-85-7	6.1E+01	n	6.2E+02	n					1.1E+01	n	7.0E+00	9.8E-02	6.2E-02
1.0E-01	I	7.7E-06	C	3.0E-02	I	1.1E-01	A			1	0.1		Dioxane, 1,4-	123-91-1	4.9E+00	c	1.7E+01	c	3.2E-01	c	1.6E+00	c	6.7E-01	c		1.4E-04	
													Dioxins														
6.2E+03	I	1.3E+00	I							1	0.03		~Hexachlorodibenzo-p-dioxin, Mixture	NA	9.4E-05	c	3.9E-04	c	1.9E-06	c	9.4E-06	c	1.1E-05	c		1.5E-05	
1.3E+05	C	3.8E+01	C	7.0E-10	I	4.0E-08	C			1	0.03		~TCDD, 2,3,7,8-	1746-01-6	4.5E-06	c*	1.8E-05	c*	6.4E-08	c	3.2E-07	c	5.2E-07	c*	3.0E-05	2.6E-07	1.5E-05
				3.0E-02	I					1	0.1		Diphenamid	957-51-7	1.8E+03	n	1.8E+04	n					4.1E+02	n		4.0E+00	
				8.0E-04	X					1	0.1		Diphenyl Sulfone	127-63-9	4.9E+01	n	4.9E+02	n					1.1E+01	n		2.8E-02	
				2.5E-02	I					1	0.1		Diphenylamine	122-39-4	1.5E+03	n	1.5E+04	n					2.4E+02	n		4.4E-01	
8.0E-01	I	2.2E-04	I							1	0.1		Diphenylhydrazine, 1,2-	122-66-7	6.1E-01	c	2.2E+00	c	1.1E-02	c	5.6E-02	c	6.7E-02	c		2.2E-04	
				2.2E-03	I					1	0.1		Diquat	85-00-7	1.3E+02	n	1.4E+03	n					3.4E+01	n	2.0E+01	6.5E-01	3.7E-01
7.4E+00	C	2.1E-03	C							1	0.1		Direct Black 38	1937-37-7	6.6E-02	c	2.3E-01	c	1.2E-03	c	5.8E-03	c	9.1E-03	c		4.4E+00	
7.4E+00	C	2.1E-03	C							1	0.1		Direct Blue 6	2602-46-2	6.6E-02	c	2.3E-01	c	1.2E-03	c	5.8E-03	c	9.1E-03	c		1.4E+01	
6.7E+00	C	1.9E-03	C							1	0.1		Direct Brown 95	16071-86-6	7.3E-02	c	2.6E-01	c	1.3E-03	c	6.5E-03	c	1.0E-02	c			
				4.0E-05	I					1	0.1		Disulfoton	298-04-4	2.4E+00	n	2.5E+01	n					3.8E-01	n		7.1E-04	
				1.0E-02	I			V		1	0.1		Dithiane, 1,4-	505-29-3	6.1E+02	n	6.2E+03	n					1.5E+02	n		7.6E-02	
				2.0E-03	I					1	0.1		Diuron	330-54-1	1.2E+02	n	1.2E+03	n					2.8E+01	n		1.2E-02	
				4.0E-03	I					1	0.1		Dodine	2439-10-3	2.4E+02	n	2.5E+03	n					6.2E+01	n		3.2E-01	
				2.5E-02	I			V		1			EPTC	759-94-4	2.0E+03	n	2.6E+04	n					2.9E+02	n		1.5E-01	
				6.0E-03	I					1	0.1		Endosulfan	115-29-7	3.7E+02	n	3.7E+03	n					7.8E+01	n		1.1E+00	
				2.0E-02	I					1	0.1		Endothall	145-73-3	1.2E+03	n	1.2E+04	n					3.0E+02	n	1.0E+02	7.1E-02	2.4E-02
				3.0E-04	I					1	0.1		Endrin	72-20-8	1.8E+01	n	1.8E+02	n					1.7E+00	n	2.0E+00	6.8E-02	8.1E-02
9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V		1		1.1E+04	Epichlorohydrin	106-89-8	2.0E+01	n	8.8E+01	n	1.0E+00	n	4.4E+00	n	2.0E+00	n		4.5E-04	
						2.0E-02	I	V		1		1.5E+04	Epoxybutane, 1,2-	106-88-7	1.7E+02	n	7.2E+02	n	2.1E+01	n	8.8E+01	n	4.2E+01	n		9.2E-03	
				5.0E-03	I					1	0.1		Ethephon	16672-87-0	3.1E+02	n	3.1E+03	n					7.8E+01	n		1.6E-02	
				5.0E-04	I					1	0.1		Ethion	563-12-2	3.1E+01	n	3.1E+02	n					3.2E+00	n		6.3E-03	
				1.0E-01	P	6.0E-02	P			1	0.1		Ethoxyethanol Acetate, 2-	111-15-9	6.1E+03	n	6.2E+04	n	6.3E+01	n	2.6E+02	n	1.5E+03	n		3.2E-01	
				4.0E-01	H	2.0E-01	I			1	0.1		Ethoxyethanol, 2-	110-80-5	2.4E+04	n	2.5E+05	nm	2.1E+02	n	8.8E+02	n	6.2E+03	n		1.3E+00	
				9.0E-01	I			V		1		1.1E+04	Ethyl Acetate	141-78-6	7.0E+04	ns	9.2E+05	nms					1.4E+04	n		2.9E+00	
4.8E-02	H							V		1		2.5E+03	Ethyl Acrylate	140-88-5	1.3E+01	c	6.0E+01	c					1.4E+00	c		3.0E-04	
						1.0E+01	I	V		1		2.1E+03	Ethyl Chloride	75-00-3	1.5E+04	ns	6.1E+04	ns	1.0E+04	n	4.4E+04	n	2.1E+04	n		5.9E+00	
				2.0E-01	I			V		1		1.0E+04	Ethyl Ether	60-29-7	1.6E+04	ns	2.0E+05	nms					3.1E+03	n		6.8E-01	
				9.0E-02	H	3.0E-01	P	V		1		1.1E+03	Ethyl Methacrylate	97-63-2	1.5E+03	ns	7.5E+03	ns	3.1E+02	n	1.3E+03	n	4.2E+02	n		9.9E-02	
				1.0E-05	I					1	0.1		Ethyl-p-nitrophenyl Phosphonate	2104-64-5	6.1E-01	n	6.2E+00	n					6.6E-02	n		2.1E-03	
1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V		1		4.8E+02	Ethylbenzene	100-41-4	5.4E+00	c	2.7E+01	c	9.7E-01	c	4.9E+00	c	1.3E+00	c	7.0E+02	1.5E-03	7.8E-01
				7.0E-02	P					1	0.1		Ethylene Cyanohydrin	109-78-4	4.3E+03	n	4.3E+04	n					1.1E+03	n		2.2E-01	
				9.0E-02	P					1	0.1		Ethylene Diamine	107-15-3	5.5E+03	n	5.5E+04	n					1.4E+03	n		3.2E-01	
				2.0E+00	I	4.0E-01	C			1	0.1		Ethylene Glycol	107-21-1	1.2E+05	nm	1.2E+06	nm	4.2E+02	n	1.8E+03	n	3.1E+04	n		6.3E+00	
				1.0E-01	I	1.6E+00	I			1	0.1		Ethylene Glycol Monobutyl Ether	111-76-2	6.1E+03	n	6.2E+04	n	1.7E+03	n	7.0E+03	n	1.5E+03	n		3.2E-01	
3.1E-01	C	8.8E-05	C			3.0E-02	C	V		1		1.2E+05	Ethylene Oxide	75-21-8	1.7E-01	c	8.3E-01	c	2.8E-02	c	1.4E-01	c	4.4E-02	c		9.1E-06	
4.5E-02	C	1.3E-05	C	8.0E-05	I					1	0.1		Ethylene Thiourea	96-45-7	4.9E+00	n	3.8E+01	c**	1.9E-01	c	9.4E-01	c	1.2E+00	n		2.8E-04	
6.5E+01	C	1.9E-02	C					V		1	0.1	1.5E+05	Ethyleneimine	151-56-4	2.3E-03	c	1.0E-02	c	1.3E-04	c	6.5E-04	c	2.1E-04	c		4.5E-08	
				3.0E+00	I					1	0.1		Ethylphthalyl Ethyl Glycolate	84-72-0	1.8E+05	nm	1.8E+06	nm					4.5E+04	n		1.0E+02	
				8.0E-03	I					1	0.1		Express	101200-48-0	4.9E+02	n	4.9E+03	n					1.2E+02	n		4.7E-02	
				2.5E-04	I					1	0.1		Fenamiphos	22224-92-6	1.5E+01	n	1.5E+02	n					3.4E+00	n		3.3E-03	
				2.5E-02	I					1	0.1		Fenpropathrin	39515-41-8	1.5E+03	n	1.5E+04	n					4.6E+01	n		2.1E+00	
				1.3E-02	I					1	0.1		Fluometuron	2164-17-2	7.9E+02	n	8.0E+03	n					1.9E+02	n		1.4E-01	
				4.0E-02	C	1.3E-02	C			1			Fluoride	16984-48-8	3.1E+03	n	4.1E+04	n	1.4E+01	n	5.7E+01	n	6.2E+02	n		9.3E+01	
				6.0E-02	I	1.3E-02	C			1			Fluorine (Soluble Fluoride)	7782-41-4	4.7E+03	n	6.1E+04	n	1.4E+01	n	5.7E+01	n	9.3E+02	n	4.0E+03	1.4E+02	6.0E+02

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Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs	
SFO $(mg/kg\text{-}day)^{-1}$	key	IUR $(ug/m^3)^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	voc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
				8.0E-02	I					1	0.1		Fluridone	59756-60-4	4.9E+03	n	4.9E+04	n					1.1E+03	n		1.3E+02	
				2.0E-02	I					1	0.1		Flurprimidol	56425-91-3	1.2E+03	n	1.2E+04	n					2.6E+02	n		1.2E+00	
				6.0E-02	I					1	0.1		Flutolanil	66332-96-5	3.7E+03	n	3.7E+04	n					7.2E+02	n		3.9E+00	
				1.0E-02	I					1	0.1		Fluvalinate	69409-94-5	6.1E+02	n	6.2E+03	n					1.6E+02	n		2.3E+02	
3.5E-03	I			1.0E-01	I					1	0.1		Folpet	133-07-3	1.4E+02	c*	4.9E+02	c					1.7E+01	c*		4.1E-03	
1.9E-01	I									1	0.1		Fomesafen	72178-02-0	2.6E+00	c	9.1E+00	c					3.4E-01	c		1.1E-03	
				2.0E-03	I					1	0.1		Fonofos	944-22-9	1.2E+02	n	1.2E+03	n					1.8E+01	n		3.5E-02	
		1.3E-05	I	2.0E-01	I	9.8E-03	A			1	0.1		Formaldehyde	50-00-0	1.2E+04	n	1.2E+05	nm	1.9E-01	c*	9.4E-01	c*	3.1E+03	n		6.2E-01	
				9.0E-01	P	3.0E-04	X			1	0.1		Formic Acid	64-18-6	4.9E+04	n	4.2E+05	nm	3.1E-01	n	1.3E+00	n	1.4E+04	n		2.8E+00	
				3.0E+00	I					1	0.1		Fosetyl-AL	39148-24-8	1.8E+05	nm	1.8E+06	nm					4.7E+04	n			
													Furans														
				1.0E-03	X			V		1			~Dibenzofuran	132-64-9	7.8E+01	n	1.0E+03	n					5.8E+00	n		1.1E-01	
				1.0E-03	I			V		1		6.2E+03	~Furan	110-00-9	7.8E+01	n	1.0E+03	n					1.5E+01	n		5.7E-03	
				9.0E-01	I	2.0E+00	I	V		1	0.1	1.7E+05	~Tetrahydrofuran	109-99-9	1.8E+04	n	9.5E+04	n	2.1E+03	n	8.8E+03	n	3.2E+03	n		7.1E-01	
3.8E+00	H									1	0.1		Furazolidone	67-45-8	1.3E-01	c	4.5E-01	c					1.8E-02	c		3.4E-05	
				3.0E-03	I	5.0E-02	H			1	0.1		Furfural	98-01-1	1.8E+02	n	1.8E+03	n	5.2E+01	n	2.2E+02	n	4.6E+01	n		9.9E-03	
1.5E+00	C	4.3E-04	C							1	0.1		Furium	531-82-8	3.2E-01	c	1.1E+00	c	5.7E-03	c	2.9E-02	c	4.4E-02	c		5.9E-05	
3.0E-02	I	8.6E-06	C							1	0.1		Furmecyclox	60568-05-0	1.6E+01	c	5.7E+01	c	2.8E-01	c	1.4E+00	c	9.6E-01	c		1.0E-03	
				4.0E-04	I					1	0.1		Glufosinate, Ammonium	77182-82-2	2.4E+01	n	2.5E+02	n					6.3E+00	n		1.4E-03	
						8.0E-05	C			1	0.1		Glutaraldehyde	111-30-8	1.1E+05	nm	4.8E+05	nm	8.3E-02	n	3.5E-01	n					
				4.0E-04	I	1.0E-03	H			1	0.1		Glycidyl	765-34-4	2.4E+01	n	2.5E+02	n	1.0E+00	n	4.4E+00	n	6.2E+00	n		1.3E-03	
				1.0E-01	I					1	0.1		Glyphosate	1071-83-6	6.1E+03	n	6.2E+04	n					1.6E+03	n	7.0E+02	6.9E+00	3.1E+00
				3.0E-03	I					1	0.1		Goal	42874-03-3	1.8E+02	n	1.8E+03	n					2.4E+01	n		1.9E+00	
				3.0E-03	A	1.0E-02	A			1	0.1		Guthion	86-50-0	1.8E+02	n	1.8E+03	n	1.0E+01	n	4.4E+01	n	4.3E+01	n		1.3E-02	
				5.0E-05	I					1	0.1		Haloxyfop, Methyl	69806-40-2	3.1E+00	n	3.1E+01	n					5.8E-01	n		6.4E-03	
				1.3E-02	I					1	0.1		Harmony	79277-27-3	7.9E+02	n	8.0E+03	n					2.0E+02	n		6.1E-02	
4.5E+00	I	1.3E-03	I	5.0E-04	I					1	0.1		Heptachlor	76-44-8	1.1E-01	c	3.8E-01	c	1.9E-03	c	9.4E-03	c	1.8E-03	c	4.0E-01	1.4E-04	3.3E-02
9.1E+00	I	2.6E-03	I	1.3E-05	I					1	0.1		Heptachlor Epoxide	1024-57-3	5.3E-02	c*	1.9E-01	c*	9.4E-04	c	4.7E-03	c	3.3E-03	c*	2.0E-01	6.8E-05	4.1E-03
				2.0E-03	I					1	0.1		Hexabromobenzene	87-82-1	1.2E+02	n	1.2E+03	n					3.1E+01	n		1.8E-01	
				2.0E-04	I					1	0.1		Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2	1.2E+01	n	1.2E+02	n					3.1E+00	n			
1.6E+00	I	4.6E-04	I	8.0E-04	I					1	0.1		Hexachlorobenzene	118-74-1	3.0E-01	c	1.1E+00	c	5.3E-03	c	2.7E-02	c	4.2E-02	c	1.0E+00	5.3E-04	1.3E-02
7.8E-02	I	2.2E-05	I	1.0E-03	P					1	0.1		Hexachlorobutadiene	87-68-3	6.2E+00	c**	2.2E+01	c*	1.1E-01	c	5.6E-01	c	2.6E-01	c*		5.0E-04	
6.3E+00	I	1.8E-03	I	8.0E-03	A					1	0.1		Hexachlorocyclohexane, Alpha-	319-84-6	7.7E-02	c	2.7E-01	c	1.4E-03	c	6.8E-03	c	6.2E-03	c		3.6E-05	
1.8E+00	I	5.3E-04	I							1	0.1		Hexachlorocyclohexane, Beta-	319-85-7	2.7E-01	c	9.6E-01	c	4.6E-03	c	2.3E-02	c	2.2E-02	c		1.3E-04	
1.1E+00	C	3.1E-04	C	3.0E-04	I					1	0.04		Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	5.2E-01	c*	2.1E+00	c	7.8E-03	c	4.0E-02	c	3.6E-02	c*	2.0E-01	2.1E-04	1.2E-03
1.8E+00	I	5.1E-04	I							1	0.1		Hexachlorocyclohexane, Technical	608-73-1	2.7E-01	c	9.6E-01	c	4.8E-03	c	2.4E-02	c	2.2E-02	c		1.3E-04	
				6.0E-03	I	2.0E-04	I			1	0.1		Hexachlorocyclopentadiene	77-47-4	3.7E+02	n	3.7E+03	n	2.1E-01	n	8.8E-01	n	2.2E+01	n	5.0E+01	7.0E-02	1.6E-01
4.0E-02	I	1.1E-05	C	7.0E-04	I	3.0E-02	I			1	0.1		Hexachloroethane	67-72-1	1.2E+01	c**	4.3E+01	c*	2.2E-01	c	1.1E+00	c	7.9E-01	c**		4.8E-04	
				3.0E-04	I					1	0.1		Hexachlorophene	70-30-4	1.8E+01	n	1.8E+02	n					4.7E+00	n		6.3E+00	
1.1E-01	I			3.0E-03	I					1	0.015		Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	5.6E+00	c*	2.4E+01	c					6.1E-01	c*		2.3E-04	
						1.0E-05	I	V		1		5.2E+03	Hexamethylene Diisocyanate, 1,6-	822-06-0	3.4E+00	n	1.4E+01	n	1.0E-02	n	4.4E-02	n	2.1E-02	n		2.1E-04	
				4.0E-04	P					1	0.1		Hexamethylphosphoramide	680-31-9	2.4E+01	n	2.5E+02	n					6.2E+00	n		1.4E-03	
				6.0E-02	H	7.0E-01	I	V		1		1.4E+02	Hexane, N-	110-54-3	5.7E+02	ns	2.6E+03	ns	7.3E+02	n	3.1E+03	n	2.5E+02	n		1.8E+00	
				2.0E+00	P					1	0.1		Hexanedioic Acid	124-04-9	1.2E+05	nm	1.2E+06	nm					3.1E+04	n		7.7E+00	
				5.0E-03	I	3.0E-02	I	V		1		3.3E+03	Hexanone, 2-	591-78-6	2.1E+02	n	1.4E+03	n	3.1E+01	n	1.3E+02	n	3.4E+01	n		7.9E-03	
				3.3E-02	I					1	0.1		Hexazinone	51235-04-2	2.0E+03	n	2.0E+04	n					5.0E+02	n		2.3E-01	
3.0E+00	I	4.9E-03	I			3.0E-05	P			1			Hydrazine	302-01-2	2.1E-01	c	9.5E-01	c	5.0E-04	c*	2.5E-03	c*	2.2E-02	c			
3.0E+00	I	4.9E-03	I							1			Hydrazine Sulfate	10034-93-2	2.1E-01	c	9.5E-01	c	5.0E-04	c	2.5E-03	c	2.2E-02	c			
						2.0E-02	I			1			Hydrogen Chloride	7647-01-0	2.8E+07	nm	1.2E+08	nm	2.1E+01	n	8.8E+01	n					
				4.0E-02	C	1.4E-02	C			1			Hydrogen Fluoride	7664-39-3	3.1E+03	n	4.1E+04	n	1.5E+01	n	6.1E+01	n	6.2E+02	n			
						2.0E-03	I			1			Hydrogen Sulfide	7783-06-4	2.8E+06	nm	1.2E+07	nm	2.1E+00	n	8.8E+00	n					
6.0E-02	P			4.0E-02	P					1	0.1		Hydroquinone	123-31-9	8.1E+00	c	2.9E+01	c					1.1E+00	c		7.5E-04	
				1.3E-02	I					1	0.1		Imazalil	35554-44-0	7.9E+02	n	8.0E+03	n					1.4E+02	n		2.5E+00	
				2.5E-01	I					1	0.1		Imazaquin	81335-37-7	1.5E+04	n	1.5E+05	nm					3.8E+03	n		1.9E+01	
				1.0E-02	A					1			Iodine	7553-56-2	7.8E+02	n	1.0E+04	n					1.6E+02	n		9.4E+00	
				4.0E-02	I					1	0.1		Iprodione	36734-19-7	2.4E+03	n	2.5E+04	n					5.7E+02	n		1.7E-01	
				7.0E-01	P					1			Iron	7439-89-6	5.5E+04	n	7.2E+05	nm					1.1E+04	n		2.7E+02	
				3.0E-01	I					1	0.1		Isobutyl Alcohol	78-83-1	1.8E+04	n	1.8E+05	nm					4.6E+03	n		9.5E-01	
9.5E-04	I			2.0E-01	I	2.0E+00	C			1	0.1		Isophorone	78-59-1	5.1E+02	c*	1.8E+03	c*	2.1E+03	n	8.8E+03	n	6.7E+01	c*		2.2E-02	
				1.5E-02	I					1	0.1		Isopropalin	33820-53-0	9.2E+02	n	9.2E+03	n					2.9E+01	n		6.6E-01	
						7.0E+00	C			1	0.1		Isopropanol	67-63-0	9.9E+09	nm	4.2E+10	nm	7.3E+03	n	3.1E+04	n					
				1.0E-01	I					1	0.1		Isopropyl Methyl Phosphonic Acid	1832-54-8	6.1E+03	n	6.2E+04	n					1.6E+03	n		3.4E-01	
				5.0E-02	I					1	0.1		Isoxaben	82558-50-7	3.1E+03	n	3.1E+04	n					5.6E+02	n		1.5E+00	
						3.0E-01	A	V		1			JP-7	NA	4.3E+08	nm	1.8E+09	nm	3.1E+02	n	1.3E+03	n	6.3E+02	n			
				7.5E-02	I					1	0.1		Kerb	23950-58-5	4.6E+03	n	4.6E+04	n					9.0E+02	n		9.1E-01	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs	
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	voc	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
				2.0E-03	I					1	0.1		Lactofen	77501-63-4	1.2E+02	n	1.2E+03	n					1.9E+01	n		8.7E-01	
													Lead Compounds														
2.8E-01	C	8.0E-05	C							1	0.1		~Lead acetate	301-04-2	1.7E+00	c	6.2E+00	c	3.0E-02	c	1.5E-01	c	2.4E-01	c			
										1			~Lead and Compounds	7439-92-1	4.0E+02	L	8.0E+02	L	1.5E-01	L		L		L	1.5E+01		1.4E+01
3.8E-02	C	1.1E-05	C							1	0.1		~Lead subacetate	1335-32-6	1.3E+01	c	4.5E+01	c	2.2E-01	c	1.1E+00	c	1.8E+00	c			
				1.0E-07	I					1	0.1		~Tetraethyl Lead	78-00-2	6.1E-03	n	6.2E-02	n					9.9E-04	n		3.5E-06	
				2.0E-03	I					1	0.1		Linuron	330-55-2	1.2E+02	n	1.2E+03	n					2.6E+01	n		2.3E-02	
				2.0E-03	P					1			Lithium	7439-93-2	1.6E+02	n	2.0E+03	n					3.1E+01	n		9.3E+00	
				2.0E-01	I					1	0.1		Londax	83055-99-6	1.2E+04	n	1.2E+05	nm					3.1E+03	n		7.9E-01	
				5.0E-04	I					1	0.1		MCPA	94-74-6	3.1E+01	n	3.1E+02	n					5.7E+00	n		1.5E-03	
				1.0E-02	I					1	0.1		MCPB	94-81-5	6.1E+02	n	6.2E+03	n					1.1E+02	n		4.4E-02	
				1.0E-03	I					1	0.1		MCPP	93-65-2	6.1E+01	n	6.2E+02	n					1.2E+01	n		3.5E-03	
				2.0E-02	I					1	0.1		Malathion	121-75-5	1.2E+03	n	1.2E+04	n					3.0E+02	n		7.9E-02	
				1.0E-01	I	7.0E-04	C			1	0.1		Maleic Anhydride	108-31-6	6.1E+03	n	6.1E+04	n	7.3E-01	n	3.1E+00	n	1.5E+03	n		3.0E-01	
				5.0E-01	I					1	0.1		Maleic Hydrazide	123-33-1	3.1E+04	n	3.1E+05	nm					7.8E+03	n		1.6E+00	
				1.0E-04	P					1	0.1		Malononitrile	109-77-3	6.1E+00	n	6.2E+01	n					1.6E+00	n		3.2E-04	
				3.0E-02	H					1	0.1		Mancozeb	8018-01-7	1.8E+03	n	1.8E+04	n					4.6E+02	n		6.5E-01	
				5.0E-03	I					1	0.1		Maneb	12427-38-2	3.1E+02	n	3.1E+03	n					7.7E+01	n		1.1E-01	
				1.4E-01	I	5.0E-05	I			1			Manganese (Diet)	7439-96-5													
				2.4E-02	S	5.0E-05	I			0.04			Manganese (Non-diet)	7439-96-5	1.8E+03	n	2.3E+04	n	5.2E-02	n	2.2E-01	n	3.2E+02	n		2.1E+01	
				9.0E-05	H					1	0.1		Mephosfolan	950-10-7	5.5E+00	n	5.5E+01	n					1.4E+00	n		2.1E-03	
				3.0E-02	I					1	0.1		Mepiquat Chloride	24307-26-4	1.8E+03	n	1.8E+04	n					4.7E+02	n		1.6E-01	
													Mercury Compounds														
				3.0E-04	I	3.0E-04	S			0.07			~Mercuric Chloride (and other Mercury salts)	7487-94-7	2.3E+01	n	3.1E+02	n	3.1E-01	n	1.3E+00	n	4.3E+00	n	2.0E+00		
						3.0E-04	I	V		1		3.1E+00	~Mercury (elemental)	7439-97-6	1.0E+01	ns	4.3E+01	ns	3.1E-01	n	1.3E+00	n	6.3E-01	n	2.0E+00	3.3E-02	1.0E-01
				1.0E-04	I					1			~Methyl Mercury	22967-92-6	7.8E+00	n	1.0E+02	n					1.6E+00	n			
				8.0E-05	I					1	0.1		~Phenylmercuric Acetate	62-38-4	4.9E+00	n	4.9E+01	n					1.2E+00	n		3.9E-04	
				3.0E-05	I					1	0.1		Merphos	150-50-5	1.8E+00	n	1.8E+01	n					4.7E-01	n		4.6E-02	
				3.0E-05	I					1	0.1		Merphos Oxide	78-48-8	1.8E+00	n	1.8E+01	n					6.1E-02	n		3.0E-04	
				6.0E-02	I					1	0.1		Metalaxyl	57837-19-1	3.7E+03	n	3.7E+04	n					9.2E+02	n		2.5E-01	
				1.0E-04	I	3.0E-02	P	V		1		4.6E+03	Methacrylonitrile	126-98-7	7.6E+00	n	9.2E+01	n	3.1E+01	n	1.3E+02	n	1.5E+00	n		3.4E-04	
				5.0E-05	I					1	0.1		Methamidophos	10265-92-6	3.1E+00	n	3.1E+01	n					7.8E-01	n		1.6E-04	
				5.0E-01	I	4.0E+00	C			1	0.1		Methanol	67-56-1	3.1E+04	n	3.1E+05	nm	4.2E+03	n	1.8E+04	n	7.8E+03	n		1.6E+00	
				1.0E-03	I					1	0.1		Methidathion	950-37-8	6.1E+01	n	6.2E+02	n					1.5E+01	n		3.7E-03	
				2.5E-02	I					1	0.1		Methomyl	16752-77-5	1.5E+03	n	1.5E+04	n					3.9E+02	n		8.5E-02	
4.9E-02	C	1.4E-05	C							1	0.1		Methoxy-5-nitroaniline, 2-	99-59-2	9.9E+00	c	3.5E+01	c	1.7E-01	c	8.8E-01	c	1.3E+00	c		4.6E-04	
				5.0E-03	I					1	0.1		Methoxychlor	72-43-5	3.1E+02	n	3.1E+03	n					2.7E+01	n	4.0E+01	1.5E+00	2.2E+00
				8.0E-03	P	1.0E-03	P			1	0.1		Methoxyethanol Acetate, 2-	110-49-6	4.9E+02	n	4.9E+03	n	1.0E+00	n	4.4E+00	n	1.2E+02	n		2.6E-02	
				5.0E-03	P	2.0E-02	I			1	0.1		Methoxyethanol, 2-	109-86-4	3.1E+02	n	3.1E+03	n	2.1E+01	n	8.8E+01	n	7.8E+01	n		1.6E-02	
				1.0E+00	X			V		1		2.9E+04	Methyl Acetate	79-20-9	7.8E+04	ns	1.0E+06	nms					1.6E+04	n		3.2E+00	
				3.0E-02	H	2.0E-02	P	V		1		6.8E+03	Methyl Acrylate	96-33-3	1.5E+02	n	6.4E+02	n	2.1E+01	n	8.8E+01	n	3.8E+01	n		8.1E-03	
				6.0E-01	I	5.0E+00	I	V		1		2.8E+04	Methyl Ethyl Ketone (2-Butanone)	78-93-3	2.8E+04	n	2.0E+05	nms	5.2E+03	n	2.2E+04	n	4.9E+03	n		1.0E+00	
		1.0E-03	X	1.0E-03	P	2.0E-05	X			1	0.1		Methyl Hydrazine	60-34-4	6.1E+01	n	6.1E+02	n	2.4E-03	c**	1.2E-02	c**	1.6E+01	n		3.5E-03	
				8.0E-02	H	3.0E+00	I	V		1		3.4E+03	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	5.3E+03	ns	5.3E+04	ns	3.1E+03	n	1.3E+04	n	1.0E+03	n		2.3E-01	
						1.0E-03	C	V		1	0.1	1.7E+04	Methyl Isocyanate	624-83-9	5.0E+00	n	2.1E+01	n	1.0E+00	n	4.4E+00	n	2.1E+00	n		5.9E-04	
				1.4E+00	I	7.0E-01	I	V		1		2.4E+03	Methyl Methacrylate	80-62-6	4.8E+03	ns	2.1E+04	ns	7.3E+02	n	3.1E+03	n	1.4E+03	n		3.0E-01	
				2.5E-04	I					1	0.1		Methyl Parathion	298-00-0	1.5E+01	n	1.5E+02	n					3.4E+00	n		5.7E-03	
				6.0E-02	X					1	0.1		Methyl Phosphonic Acid	993-13-5	3.7E+03	n	3.7E+04	n					9.4E+02	n		1.9E-01	
				6.0E-03	H	4.0E-02	H	V		1		3.9E+02	Methyl Styrene (Mixed Isomers)	25013-15-4	2.4E+02	n	1.5E+03	ns	4.2E+01	n	1.8E+02	n	3.2E+01	n		5.2E-02	
9.9E-02	C	2.8E-05	C							1	0.1		Methyl methanesulfonate	66-27-3	4.9E+00	c	1.7E+01	c	8.7E-02	c	4.4E-01	c	6.8E-01	c		1.4E-04	
1.8E-03	C	2.6E-07	C			3.0E+00	I	V		1		8.9E+03	Methyl tert-Butyl Ether (MTBE)	1634-04-4	4.3E+01	c	2.2E+02	c	9.4E+00	c	4.7E+01	c	1.2E+01	c		2.8E-03	
				3.0E-04	X					1	0.1		Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2	1.8E+01	n	1.8E+02	n					4.7E+00	n		2.8E-03	
9.0E-03	P			2.0E-02	X					1	0.1		Methyl-5-Nitroaniline, 2-	99-55-8	5.4E+01	c*	1.9E+02	c*					7.0E+00	c*		3.9E-03	
8.3E+00	C	2.4E-03	C							1	0.1		Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	5.9E-02	c	2.1E-01	c	1.0E-03	c	5.1E-03	c	8.1E-03	c		2.8E-06	
1.3E-01	C	3.7E-05	C							1	0.1		Methylaniline Hydrochloride, 2-	636-21-5	3.7E+00	c	1.3E+01	c	6.6E-02	c	3.3E-01	c	5.0E-01	c		2.1E-04	
				1.0E-02	A					1	0.1		Methylarsonic acid	124-58-3	6.1E+02	n	6.2E+03	n					1.6E+02	n			
				2.0E-04	X					1	0.1		Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7	1.2E+01	n	1.2E+02	n					3.1E+00	n			
1.0E-01	X			3.0E-04	X					1	0.1		Methylbenzene-1,4-diamine sulfate, 2-	615-50-9	4.9E+00	c**	1.7E+01	c*					6.7E-01	c**			
2.2E+01	C	6.3E-03	C						M	1	0.1		Methylcholanthrene, 3-	56-49-5	5.2E-03	c	7.8E-02	c	1.5E-04	c	1.9E-03	c	9.8E-04	c		1.9E-03	
2.0E-03	I	1.0E-08	I	6.0E-03	I	6.0E-01	I	V	M	1		3.3E+03	Methylene Chloride	75-09-2	5.6E+01	c**	9.6E+02	c**	9.6E+01	c**	1.2E+03	c**	9.9E+00	c**	5.0E+00	2.5E-03	1.3E-03
1.0E-01	P	4.3E-04	C	2.0E-03	P				M	1	0.1		Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	1.2E+00	c	1.7E+01	c*	2.2E-03	c	2.9E-02	c	1.4E-01	c		1.6E-03	
4.6E-02	I	1.3E-05	C							1	0.1		Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	1.1E+01	c	3.7E+01	c	1.9E-01	c	9.4E-01	c	4.1E-01	c		2.3E-03	
1.6E+00	C	4.6E-04	C			2.0E-02	C			1	0.1		Methylenebisbenzenamine, 4,4'-	101-77-9	3.0E-01	c	1.1E+00	c	5.3E-03	c	2.7E-02	c	4.1E-02	c		1.8E-04	
						6.0E-04	I			1	0.1		Methylenediphenyl Diisocyanate	101-68-8	8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n					
				7.0E-02	H			V		1		5.0E+02	Methylstyrene, Alpha-	98-83-9	5.5E+03	ns	7.2E+04	ns					5.8E+02	n		9.3E-01	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs	
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	voc	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
				1.5E-01	I					1	0.1		Metolachlor	51218-45-2	9.2E+03	n	9.2E+04	n					2.1E+03	n		2.5E+00	
				2.5E-02	I					1	0.1		Metribuzin	21087-64-9	1.5E+03	n	1.5E+04	n					3.8E+02	n		1.2E-01	
				3.0E+00	P			V		1	0.1	3.4E-01	Mineral oils	8012-95-1	1.8E+05	nms	1.8E+06	nms					4.7E+04	n		1.9E+03	
1.8E+01	C	5.1E-03	C	2.0E-04	I					1	0.1		Mirex	2385-85-5	2.7E-02	c	9.6E-02	c	4.8E-04	c	2.4E-03	c	3.7E-03	c		2.7E-03	
				2.0E-03	I					1	0.1		Molinate	2212-67-1	1.2E+02	n	1.2E+03	n					2.3E+01	n		1.3E-02	
				5.0E-03	I					1			Molybdenum	7439-98-7	3.9E+02	n	5.1E+03	n					7.8E+01	n		1.6E+00	
				1.0E-01	I					1			Monochloramine	10599-90-3	7.8E+03	n	1.0E+05	nm					1.6E+03	n	4.0E+03		
				2.0E-03	P					1	0.1		Monomethylaniline	100-61-8	1.2E+02	n	1.2E+03	n					3.0E+01	n		1.1E-02	
				3.0E-04	X					1	0.1		N,N'-Diphenyl-1,4-benzenediamine	74-31-7	1.8E+01	n	1.8E+02	n					2.7E+00	n		2.8E-01	
				2.0E-03	I					1	0.1		Naled	300-76-5	1.2E+02	n	1.2E+03	n					3.1E+01	n		1.4E-02	
				3.0E-02	X	1.0E-01	P	V		1			Naphtha, High Flash Aromatic (HFAN)	64724-95-6	2.3E+03	n	3.1E+04	n	1.0E+02	n	4.4E+02	n	1.4E+02	n			
1.8E+00	C	0.0E+00	C							1	0.1		Naphthylamine, 2-	91-59-8	2.7E-01	c	9.6E-01	c					3.3E-02	c		1.7E-04	
				1.0E-01	I					1	0.1		Napropamide	15299-99-7	6.1E+03	n	6.2E+04	n					1.3E+03	n		8.3E+00	
				1.1E-02	C	1.4E-05	C			0.04			Nickel Carbonyl	13463-39-3	8.2E+02	n	9.9E+03	n	1.5E-02	n	6.1E-02	n	1.5E+02	n			
				1.1E-02	C	2.0E-05	C			1			Nickel Oxide	1313-99-1	8.4E+02	n	1.0E+04	n	2.1E-02	n	8.8E-02	n	1.7E+02	n			
		2.4E-04	I	1.1E-02	C	1.4E-05	C			0.04			Nickel Refinery Dust	NA	8.2E+02	n	9.9E+03	n	1.0E-02	c**	5.1E-02	c**	1.7E+02	n		2.5E+01	
		2.6E-04	C	2.0E-02	I	9.0E-05	A			0.04			Nickel Soluble Salts	7440-02-0	1.5E+03	n	2.0E+04	n	9.4E-03	c*	4.7E-02	c**	3.0E+02	n		2.0E+01	
1.7E+00	C	4.8E-04	I	1.1E-02	C	1.4E-05	C			0.04			Nickel Subsulfide	12035-72-2	3.8E-01	c	1.7E+00	c	5.1E-03	c**	2.6E-02	c**	3.9E-02	c			
				1.6E+00	I					1			Nitrate	14797-55-8	1.3E+05	nm	1.6E+06	nm					2.5E+04	n	1.0E+04		
										1			Nitrate + Nitrite (as N)	NA											1.0E+04		
				1.0E-01	I					1			Nitrite	14797-65-0	7.8E+03	n	1.0E+05	nm					1.6E+03	n	1.0E+03		
				1.0E-02	X	5.0E-05	X			1	0.1		Nitroaniline, 2-	88-74-4	6.1E+02	n	6.0E+03	n	5.2E-02	n	2.2E-01	n	1.5E+02	n		6.2E-02	
2.0E-02	P			4.0E-03	P	6.0E-03	P			1	0.1		Nitroaniline, 4-	100-01-6	2.4E+01	c*	8.6E+01	c*	6.3E+00	n	2.6E+01	n	3.3E+00	c*		1.4E-03	
		4.0E-05	I	2.0E-03	I	9.0E-03	I	V		1		3.1E+03	Nitrobenzene	98-95-3	4.8E+00	c*	2.4E+01	c*	6.1E-02	c	3.1E-01	c	1.2E-01	c*		7.9E-05	
				3.0E+03	P					1	0.1		Nitrocellulose	9004-70-0	1.8E+08	nm	1.8E+09	nm					4.7E+07	n		1.0E+04	
				7.0E-02	H					1	0.1		Nitrofurantoin	67-20-9	4.3E+03	n	4.3E+04	n					1.1E+03	n		4.7E-01	
1.3E+00	C	3.7E-04	C							1	0.1		Nitrofurazone	59-87-0	3.7E-01	c	1.3E+00	c	6.6E-03	c	3.3E-02	c	5.2E-02	c		4.6E-05	
1.7E-02	P			1.0E-04	P					1	0.1		Nitroglycerin	55-63-0	6.1E+00	n	6.2E+01	n					1.5E+00	n		6.6E-04	
				1.0E-01	I					1	0.1		Nitroguanidine	556-88-7	6.1E+03	n	6.2E+04	n					1.6E+03	n		3.8E-01	
		9.0E-06	P			2.0E-02	P	V		1		1.8E+04	Nitromethane	75-52-5	4.9E+00	c*	2.5E+01	c*	2.7E-01	c*	1.4E+00	c*	5.4E-01	c*		1.2E-04	
		2.7E-03	H			2.0E-02	I	V		1		4.9E+03	Nitropropane, 2-	79-46-9	1.3E-02	c	6.4E-02	c	9.0E-04	c	4.5E-03	c	1.8E-03	c		4.7E-07	
2.7E+01	C	7.7E-03	C						M	1	0.1		Nitroso-N-ethylurea, N-	759-73-9	4.3E-03	c	6.4E-02	c	1.2E-04	c	1.6E-03	c	7.9E-04	c		1.9E-07	
1.2E+02	C	3.4E-02	C						M	1	0.1		Nitroso-N-methylurea, N-	684-93-5	9.6E-04	c	1.4E-02	c	2.8E-05	c	3.6E-04	c	1.8E-04	c		4.0E-08	
5.4E+00	I	1.6E-03	I					V		1			Nitroso-di-N-butylamine, N-	924-16-3	8.7E-02	c	4.0E-01	c	1.5E-03	c	7.7E-03	c	2.4E-03	c		4.8E-06	
7.0E+00	I	2.0E-03	C							1	0.1		Nitroso-di-N-propylamine, N-	621-64-7	6.9E-02	c	2.5E-01	c	1.2E-03	c	6.1E-03	c	9.3E-03	c		7.0E-06	
2.8E+00	I	8.0E-04	C							1	0.1		Nitrosodiethanolamine, N-	1116-54-7	1.7E-01	c	6.2E-01	c	3.0E-03	c	1.5E-02	c	2.4E-02	c		4.8E-06	
1.5E+02	I	4.3E-02	I						M	1	0.1		Nitrosodiethylamine, N-	55-18-5	7.7E-04	c	1.1E-02	c	2.2E-05	c	2.9E-04	c	1.4E-04	c		5.2E-08	
5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X		M	1	0.1		Nitrosodimethylamine, N-	62-75-9	2.3E-03	c	3.4E-02	c	6.9E-05	c	8.8E-04	c	4.2E-04	c		1.0E-07	
4.9E-03	I	2.6E-06	C							1	0.1		Nitrosodiphenylamine, N-	86-30-6	9.9E+01	c	3.5E+02	c	9.4E-01	c	4.7E+00	c	1.0E+01	c		5.7E-02	
2.2E+01	I	6.3E-03	C							1	0.1		Nitrosomethylethylamine, N-	10595-95-6	2.2E-02	c	7.8E-02	c	3.9E-04	c	1.9E-03	c	3.0E-03	c		8.7E-07	
6.7E+00	C	1.9E-03	C							1	0.1		Nitrosomorpholine [N-]	59-89-2	7.3E-02	c	2.6E-01	c	1.3E-03	c	6.5E-03	c	1.0E-02	c		2.5E-06	
9.4E+00	C	2.7E-03	C							1	0.1		Nitrosopiperidine [N-]	100-75-4	5.2E-02	c	1.8E-01	c	9.0E-04	c	4.5E-03	c	7.1E-03	c		3.8E-06	
2.1E+00	I	6.1E-04	I							1	0.1		Nitrosopyrrolidine, N-	930-55-2	2.3E-01	c	8.2E-01	c	4.0E-03	c	2.0E-02	c	3.2E-02	c		1.2E-05	
				1.0E-04	X					1	0.1		Nitrotoluene, m-	99-08-1	6.1E+00	n	6.2E+01	n					1.3E+00	n		1.2E-03	
2.2E-01	P			9.0E-04	P			V		1		1.5E+03	Nitrotoluene, o-	88-72-2	2.9E+00	c*	1.3E+01	c*					2.7E-01	c*		2.5E-04	
1.6E-02	P			4.0E-03	P					1	0.1		Nitrotoluene, p-	99-99-0	3.0E+01	c**	1.1E+02	c*					3.7E+00	c*		3.4E-03	
				3.0E-04	X	2.0E-01	P	V		1		6.9E+00	Nonane, n-	111-84-2	2.1E+01	ns	2.3E+02	ns	2.1E+02	n	8.8E+02	n	4.6E+00	n		6.6E-02	
				4.0E-02	I					1	0.1		Norflurazon	27314-13-2	2.4E+03	n	2.5E+04	n					6.0E+02	n		3.9E+00	
				7.0E-04	I					1	0.1		Nustar	85509-19-9	4.3E+01	n	4.3E+02	n					8.3E+00	n		1.4E+00	
				3.0E-03	I					1	0.1		Octabromodiphenyl Ether	32536-52-0	1.8E+02	n	1.8E+03	n					4.7E+01	n		9.3E+00	
				5.0E-02	I					1	0.006		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra (HMX)	2691-41-0	3.8E+03	n	4.9E+04	n					7.8E+02	n		9.9E-01	
				2.0E-03	H					1	0.1		Octamethylpyrophosphoramide	152-16-9	1.2E+02	n	1.2E+03	n					3.1E+01	n		7.5E-03	
				1.0E-02	P					1	0.1		Octyl Phthalate, di-N-	117-84-0	6.1E+02	n	6.2E+03	n					1.6E+02	n		4.4E+01	
				5.0E-02	I					1	0.1		Oryzalin	19044-88-3	3.1E+03	n	3.1E+04	n					6.2E+02	n		1.1E+00	
				5.0E-03	I					1	0.1		Oxadiazon	19666-30-9	3.1E+02	n	3.1E+03	n					3.5E+01	n		3.6E-01	
				2.5E-02	I					1	0.1		Oxamyl	23135-22-0	1.5E+03	n	1.5E+04	n					3.9E+02	n	2.0E+02	8.6E-02	4.4E-02
				1.3E-02	I					1	0.1		Paclobutrazol	76738-62-0	7.9E+02	n	8.0E+03	n					1.7E+02	n		3.6E-01	
				4.5E-03	I					1	0.1		Paraquat Dichloride	1910-42-5	2.7E+02	n	2.8E+03	n					7.0E+01	n		9.7E-01	
				6.0E-03	H					1	0.1		Parathion	56-38-2	3.7E+02	n	3.7E+03	n					6.5E+01	n		3.3E-01	
				5.0E-02	H					1	0.1		Pebulate	1114-71-2	3.1E+03	n	3.1E+04	n					4.2E+02	n		3.3E-01	
				4.0E-02	I					1	0.1		Pendimethalin	40487-42-1	2.4E+03	n	2.5E+04	n					1.3E+02	n		1.5E+00	
				2.0E-03	I					1	0.1		Pentabromodiphenyl Ether	32534-81-9	1.2E+02	n	1.2E+03	n					3.1E+01	n		1.4E+00	
				1.0E-04	I					1	0.1		Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9	6.1E+00	n	6.2E+01	n					1.6E+00	n		6.8E-02	
				8.0E-04	I					1	0.1		Pentachlorobenzene	608-93-5	4.9E+01	n	4.9E+02	n					2.3E+00	n		1.7E-02	
9.0E-02	P									1	0.1		Pentachloroethane	76-01-7	5.4E+00	c	1.9E+01	c					5.6E-01	c		2.7E-04	

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Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs	
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	voc	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
2.6E-01	H			3.0E-03	I					1	0.1		Pentachloronitrobenzene	82-68-8	1.9E+00	c*	6.6E+00	c					1.0E-01	c		1.3E-03	
4.0E-01	I	5.1E-06	C	5.0E-03	I					1	0.25		Pentachlorophenol	87-86-5	8.9E-01	c	2.7E+00	c	4.8E-01	c	2.4E+00	c	3.5E-02	c	1.0E+00	3.6E-04	1.0E-02
4.0E-03	X			2.0E-03	P					1	0.1		Pentaerythritol tetranitrate (PETN)	78-11-5	1.2E+02	c**	4.3E+02	c**					1.6E+01	c**		2.4E-02	
						1.0E+00	P	V		1		3.9E+02	Pentane, n-	109-66-0	8.7E+02	ns	3.7E+03	ns	1.0E+03	n	4.4E+03	n	2.1E+03	n		1.0E+01	
													Perchlorates														
				7.0E-04	I					1			~Ammonium Perchlorate	7790-98-9	5.5E+01	n	7.2E+02	n					1.1E+01	n			
				7.0E-04	I					1			~Lithium Perchlorate	7791-03-9	5.5E+01	n	7.2E+02	n					1.1E+01	n			
				7.0E-04	I					1			~Perchlorate and Perchlorate Salts	14797-73-0	5.5E+01	n	7.2E+02	n					1.1E+01	n	1.5E+01(F)		
				7.0E-04	I					1			~Potassium Perchlorate	7778-74-7	5.5E+01	n	7.2E+02	n					1.1E+01	n			
				7.0E-04	I					1			~Sodium Perchlorate	7601-89-0	5.5E+01	n	7.2E+02	n					1.1E+01	n			
				5.0E-02	I					1	0.1		Permethrin	52645-53-1	3.1E+03	n	3.1E+04	n					7.8E+02	n		1.9E+02	
2.2E-03	C	6.3E-07	C							1	0.1		Phenacetin	62-44-2	2.2E+02	c	7.8E+02	c	3.9E+00	c	1.9E+01	c	3.0E+01	c		8.3E-03	
				2.5E-01	I					1	0.1		Phenmedipham	13684-63-4	1.5E+04	n	1.5E+05	nm					3.0E+03	n		1.6E+01	
				3.0E-01	I	2.0E-01	C			1	0.1		Phenol	108-95-2	1.8E+04	n	1.8E+05	nm	2.1E+02	n	8.8E+02	n	4.5E+03	n		2.6E+00	
				5.0E-04	X					1	0.1		Phenothiazine	92-84-2	3.1E+01	n	3.1E+02	n					3.2E+00	n		1.0E-02	
				6.0E-03	I					1	0.1		Phenylenediamine, m-	108-45-2	3.7E+02	n	3.7E+03	n					9.4E+01	n		2.5E-02	
4.7E-02	H									1	0.1		Phenylenediamine, o-	95-54-5	1.0E+01	c	3.7E+01	c					1.4E+00	c		3.8E-04	
				1.9E-01	H					1	0.1		Phenylenediamine, p-	106-50-3	1.2E+04	n	1.2E+05	nm					3.0E+03	n		7.9E-01	
1.9E-03	H									1	0.1		Phenylphenol, 2-	90-43-7	2.5E+02	c	8.9E+02	c					2.6E+01	c		3.5E-01	
				2.0E-04	H					1	0.1		Phorate	298-02-2	1.2E+01	n	1.2E+02	n					2.3E+00	n		2.6E-03	
						3.0E-04	I	V		1		1.6E+03	Phosgene	75-44-5	3.3E-01	n	1.4E+00	n	3.1E-01	n	1.3E+00	n					
				2.0E-02	I					1	0.1		Phosmet	732-11-6	1.2E+03	n	1.2E+04	n					2.9E+02	n		6.4E-02	
													Phosphates, Inorganic														
				4.9E+01	P					1			~Aluminum metaphosphate	13776-88-0	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Ammonium polyphosphate	68333-79-9	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Calcium pyrophosphate	7790-76-3	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Diammonium phosphate	7783-28-0	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Dicalcium phosphate	7757-93-9	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Dimagnesium phosphate	7782-75-4	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Dipotassium phosphate	7758-11-4	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Disodium phosphate	7558-79-4	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Monoaluminum phosphate	13530-50-2	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Monoammonium phosphate	7722-76-1	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Monocalcium phosphate	7758-23-8	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Monomagnesium phosphate	7757-86-0	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Monopotassium phosphate	7778-77-0	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Monosodium phosphate	7558-80-7	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Polyphosphoric acid	8017-16-1	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Potassium tripolyphosphate	13845-36-8	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Sodium acid pyrophosphate	7758-16-9	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Sodium aluminum phosphate (acidic)	7785-88-8	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Sodium aluminum phosphate (anhydrous)	10279-59-1	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Sodium aluminum phosphate (tetrahydrate)	10305-76-7	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Sodium hexametaphosphate	10124-56-8	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Sodium polyphosphate	68915-31-1	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Sodium trimetaphosphate	7785-84-4	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Sodium tripolyphosphate	7758-29-4	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Tetrapotassium phosphate	7320-34-5	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Tetrasodium pyrophosphate	7722-88-5	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Tricalcium phosphate	7758-87-4	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Trimagnesium phosphate	7757-87-1	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Tripotassium phosphate	7778-53-2	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				4.9E+01	P					1			~Trisodium phosphate	7601-54-9	3.8E+06	nm	5.0E+07	nm					7.6E+05	n			
				3.0E-04	I	3.0E-04	I			1			Phosphine	7803-51-2	2.3E+01	n	3.1E+02	n	3.1E-01	n	1.3E+00	n	4.7E+00	n			
				4.9E+01	P	1.0E-02	I			1			Phosphoric Acid	7664-38-2	3.0E+06	nm	2.7E+07	nm	1.0E+01	n	4.4E+01	n	7.6E+05	n			
				2.0E-05	I					1			Phosphorus, White	7723-14-0	1.6E+00	n	2.0E+01	n					3.1E-01	n		1.1E-03	
				1.0E+00	H					1	0.1		Phthalic Acid, P-	100-21-0	6.1E+04	n	6.2E+05	nm					1.5E+04	n		5.3E+00	
				2.0E+00	I	2.0E-02	C			1	0.1		Phthalic Anhydride	85-44-9	1.2E+05	nm	1.2E+06	nm	2.1E+01	n	8.8E+01	n	3.0E+04	n		6.6E+00	
				7.0E-02	I					1	0.1		Picloram	1918-02-1	4.3E+03	n	4.3E+04	n					1.1E+03	n	5.0E+02	2.9E-01	1.4E-01
				1.0E-04	X					1	0.1		Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3	6.1E+00	n	6.2E+01	n					1.5E+00	n		1.0E-03	
				1.0E-02	I					1	0.1		Pirimiphos, Methyl	29232-93-7	6.1E+02	n	6.2E+03	n					9.1E+01	n		8.7E-02	
3.0E+01	C	8.6E-03	C	7.0E-06	H					1	0.1		Polybrominated Biphenyls	59536-65-1	1.6E-02	c*	5.7E-02	c*	2.8E-04	c	1.4E-03	c	2.2E-03	c*			
													Polychlorinated Biphenyls (PCBs)														
7.0E-02	S	2.0E-05	S	7.0E-05	I					1	0.14		~Aroclor 1016	12674-11-2	3.9E+00	n	2.1E+01	c**	1.2E-01	c	6.1E-01	c	9.6E-01	c**		9.2E-02	

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Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs	
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	voc	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
2.0E+00	S	5.7E-04	S					V		1	0.14	7.6E+02	~Aroclor 1221	11104-28-2	1.4E-01	c	5.4E-01	c	4.3E-03	c	2.1E-02	c	4.0E-03	c		6.9E-05	
2.0E+00	S	5.7E-04	S					V		1	0.14	7.3E+01	~Aroclor 1232	11141-16-5	1.4E-01	c	5.4E-01	c	4.3E-03	c	2.1E-02	c	4.0E-03	c		6.9E-05	
2.0E+00	S	5.7E-04	S							1	0.14		~Aroclor 1242	53469-21-9	2.2E-01	c	7.4E-01	c	4.3E-03	c	2.1E-02	c	3.4E-02	c		5.3E-03	
2.0E+00	S	5.7E-04	S							1	0.14		~Aroclor 1248	12672-29-6	2.2E-01	c	7.4E-01	c	4.3E-03	c	2.1E-02	c	3.4E-02	c		5.2E-03	
2.0E+00	S	5.7E-04	S	2.0E-05	I					1	0.14		~Aroclor 1254	11097-69-1	2.2E-01	c**	7.4E-01	c*	4.3E-03	c	2.1E-02	c	3.4E-02	c**		8.8E-03	
2.0E+00	S	5.7E-04	S							1	0.14		~Aroclor 1260	11096-82-5	2.2E-01	c	7.4E-01	c	4.3E-03	c	2.1E-02	c	3.4E-02	c		2.4E-02	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E			1	0.14		~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.1E-01	c*	3.8E-01	c*	2.1E-03	c	1.1E-02	c	1.7E-02	c*		1.2E-02	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E			1	0.14		~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.1E-01	c*	3.8E-01	c*	2.1E-03	c	1.1E-02	c	1.7E-02	c*		7.2E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E			1	0.14		~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	1.1E-01	c*	3.8E-01	c*	2.1E-03	c	1.1E-02	c	1.7E-02	c*		7.4E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E			1	0.14		~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	1.1E-01	c*	3.8E-01	c*	2.1E-03	c	1.1E-02	c	1.7E-02	c*		7.4E-03	
3.9E+03	E	1.1E+00	E	2.3E-08	E	1.3E-06	E			1	0.14		~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	1.1E-04	c*	3.8E-04	c*	2.1E-06	c	1.1E-05	c	1.7E-05	c*		7.2E-06	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E			1	0.14		~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	1.1E-01	c*	3.8E-01	c*	2.1E-03	c	1.1E-02	c	1.7E-02	c*		4.5E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E			1	0.14		~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	1.1E-01	c*	3.8E-01	c*	2.1E-03	c	1.1E-02	c	1.7E-02	c*		4.4E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E			1	0.14		~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	1.1E-01	c*	3.8E-01	c*	2.1E-03	c	1.1E-02	c	1.7E-02	c*		4.5E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E			1	0.14		~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	1.1E-01	c*	3.8E-01	c*	2.1E-03	c	1.1E-02	c	1.7E-02	c*		4.5E-03	
1.3E+04	E	3.8E+00	E	7.0E-09	E	4.0E-07	E			1	0.14		~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	3.4E-05	c*	1.1E-04	c*	6.4E-07	c	3.2E-06	c	5.2E-06	c*		1.3E-06	
2.0E+00	I	5.7E-04	I							1	0.14		~Polychlorinated Biphenyls (high risk)	1336-36-3	2.2E-01	c	7.4E-01	c	4.3E-03	c	2.1E-02	c					
4.0E-01	I	1.0E-04	I							1	0.14		~Polychlorinated Biphenyls (low risk)	1336-36-3					2.4E-02	c	1.2E-01	c	1.7E-01	c	5.0E-01	2.6E-02	7.8E-02
7.0E-02	I	2.0E-05	I							1	0.14		~Polychlorinated Biphenyls (lowest risk)	1336-36-3					1.2E-01	c	6.1E-01	c					
1.3E+01	E	3.8E-03	E	7.0E-06	E	4.0E-04	E			1	0.14		~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	3.4E-02	c*	1.1E-01	c*	6.4E-04	c	3.2E-03	c	5.2E-03	c*		8.1E-04	
3.9E+01	E	1.1E-02	E	2.3E-06	E	1.3E-04	E			1	0.14		~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	1.1E-02	c*	3.8E-02	c*	2.1E-04	c	1.1E-03	c	1.7E-03	c*		2.7E-04	
						6.0E-04	I			1	0.1		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9	8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n					
													Polynuclear Aromatic Hydrocarbons (PAHs)														
				6.0E-02	I			V		1	0.13		~Acenaphthene	83-32-9	3.4E+03	n	3.3E+04	n					4.0E+02	n		4.1E+00	
				3.0E-01	I			V		1	0.13		~Anthracene	120-12-7	1.7E+04	n	1.7E+05	nm					1.3E+03	n		4.2E+01	
7.3E-01	E	1.1E-04	C						M	1	0.13		~Benz[a]anthracene	56-55-3	1.5E-01	c	2.1E+00	c	8.7E-03	c	1.1E-01	c	2.9E-02	c		1.0E-02	
1.2E+00	C	1.1E-04	C							1	0.13		~Benzo(j)fluoranthene	205-82-3	3.8E-01	c	1.3E+00	c	2.2E-02	c	1.1E-01	c	5.6E-02	c		6.7E-02	
7.3E+00	I	1.1E-03	C						M	1	0.13		~Benzo[a]pyrene	50-32-8	1.5E-02	c	2.1E-01	c	8.7E-04	c	1.1E-02	c	2.9E-03	c	2.0E-01	3.5E-03	2.4E-01
7.3E-01	E	1.1E-04	C						M	1	0.13		~Benzo[b]fluoranthene	205-99-2	1.5E-01	c	2.1E+00	c	8.7E-03	c	1.1E-01	c	2.9E-02	c		3.5E-02	
7.3E-02	E	1.1E-04	C						M	1	0.13		~Benzo[k]fluoranthene	207-08-9	1.5E+00	c	2.1E+01	c	8.7E-03	c	1.1E-01	c	2.9E-01	c		3.5E-01	
7.3E-03	E	1.1E-05	C						M	1	0.13		~Chrysene	218-01-9	1.5E+01	c	2.1E+02	c	8.7E-02	c	1.1E+00	c	2.9E+00	c		1.1E+00	
7.3E+00	E	1.2E-03	C						M	1	0.13		~Dibenz[a,h]anthracene	53-70-3	1.5E-02	c	2.1E-01	c	8.0E-04	c	1.0E-02	c	2.9E-03	c		1.1E-02	
1.2E+01	C	1.1E-03	C							1	0.13		~Dibenzo(a,e)pyrene	192-65-4	3.8E-02	c	1.3E-01	c	2.2E-03	c	1.1E-02	c	5.6E-03	c		7.3E-02	
2.5E+02	C	7.1E-02	C						M	1	0.13		~Dimethylbenz(a)anthracene, 7,12-	57-97-6	4.3E-04	c	6.2E-03	c	1.4E-05	c	1.7E-04	c	8.6E-05	c		8.5E-05	
				4.0E-02	I					1	0.13		~Fluoranthene	206-44-0	2.3E+03	n	2.2E+04	n					6.3E+02	n		7.0E+01	
				4.0E-02	I			V		1	0.13		~Fluorene	86-73-7	2.3E+03	n	2.2E+04	n					2.2E+02	n		4.0E+00	
7.3E-01	E	1.1E-04	C						M	1	0.13		~Indeno[1,2,3-cd]pyrene	193-39-5	1.5E-01	c	2.1E+00	c	8.7E-03	c	1.1E-01	c	2.9E-02	c		2.0E-01	
2.9E-02	P			7.0E-02	A			V		1	0.13		~Methylnaphthalene, 1-	90-12-0	1.6E+01	c	5.3E+01	c					9.7E-01	c		5.1E-03	
				4.0E-03	I			V		1	0.13		~Methylnaphthalene, 2-	91-57-6	2.3E+02	n	2.2E+03	n					2.7E+01	n		1.4E-01	
		3.4E-05	C	2.0E-02	I	3.0E-03	I	V		1	0.13		~Naphthalene	91-20-3	3.6E+00	c*	1.8E+01	c*	7.2E-02	c*	3.6E-01	c*	1.4E-01	c*		4.7E-04	
1.2E+00	C	1.1E-04	C							1	0.13		~Nitropyrene, 4-	57835-92-4	3.8E-01	c	1.3E+00	c	2.2E-02	c	1.1E-01	c	1.6E-02	c		2.8E-03	
				3.0E-02	I			V		1	0.13		~Pyrene	129-00-0	1.7E+03	n	1.7E+04	n					8.7E+01	n		9.5E+00	
1.5E-01	I			9.0E-03	I					1	0.1		Prochloraz	67747-09-5	3.2E+00	c	1.1E+01	c					3.2E-01	c		1.6E-03	
				6.0E-03	H					1	0.1		Profluralin	26399-36-0	3.7E+02	n	3.7E+03	n					1.9E+01	n		1.2E+00	
				1.5E-02	I					1	0.1		Prometon	1610-18-0	9.2E+02	n	9.2E+03	n					1.9E+02	n		9.2E-02	
				4.0E-03	I					1	0.1		Prometryn	7287-19-6	2.4E+02	n	2.5E+03	n					4.5E+01	n		6.9E-02	
				1.3E-02	I					1	0.1		Propachlor	1918-16-7	7.9E+02	n	8.0E+03	n					1.9E+02	n		1.2E-01	
				5.0E-03	I					1	0.1		Propanil	709-98-8	3.1E+02	n	3.1E+03	n					6.3E+01	n		3.5E-02	
				2.0E-02	I					1	0.1		Propargite	2312-35-8	1.2E+03	n	1.2E+04	n					1.2E+02	n		8.8E+00	
				2.0E-03	I					1	0.1		Propargyl Alcohol	107-19-7	1.2E+02	n	1.2E+03	n					3.1E+01	n		6.4E-03	
				2.0E-02	I					1	0.1		Propazine	139-40-2	1.2E+03	n	1.2E+04	n					2.6E+02	n		2.3E-01	
				2.0E-02	I					1	0.1		Propham	122-42-9	1.2E+03	n	1.2E+04	n					2.7E+02	n		1.7E-01	
				1.3E-02	I					1	0.1		Propiconazole	60207-90-1	7.9E+02	n	8.0E+03	n					1.6E+02	n		5.3E-01	
						8.0E-03	I	V		1		3.3E+04	Propionaldehyde	123-38-6	8.0E+01	n	3.4E+02	n	8.3E+00	n	3.5E+01	n	1.7E+01	n		3.4E-03	
				1.0E-01	X	1.0E+00	X	V		1	0.1	2.6E+02	Propyl benzene	103-65-1	3.4E+03	ns	2.1E+04	ns	1.0E+03	n	4.4E+03	n	5.3E+02	n		9.9E-01	
						3.0E+00	C	V		1	0.1	3.5E+02	Propylene	115-07-1	2.4E+03	ns	1.0E+04	ns	3.1E+03	n	1.3E+04	n	6.3E+03	n		6.0E+00	
				2.0E+01	P					1	0.1		Propylene Glycol	57-55-6	1.2E+06	nm	1.2E+07	nm					3.1E+05	n		6.3E+01	
						2.7E-04	A			1	0.1		Propylene Glycol Dinitrate	6423-43-4	3.9E+05	nm	1.6E+06	nm	2.8E-01	n	1.2E+00	n					
				7.0E-01	H					1	0.1		Propylene Glycol Monoethyl Ether	1569-02-4	4.3E+04	n	4.3E+05	nm					1.1E+04	n		2.2E+00	
				7.0E-01	H	2.0E+00	I			1	0.1		Propylene Glycol Monomethyl Ether	107-98-2	4.3E+04	n	4.3E+05	nm	2.1E+03	n	8.8E+03	n	1.1E+04	n		2.2E+00	
2.4E-01	I	3.7E-06	I			3.0E-02	I	V		1		7.8E+04	Propylene Oxide	75-56-9	2.0E+00	c	9.0E+00	c	6.6E-01	c*	3.3E+00	c*	2.3E-01	c		4.8E-05	
				2.5E-01	I					1	0.1		Pursuit	81335-77-5	1.5E+04	n	1.5E+05	nm					3.6E+03	n		3.2E+00	
				2.5E-02	I					1	0.1		Pydrin	51630-58-1	1.5E+03	n	1.5E+04	n					3.9E+02	n		2.5E+02	
				1.0E-03	I			V		1		5.3E+05	Pyridine	110-86-1	7.8E+01	n	1.0E+03	n					1.5E+01	n		5.3E-03	
				5.0E-04	I					1	0.1		Quinalphos	13593-03-8	3.1E+01	n	3.1E+02	n					3.8E+00	n		3.2E-02	

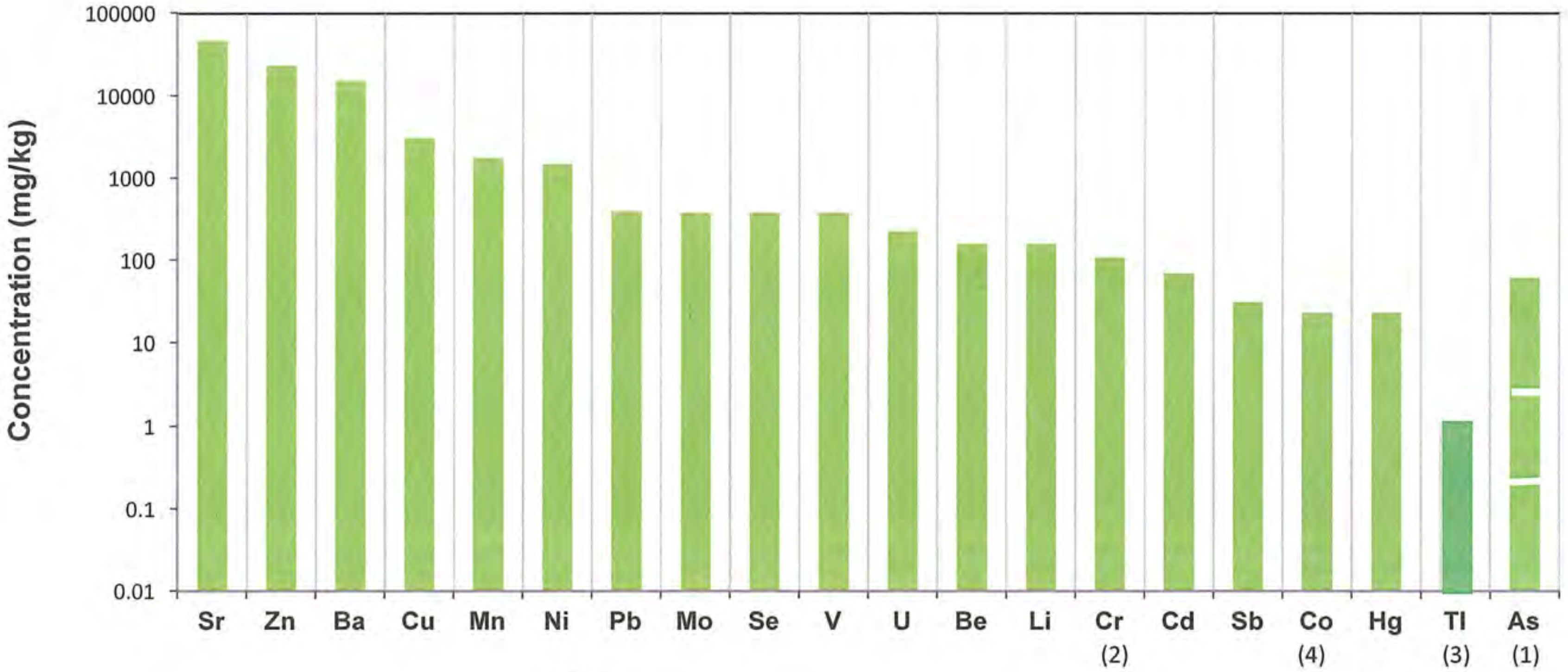
Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs	
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	voc	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
3.0E+00	I									1	0.1		Quinoline	91-22-5	1.6E-01	c	5.7E-01	c					2.1E-02	c		6.8E-05	
						3.0E-02	A			1			Refractory Ceramic Fibers	NA	4.3E+07	nm	1.8E+08	nm	3.1E+01	n	1.3E+02	n					
				3.0E-02	I					1	0.1		Resmethrin	10453-86-8	1.8E+03	n	1.8E+04	n					4.8E+01	n		3.0E+01	
				5.0E-02	H					1	0.1		Ronnel	299-84-3	3.1E+03	n	3.1E+04	n					3.0E+02	n		2.7E+00	
				4.0E-03	I					1	0.1		Rotenone	83-79-4	2.4E+02	n	2.5E+03	n					4.7E+01	n		2.4E+01	
2.2E-01	C	6.3E-05	C						M	1	0.1		Safrole	94-59-7	5.2E-01	c	7.8E+00	c	1.5E-02	c	1.9E-01	c	8.3E-02	c		5.1E-05	
				2.5E-02	I					1	0.1		Savey	78587-05-0	1.5E+03	n	1.5E+04	n					8.1E+01	n		3.6E-01	
				5.0E-03	I					1			Selenious Acid	7783-00-8	3.9E+02	n	5.1E+03	n					7.8E+01	n			
				5.0E-03	I	2.0E-02	C			1			Selenium	7782-49-2	3.9E+02	n	5.1E+03	n	2.1E+01	n	8.8E+01	n	7.8E+01	n	5.0E+01	4.0E-01	2.6E-01
				5.0E-03	C	2.0E-02	C			1			Selenium Sulfide	7446-34-6	3.9E+02	n	5.1E+03	n	2.1E+01	n	8.8E+01	n	7.8E+01	n			
				9.0E-02	I					1	0.1		Sethoxydim	74051-80-2	5.5E+03	n	5.5E+04	n					7.8E+02	n		6.9E+00	
						3.0E-03	C			1			Silica (crystalline, respirable)	7631-86-9	4.3E+06	nm	1.8E+07	nm	3.1E+00	n	1.3E+01	n					
				5.0E-03	I					0.04			Silver	7440-22-4	3.9E+02	n	5.1E+03	n					7.1E+01	n		6.0E-01	
1.2E-01	H			5.0E-03	I					1	0.1		Simazine	122-34-9	4.1E+00	c*	1.4E+01	c					5.2E-01	c	4.0E+00	2.6E-04	2.0E-03
				1.3E-02	I					1	0.1		Sodium Acifluorfen	62476-59-9	7.9E+02	n	8.0E+03	n					2.0E+02	n		1.6E+00	
				4.0E-03	I					1			Sodium Azide	26628-22-8	3.1E+02	n	4.1E+03	n					6.2E+01	n			
2.7E-01	H			3.0E-02	I					1	0.1		Sodium Diethyldithiocarbamate	148-18-5	1.8E+00	c	6.4E+00	c					2.5E-01	c			
				5.0E-02	A	1.3E-02	C			1			Sodium Fluoride	7681-49-4	3.9E+03	n	5.1E+04	n	1.4E+01	n	5.7E+01	n	7.8E+02	n			
				2.0E-05	I					1	0.1		Sodium Fluoroacetate	62-74-8	1.2E+00	n	1.2E+01	n					3.1E-01	n		6.3E-05	
				1.0E-03	H					1			Sodium Metavanadate	13718-26-8	7.8E+01	n	1.0E+03	n					1.6E+01	n			
2.4E-02	H			3.0E-02	I					1	0.1		Stirofos (Tetrachlorovinphos)	961-11-5	2.0E+01	c*	7.2E+01	c					2.4E+00	c		7.0E-03	
				6.0E-01	I					1			Strontium, Stable	7440-24-6	4.7E+04	n	6.1E+05	nm					9.3E+03	n		3.3E+02	
				3.0E-04	I					1	0.1		Strychnine	57-24-9	1.8E+01	n	1.8E+02	n					4.6E+00	n		5.1E-02	
				2.0E-01	I	1.0E+00	I	V		1		8.7E+02	Styrene	100-42-5	6.3E+03	ns	3.6E+04	ns	1.0E+03	n	4.4E+03	n	1.1E+03	n	1.0E+02	1.2E+00	1.1E-01
				1.0E-03	P	2.0E-03	P			1	0.1		Sulfolane	126-33-0	6.1E+01	n	6.2E+02	n	2.1E+00	n	8.8E+00	n	1.6E+01	n		3.4E-03	
				8.0E-04	P					1	0.1		Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9	4.9E+01	n	4.9E+02	n					8.3E+00	n		4.9E-02	
						1.0E-03	C			1			Sulfuric Acid	7664-93-9	1.4E+06	nm	6.0E+06	nm	1.0E+00	n	4.4E+00	n					
				2.5E-02	I					1	0.1		Systhane	88671-89-0	1.5E+03	n	1.5E+04	n					3.5E+02	n		4.3E+00	
				3.0E-02	H					1	0.1		TCMTB	21564-17-0	1.8E+03	n	1.8E+04	n					3.7E+02	n		2.6E+00	
				7.0E-02	I					1	0.1		Tebuthiuron	34014-18-1	4.3E+03	n	4.3E+04	n					1.1E+03	n		3.0E-01	
				2.0E-02	H					1	0.1		Temephos	3383-96-8	1.2E+03	n	1.2E+04	n					3.1E+02	n		6.0E+01	
				1.3E-02	I					1	0.1		Terbacil	5902-51-2	7.9E+02	n	8.0E+03	n					2.0E+02	n		5.9E-02	
				2.5E-05	H					1	0.1		Terbufos	13071-79-9	1.5E+00	n	1.5E+01	n					1.8E-01	n		3.9E-04	
				1.0E-03	I					1	0.1		Terbutryn	886-50-0	6.1E+01	n	6.2E+02	n					1.0E+01	n		1.4E-02	
				1.0E-04	I					1	0.1		Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1	6.1E+00	n	6.2E+01	n					1.6E+00	n		4.2E-02	
				3.0E-04	I					1	0.1		Tetrachlorobenzene, 1,2,4,5-	95-94-3	1.8E+01	n	1.8E+02	n					1.2E+00	n		5.8E-03	
2.6E-02	I	7.4E-06	I	3.0E-02	I			V		1		6.8E+02	Tetrachloroethane, 1,1,1,2-	630-20-6	1.9E+00	c	9.3E+00	c	3.3E-01	c	1.7E+00	c	5.0E-01	c		1.9E-04	
2.0E-01	I	5.8E-05	C	2.0E-02	I			V		1		1.9E+03	Tetrachloroethane, 1,1,2,2-	79-34-5	5.6E-01	c	2.8E+00	c	4.2E-02	c	2.1E-01	c	6.6E-02	c		2.6E-05	
2.1E-03	I	2.6E-07	I	6.0E-03	I	4.0E-02	I	V		1		1.7E+02	Tetrachloroethylene	127-18-4	2.2E+01	c**	1.1E+02	c**	9.4E+00	c**	4.7E+01	c**	9.7E+00	c**	5.0E+00	4.4E-03	2.3E-03
				3.0E-02	I					1	0.1		Tetrachlorophenol, 2,3,4,6-	58-90-2	1.8E+03	n	1.8E+04	n					1.7E+02	n		1.1E+00	
2.0E+01	H									1	0.1		Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	2.4E-02	c	8.6E-02	c					1.1E-03	c		3.9E-06	
				5.0E-04	I					1	0.1		Tetraethyl Dithiopyrophosphate	3689-24-5	3.1E+01	n	3.1E+02	n					5.3E+00	n		3.9E-03	
						8.0E+01	I	V		1		1.1E+03	Tetrafluoroethane, 1,1,1,2-	811-97-2	1.1E+05	nms	4.6E+05	nms	8.3E+04	n	3.5E+05	n	1.7E+05	n		9.3E+01	
				4.0E-03	P					1	0.1		Tetryl (Trinitrophenylmethylnitramine)	479-45-8	2.4E+02	n	2.5E+03	n					6.1E+01	n		5.8E-01	
				7.0E-06	X					1			Thallium (I) Nitrate	10102-45-1	5.5E-01	n	7.2E+00	n					1.1E-01	n			
				1.0E-05	X					1			Thallium (Soluble Salts)	7440-28-0	7.8E-01	n	1.0E+01	n					1.6E-01	n	2.0E+00	1.1E-02	1.4E-01
				6.0E-06	X					1			Thallium Acetate	563-68-8	4.7E-01	n	6.1E+00	n					9.3E-02	n			
				2.0E-05	X					1			Thallium Carbonate	6533-73-9	1.6E+00	n	2.0E+01	n					3.1E-01	n			
				6.0E-06	X					1			Thallium Chloride	7791-12-0	4.7E-01	n	6.1E+00	n					9.3E-02	n			
				2.0E-05	X					1			Thallium Sulfate	7446-18-6	1.6E+00	n	2.0E+01	n					3.1E-01	n			
				1.0E-02	I					1	0.1		Thiobencarb	28249-77-6	6.1E+02	n	6.2E+03	n					1.2E+02	n		4.2E-01	
				7.0E-02	X					1	0.008		Thiodiglycol	111-48-8	5.4E+03	n	6.8E+04	n					1.1E+03	n		2.2E-01	
				3.0E-04	H					1	0.1		Thiofanox	39196-18-4	1.8E+01	n	1.8E+02	n					4.1E+00	n		1.4E-03	
				8.0E-02	I					1	0.1		Thiophanate, Methyl	23564-05-8	4.9E+03	n	4.9E+04	n					1.2E+03	n		1.1E+00	
				5.0E-03	I					1	0.1		Thiram	137-26-8	3.1E+02	n	3.1E+03	n					7.6E+01	n		1.1E-01	
				6.0E-01	H					1			Tin	7440-31-5	4.7E+04	n	6.1E+05	nm					9.3E+03	n		2.3E+03	
						1.0E-04	A			1			Titanium Tetrachloride	7550-45-0	1.4E+05	nm	6.0E+05	nm	1.0E-01	n	4.4E-01	n					
				8.0E-02	I	5.0E+00	I	V		1		8.2E+02	Toluene	108-88-3	5.0E+03	ns	4.5E+04	ns	5.2E+03	n	2.2E+04	n	8.6E+02	n	1.0E+03	5.9E-01	6.9E-01
1.8E-01	X			2.0E-04	X					1	0.1		Toluene-2,5-diamine	95-70-5	2.7E+00	c**	9.6E+00	c*					3.7E-01	c**		1.2E-04	
3.0E-02	P			4.0E-03	X					1	0.1		Toluidine, p-	106-49-0	1.6E+01	c*	5.7E+01	c*					2.2E+00	c*		9.2E-04	
1.1E+00	I	3.2E-04	I							1	0.1		Toxaphene	8001-35-2	4.4E-01	c	1.6E+00	c	7.6E-03	c	3.8E-02	c	1.3E-02	c	3.0E+00	2.1E-03	4.6E-01
				7.5E-03	I					1	0.1		Tralomethrin	66841-25-6	4.6E+02	n	4.6E+03	n					1.2E+02	n		4.5E+01	
				3.0E-04	A					1	0.1		Tri-n-butyltin	688-73-3	1.8E+01	n	1.8E+02	n					2.8E+00	n		6.2E-02	
				8.0E+01	X					1	0.1		Triacetin	102-76-1	4.9E+06	nm	4.9E+07	nm					1.2E+06	n		3.5E+02	
				1.3E-02	I					1	0.1		Triallate	2303-17-5	7.9E+02	n	8.0E+03	n					8.7E+01	n		1.9E-01	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs	
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	voc	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)
				1.0E-02	I					1	0.1		Triasulfuron	82097-50-5	6.1E+02	n	6.2E+03	n					1.6E+02	n		1.6E-01	
				5.0E-03	I					1	0.1		Tribromobenzene, 1,2,4-	615-54-3	3.1E+02	n	3.1E+03	n					3.3E+01	n		4.7E-02	
9.0E-03	P			1.0E-02	P					1	0.1		Tributyl Phosphate	126-73-8	5.4E+01	c*	1.9E+02	c*					4.5E+00	c*		2.2E-02	
				3.0E-04	P					1	0.1		Tributyltin Compounds	NA	1.8E+01	n	1.8E+02	n					4.7E+00	n			
				3.0E-04	I					1	0.1		Tributyltin Oxide	56-35-9	1.8E+01	n	1.8E+02	n					4.4E+00	n		2.3E+02	
				3.0E+01	I	3.0E+01	H	V		1		9.1E+02	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1	4.3E+04	ns	1.8E+05	nms	3.1E+04	n	1.3E+05	n	5.3E+04	n		1.3E+02	
7.0E-02	I			2.0E-02	I					1	0.1		Trichloroacetic Acid	76-03-9	6.9E+00	c	2.5E+01	c					9.4E-01	c	6.0E+01	1.9E-04	1.2E-02
2.9E-02	H									1	0.1		Trichloroaniline HCl, 2,4,6-	33663-50-2	1.7E+01	c	5.9E+01	c					2.3E+00	c		6.4E-03	
7.0E-03	X			3.0E-05	X					1	0.1		Trichloroaniline, 2,4,6-	634-93-5	1.8E+00	n	1.8E+01	n					3.0E-01	n		2.7E-03	
				8.0E-04	X			V		1	0.1		Trichlorobenzene, 1,2,3-	87-61-6	4.9E+01	n	4.9E+02	n					5.2E+00	n		1.5E-02	
2.9E-02	P			1.0E-02	I	2.0E-03	P	V		1		4.0E+02	Trichlorobenzene, 1,2,4-	120-82-1	2.2E+01	c**	9.9E+01	c**	2.1E+00	n	8.8E+00	n	9.9E-01	c**	7.0E+01	2.9E-03	2.0E-01
				2.0E+00	I	5.0E+00	I	V		1		6.4E+02	Trichloroethane, 1,1,1-	71-55-6	8.7E+03	ns	3.8E+04	ns	5.2E+03	n	2.2E+04	n	7.5E+03	n	2.0E+02	2.6E+00	7.0E-02
5.7E-02	I	1.6E-05	I	4.0E-03	I	2.0E-04	X	V		1		2.2E+03	Trichloroethane, 1,1,2-	79-00-5	1.1E+00	c**	5.3E+00	c**	1.5E-01	c**	7.7E-01	c**	2.4E-01	c**	5.0E+00	7.7E-05	1.6E-03
4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I	V	M	1		6.9E+02	Trichloroethylene	79-01-6	9.1E-01	c**	6.4E+00	c**	4.3E-01	c**	3.0E+00	c**	4.4E-01	c**	5.0E+00	1.6E-04	1.8E-03
				3.0E-01	I	7.0E-01	H	V		1		1.2E+03	Trichlorofluoromethane	75-69-4	7.9E+02	n	3.4E+03	ns	7.3E+02	n	3.1E+03	n	1.1E+03	n		6.9E-01	
				1.0E-01	I					1	0.1		Trichlorophenol, 2,4,5-	95-95-4	6.1E+03	n	6.2E+04	n					8.9E+02	n		3.3E+00	
1.1E-02	I	3.1E-06	I	1.0E-03	P					1	0.1		Trichlorophenol, 2,4,6-	88-06-2	4.4E+01	c**	1.6E+02	c**	7.8E-01	c	4.0E+00	c	3.5E+00	c**		1.3E-02	
				1.0E-02	I					1	0.1		Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5	6.1E+02	n	6.2E+03	n					1.2E+02	n		5.2E-02	
				8.0E-03	I					1	0.1		Trichlorophenoxypropionic acid, -2,4,5	93-72-1	4.9E+02	n	4.9E+03	n					8.4E+01	n	5.0E+01	4.6E-02	2.8E-02
				5.0E-03	I			V		1		1.3E+03	Trichloropropane, 1,1,2-	598-77-6	3.9E+02	n	5.1E+03	ns					6.8E+01	n		2.7E-02	
3.0E+01	I			4.0E-03	I	3.0E-04	I	V	M	1		1.4E+03	Trichloropropane, 1,2,3-	96-18-4	5.0E-03	c	9.5E-02	c	3.1E-01	n	1.3E+00	n	6.5E-04	c		2.8E-07	
				3.0E-03	X	3.0E-04	P	V		1		4.5E+02	Trichloropropene, 1,2,3-	96-19-5	7.8E-01	n	3.3E+00	n	3.1E-01	n	1.3E+00	n	6.2E-01	n		3.1E-04	
				2.0E-02	A					1	0.1		Tricresyl Phosphate (TCP)	1330-78-5	5.6E+03	n	3.1E+04	n					1.2E+02	n		1.1E+01	
				3.0E-03	I					1	0.1		Tridiphane	58138-08-2	1.8E+02	n	1.8E+03	n					1.3E+01	n		9.3E-02	
						7.0E-03	I	V		1		2.8E+04	Triethylamine	121-44-8	1.2E+02	n	5.2E+02	n	7.3E+00	n	3.1E+01	n	1.5E+01	n		4.4E-03	
7.7E-03	I			7.5E-03	I					1	0.1		Trifluralin	1582-09-8	6.3E+01	c**	2.2E+02	c*					2.2E+00	c*		7.2E-02	
2.0E-02	P			1.0E-02	P					1	0.1		Trimethyl Phosphate	512-56-1	2.4E+01	c*	8.6E+01	c*					3.4E+00	c*		7.4E-04	
						5.0E-03	P	V		1		2.9E+02	Trimethylbenzene, 1,2,3-	526-73-8	5.3E+01	n	2.2E+02	n	5.2E+00	n	2.2E+01	n	1.0E+01	n		1.5E-02	
						7.0E-03	P	V		1		2.2E+02	Trimethylbenzene, 1,2,4-	95-63-6	6.2E+01	n	2.6E+02	ns	7.3E+00	n	3.1E+01	n	1.5E+01	n		2.1E-02	
				1.0E-02	X			V		1		1.8E+02	Trimethylbenzene, 1,3,5-	108-67-8	7.8E+02	ns	1.0E+04	ns					8.7E+01	n		1.2E-01	
				3.0E-02	I					1	0.019		Trinitrobenzene, 1,3,5-	99-35-4	2.2E+03	n	2.7E+04	n					4.6E+02	n		1.7E+00	
3.0E-02	I			5.0E-04	I					1	0.032		Trinitrotoluene, 2,4,6-	118-96-7	1.9E+01	c**	7.9E+01	c**					2.2E+00	c**		1.3E-02	
				2.0E-02	P					1	0.1		Triphenylphosphine Oxide	791-28-6	1.2E+03	n	1.2E+04	n					2.8E+02	n		1.2E+00	
				2.0E-02	A					1	0.1		Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8	1.2E+03	n	1.2E+04	n					2.8E+02	n		6.2E+00	
				1.0E-02	X					1	0.1		Tris(1-chloro-2-propyl)phosphate	13674-84-5	6.1E+02	n	6.2E+03	n					1.5E+02	n		5.0E-01	
2.0E-02	P			7.0E-03	P					1	0.1		Tris(2-chloroethyl)phosphate	115-96-8	2.4E+01	c*	8.6E+01	c*					3.3E+00	c*		3.2E-03	
3.2E-03	P			1.0E-01	P					1	0.1		Tris(2-ethylhexyl)phosphate	78-42-2	1.5E+02	c*	5.4E+02	c					2.1E+01	c*		1.0E+02	
				3.0E-03	I	4.0E-05	A			1			Uranium (Soluble Salts)	NA	2.3E+02	n	3.0E+03	n	4.2E-02	n	1.8E-01	n	4.7E+01	n	3.0E+01	2.1E+01	1.4E+01
1.0E+00	C	2.9E-04	C						M	1	0.1		Urethane	51-79-6	1.2E-01	c	1.7E+00	c	3.3E-03	c	4.2E-02	c	2.1E-02	c		4.8E-06	
		8.3E-03	P	9.0E-03	I	7.0E-06	P			0.026			Vanadium Pentoxide	1314-62-1	4.0E+02	c**	2.0E+03	c**	2.9E-04	c*	1.5E-03	c*	1.1E+02	n			
				5.0E-03	S	1.0E-04	A			0.026			Vanadium and Compounds	7440-62-2	3.9E+02	n	5.1E+03	n	1.0E-01	n	4.4E-01	n	6.3E+01	n		6.3E+01	
				1.0E-03	I					1	0.1		Vernolate	1929-77-7	6.1E+01	n	6.2E+02	n					8.3E+00	n		6.6E-03	
				2.5E-02	I					1	0.1		Vinclozolin	50471-44-8	1.5E+03	n	1.5E+04	n					3.4E+02	n		2.6E-01	
				1.0E+00	H	2.0E-01	I	V		1		2.8E+03	Vinyl Acetate	108-05-4	9.7E+02	n	4.1E+03	ns	2.1E+02	n	8.8E+02	n	4.1E+02	n		8.7E-02	
		3.2E-05	H			3.0E-03	I	V		1		3.4E+03	Vinyl Bromide	593-60-2	1.1E-01	c*	5.6E-01	c*	7.6E-02	c*	3.8E-01	c*	1.5E-01	c*		4.4E-05	
7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	M	1		3.9E+03	Vinyl Chloride	75-01-4	6.0E-02	c	1.7E+00	c	1.6E-01	c	2.8E+00	c	1.5E-02	c	2.0E+00	5.3E-06	6.9E-04
				3.0E-04	I					1	0.1		Warfarin	81-81-2	1.8E+01	n	1.8E+02	n					4.4E+00	n		4.6E-03	
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	Xylene, P-	106-42-3	6.0E+02	ns	2.6E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.8E-01	
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	Xylene, m-	108-38-3	5.9E+02	ns	2.5E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.8E-01	
				2.0E-01	S	1.0E-01	S	V		1		4.3E+02	Xylene, o-	95-47-6	6.9E+02	ns	3.0E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.9E-01	
				2.0E-01	I	1.0E-01	I	V		1		2.6E+02	Xylenes	1330-20-7	6.3E+02	ns	2.7E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n	1.0E+04	1.9E-01	9.8E+00
				3.0E-04	I					1			Zinc Phosphide	1314-84-7	2.3E+01	n	3.1E+02	n					4.7E+00	n			
				3.0E-01	I					1			Zinc and Compounds	7440-66-6	2.3E+04	n	3.1E+05	nm					4.7E+03	n		2.9E+02	
				5.0E-02	I					1	0.1		Zineb	12122-67-7	3.1E+03	n	3.1E+04	n					7.7E+02	n		2.2E+00	
				8.0E-05	X					1			Zirconium	7440-67-7	6.3E+00	n	8.2E+01	n					1.2E+00	n		3.7E+00	

USEPA Regional Screening Levels for Residential Soils



🟩 Top of bar corresponds to the USEPA Regional Screening Level (RSL) - Residential Soil (May 2012)

http://www.epa.gov/region9/superfund//prg/index.html

Notes:

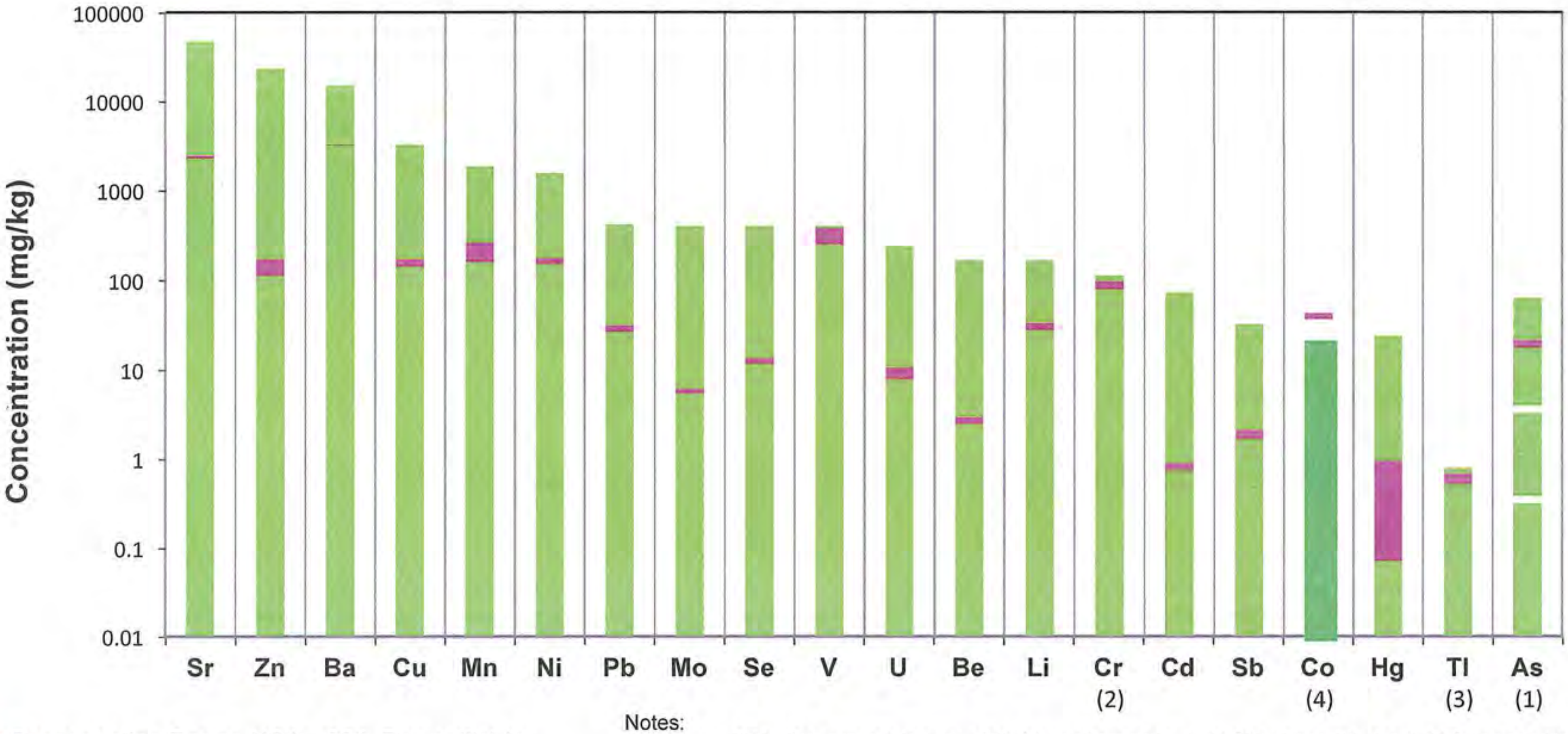
(1) Arsenic RSLs for target risk level of 10^{-4} (top of green bar), 10^{-5} (middle white bar), 10^{-6} (lower white bar.

(2) The screening level shown for chromium is the value calculated using toxicity information for hexavalent chromium currently available on USEPA's IRIS database [http://www.epa.gov/iris/subst/0144.htm]. The screening level for trivalent chromium is 120,000 mg/kg.

(3) The RSL for thallium is identified by USEPA as a "provisional value" of "limited usefulness" that was developed for information purposes although USEPA states "it is inappropriate to derive a provisional subchronic or chronic [toxicity value] for thallium" [http://hhpprtv.ornl.gov/issue_papers/ThalliumandCompounds.pdf]

(4) The RSL for cobalt is based on a provisional dose-response value that is two orders of magnitude lower than values from other regulatory sources, and higher than most dietary intake estimates. Thus, a more realistic RSL could be more than an order of magnitude higher than the value shown here.

Comparison of USGS Database Constituent Concentrations in Fly Ash at the Wyoming Coal Power Plant to the USEPA Regional Screening Levels for Residential Soils



🟪 Concentration Range (10th - 90th Percentile) in Wyoming Fly Ash; USGS 2011

http://pubs.usgs.gov/ds/635/

🟩 Top of bar corresponds to the USEPA Regional Screening Level (RSL) - Residential Soil (May 2012)

http://www.epa.gov/region9/superfund//prg/index.html

Notes:

(1) Arsenic RSLs for target risk level of 10^{-4} (top of green bar), 10^{-5} (middle white bar), 10^{-6} (lower white bar.

(2) The screening level shown for chromium is the value calculated using toxicity information for hexavalent chromium currently available on USEPA's IRIS database [http://www.epa.gov/iris/subst/0144.htm]. The screening level for trivalent chromium is 120,000 mg/kg.

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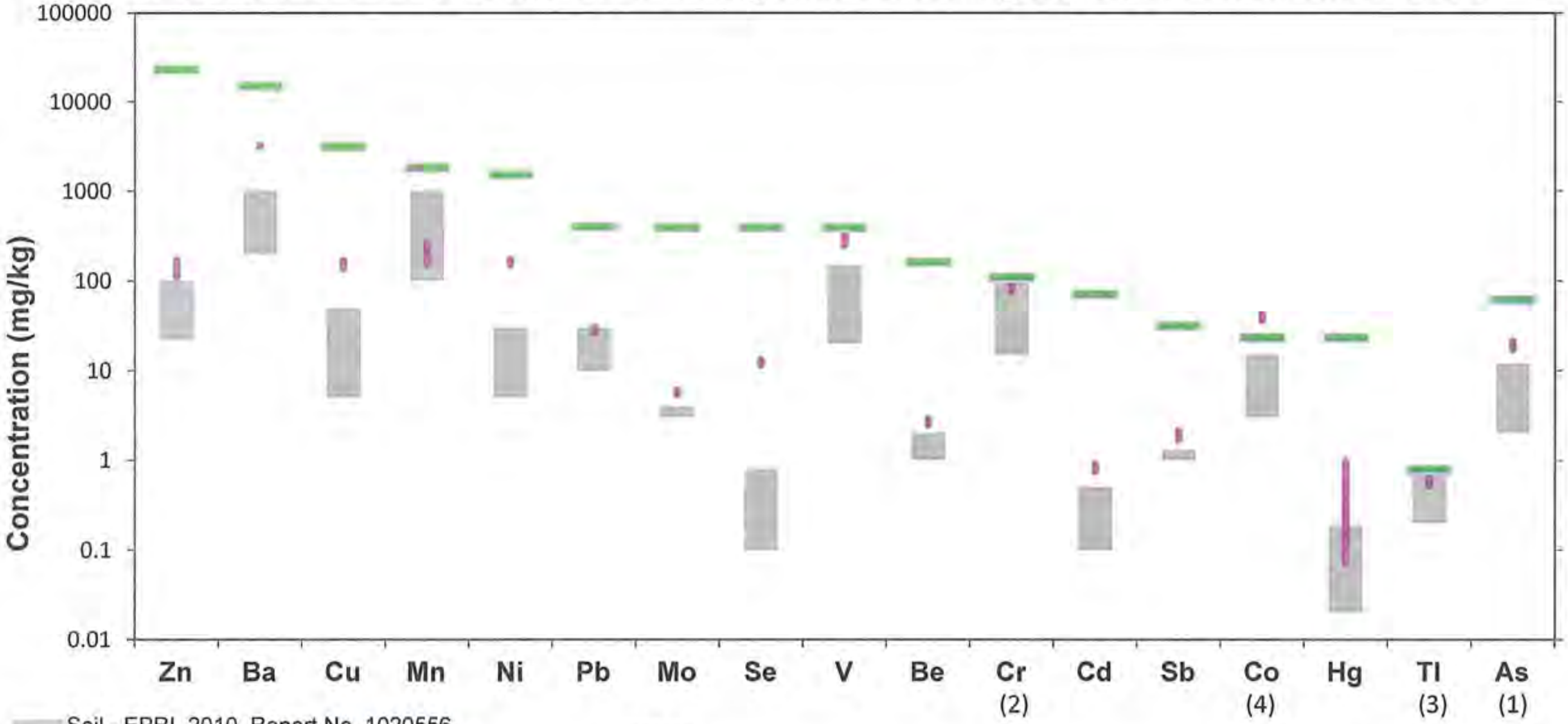
(4) The RSL for cobalt is based on a provisional dose-response value that is two orders of magnitude lower than values from other regulatory sources, and higher than most dietary intake estimates. Thus, a more realistic RSL could be more than an order of magnitude higher than the value shown here.

SCHEDULE LJNB-S9

Comparison of 10th and 90th percentile USGS Database Constituent Concentrations in Fly Ash from the Wyoming Coal Power Plant and Background Levels in US Soils to the USEPA Regional Screening Levels for Residential Soils



▭ Soil - EPRI, 2010. Report No. 1020556. Available for download at www.epri.com

▬ Concentration Range (10th - 90th Percentile) in Wyoming Fly Ash; USGS, 2011. http://pubs.usgs.gov/ds/635/

🟩 USEPA Regional Screening Level (RSL) - Residential Soil (May 2012)

http://www.epa.gov/region9/superfund//prg/index.html

Notes:

(1) Arsenic RSLs for target risk level of 10^{-4} (top of green bar), 10^{-5} (middle white bar), 10^{-6} (lower white bar).

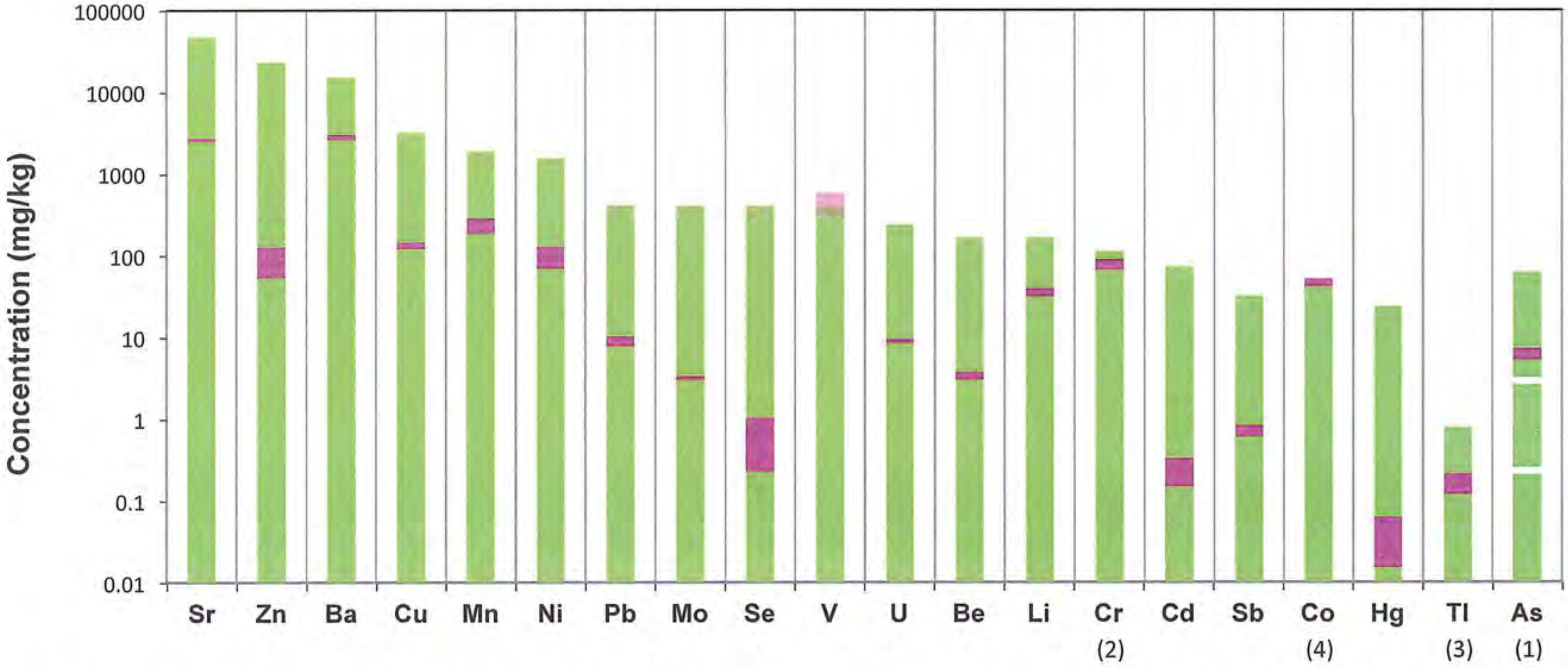
(2) The screening level shown for chromium is the value calculated using toxicity information for hexavalent chromium currently available on USEPA's IRIS database [http://www.epa.gov/iris/subst/0144.htm]. The screening level for trivalent chromium is 120,000 mg/kg.

(3) The RSL for thallium is identified by USEPA as a "provisional value" of "limited usefulness" that was developed for information purposes although USEPA states "it is inappropriate to derive a provisional subchronic or chronic [toxicity value] for thallium" [http://hhpprtv.ornl.gov/issue_papers/ThalliumandCompounds.pdf]

(4) The RSL for cobalt is based on a provisional dose-response value that is two orders of magnitude lower than values from other regulatory sources, and higher than most dietary intake estimates. Thus, a more realistic RSL could be more than an order of magnitude higher than the value shown here.

SCHEDULE LJNB-S10

Comparison of the USGS Database Constituent Concentrations in Bottom Ash at the Wyoming Coal Power Plant to the USEPA Regional Screening Levels for Residential Soils



🟪 Concentration Range (10th - 90th Percentile) in Wyoming Bottom Ash; USGS 2011

http://pubs.usgs.gov/ds/635/

🟩 Top of bar corresponds to the USEPA Regional Screening Level (RSL) - Residential Soil (May 2012)

http://www.epa.gov/region9/superfund//prg/index.html

Notes:

(1) Arsenic RSLs for target risk level of 10^{-4} (top of green bar), 10^{-5} (middle white bar), 10^{-6} (lower white bar.

(2) The screening level shown for chromium is the value calculated using toxicity information for hexavalent chromium currently available on USEPA's IRIS database [http://www.epa.gov/iris/subst/0144.htm]. The screening level for trivalent chromium is 120,000 mg/kg.

(3) The RSL for thallium is identified by USEPA as a "provisional value" of "limited usefulness" that was developed for information purposes although USEPA states "it is inappropriate to derive a provisional subchronic or chronic [toxicity value] for thallium" [http://hhpprtv.ornl.gov/issue_papers/ThalliumandCompounds.pdf]

(4)The RSL for cobalt is based on a provisional dose-response value that is two orders of magnitude lower than values from other regulatory sources, and higher than most dietary intake estimates. Thus, a more realistic RSL could be more than an order of magnitude higher than the value shown here.

REACH CCP Human Health Toxicity Data for "Ashes, Residues" EC# 931-322-8

REACH CCP Human Health Toxicity Data (a)			
Endpoint	**Publications**	**Study Reports**	**Conclusion**
Acute Oral Toxicity	0	3	No Hazard
Acute Inhalation Toxicity	1	0	No Hazard
Acute Dermal Toxicity	0	2	No Hazard
Skin Irritation	0	8	No Hazard (7) Inconclusive (1)
Eye Irritation	0	4	No Hazard (3) Inconclusive (1)
Skin Sensitization	0	2	No Hazard
Repeated Dose Inhalation Toxicity	3	0	No Hazard
Repeated Dose Oral Toxicity	1	1	No Hazard
Genetic Toxicity	1	4	No Hazard
Reproductive Toxicity	1	1	No Hazard
Carcinogenicity	NA	NA	No Hazard
Total	**7**	**25**	**34**

Notes:

CCP - Coal Combustion Product

EC# - European Commission Number

NA - Not available

REACH - Registration, Evaluation, Authorization and Restriction of Chemical Substances

(a) - Information on REACH obtained from the European Chemicals Agency, Chemical Substances Search (http://echa.europa.eu) and the search term: Ashes, residues EC# 931-322-8.

SCHEDULE LJNB-S12

AECOM
AECOM
250 Apollo Drive
Chelmsford, MA 01824

978-905-2100 tel
978-905-2101 fax

Memorandum

To	Ameren Missouri	Page	1
CC			
Subject	Review of Groundwater Analytical Data Collected in the Vicinity of the Proposed Utility Waste Landfill for the Ameren Missouri Labadie Energy Center		
From	Lisa JN Bradley, PhD, DABT		
Date	September 9, 2013		

Introduction

Per your request, I have conducted a review of the groundwater analytical data available from three sources:

- Groundwater data from samples collected in April 16-17, 2013, as reported by Reitz & Jens, Inc., in the report titled, "Groundwater Monitoring Report – 1st Background Sampling Event – April 16-17, 2013" (May 2013). The samples were collected from 29 shallow monitoring wells, and represent the first of eight rounds of background sampling and analytical data collection required prior to construction of the Proposed Utility Waste Landfill (UWL) for the Ameren Missouri Labadie Energy Center (Facility). The monitoring well locations are shown on **Figure 1**.

- Groundwater data from samples collected in August 19-21, 2013, as reported by Reitz & Jens, Inc., in the report titled, "Groundwater Monitoring Report – 2nd Background Sampling Event – August 19-21, 2013" (September 2013).

- Groundwater data from three groundwater piezometers installed south of the Facility for temporary monitoring purposes obtained from a letter report prepared by Golder Associates Inc., titled, "Laboratory Analytical Results for Groundwater Monitoring Samples Collected on April 12-13, 2012 from Temporary Groundwater Piezometers Installed Near Labadie Plant" (April 2012). Three piezometers were installed with screened intervals in bedrock at similar depths to nearby residential water wells. The piezometer locations are shown on **Figure 2**. These piezometers were sited to be located upgradient of the Facility.

This review includes:

- A comparison of the analytical data collected from the proposed UWL site to state and federal drinking water standards and to federal risk-based screening levels for tapwater.

- A comparison of the analytical data from the three groundwater piezometers installed south of the Facility for temporary monitoring purposes, to state and federal drinking water standards and to federal risk-based screening levels for tapwater.
- A comparison of the analytical data from the proposed UWL site to the analytical data from the three temporary monitoring piezometers.
- A review of readily available information on the natural groundwater quality in the vicinity of the Facility.

Screening Levels for Groundwater

The groundwater screening levels used in this analysis are from federal and state sources and address the drinking water exposure pathway. These sources are:

- Rules of Missouri Department of Natural Resources Division 60 Safe Drinking Water Commission Chapter 4 Contaminant Levels and Monitoring. (MDNR, 2010)
- USEPA 2012 Edition of the Drinking Water Standards and Health Advisories, Spring 2012. (USEPA, 2012)
- USEPA Regional Screening Levels, May 2013, values for tapwater. (USEPA, 2013)

The screening levels obtained from these sources are primary drinking water standards or maximum contaminant levels (MCLs) and secondary drinking water standards (SMCLs); Missouri has adopted the federal MCLs and SMCLs for the state. Risk-based regional screening levels (RSLs) from USEPA for tapwater have also been used in this evaluation. **Table 1** provides a summary of the screening levels used in this evaluation.

Groundwater Analytical Data for Proposed UWL Site

Twenty-nine groundwater monitoring wells were installed around the proposed footprint of the UWL site at the Labadie Energy Center. Two of a total of eight rounds of groundwater sample collection events hve been conducted and reported. These data will be used to define pre-landfill, or background, groundwater quality conditions.

Groundwater analytical data from the first round (April 2013) of sample collection for the proposed UWL site are presented in **Table 2**. Groundwater analytical data from the second round (August 2013) of sample collection for the proposed UWL site are presented in **Table 3**. As shown in the first column of the tables, the wells are shallow, and the well depths range from 17 to 28 feet. More information on the monitoring wells and data collection and analysis is available in the Reitz & Jens reports. These data represent background groundwater quality in the area of the proposed UWL. The data presented in **Tables 2 and 3** are compared to the state/federal drinking water standards as well as risk-based screening levels. The constituents with background concentrations that are generally above state/federal drinking water standards and/or risk-based screening levels are arsenic, iron and manganese, and total dissolved solids (TDS). Groundwater samples were collected using low-flow sampling techniques. Samples were collected from the groundwater wells when low turbidity levels were stabilized, which is an important consideration as high turbidity often can result in metals concentrations above standards.

Regional Groundwater Quality

The U.S. Geological Survey (USGS) has summarized concentrations of trace elements in groundwater regions across the U.S. (USGS, 2011), including arsenic, iron, manganese and boron. Elevated concentrations of iron, manganese, and arsenic are commonly present in groundwater when oxygen is reduced (anaerobic or anoxic conditions) (USGS, 2011). Under these conditions, the iron, manganese, and/or arsenic that are naturally present in soils and rocks are dissolved from the rocks and enters the water. Based on the classification method used by the USGS to identify whether aquifers are oxic (oxidizing) or anoxic (reducing) (see Table 2 on page 14 of the USGS, 2011 report), the levels of iron, manganese and sulfate at the proposed UWL site are consistent with an anoxic, or iron/high sulfate reducing aquifer. Thus, the presence of iron, manganese, and arsenic above screening levels at the proposed UWL site is attributed to the geochemical conditions of the aquifer. Background levels of arsenic in soils in Franklin County, Missouri range from 3.4 to 12 mg/kg (USGS, 2013).

The Ameren Missouri Labadie Energy Center is located in Franklin County, MO, an area which can have high levels of sulfate in groundwater. Groundwater in Franklin County is classified as within the Ozark aquifer of the Salem Plateau groundwater province, as reported by the Missouri Department of Natural Resources (MDNR, 2013). According to the MDNR:

> Large quantities of high-quality groundwater are generally easy to obtain in this province. Minimum construction standards for private domestic wells in much of this region call for at least 80 feet of casing set 30 feet into rock. In the northeastern part of the region, including parts of Phelps, Crawford, Maries, Osage, Gasconade and Franklin counties, Pennsylvanian-age sandstone and shale units overlie the Ordovician-age bedrock. Groundwater quality in the upper part of the Ozark aquifer in this area is different than in other parts of the Ozarks. The sulfate content is commonly elevated, and may exceed the maximum recommended level of 250 mg/L. Thus, where Pennsylvanian strata are present, at least 150 feet of casing is required for a private domestic well.

Thus, the presence of sulfate in groundwater at the proposed UWL site, while below drinking water standards, is not unexpected and is consistent with information available from MDNR.

Also note that, per MDNR recommendations, "at least 150 feet of casing is required for a private domestic well" in the areas where sulfate concentrations are naturally high, such as in Franklin County, so that the wells are not drawing from the upper part of the Ozark aquifer (MDNR, 2013). MDNR notes that (the deeper) groundwater quality is generally high and that treatment of drinking water is not needed other than the optional use of water softeners to address hardness caused by calcium and magnesium levels.

Sulfate and Boron

Sulfate and boron, when both are present in high concentrations, can be indicators of releases from coal ash management units (EPRI, 2006). Neither the sulfate nor boron concentrations are elevated in groundwater at the proposed UWL site. The boron concentrations in the proposed UWL site wells are low, and are consistent with groundwater across the U.S. (90th percentile concentration of 220 ug/L – micrograms per liter), and in humid climates in particular (90th percentile concentration of 160 ug/L) (USGS, 2011, Tables 4 and 5, respectively). Thus, these groundwater data are consistent with groundwater that is not affected by constituents from coal ash management facilities.

Groundwater Analytical Data for Upgradient Wells

Groundwater analytical data were obtained from a letter report prepared by Golder Associates Inc., titled, "Laboratory Analytical Results for Groundwater Monitoring Samples Collected on April 12-13, 2012 from Temporary Groundwater Piezometers Installed Near Labadie Plant" (April 2012). The piezometer locations are shown on **Figure 2**, and they are completed into bedrock at similar depths to nearby residential water wells. The wells depths are: TPG-A – 103 feet below ground surface (ft bgs), TPG-B – 130 ft bgs, and TBG-C – 240 ft bgs. These depths are well below the shallow approximately 25-foot depth of the groundwater monitoring wells at the proposed UWL site.

All results are below federal drinking water standards and/or risk-based screening levels. Arsenic and boron were not detected in these wells, and sulfate concentrations are consistent with the data from the monitoring wells in the proposed UWL site.

Summary

This evaluation of the data from the shallow monitoring wells at the proposed UWL site indicates that while concentrations of arsenic, iron, and manganese, and TDS are above drinking water standards, these data represent natural conditions for the area. The evaluation also indicates that the detected analyte concentrations in samples of the deeper bedrock groundwater taken from the three piezometers are below drinking water standards. There are no indications of potential impacts from coal ash management at the Labadie Energy Center on the shallow or deep groundwater in the areas evaluated.

References

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USEPA. 2012. USEPA 2012 Edition of the Drinking Water Standards and Health Advisories, Spring 2012. U.S. Environmental Protection Agency. Available at: http://water.epa.gov/drink/contaminants/index.cfm.

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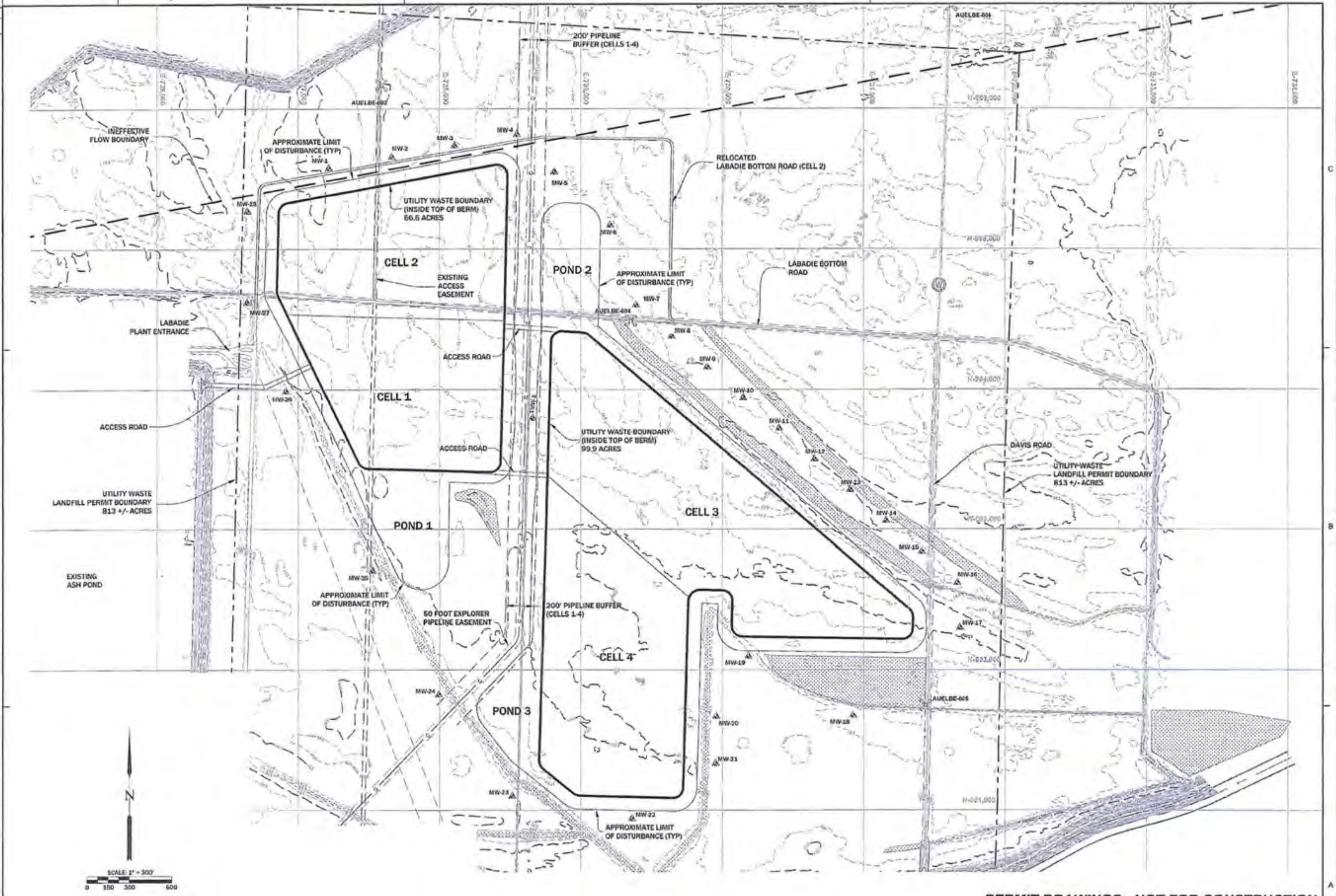
PRINT DIST.		
REVISIONS		
REV.	W.O.	GYM



SURVEY MONUMENTS

MONUMENT ID	NORTHING	EASTING	ELEVATION
AUELBE-001	990484.82	726569.81	467.19
AUELBE-002	996166.50	727588.30	470.70
AUELBE-003	989921.39	728508.32	467.59
AUELBE-004	994487.78	729353.29	467.02
AUELBE-005	991746.97	731438.29	462.78
AUELBE-006	996729.00	731621.70	467.67

Missouri State Plane Coordinate System Datum:
Horizontal Datum NAD 1983;
Vertical Datum NAVD 1988

NOTES TO THE CONTRACTOR

UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORDS AND THEREFORE, THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS AT PRESENT NOT KNOWN. VERIFICATION OF THE LOCATIONS OF UNDERGROUND UTILITIES, SHOWN OR NOT SHOWN, WILL BE THE RESPONSIBILITY OF THE CONSTRUCTION CONTRACTOR.

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Reitz & Jens, Inc.

GREDELL Engineering Resources, Inc.

PREPARED FOR Ameren

THOMAS R. GREDELL
NUMBER E-21437

DRAWN	W.J.A. (G.E.R.)
CHKD.	R.L.R. (G.E.R.)
SUPV	T.R.G. (G.E.R.)
APPD	T.R.G. (G.E.R.)

SHEET 3
PROPOSED UTILITY WASTE LANDFILL
PROJECT OVERVIEW

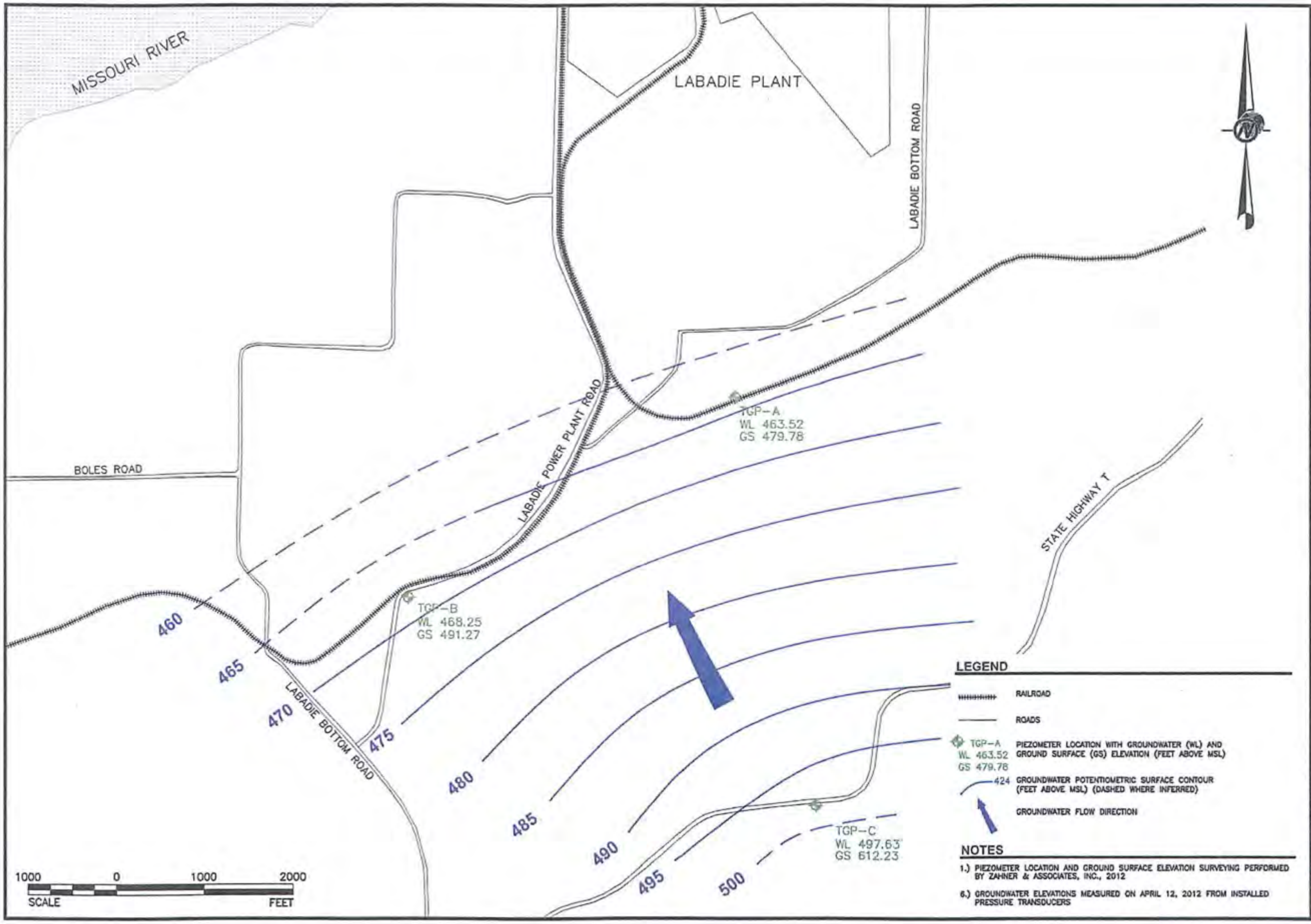
LOCATION		CLASS
001009	LABADIE ENERGY CENTER	02010

Ameren Missouri
ST. LOUIS, MISSOURI

JANUARY 2013

REV. 0

Figure 1



LEGEND

++++++++	RAILROAD
———	ROADS
◈ TGP-A WL 463.52 GS 479.78	PIEZOMETER LOCATION WITH GROUNDWATER (WL) AND GROUND SURFACE (GS) ELEVATION (FEET ABOVE MSL)
—424	GROUNDWATER POTENTIOMETRIC SURFACE CONTOUR (FEET ABOVE MSL) (DASHED WHERE INFERRED)
↑	GROUNDWATER FLOW DIRECTION

NOTES

1.) PIEZOMETER LOCATION AND GROUND SURFACE ELEVATION SURVEYING PERFORMED BY ZAHNER & ASSOCIATES, INC., 2012

6.) GROUNDWATER ELEVATIONS MEASURED ON APRIL 12, 2012 FROM INSTALLED PRESSURE TRANSDUCERS

Golder Associates
St. Louis, Missouri

PROJECT
GROUNDWATER PIEZOMETER
INSTALLATION
AMEREN LABADIE PIEZOMETERS
Labadie, MO

TITLE
**GROUNDWATER
POTENTIOMETRIC SURFACE MAP
(APRIL 2012)**

PROJECT No. 123-84274		
FILE No. 12384274-F01		
REV. 0	SCALE AS SHOWN	
DESIGN	MWD	04/09/12
CADD	MWD	04/20/12
CHECK	ALD	04/20/12
REVIEW		05/08/12
FIGURE	1	

Figure 2

Table 1
Human Health Groundwater Screening Levels
Ameren Missouri Labadie Energy Center
Proposed Utility Waste Landfill
Franklin County, Missouri

Constituent	Abbreviation	CAS	MCLs (a) (mg/L)	SMCLs (a) (mg/L)	USEPA Tapwater RSLs (d) (mg/L)
Aluminum	Al	7429-90-5	NA	0.05 - 0.2 mg/L	16
Antimony	Sb	7440-36-0	0.006	NA	0.006
Arsenic	As	7440-38-2	0.01	NA	0.000045
Barium	Ba	7440-39-3	2	NA	2.9
Beryllium	Be	7440-41-7	0.004	NA	0.016
Boron	B	7440-42-8	NA	NA	3.1
Cadmium	Cd	7440-43-9	0.005	NA	0.0069
Chloride	Cl	7647-14-5	NA	250	NA
Chromium	Cr	16065-83-1	0.1	NA	16
Cobalt	Co	7440-48-4	NA	NA	0.0047
Copper	Cu	7440-50-8	1.3	1	0.62
Fluoride	Fl	16984-48-8	4	2	0.62
Iron	Fe	7439-89-6	NA	0.3	11
Lead	Pb	7439-92-1	0.015	NA	NA
Manganese	Mn	7439-96-5	NA	0.05	0.32
Mercury	Hg	7487-94-7	0.002	NA	0.0043
Molybdenum	Mo	7439-98-7	NA	NA	0.078
Nickel	Ni	7440-02-0	NA	NA	0.3
Selenium	Se	7782-49-2	0.05	NA	0.078
Silver	Ag	7440-22-4	NA	0.1	0.071
Sulfate	SO4	7757-82-6	NA	250	NA
Thallium	Tl	7440-28-0	0.002	NA	0.00016
Zinc	Zn	7440-66-6	NA	5	4.7
pH (std)	pH	PH	NA	6.5 - 8.5	NA
Total Dissolved Solids	TDS	TDS	NA	500	NA

Notes:
CAS - Chemical Abstracts Service.
MCL - Maximum Contaminant Level.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level.
USEPA - United States Environmental Protection Agency.
(a) - The values for the Missouri MCLs (b) and USEPA MCLs (c) are the same.
(b) - Rules of Missouri Department of Natural Resources Division 60 Safe Drinking Water Commission Chapter 4 Contaminant Levels and Monitoring. http://www.sos.mo.gov/adrules/csr/current/10csr/10c60-4.pdf.
(c) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm
(d) - USEPA Regional Screening Levels (May 2013). Values for tapwater. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

Table 2
Background Water Quality Comparison to Drinking Water Standards (a), April 2013 Sampling Event
Ameren Missouri Labadie Energy Center
Proposed Utility Waste Landfill
Franklin County, Missouri

Monitoring Well ID	Well Depth	pH	Chloride	Fluoride	Sulfate	TDS	Aluminum	Antimony	Arsenic	Boron	Barium	Beryllium	Cadmium	Cobalt	Chromium	Copper	Iron	Manganese	Mercury	Molybdenum	Nickel	Lead	Selenium	Silver	Thallium	Zinc
	(feet, btor)	S.U.	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L
	MCL/SMCL (b)	6.5-8.5	250	4	250	500	50	6	10	NA	2000	0.004	5	NA	100	1300	300	50	2	NA	NA	15	50	100	2	5000
	RSL (c)	NA	NA	2	NA	NA	16000	6	0.045	3100	2900	0.016	6.9	4.7	16000	620	11000	320	4.3	78	0.3	NA	78	71	0.16	4700
MW-1	27.76	6.83	10	0.11	28	536			22.1	79.4	402			3.3			17000	[illegible]			0.0058					
MW-2	26.35	6.85	17	0.21	31	696			29.5	121	416			2.9			25400	2950								2.5
MW-3	25.15	6.99	9	0.12	54	516			1.2	63.6	415					3.3	18200	[illegible]								2.2
MW-4	25.54	6.94	6	0.18	25	532				72.8	274						115	1240			0.0091					
MW-5	24.68	6.86	2	0.16	16	482				52.9	293						210	[illegible]			0.0116					2.1
MW-6	23.1	6.82	3	0.14	19	566	37			62.2	227						53	106			0.0101					4.3
MW-7	21.94	7.07	15	0.2	26	568	246		88.6	72.6	480						30300	1570								2.9
MW-8	21.82	6.83	8	0.16	10	460			13.6	45.3	285						27500	898								2.7
MW-9	20.18	7.16	5	0.18	20	414			36.4	53.6	265						16700	1450								
MW-10^3	21.45	6.99	6	0.17	54	430	27		8.6	56.7	462						18900	1350				0.4				
MW-11	20.95	6.89	2	0.12	64	460			0.8	54.8	301			3.1			436	[illegible]			0.0068	0.5				
MW-12	20.48	6.93	2	0.1	42	448	18		1.4	52.9	253			3			419	[illegible]			0.0052					4
MW-13	20.4	6.87	2	0.12	64	498	33			53.5	295						59.2	117								5.1
MW-14	19.79	6.95	3	0.14	42	490	30		7.1	48.2	268			3.3			3590	979			0.0039					5.5
MW-15	17.91	6.84	2	0.16	27	404				58.1	206						16	18.1			0.0058					4.1
MW-16	18.5	6.85	6	0.22	30	554	31		12.5	102	102			4.4			8580	3740			0.0041					5
MW-17	19.72	6.79	2	0.13	59	580	119		5.3	64.9	275			3.4			1620	1270			0.0037	0.7				3.5
MW-18	18.24	7	1	0.18	34	476				45.8	147						22.3	89.5				0.4	36.5			4
MW-19	18.19	6.83	2	0.15	72	500				72.1	228						136	98.9			0.0057					4.2
MW-20	17.62	6.99	2	0.19	21	356				48.7	182						30.9	154			0.0074	0.5				4
MW-21	17.71	6.92	3	0.16	30	262			1	57.7	237						1080	[illegible]			0.0036					3.8
MW-22	17.92	6.88	6	0.25	30	560			45.7	156	238						[illegible]	[illegible]				0.5				4.1
MW-23	19.65	6.84	4	0.18	21	508	153		3.4	94	210						3600	180			0.0039					3.5
MW-24	19.99	5.94	3	0.18	36	426	154			47.1	190					3	277	4.1			0.0048	0.6	45.5			4.1
MW-25	20.84	7.18	4	0.14	17	406	38		6.5	124	511						4850	1730			0.0036	0.7				3.8
MW-26	23	7.02	4	0.16	45	504	55.5			82.7	286						630	[illegible]			0.0043	0.7				
MW-27^3	25.91	6.83	11	0.18	29	576	31		3.3	98.6	268			4.1			3220	1350			0.0058	0.5				5.2
MW-28	27.06	6.78	6	0.16	31	556	16		1.5	86.7	269						2020	[illegible]			0.0082	1				4.5
TMW-1	21.58	7.01	6	0.26	128	674			29.5	100	355						12100	[illegible]			0.0036					5.5

Notes:

Blank data cells indicate a non-detect value.

btor - below top of riser.

MCL - Maximum Contaminant Level.

NA - Not available.

RSL - Regional Screening Level.

SMCL - Secondary Maximum Contaminant Level. Value used if no MCL available.

S.U. - Standard Units.

TDS - Total Dissolved Solids.

USEPA - United States Environmental Protection Agency.

(a) - Numerical values were obtained from the Ameren Missouri Labadie Energy Center, Groundwater Monitoring Report, 1st Background Sampling Event – April 16-17, 2013 Report prepared by Reitz & Jens, Inc., and GREDELL Engineering Resources, Inc. May 2013.

(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm; adopted as Missouri state values at 10 CSR 60-4.

(c) - USEPA Regional Screening Levels (May 2013). Values for tapwater. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

🟨	greater than MCL
🟦	greater than MCL and RSL
🟩	greater than RSL

Table 3

Background Water Quality Comparison to Drinking Water Standards (a), August 2013 Sampling Event
Ameren Missouri Labadie Energy Center
Proposed Utility Waste Landfill
Franklin County, Missouri

Monitoring Well ID	Well Depth	pH	Chloride	Fluoride	Sulfate	TDS	Aluminum	Antimony	Arsenic	Boron	Barium	Beryllium	Cadmium	Cobalt	Chromium	Copper	Iron	Manganese	Mercury	Molybdenum	Nickel	Lead	Selenium	Silver	Thallium	Zinc
	(feet, btor)	S.U.	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L
	MCL/SMCL (b)	6.5-8.5	250	4	250	500	50	6	10	NA	2000	0.004	5	NA	100	1300	300	50	2	NA	NA	15	50	100	2	5000
	RSL (c)	NA	NA	2	NA	NA	16000	6	0.045	3100	2900	0.016	6.9	4.7	16000	620	11000	320	4.3	78	0.3	NA	78	71	0.16	4700
MW-1	27.76	6.76	7	0.16	27	600				82.6	298						176	539			0.0066					
MW-2	26.35	6.74	6	0.18	38	738			1	109	233			4.1			707	[illegible]			0.005					
MW-3	25.15	6.88	5	0.18	66	606			2.4	67.2	268						3110	[illegible]			0.0053					
MW-4	25.54	6.93	5	0.17	33	600				71.8	240		0.3				6.5	155								
MW-5	24.68	6.83	2	0.18	21	562				55	260							3.8								
MW-6	23.1	6.79	3	0.17	23	608				58.5	211															
MW-7	21.94	6.96	5	0.23	39	598			18.9	67.7	347			2.4			5900	[illegible]			0.0036					
MW-8	21.82	6.85	3	0.21	23	514			2.1	46.5	252						3440	397			0.0039					
MW-9	20.18	7.05	4	0.26	18	370			1.2	43	196						255	534			0.0082					17.6
MW-10^3	21.45	6.86	3	0.21	30	516				55.6	252						768	52								2.1
MW-11	20.95	6.79	3	0.16	48	596				60.9	179						22.1	4.3								
MW-12	20.46	6.8	3	0.16	37	540				53.5	186						19	2.3					24			
MW-13	20.4	6.77	3	0.17	49	590				62.9	178						12				0.004		70.9			3.6
MW-14	19.79	6.77	2	0.2	36	528			1.9	61.4	223			4.1			347	252			0.0044					
MW-15	17.91	6.75	3	0.22	29	538				66.8	243						111	41.1			0.0044					2.8
MW-16	18.5	6.83	3	0.26	34	636			1.6	106	392			7.2			1060	3810			0.0062					2.3
MW-17	19.72	6.85	4	0.25	21	532	21			64.4	236						17	17.4								3.4
MW-18	18.24	6.96	2	0.24	37	536				86	172							219								2.2
MW-19	18.19	6.73	2	0.27	39	506				69.1	195						83.8	249			0.0043					
MW-20	17.62	6.92	3	0.27	36	466				60.2	176						9.2	8.3								
MW-21	17.71	7.03	3	0.3	22	398			2.5	81.7	169						12	60.3								2.9
MW-22	17.92	6.86	3	0.25	30	572	20		12.1	140	230						6410	1510								3.1
MW-23	19.65	6.9	5	0.24	24	624	284		6.6	146	260						5600	519			0.0034					3.1
MW-24	19.99	6.88	4	0.22	35	486				60.1	184						15	7.1			0.0036		42.7			
MW-25	20.84	7.04	3	0.18	39	506			1.4	144	464						294	1150			0.0048					
MW-26	23	7.01	5	0.21	38	556				69.8	236						37.5	141								
MW-27^3	25.91	6.73	20	0.2	37	690			2	86.1	264			5.4			1190	967			0.0083					3.4
MW-28	27.06	6.78	8	0.19	32	600	203		1.5	91.2	261						800	147			0.0081		44.3			2.8
TMW-1	21.58	6.93	5	0.28	83	656			6.5	91.7	348			3.9			1010	[illegible]	0.06		0.0042					

Notes:

Blank data cells indicate a non-detect value.

btor - below top of riser.

MCL - Maximum Contaminant Level.

NA - Not available.

RSL - Regional Screening Level.

SMCL - Secondary Maximum Contaminant Level. Value used if no MCL available.

S.U. - Standard Units.

TDS - Total Dissolved Solids.

USEPA - United States Environmental Protection Agency.

(a) - Numerical values were obtained from the Ameren Missouri Labadie Energy Center, Groundwater Monitoring Report, 2nd Background Sampling Event – August 19-21, 2013 Report prepared by Reitz & Jens, Inc., and GREDELL Engineering Resources, Inc. September 2013.

(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm; adopted as Missouri state values at 10 CSR 60-4.

(c) - USEPA Regional Screening Levels (May 2013). Values for tapwater. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

🟨 greater than MCL
🟦 greater than MCL and RSL
🟩 greater than RSL

Table 4
Groundwater Samples Collected Upgradient of the Labadie Power Plant Comparison to Drinking Water Standards (a)
Ameren Missouri Labadie Energy Center
Proposed Utility Waste Landfill
Franklin County, Missouri

Piezometer Sample ID (d)	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chloride	Chromium	Copper	Fluoride	Lead	Mercury	Nickel	Nitrate as N	Selenium	Silver	Sulfate	Thallium	Zinc
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MCL/SMCL (b)	0.006	0.01	2	0.004	NA	0.005	250	0.1	1.3	4	0.015	0.002	NA	10	0.05	0.1	250	0.002	5
RSL (c)	0.006	0.000045	2.9	0.016	3.1	0.0069	NA	16	0.62	0.62	NA	0.0043	0.3	25	0.078	0.071	NA	0.00016	4.7
TGP-A			0.21				5.8	0.0029		0.20	0.0031		0.002	1.3			13		
DUP-1 (e)			0.22				5.7	0.0034		0.18	0.0037		0.0021	1.3			14		
TGP-B	0.0026		0.1				29	0.0025		0.25	0.0036			7.9			25		
TGP-C			0.15				43	0.0013		0.16	0.0044			5.0			34		0.0064

Notes:
Blank data cells indicate a non-detect value.
MCL - Maximum Contaminant Level.
NA - Not available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. Used if no MCL available.
USEPA - United States Environmental Protection Agency.
(a) - Numerical values were obtained from the Ameren Missouri Labadie Energy Center Utility Waste Landfill, Missouri, Solid Waste Disposal Area, Franklin County, Laboratory Analytical Results for Groundwater Monitoring Samples Collected on April 12-13, 2012 from Temporary Groundwater Piezometers Installed Near Labadie Plant, April 2012.
(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (May 2013). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - Piezometer samples are screened in bedrock.
(e) - Duplicate sample from TGP-A.

🟨	greater than MCL
🟦	greater than MCL and RSL
🟩	greater than RSL

Human and Ecological Risk Assessment of Coal Combustion Wastes

April 2010

DRAFT

U.S. Environmental Protection Agency
Office of Solid Waste and Emergency Response
Office of Resource Conservation and Recovery

Regulation Identifier Number (RIN) 2050-AE81

SCHEDULE LJNB-S14

When viewing the results in Tables 4-1 through 4-4, readers should note that these risks assume that the contaminated groundwater plume will intercept a receptor well. Because approximately two-thirds of the model runs showed surface water bodies intersecting the groundwater plume, there could be a significant number of instances where a well is either not contaminated or is less contaminated than the results below would indicate. This uncertainty is discussed further in **Section 4.4.3.3**.

Table 4-1. 90th Percentile Risk Results by CCW Type: Landfills, Groundwater-to-Drinking-Water Pathway

Chemical	90th Percentile HQ or Cancer Risk Value[a]		
	Unlined Units	Clay-Lined Units	Composite-Lined Units
Conventional CCW – 79 landfills			
Cancer			
Arsenic III	4E-04	2E-04	0
Arsenic V	2E-04	3E-05	0
Noncancer			
Aluminum	2E-03	1E-04	0
Antimony	2	0.8	0
Barium	3E-03	7E-04	0
Boron	0.7	0.4	0
Cadmium	0.7	0.4	0
Cobalt	1	0.4	0
Lead (MCL)[b]	1	0.3	0
Molybdenum	2	0.8	0
Nitrate/nitrite (MCL)[b]	0.1	0.06	2E-06
Selenium IV	0.01	3E-3	0
Selenium VI	0.2	0.1	0
Thallium	3	2	0
Codisposed CCW and Coal Refuse – 41 landfills			
Cancer			
Arsenic III	5E-04	2E-04	0
Arsenic V	4E-04	6E-05	0
Noncancer			
Aluminum	0.02	4E-04	0
Antimony	0.8	0.3	0
Barium	0.04	4E-03	0
Boron	0.3	0.1	0
Cadmium	0.2	0.07	0
Cobalt	0.8	0.09	0
Lead (MCL)[b]	0.7	0.09	0
Molybdenum	2	0.6	0

(continued)

90th Percentile Risk Results by CCW Type: Landfills, Groundwater-to-Drinking-Water Pathway (continued)

Chemical	90th Percentile HQ or Cancer Risk Value[a]		
	Unlined Units	Clay-Lined Units	Composite-Lined Units
Nitrate/nitrite (MCL)[b]	0.2	0.1	3E-06
Selenium IV	0.1	0.04	0
Selenium VI	0.7	0.3	0
Thallium	2	1	0

[a] Values are HQs for all chemicals except arsenic; arsenic values are cancer risk. Zero results indicate that contaminant infiltration rates were too small for the contaminant plume to reach the receptor during the 10,000 year period of the analysis.

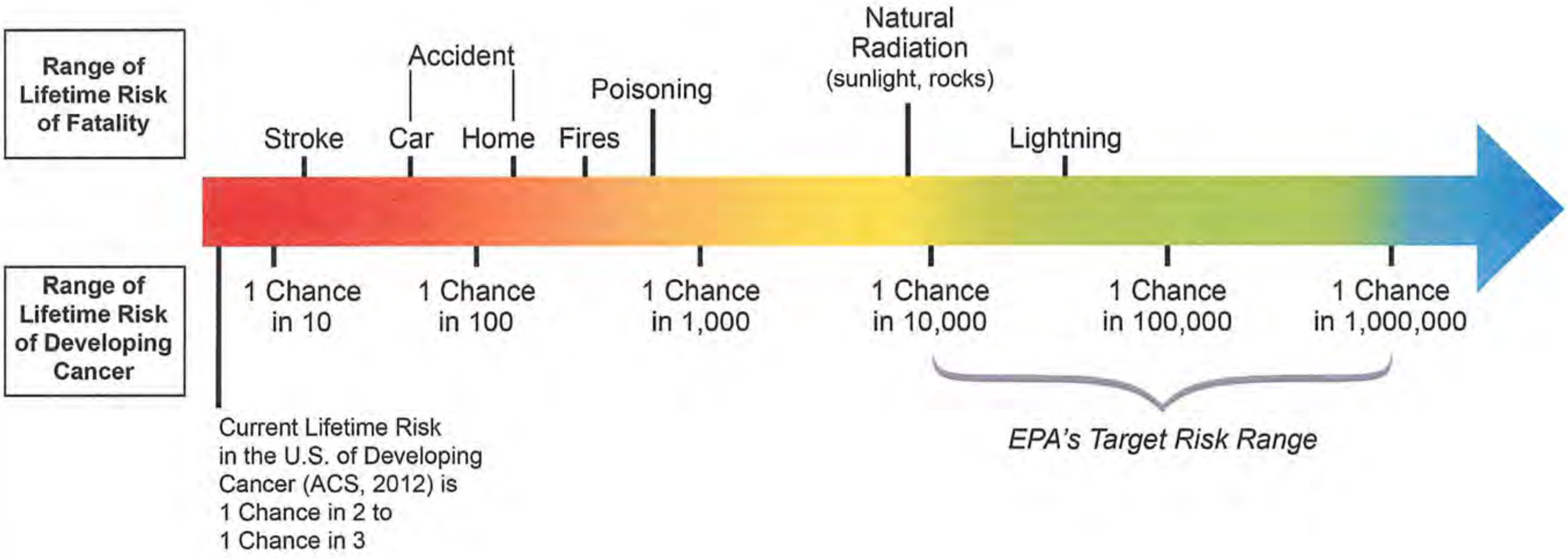
[b] Values are ratios of exposure concentration to MCL.

Table 4-2. 50th Percentile Risk Results by CCW Type: Landfills, Groundwater-to-Drinking-Water Pathway

Chemical	50th Percentile HQ or Cancer Risk Value[a]		
	Unlined Units	Clay-Lined Units	Composite-Lined Units
Conventional CCW – 79 landfills			
Cancer			
Arsenic III	6E-06	4E-06	0
Arsenic V	6E-10	3E-14	0
Noncancer			
Aluminum	5E-07	3E-07	0
Antimony	0.04	0.02	0
Barium	0	0	0
Boron	0.01	0.01	0
Cadmium	0.01	8E-03	0
Cobalt	3E-03	8E-06	0
Lead (MCL)[b]	4E-04	2E-08	0
Molybdenum	0.1	0.04	0
Nitrate/nitrite (MCL)[b]	0.004	0.003	0
Selenium IV	0	0	0
Selenium VI	9E-03	6E-03	0
Thallium	0.2	0.1	0
Codisposed CCW and Coal Refuse – 41 landfills			
Cancer			
Arsenic III	2E-05	6E-06	0
Arsenic V	6E-06	7E-10	0

(continued)

Risks in Perspective



Range of Lifetime Risk of Fatality

Stroke

Accident

Car

Home

Fires

Poisoning

Natural Radiation (sunlight, rocks)

Lightning

Range of Lifetime Risk of Developing Cancer

1 Chance in 10

1 Chance in 100

1 Chance in 1,000

1 Chance in 10,000

1 Chance in 100,000

1 Chance in 1,000,000

Current Lifetime Risk in the U.S. of Developing Cancer (ACS, 2012) is 1 Chance in 2 to 1 Chance in 3

EPA's Target Risk Range

- *Adapted from U.S. EPA 450/3-90-022, Mar. 1991, http://www.epa.gov/air/oaqps/air_risc/3_90_022.html (1996)*
- *American Cancer Society. 2012. Cancer Facts and Figures 2012. http://www.cancer.org/acs/groups/content/@nho/documents/document/acspc-024113.pdf*

SCHEDULE LJNB-S15

Overview of Deficiencies and Errors Contained in Reports Issued by The Environmental Integrity Project Regarding Coal Combustion Waste Disposal Impoundments in Pennsylvania

Pennsylvania Department of Environmental Protection
Bureau of Waste Management
November 1, 2011

The Environmental Integrity Project ("EIP") issued three reports which contain claims that certain coal combustion waste impoundments throughout the United States are causing groundwater and surface water contamination. The reports are entitled and dated:

> "*Out of Control: Mounting Damages from Coal Ash Waste Sites*." February 24, 2010.
>
> "*In Harm's Way: Lack of Federal Coal Ash Regulations Endangers Americans and Their Environment*," August 26, 2010.
>
> "*EPA's Blind Spot: Hexavalent Chromium in Coal Ash*." February 1, 2011.

DEP's Licensed Professional Geologists in the Southwest and Northeast Regional Offices have reviewed EIP's claims concerning the Pennsylvania facilities, and have prepared detailed point-by-point responses to EIP's findings. This summary describes the errors in EIP's reports in a more general format.

Several fundamental research flaws characterize EIP's claims, which undermine the scientific validity of these reports. These recurring flaws are summarized immediately below, and are then illustrated with several examples drawn from EIP's reports for the specific facilities.

1. **Faulty assumptions and pre-conceived conclusions show EIP's bias**. Scientists use a common expression: "Garbage in, leads to garbage out," meaning that if a researcher begins with faulty assumptions or data, all results from the research will be just as faulty. Pre-conceived assumptions underlying a researcher's conclusions (*e.g.*, that coal combustion waste results in groundwater contamination) will cause a researcher to rely upon weak data and ignore contrary evidence.

    - **Yet**, EIP often ignores sampling and other data which indicate that its assumptions and data are wrong. EIP makes misleading comparisons, referring to regulatory standards interchangeably and inaccurately, for example, by comparing impoundment discharge samples to drinking water standards.

2. **EIP's groundwater studies which ignore groundwater direction are poor science.** A valid scientific study must consider the direction that groundwater is flowing in the subsurface. In this way, researchers can tell if a sample is showing contaminants

originating from a site *or* moving towards it from other locations. Contaminants in groundwater moving towards an impoundment are either naturally occurring or from other sources.

- **Yet**, EIP's reports often simply assume that all sampling results must be caused by coal combustion waste, disregarding critical facts such as the direction of groundwater flow and aquifer characteristics. These assumptions show either bias or a disregard of scientific accuracy.

3. **EIP's data is often not credible because the results cannot be reproduced by other scientists**. To be credible, scientific research data must be "reproducible," that is, if one runs a test a second or third time, similar results will be obtained. This is a critical safeguard to ensure that a single test was not performed incorrectly, or skewed by outside influences.

   - **Yet**, EIP often draws conclusions from a single sample, which in many cases was inconsistent with prior and later sampling. EIP's claims therefore lack credibility, because they cannot be confirmed or were actually refuted by other data.

4. **EIP's research is largely not transparent or verifiable**. A critical element in valid scientific study is that the source of one's information be disclosed, so that others can verify the data's accuracy.

   - **Yet**, EIP's reports often refer only vaguely to the sources of its data, without identifying the specific locations, dates or sampling source. EIP's conclusions are therefore not credible, because its claims are impossible to verify.

I. FAULTY ASSUMPTIONS AND PRE-CONCEIVED CONCLUSIONS SHOW EIP'S BIAS.

Scientists use a common expression: "Garbage in, leads to garbage out," meaning that if a researcher begins with faulty assumptions or data, all results from the research will be just as faulty. Pre-conceived assumptions underlying a researcher's conclusions (*e.g.*, that coal combustion waste results in groundwater contamination) will cause a researcher to rely upon weak data and downplay or ignore contrary evidence.

- **Yet**, EIP often ignores sampling and other data which indicate that its assumptions and data are wrong. EIP makes misleading comparisons, referring to regulatory standards interchangeably and inaccurately, for example, by comparing impoundment discharge samples to drinking water standards.

Examples of these deficiencies include:

A. Bruce Mansfield Power Plant's Little Blue Run Surface Impoundment

1. EIP's February 24, 2010 report, p. 162 ("For example") claims:

> Arsenic has been measured in at least two off-site residential drinking wells above the MCL of 0.01 mg/L, including a reading of 0.0146 mg/L in one family's well in 2008, and a reading of 0.021 mg/L at another family's well.

In fact, although one sample collected from a private water supply well in late 2008 did contain arsenic at a concentration of 0.013 mg/L (not 0.0146 mg/L); the homeowner was aware that his well water was muddy. Another sample from the water well early in 2009 and the analytical results concentrations of metals were much lower compared to the 2008 sample. Total arsenic was reported at 0.0025 mg/L and dissolved arsenic at <0.0025 mg/L - well below the MCL. The DEP also collected a sample from this well two months later and confirmed these results. Both total and dissolved arsenic were less than <0.003 mg/L the detection limit. In addition, the location and elevation of this water well clearly indicates the well is located up gradient (background) from the impoundment.

Further, while arsenic was reported at a concentration of 0.021 mg/L in a sample collected from a private water well in 1993, six later samples from this well were analyzed for arsenic. The greatest concentration found was 0.005 mg/L, and most of the samples were non-detect. In addition, this well did not contain other concentrations of constituents that would suggest any impacts from the impoundment. Arsenic is found in soils of Western Pennsylvania, its presence does not confirm impacts from the impoundment.

2. **EIP's February 24, 2010 report, p. 166 ("On Site") claims:**

> On-site surface water showed an exceedance of the CCC for selenium at SW-3 (a seep in Pennsylvania just below the earthen dam.

In fact, EIP misidentifies sampling point SW-3 as a seep below the dam. SW-3 is a sampling point at the stilling basin and is a permitted discharge from the impoundment. Comparing this sampling point to WQC is not appropriate.

3. **EIP's February 24, 2010 report, p. 161, "Summary" claims:**

> Discharges to groundwater and surface water from the 1,300-acre 'Little Blue' surface impoundment have exceeded MCLs for arsenic and other parameters in multiple off-site residential drinking wells (prompting several property buyouts by FirstEnergy), exceeded Pennsylvania Water Quality Criteria (PA WQC), including the Criteria Continuous Concentration (CCC) and Criteria Maximum Concentration (CMC), in Mark's Run and other off-site surface water sources, and pervasively exceeded federal Maximum Contaminant Levels (MCLs) at many on-site groundwater monitoring wells.

In fact, there have been no confirmed concentrations in off-site residential drinking water wells located near the impoundment in excess of an MCL. Second, EIP improperly concludes that any private water well sampled by FirstEnergy or the DEP is impacted by the impoundment. This conclusion ignores the facts that many of the wells are hydrogeologically separate from the impoundment and/or may be impacted by other sources, including naturally occurring sources such as coal seams and brines, and other man-made sources such as past mining or oil and gas operations. Finally, surface water discharges are monitored and reported under the NPDES permit program and the facility is in compliance with those permits.

4. **EIP's February 24, 2010 report, p. 163 claims:**

> Between 2008 and 2010, arsenic was found in two additional surface water points, including exceedances at S-31 (a monitoring point in Mark's Run, in a residential neighborhood in West Virginia) and at SW-5 (a spring over 2,000 feet from Little Blue), with arsenic concentrations of 0.024 and 0.028 mg/L.

In fact, EIP misidentified sampling point SW-5 as a spring over 2,000 feet from the impoundment. SW-5 is a sampling point for the wastewater collected directly from the disposal impoundment. Further, EIP fails to note that seep S-31 emanates from the Brush Creek coal, and arsenic is often found in coal seeps.

5. **EIP's February 24, 2010 report, p. 162 claims:**

> In on-site groundwater that flows off-site, arsenic exceeded the 0.010 mg/L at least 24 times in 14 wells in 2006, 2009, and 2010, including concentrations of 0.030, 0.033, and 0.036 mg/L in three different wells. Fluoride, lead, and turbidity MCLs were also exceeded, as well as SMCLs for several other pollutants. On-site groundwater monitoring wells also had exceedances of SMCLs for chloride, iron, manganese sulfate, and turbidity.

In fact, FirstEnergy began regularly analyzing water samples for arsenic in 2006. Although arsenic was found in some samples, many of these detections were not replicated in subsequent samples from the same wells.

FirstEnergy has implemented studies to determine the reason(s) for the elevated arsenic in Well 16A and, if necessary, determine what steps may be taken to address it. Monitoring wells immediately downgradient of MW-16A do not contain arsenic above the MCLs. Therefore, groundwater leaving the Little Blue Run Impoundment downgradient of the dam does not exceed MCLs.

The other parameters that EIP indicates exceed MCLs and SMCLs occur naturally in the environment. EIP made no attempt to assess if a monitoring well contains water representative of background water quality, shows brine impacts from historic oil and gas exploration and production in the area, or contains concentrations of parameters associated with coal seams.

6. **EIP's February 24, 2010 report, p. 166 claims:**

> In addition, a monitoring well that appears to be monitoring surface water of the impoundment itself (SW-7) measured exceedances of the PA CCC for arsenic (0.010 mg/L) twice in 2009-2010, with readings of 0.023 and 0.025 mg/L, and it also measured at least six exceedances of the boron PA CCC (1.6 mg/L), with a high reading of 15.7 mg/L

In fact, EIP is comparing concentrations measured from SW-7 which is sampled from within the disposal impoundment (prior to discharge) to Fish and Aquatic Life Criteria.

7. **EIP's February 24, 2010 report, p. 162, claims:**

> MCLs were also exceeded in off-site groundwater wells for cadmium, barium, fluoride, lead, and turbidity.

In fact, no samples have found any private drinking water wells to contain constituents that exceed primary MCL's. Only a tiny percent of groundwater monitoring well samples have shown elevated cadmium, barium, fluoride or lead, and evidence indicates these are likely background conditions, and not the result of the impoundment. Turbidity is a function of mud and sediment in a well.

B. Allegheny Energy – Mitchell Power Station

1. EIP's February 24, 2010 report claims:

> In 1997, Allegheny Power initiated preliminary groundwater investigations in the vicinity of the two CCW lagoons.... However, the initial groundwater investigation found that groundwater was being degraded by the impoundments.

In fact, the groundwater investigation demonstrated that groundwater at the station had been affected by deep mining of the Pittsburgh Coal Seam upgradient of the site, and not by the impoundments. Some parameters were elevated due to acid mine drainage from past mining of the coal seam.

2. EIP's February 24, 2010 report claims:

> Boron was detected at 1.9 mg/l and 3.7 mg/l at the two downgradient wells of Lagoon No. 2.

In fact, while data presented to the Department shows that there have been rare detections of boron, these levels have been attributable to the past deep mining of the Pittsburgh Coal Seam upgradient of the site.

3. EIP's February 24, 1010 report claims:

> As a result of Allegheny Energy's evidence of groundwater degradation by the lagoons, a groundwater monitoring plan was implemented with an upgradient well two downgradient wells for each lagoon.

In fact, the groundwater monitoring plan was implemented for all similar facilities as required by the Residual Waste Regulations, and not "as a result of Allegheny Energy's evidence."

4. EIP's February 24, 2010 report claims:

> Analyses of quarterly monitoring data for samples collected from the two monitoring wells downgradient of Ash Lagoon No. 2 in 2007 (GW-4 and GW-5) found the following:
>
> - Boron levels were more than twice the EPA's Child Health Advisory of 3.0 mg/l and much higher than boron levels in upgradient wells or at surface monitoring points.
>
> - Arsenic concentrations have been 1 to 2 times the primary MCL of 0.010 mg/l at downgradient wells and exceeded the highest concentrations for arsenic in upgradient points.

- Levels of nickel, molybdenum, and manganese have also been noticeably higher at downgradient than upgradient points.

In fact, nothing in the report substantiates EIP's claims. Monitoring has been ongoing for more than 10 years and no upward trends have been established. Moreover, arsenic was detected in the upgradient (background) wells, showing that the origin is from past mining of the Pittsburgh Coal Seam.

5. EIP's February 24, 2010 report claims:

> Allegheny Energy does not monitor groundwater around the ash landfill that lies west of Mitchell Power Plant. Review of a topographic map of the landfill shows that surface drainage from the landfill flows towards Lagoon No. 1, and the position of the landfill with respect to Lagoon No. 2 creates the possibility that the upgradient monitoring wells from both lagoons could be affected by groundwater flowing from the ash fill.

In fact, Allegheny Energy does have an approved groundwater monitoring system around the FGD disposal facility referenced above. Groundwater has been monitored for over 10 years. The Report makes an assumption regarding groundwater flow that is based on a topographic map and not a groundwater flow map which is based on subsurface data. Topographically, surface water from around the landfill flows in a general direction towards the power station but is diverted around it by surface water controls.

C. <u>RRI Energy – Seward Generating Station</u>

1. EIP's February 24, 2010 report (Summary) claims:

> The Seward Generating Station's unlined coal ash and coal refuse pit, as well as its Closed Ash Sites No. 1 and No. 2, have leached and continue to leach many pollutants into the underlying aquifer at levels that far exceed both Pennsylvania and federal primary MCLs, and upgradient concentrations.

In fact, the original Seward Power Station has been demolished and a new Co-Gen plant built on site. No new fly ash is being disposed at the Seward Generating Station. As part of the permitting process for the Co-Gen plant, RRI entered into a Consent Order and Agreement (CO&A) in 2000 to remediate several old coal refuse piles on site which were discharging acid mine drainage into the groundwater and adjacent river.

All of the groundwater data referenced in the EIP report for this facility is from the monitoring wells around former coal refuse piles and not from any fly ash disposal sites. The only elevated parameters detected in the groundwater wells around the permitted flyash sites No. 1 and No. 2 has been secondary and non-health related (relating to the taste, odor or appearance of the water).

2. **EIP's February 24, 2010 report claims:**

> Groundwater levels of antimony consistently exceeded the primary MCL of 0.006 mg/L, including a concentration of 0.1 mg/L (nearly 17 times the standard) at monitoring well MW-7 in the third quarter of 2008. Cadmium exceeded the primary MCL of 0.005 mg/L at 4 different monitoring wells, MW-5R, MW-6R, MW-7, and MW-8R, including a MW-7R reading of 0.041, over eight times the standard, in the second quarter of 2009.

In fact, the groundwater data referenced in this statement is related to the past coal refuse disposal and not fly ash.

3. **EIP's February 24, 2010 report claims:**

> In addition, 13 of 16 quarters for which we have downstream surface water data from 2005 to 2009 contained at least one exceedance of Pennsylvania's Water Quality Criteria for Fish and Aquatic Life. There were 27 exceedances for aluminum, nickel, and zinc, including an aluminum exceedance of 5.3 mg/L (compared to a Criteria Maximum Concentration of .075 mg/L) and a nickel concentration of 30 Ug/L (compared to a Criteria Continuous Concentration of 4.05 Ug/L).

In fact, all of the references in this statement to impacted surface water quality data are related to the past coal refuse disposal and not to any fly ash disposal. As part of the remediation of the coal refuse piles, the company was required to establish up gradient and down gradient surface monitoring points on the adjacent stream. The upgradient (background) data collected prior to the removal of the coal refuse indicated that coal refuse piles were impacting the stream.

4. **EIP's February 24, 2010 report claims:** Demonstrated off-site damage to surface water.

In fact, the groundwater investigation indicates that it is not fly ash which has impacted the adjacent stream, but the coal refuse pile currently under remediation.

5. **EIP's February 24, 2010 report claims:**

> In addition, groundwater monitoring results continue to exceed Primary and Secondary Drinking Water Standards (MCL). These exceedances have been consistently documented since at least 2004.

In fact, all of the groundwater data referenced in the section relates to coal refuse piles that were disposed on site decades ago and do not correlate to flyash disposal. Remediation of these coal refuse piles has occurred to reduce and cease contamination, and data shows that contaminant levels are decreasing.

6. **EIP's February 24, 2010 report claims:**

> Surface water monitoring downstream of the ash sites contained 27 exceedances of Pennsylvania's Water Quality Criteria for Fish and Aquatic Life, with one or more exceedances occurring in 13 of the 16 quarters in downstream surface water data from 2005 to 2009.

In fact, all of the surface data referenced in this section relates to the refuse piles that are undergoing remediation, not fly ash.

7. **EIP's February 24, 2010 report claims:**

> Coal combustion waste including more recently (after 2004), CCW from fluidized bed combustion of waste coal which is co-disposed with coal refuse.

In fact, alkaline ash has been used to help to neutralize the effect of the acidic refuse disposed of on site years ago. There has been no traditional disposal of fly ash at Seward since Ash Sites No. 1 and No. 2 were closed.

D. Allegheny Energy – Hatfield's Ferry Power Station

1. **EIP's August 26, 2010 report, p. 174 claims:**

> An unlined CCW landfill located off-property from the Hatfield's Ferry Power Station has contaminated groundwater, polluted surface water, and damaged aquatic ecosystems since at least 2001.

In fact, a comprehensive groundwater and surface water assessment and investigation at the disposal site concluded that the past unreclaimed surface mining and the resultant acid mine drainage (and not ash disposal) within the watershed of the landfill had negatively impacted the aquifers beneath the landfill. The EIP report has not presented any supporting data that coal combustion waste has contaminated groundwater, surface water, or damaged aquatic life.

2. **EIP's August 26, 2010 report, p. 175 claims:**

> In addition, a stream habitat and macroinvertebrate survey of four streams emanating from the landfill property shows that two streams closest to the CCW landfill are impaired by CCW leachate from the landfill.

In fact, the low benthic counts were a result of the stream size, bank erosion, and habitat disturbance and not activities related to the landfill.

3. **EIP's August 26, 2010 report, p. 179 claims:**

> Samples collected from well MW-213A, downgradient of coal ash in the Hartley Mine and more than a thousand yards south of Phases 1 and 2 of the landfill and from MW-217A, and MW-218A, more than 500 yards east of waste placement areas in the landfill, show that arsenic concentrations well above the MCL have been measured beyond the site in downgradient groundwater since at least 2005.

In fact, only a single sample from MW-213A shows elevated levels of arsenic, rather than "samples" as EIP claims. Further, MW-213A is an upgradient well for the disposal area, and therefore would show background contaminants rather than any impact from the disposal area. This is consistent with an extensive groundwater assessment indicating that abandoned surface mining in the area has had an unrelated negative impact on groundwater. Finally, MW-217A and MW-218A were installed to monitor downgradient conditions from the leachate impoundment. These wells are screened in mine spoil, and document contaminants resulting from the nearby abandoned strip mine.

4. **Damage Case Claim – p. 175**

> The wetland treatment system was designed to remove or reduce concentrations of iron, aluminum, manganese, and total suspended solids and to control pH - but was not specifically designed to treat other problematic constituents in CCW leachate.

In fact, the passive wetland treatment system at the disposal site is a state-of-the-art use of passive technologies to treat the discharge of the active landfill. The system was designed to remove iron, aluminum and manganese from landfill leachate. The control of pH and treatment of many other parameters occurs in passive wetland treatment technology.

5. **EIP's August 26, 2010 report, p. 176, claims:**

> Finally there are increasing concentrations of calcium and magnesium which are highly soluble parameters frequently found in coal ashes.

In fact, calcium and magnesium are commonly found in abundance in the soils and groundwater of western Pennsylvania and are not solely related with coal combustion waste.

6. **EIP's August 26, 2010 report, pp. 176-177 claims:**

> Of the four streams, the stream sections with the healthiest benthic macroinvertebrate community structure were the downstream portions of the unnamed tributary to the southwest (discharges to Little Whitely Creek north of the unnamed tributary that the landfill flows into) and the

> unnamed tributary to the southeast (discharges to the Monongahela River)
> - both being the farthest from the landfill.

In fact, while the report implies that the worst conditions are due to the proximity of the streams to the landfill, the low benthic community counts were actually due to the small stream size, substrate conditions, and available habitat.

7. **EIP's August 26, 2010 report, p. 175 claims:**

> The PADEP in-stream Human Health Water Quality Criteria for thallium is 0.00024 mg/L, which is an order of magnitude less than the 0.0021 mg/L monthly average and 0.0042 mg/L daily maximum concentrations allowed in the NPDES permit.

In fact, the applicable regulatory standard for waters from which there is no human consumption, per regulation, is 0.013 mg/l (on a continuous basis) and 0.065 mg/l (maximum). See 25 Pa. Code Section 93.8c, Table 5. EIP's reference to human health based Water Quality is misleading.

8. **EIP's August 26, 2010 report, p. 176 claims:**

> In addition, all three years of boron measurements in this stream also exceeded the U.S. Environmental Protection Agency's (USEPA) Child Health Advisory for boron (3 mg/L), with the 2006 and 2008 concentrations more than twice as high as this Advisory and also exceeding the Life-time Advisory for boron of 6 mg/L.

In fact, the unnamed tributary to Little Whitely Creek is not a source of public drinking water, so comparisons to EPA Health Advisories is misleading and inappropriate.

9. **EIP's August 26, 2010 report, p. 177, claims:**

> For reference, if PA WQC were compared to the leachate sump water (to which PA WQC would not apply), concentrations of boron would be exceeding the CCC by at least a factor of 10 in every single reading in the table below.

In fact, the report first states that comparisons to Water Quality Criteria are not appropriate, and then proceeds to make this comparison.

E. PPL Martins Creek Power Plant

1. EIP's report, "EPA's Blind Spot: Hexavalent Chromium in Coal Ash," p. 7, item 21 claims that PPL Martins Creek as exceeding California's drinking water goal for hexavalent chromium by 5000 times.

In fact, analytical data showed no valid data to indicate total chromium exceeded a standard. Therefore stating hexavalent chromium may exceed a presumed standard or is present is without basis. The EIP used invalid data to report chromium in groundwater exceeding a drinking water standard and further assumed all chromium tested is comprised of 100% hexavalent chromium with no basis for that assumption.

2. EIP's February 1, 2011 report, p. 7, item 21 claims that an unlined pond at PPL Martins Creek has groundwater contamination above 100 ug/l.

In fact, the data does not support the claim of chromium present in groundwater at the site. Ninety five percent of the groundwater monitoring results for this disposal impoundment are reported non-detect for total or dissolved chromium.

F. Portland Generating Station's Bangor Quarry Ash Disposal Site, RRI Energy, Inc., Northampton County

1. EIP's February 24, 2010 report claims:

> Surface water discharges from the landfill are sending concentrations of boron, cadmium, hexavalent chromium, and selenium into Brushy Meadow Creek that are notably higher than Pennsylvania's Water Quality Criteria Continuous Concentration for Fish and Aquatic Life (CCC).

In fact, the surface water data indicates the concentration of these parameters is already found to be elevated in the upgradient surface water samples located above the disposal site's boundary. The higher concentrations for the listed parameters at the upgradient surface water location suggest that the water is impacted upstream and not impacted by discharges at the Bangor Ash site.

2. EIP's February 24, 2010 report claims:

> The ash that has been dumped at this landfill has sometimes been more toxic than regulations allow. Trona test ash was disposed of on-site despite having failed two of nine leachability tests for arsenic.
>
> A letter from RRI to PADEP in 2007 reports that of nine composite samples of Trona ash (a test ash) disposed of at this site, two samples exhibited high levels of leachable arsenic in excess of Pennsylvania Class II landfill limits. Specifically, the Class II landfill limit for leachable

> arsenic is 0.5 mg/L; however leach test results measured arsenic at 1.61 mg/L (more than three times the limit) and 2.02 mg/L (more than four times the limit).

In fact, the maximum concentration of a contaminant, based on chemical analysis for its leachate for a Class II Residual Waste landfill is 50 times the waste classification standard for that contaminant (§ 288.523(a)(1)). For Arsenic, the Class II limit would be 2.5 mg/L, not the 0.5 mg/L that EIP claims. None of the Trona ash samples exceeded this limit.

3. **EIP's February 24, 2010 report claims:**

> A GAI Consultants 2006 Annual Evaluation Summary of this site, describing results collected from downgradient monitoring wells during 2006, states: Analytical results for dissolved iron, dissolved manganese, pH (field), pH (lab), sulfate, and total dissolved solids exceed the USEPA [MCLs]. Furthermore, results from GAI Consultants' trend analysis of data collected after July 1, 1995 and prior to January 1, 2007 state: Upward trends for dissolved arsenic, dissolved boron, and dissolved potassium and downward trends for pH (field) and pH (lab) are unique to downgradient monitoring wells and may be the result of actions occurring at Bangor.

In fact, the 2006 report EIP relies upon to show an upward trend for pH and sodium goes on to conclude that the upward trend is due to seasonal variation and is not attributed to the ash disposal at the facility. The report also states that any upward trend in sulfate levels is shown in wells upgradient to the facility, and is not being caused by the ash disposal facility.

4. **EIPs February 24, 2010 report claims:**

> Unpermitted discharges of boron, cadmium, hexavalent chromium, and selenium into Brushy Meadow Creek from Outfall 001 exceeded the Pennsylvania water quality standard for the protection of aquatic life from pollutant concentrations that are chronically toxic (Criteria Continuous Concentration or CCC) in samples analyzed in October 2006. … Unpermitted discharges of boron, cadmium, and selenium into Brushy Meadow Creek from Outfall 002 also exceeded the PA CCC in samples analyzed in November 2006.

In fact, the data shows that these parameters are already elevated in upgradient surface water samples, which shows that the disposal facility is not the cause of these contaminants. Surface discharges are regulated through a NPDES permit, and Reliant has not been in violation of their permit.

5. **EIP's February 24, 2010 report claims:**

> Exceedances of PA CCC were documented in unpermitted discharges to surface waters in 2006. No regulatory actions required.

In fact, the exceedances in the surface water are also present in the upgradient surface water sampling. The above referenced exceedances are for Secondary Drinking Water Regulations (SWDR) that set non-mandatory water quality standards for 15 contaminants. These contaminants are not considered to present a risk to human health at the SMCL, and exceedances do not require regulatory action.

6. **EIP's February 24, 2010 report claims:**

> There are least two public water supply wells approximately ¾-mile away from the site; Hartzell's Auction Inc. serves three families and Meadowbrook Mobile Home Park serves approximately 98 individuals.

In fact, there are three Public Water Supply Wells (PWS) that are less than a mile from the Ash Disposal Facility. However, all three wells are upgradient from the Ash Disposal Area and not affected by the ash disposal site. The well at Hartzell's Auction (ID # 3480835) is not a public water supply. The two other PWS wells at Meadow Brook Mobile Home Park (ID # 3480008) are also upgradient.

G. Phillips Power Plant Landfill, Duquesne Light Co.

1. **EIP's February 24, 2010 report claims:**

> A groundwater assessment was conducted to determine whether the landfill was adversely affecting groundwater. As a result of the groundwater assessment, PADEP required groundwater monitoring to continue after final cover and grading of the landfill.

In fact, the Residual Waste Regulations required groundwater monitoring for all permitted disposal areas regardless of water quality.

2. **EIP's February 24, 2010 report claims:**

> As part of the closure plan for the Phillips Ash Landfill, PADEP required quarterly groundwater monitoring due to evidence of groundwater degradation.

In fact, regardless of the groundwater quality, the 1992 Residual Waste Regulations required quarterly monitoring.

H. Fern Valley Landfill, Orion Power Holdings, Inc.

1. EIP's February 24, 2010 report claims:

> A review of the Fern Valley Disposal Site maps (DPL, 1996) and the recent satellite photographs of the final fill area, reinforces the concern that none of the designated "upgradient" monitoring wells (MW12, MW15 and MW5A) can be reliably considered upgradient.

In fact, in comparing the water elevations in the seven wells, the upgradient wells have higher water level elevations than the downgradient wells. The difference in elevation between the upgradient wells and the downgradient wells is about 100 feet for MW-12 and MW-5A and about 200 feet for MW-15. This data supports the conclusion that the upgradient wells are in fact in upgradient positions.

Upgradient Wells 1st Quarter 2010 Static Water Elevations

MW-5A - 857'
MW-15 - 955'
MW-12 - 856'

Downgradient Wells 1st Quarter 2010 Static Water Elevations

MW-6 - 745'
MW-7 - 734'
MW-20 - 751'
MW-21 - 754'

Further, based on the original topography of the valley, the upgradient wells are in upgradient positions and the downgradient wells are in downgradient positions. Based upon the above, the upgradient wells at the Fern Valley Landfill are, in fact, upgradient of the site.

II. EIP'S GROUNDWATER STUDIES, WHICH IGNORE GROUNDWATER DIRECTION, ARE POOR SCIENCE.

A valid scientific study must consider the direction that groundwater is flowing in the subsurface. In this way, researchers can tell if a sample is showing contaminants originating from a site *or* moving towards it from other locations. Contaminants in groundwater moving towards an impoundment are either naturally occurring or from other sources.

Yet, EIP's reports often simply assume that all sampling results must be caused by coal combustion waste, disregarding facts such as the direction of groundwater flow and aquifer characteristics. These assumptions show either bias or a lack of scientific knowledge.

Examples of these deficiencies include:

A. Bruce Mansfield Power Plant's Little Blue Run Surface Impoundment

1. EIP's February 24, 2010 report, p. 161, claims:

> Discharges to groundwater and surface water from the 1,300-acre 'Little Blue' surface impoundment have exceeded MCLs for arsenic and other parameters in multiple off-site residential drinking wells ....

In fact, there have been no confirmed concentrations of these parameters in off-site residential drinking water wells located near the impoundment in excess of an MCL. Many of the wells are hydrogeologically separate from the impoundment and/or may be impacted by other sources, including naturally occurring sources such as coal seams and brines, and other man-made sources such as past mining or oil and gas operations. Surface water discharges are monitored and reported under the NPDES permit program and the facility is in compliance with those permits.

2. EIP's February 24, 2010 report, p. 161-2 claims there is:

> Demonstrated [arsenic] damage to off-site groundwater and off-site surface water (in domestic wells and in Marks Run and other surface waters)

In fact, EIP fails to identify the data is it relying on, making verification impossible. However, based on analysis of private water supplies around the impoundment collected by DEP over the last six years, arsenic has not been detected. (See Table 1.)

Table 1 – DEP Private Well Sampling Data

Name/Sample No.	Location	Sample Date	Appr. Dist. from Impoundment	Arsenic Data
Carpenter, M 707 833	Cullen Dr, Georgetown, PA	08/17/04 07/30/09	1600'	Non-detect (ND) ND
Cooper, C 753	Rt 30, Georgetown, PA	08/16/06	1.5 miles	ND
Cooper, J 751	Rt 30, Georgetown, PA	08/16/06	1.5 miles	ND
Cooper, P 750	Rt 30, Georgetown, PA	08/16/06	1.5 miles	ND
Cooper, T 841	Lawrenceville, WV	09/03/10	2000'	ND
Dear 708	Cullen Dr, Georgetown, PA	08/17/04	500'	ND
Flemming 717	Red Dog Rd, Georgetown, PA	09/02/04	2800'	ND
Halisy 711	Cullen Dr, Georgetown, PA	08/24/04 10/18/04	700'	ND ND
Kavals, M 733	Cullen Dr, Georgetown, PA	09/19/05	1200'	ND
Kolmer 700	Cullen Dr, Georgetown, PA	08/02/04	1500'	ND
McCoughlin 843	Lawrenceville, WV	09/03/10	1500'	ND
McHaffery 712 722	Cullen Dr, Georgetown, PA	08/24/04 10/18/04	500'	ND ND
Milliron 706	Cullen Dr, Georgetown, PA	08/17/04	700'	ND
Pollicastro, A 727	Georgetown Rd, Georgetown, PA	04/04/05	3100'	ND
Pollicastro, C 728	Georgetown Rd, Georgetown, PA	04/04/05	3000'	ND
Ponnis 734	Little Blue Run Rd, Georgetown, PA	09/22/05	3500'	ND
Reed 820	Crummit Ln, WV	05/15/09	2000'	ND
Richards 701	Cullen Dr, Georgetown, PA	08/02/04	2000'	ND
Sharp 752	Rt 30, Georgetown, PA	08/16/06	1.5 miles	ND
Skavinski 729	Lawrenceville, WV	04/11/05	400'	ND
Smith 735	Little Blue Run Rd, Georgetown, PA	09/22/05	3500'	ND
Stipec 730 736	Crummit Ln, WV	05/27/05 11/08/05	2800'	ND ND
Stout 718	Cullen Dr, Georgetown, PA	09/09/04	1000'	ND
Tudor 705	Red Dog Rd, Georgetown, PA	08/17/04	2500'	ND
Walters 749	Rt 30, Georgetown, PA	08/18/06	1.5 miles	ND
Wilkenson 710	Cullen Dr,, Georgetown, PA	08/24/04	500'	ND
Young 709	Cullen Dr, Georgetown, PA	08/17/04	500'	ND

3. **EIP's February 24, 2010 report, p. 166, claims:**

> On February 16, 2010, PADEP sent a letter to FirstEnergy regarding high arsenic levels at 10 groundwater and surface water monitoring points, stating, "According to the data, elevated levels of Arsenic were detected in Monitoring Wells MW-13A, MW-15B, MW-16C, MW-17A, MW-20B, MW-23B, SW-5, SW-7, S-17, and S-31."

In fact, the referenced sampling data shows that elevated arsenic concentrations showing impacts from the impoundment were comparable to concentrations in background monitoring wells. More recently, arsenic levels have continued to drop.

4. **EIP's February 24, 2010 report, p. 167, claims:**

> In 1994, FirstEnergy was required to provide a water supply to a private residence, and a PADEP letter to Penn Power admits that the impoundment contaminated and made unusable a private well (PADEP, 1994):
>
>> This result indicates a continuing upward trend in levels of sodium, chloride and sulfate which has persisted since 1991. . . . This trend represents a measurable increase in the concentration of these contaminants and therefore is defined as groundwater degradation. Since the groundwater gradient is probably from the impoundment supernatant at elevation of 1050' toward the [XXXX] well water elevation at approximately 985', it is very probable that the impoundment is responsible for this adverse effect on the water supply. This letter is notice from the Department that the operator, Pennsylvania Power Company, is responsible for adversely affecting the water supply of Mr. [XXXX].

In fact, later data demonstrated that this preliminary conclusion was simply wrong. Concentrations of sodium, chloride and sulfate in the water well referenced in the EIP report showed an increase between November 1993 and March 1994, because FirstEnergy's consultant used improper sampling techniques. Later laboratory analyses showed the water quality in this well improved and confirmed that the well had exhibited increases in contaminants after the homeowner used household bleach to treat his well for bacterial contamination late in 1993.

B. Allegheny Energy – Hatfield's Ferry Power Station

1. **EIP's August 26, 2010 report, p. 176, claims:**

> A 2006 habitat and stream survey shows that CCW leachate from Phases 1 and 2 of the landfill have degraded the two streams closest to the landfill.

In fact, the survey (conducted in 2001 not 2006) makes clear that the suboptimal stream habitat scores were due to such things as insufficient desirable in-stream cover, moderately eroded stream banks and less than optimal frequency of pool area - none of which are due to the fly ash landfill.

2. EIP's August 26, 2010 report, p. 178, claims:

> MW-206A and MW-207A are situated where groundwater flows radially to the west, north, and east from the crest of the landfill property, in addition to being downgradient from a portion of the strip mine where ash was placed. Neither the easterly nor westerly groundwater flow component is completely monitored.

In fact, sampling wells MW 206A and MW-207A have been abandoned and replaced with wells MW-212A, MW-213A, and MW-215A. All groundwater flow regimens are properly monitored in accordance with the regulations.

3. EIP's August 26, 2010 report, p. 179, claims:

> The concentrations of CCW parameters in MW-217A and MW-218A and their locations show an easterly groundwater flow direction beyond the landfill, a flow direction that was not monitored until 2005. This easterly flow is still not monitored for the newest phase of the landfill (Phase 3). Further, there are no wells downgradient from MW-217A and MW-218A defining the horizontal extent of the contamination towards the Monongahela River from Phases 1 and 2.

In fact, the original disposal area for Hatfield was constructed on an abandoned, unreclaimed strip mine from the pre-regulation era. A comprehensive groundwater and surface water assessment and investigation at the disposal site concluded that the past unreclaimed surface mining and the resultant acid mine drainage (not ash disposal) within the watershed of the landfill had negatively impacted the groundwater beneath the landfill.

C. Fern Valley Landfill, Orion Power Holdings, Inc.

1. EIP's February 24, 2010 report claims:

> The Fern Valley CCW Landfill, on the west side of the Monongahela River across from Elizabeth PA, received coal ash from the Elrama Power Plant from 1989 to 2003. Arsenic levels 2.8 times higher than primary MCL (0.010 mg/L) were first noted in groundwater monitoring in 1995, and peaked in 2001 when the arsenic concentration was 36 times the primary MCL in one downgradient well and 29 times the primary MCL in another. Concentrations of boron, chloride, sulfate and total dissolved

> solids (TDS) in monitoring wells regularly exceeded health-based levels or secondary MCLs.

In fact, the Fern Valley landfill was constructed down gradient of an abandoned surface coal mine and adjacent to an old unlined municipal waste landfill (Clairton Landfill). In 1995 a groundwater assessment was conducted and the Department concluded that both of these past activities have had a negative impact on groundwater and surface water upgradient and sidegradient of the landfill, as evidenced by background groundwater monitoring.

2. **EIP's February 24, 2010 report claims:**

> Arsenic has been a troublesome contaminant in the groundwater at the landfill as have boron, sulfate, chloride, and TDS. (Data from GAI, 2002 and GAI 2002-2007)
> Total arsenic was identified in downgradient MW-20 in June 1995 at 0.028 mg/L, 2.8 times the primary MCL.

In fact, sporadic low levels of arsenic have been identified in upgradient wells, and this has been shown to have come from acid mine drainage upgradient of the landfill. In addition, with over 10 years of groundwater data collected, this is the only data point presented with an elevated level of arsenic for MW-20. No statistical analysis or trends have been demonstrated.

3. **EIP's February 24, 2010 report claims:**

> The degradation of surface water quality downstream from the CCW landfill has had an adverse impact on aquatic organisms. A benthic study commissioned by the operator in 1995 found that for two key environmental indexes, mean species diversity and equitability, the downstream location (SW-2) was degraded relative to the upstream sampling location near SW-1 (Norris, 2002).

In fact, an abandoned municipal landfill discharges untreated leachate upstream of surface sampling point SW-2, and is the likely cause of this finding.

D. Portland Generating Station's Bangor Quarry Ash Disposal Site, RRI Energy, Inc., Northampton County

1. **EIP's February 24, 2010 report claims:**

> Surface water discharges from the landfill are sending concentrations of boron, cadmium, hexavalent chromium, and selenium into Brushy Meadow Creek that are notably higher than Pennsylvania's Water Quality Criteria Continuous Concentration for Fish and Aquatic Life (CCC).

In fact, the surface water data indicates the concentration of these parameters is already found to be elevated in the upgradient surface water samples located above the disposal site's boundary. The higher concentrations for the listed parameters at the upgradient surface water location suggest that the water is impacted upstream and not impacted by discharges at the Bangor Ash site.

2. EIP's February 24, 2010 report claims:

> The ash that has been dumped at this landfill has sometimes been more toxic than regulations allow. Trona test ash was disposed of on-site despite having failed two of nine leachability tests for arsenic.
>
> A letter from RRI to PADEP in 2007 reports that of nine composite samples of Trona ash (a test ash) disposed of at this site, two samples exhibited high levels of leachable arsenic in excess of Pennsylvania Class II landfill limits. Specifically, the Class II landfill limit for leachable arsenic is 0.5 mg/L; however leach test results measured arsenic at 1.61 mg/L (more than three times the limit) and 2.02 mg/L (more than four times the limit).

In fact, the maximum concentration of a contaminant, based on chemical analysis for its leachate for a Class II Residual Waste landfill is 50 times the waste classification standard for that contaminant (§ 288.523(a)(1)). For Arsenic, the Class II limit would be 2.5 mg/L, not the 0.5 mg/L that EIP claims. None of the Trona ash samples exceeded this limit.

3. EIP's February 24, 2010 report claims:

> A GAI Consultants 2006 Annual Evaluation Summary of this site, describing results collected from downgradient monitoring wells during 2006, states: Analytical results for dissolved iron, dissolved manganese, pH (field), pH (lab), sulfate, and total dissolved solids exceed the USEPA [MCLs]. Furthermore, results from GAI Consultants' trend analysis of data collected after July 1, 1995 and prior to January 1, 2007 state: Upward trends for dissolved arsenic, dissolved boron, and dissolved potassium and downward trends for pH (field) and pH (lab) are unique to downgradient monitoring wells and may be the result of actions occurring at Bangor.

In fact, the 2006 report EIP relies upon to show an upward trend for pH and sodium goes on to conclude that the upward trend is due to seasonal variation and not attributed to the ash disposal at the facility. The report also states that any upward trend in sulfate levels is shown in wells upgradient to the facility, and is not being caused by the ash disposal facility.

4. **EIP's February 24, 2010 report claims:**

> Unpermitted discharges of boron, cadmium, hexavalent chromium, and selenium into Brushy Meadow Creek from Outfall 001 exceeded the Pennsylvania water quality standard for the protection of aquatic life from pollutant concentrations that are chronically toxic (Criteria Continuous Concentration or CCC) in samples analyzed in October 2006. ... Unpermitted discharges of boron, cadmium, and selenium into Brushy Meadow Creek from Outfall 002 also exceeded the PA CCC in samples analyzed in November 2006.

In fact, the data shows that these parameters are already elevated in upgradient surface water samples, which shows that the disposal facility is not the cause of these contaminants. Surface discharges are regulated through a NPDES permit, and Reliant has not been in violation of their permit.

5. **EIP's February 24, 2010 report claims:**

> Exceedances of PA MCLs in groundwater on-site have occurred in 2001, 2002, 2005, and 2006, with an upward trend detected between 1995 and 2006. Exceedances of PA CCC were documented in unpermitted discharges to surface waters in 2006. No regulatory actions required.

In fact, the exceedances in the surface water are also present in the upgradient surface water sampling. The above referenced exceedances are for Secondary Drinking Water Regulations (SWDR) that set non-mandatory water quality standards for 15 contaminants. These contaminants are not considered to present a risk to human health at the SMCL, and exceedances do not require regulatory action.

6. **EIP's February 24, 2010 report claims:**

> There are least two public water supply wells approximately ¾-mile away from the site; Hartzell's Auction Inc. serves three families and Meadowbrook Mobile Home Park serves approximately 98 individuals.

In fact, there are 3 Public Water Supply Wells (PWS) that are less than a mile from the Ash Disposal Facility. However, all 3 wells are upgradient from the Ash Disposal Area and not affected by the ash disposal site.

III. EIP'S DATA IS NOT CREDIBLE BECAUSE THE RESULTS CANNOT BE REPRODUCED BY OTHER SCIENTISTS.

To be valid, scientific research data must be "reproducible," that is, if one runs a test a second or third time, similar results will be obtained.

This is a critical safeguard to ensure that a single test was not performed incorrectly, or skewed by outside influences.

But in many of its claims, EIP draws conclusions from a single sample, which was not reproduced with confirmatory sampling and which in many cases was inconsistent with prior and later sampling.
EIP's claims therefore often lack credibility, because they can't be confirmed or were actually refuted by other data.

Examples of these deficiencies include:

A. Bruce Mansfield Power Plant's Little Blue Run Surface Impoundment

1. EIP's February 24, 2010 report, p. 162 ("For example") claims:

> Arsenic has been measured in at least two off-site residential drinking wells above the MCL of 0.01 mg/L, including a reading of 0.0146 mg/L in one family's well in 2008, and a reading of 0.021 mg/L at another family's well.

In fact, although one sample collected from a private water supply well in late 2008 did contain arsenic at a concentration of 0.013 mg/L (not 0.0146 mg/L); the homeowner was aware that his well water was muddy. Another sample from the water well early in 2009 and the analytical results concentrations of metals were much lower compared to the 2008 sample. Total arsenic was reported at 0.0025 mg/L and dissolved arsenic at <0.0025 mg/L - well below the MCL. The DEP also collected a sample from this well two months later and confirmed these results. Both total and dissolved arsenic were less than <0.003 mg/L the detection limit. In addition, the location and elevation of this water well clearly indicates the well is located up gradient (background) from the impoundment.

Further, while arsenic was reported at a concentration of 0.021 mg/L in a sample collected from another private water well in 1993, six later samples from this well were analyzed for arsenic. The greatest concentration found was 0.005 mg/L, and most of the samples were non-detect. In addition, this well did not contain other concentrations of constituents that would suggest any impacts from the impoundment. Arsenic is found in soils of Western Pennsylvania; its presence does not confirm impacts from the impoundment.

2. **EIP's February 24, 2010 report, p. 166 ("On Site") claims:**

> On-site surface water showed an exceedance of the CCC for selenium at SW-3 (a seep in Pennsylvania just below the earthen dam.)

In fact, EIP misidentifies sampling point SW-3 as a seep below the dam. SW-3 is a sampling point at the stilling basin and is a permitted discharge from the impoundment. Comparing this sampling point to WQC is not appropriate.

3. **EIP's February 24, 2010 report, p. 162 claims:**

> In on-site groundwater that flows off-site, arsenic exceeded the 0.010 mg/L at least 24 times in 14 wells in 2006, 2009, and 2010, including concentrations of 0.030, 0.033, and 0.036 mg/L in three different wells. Fluoride, lead, and turbidity MCLs were also exceeded, as well as SMCLs for several other pollutants. On-site groundwater monitoring wells also had exceedances of SMCLs for chloride, iron, manganese sulfate, and turbidity.

In fact, FirstEnergy began regularly analyzing water samples for arsenic in 2006. Although arsenic was found in some samples, many of these detections were not replicated in subsequent samples from the same wells.

FirstEnergy has implemented studies to determine the reason(s) for the elevated arsenic in these wells and, if necessary, determine what steps may be taken to address it. Arsenic levels in all drinking water wells sampled by the Department have been "non-detect" for arsenic.

The other parameters that EIP indicates exceed MCLs and SMCLs occur naturally in the environment. EIP made no attempt to assess if a monitoring well contains water representative of background water quality, shows brine impacts from historic oil and gas exploration and production in the area, or contains concentrations of parameters associated with coal seams.

B. Allegheny Energy – Mitchell Power Station

1. **EIP's February 24, 2010 report claims:**

> Analyses of quarterly monitoring data for samples collected from the two monitoring wells downgradient of Ash Lagoon No. 2 in 2007 (GW-4 and GW-5) found the following:
>
> - Boron levels were more than twice the EPA's Child Health Advisory of 3.0 mg/l and much higher than boron levels in upgradient wells or at surface monitoring points.

- Arsenic concentrations have been 1 to 2 times the primary MCL of 0.010 mg/l at downgradient wells and exceeded the highest concentrations for arsenic in upgradient points.

- Levels of nickel, molybdenum, and manganese have also been noticeably higher at downgradient than upgradient points."

In fact, monitoring has been ongoing for more than 10 years and no upward trends have been established for these or other contaminants.

C. RRI Energy – Seward Generating Station

1. **EIP's February 24, 2010 report claims:**

The No. 1 Ash Disposal Site was forced to be closed due to pollutants leaching from the ash pile.

In fact, Ash disposal site No. 1 was closed when the power station shut down. The site was capped and monitoring wells were installed.

2. **EIP's February 24, 2010 report claims:**
RRI has discharged pollutants in excess of permit limits for iron, manganese, aluminum, and pH from Outfall 012, on a monthly basis for the past five years. A surface water monitoring point downstream of the site has recorded at least 27 exceedances of Pennsylvania's Water Quality Criteria for Fish and Aquatic Life in the last five years for aluminum, nickel, and zinc. In addition, this downstream point regularly recorded higher concentrations of sulfate, total dissolved solids and many other pollutants than concentrations of these pollutants recorded upstream of the site in this period.

In fact, EIP's information does not reflect any impact from the flyash disposal sites No. 1 and No. 2. EIP has relied on data relating to the remediation activities associated with several old coal refuse piles, not these flyash disposal sites.

3. **EIP's February 24, 2010 report claims:**

Also, pollutants including iron, manganese, pH, and aluminum are being discharged from the "remediated" coal ash and coal refuse pile directly into the Conemaugh River through NPDES permitted Outfall 012 in violation of permit limits.

In fact, EIP's report presents no data to substantiate its claims about Outfall 012. Nor is there a remediated coal ash pile on site.

D. Allegheny Energy – Hatfield's Ferry Power Station

1. EIP's August 26, 2010 report, p. 179, claims:

> None of the new wells were located east or west of Phase 3 in the indicated direction of groundwater flow that mimics the ground surface, according to Allegheny.

In fact, the locations of these monitoring wells were based on a comprehensive analysis of proper upgradient and downgradient monitoring around the new leachate storage impoundment. The data table accompanying this claim lists data for one sample event (December 2009), and no conclusions can be drawn from an isolated sample.

2. EIP's August 26, 2010 report, p. 179 claims:

> Samples collected from well MW-213A, downgradient of coal ash in the Hartley Mine and more than a thousand yards south of Phases 1 and 2 of the landfill and from MW-217A, and MW-218A, more than 500 yards east of waste placement areas in the landfill, show that arsenic concentrations well above the MCL have been measured beyond the site in downgradient groundwater since at least 2005.

In fact, only a single sample from MW-213A shows elevated levels of arsenic, rather than "samples" as EIP claims. Further, MW-213A is an upgradient well for the disposal area, and therefore would show background contaminants rather than any impact from the disposal area. This is consistent with an extensive groundwater assessment indicating that abandoned surface mining in the area has had an unrelated negative impact on groundwater. Monitoring wells MW-217A and MW-218A are for the new leachate storage impoundment, and are screened in mine spoil from past surface mining activities.

E. PPL Martins Creek Power Plant

1. EIP's February 1, 2011 report, p. 7, item 21 claims:

> An unlined pond at PPL Martins Creek has groundwater contamination above 100 ug/l.

In fact, analytical data from 1997 to the present for groundwater monitoring wells at Basin 1 does not indicate groundwater contamination. DEP files include correspondence documenting invalidation of the referenced result. Ninety five percent of the groundwater monitoring results for this disposal impoundment reported non-detect for total or dissolved chromium.

IV. EIP'S RESEARCH IS NOT TRANSPARENT OR VERIFIABLE.

A critical element in valid scientific study is that the source of one's information be disclosed, so that others can verify the data's accuracy.

However, EIP's reports often refer only vaguely to the sources of its data, without identifying the specific locations, dates or sampling source.

EIP's conclusions are therefore not credible, because its claims are impossible to verify.

Examples of these deficiencies include:

A. Bruce Mansfield Power Plant's Little Blue Run Surface Impoundment

1. EIP's February 24, 2010 report, p.161 ("Summary") claims:

> Discharges to groundwater and surface water from the 1,300-acre "Little Blue" surface impoundment have exceeded MCLs for arsenic and other parameters in multiple off-site residential drinking wells (prompting several property buyouts by FirstEnergy), exceeded Pennsylvania Water Quality Criteria (PA WQC), including the Criteria Continuous Concentration (CCC) and Criteria Maximum Concentration (CMC), in Mark's Run and other off-site surface water sources, and pervasively exceeded federal Maximum Contaminant Levels (MCLs) at many on-site groundwater monitoring wells.

In fact, there have been no confirmed concentrations in off-site residential drinking water wells located near the impoundment in excess of an MCL. Although EIP concludes that any private water well sampled by FirstEnergy or the DEP is impacted by the impoundment, this conclusion ignores the facts that many of these wells are hydrogeologically separate from the impoundment and/or may be impacted by other sources, including naturally occurring sources such as coal seams and brines, and other man-made sources such as past mining or oil and gas operations. Third, the Department has never found any drinking water wells to be contaminated by MCL's (primary drinking water contaminants). Finally, surface water discharges are monitored and reported under the NPDES permit program and the facility is in compliance with those permits.

2. EIP's February 24, 2010 report, p. 162, claims:

> MCLs for cadmium, barium, fluoride, lead, and turbidity were also exceeded in off-site residential drinking wells, as were Secondary MCLs (SMCLs) for aluminum, chloride, iron, manganese, pH, sulfate, and total dissolved solids (TDS).

In fact, EIP's report does not cite specific names, locations or sample dates for the alleged "off-site" residential drinking water well contamination. Further, the primary constituents of lead, cadmium and barium are only found in trace amounts in the waste and could not be producing high concentrations in the groundwater.

3. **EIP's February 24, 2010 report, p. 162 ("Off-Site Surface water") refers to "Chart 1" and claims:**

> Off-site surface water contamination includes exceedances of both continuous/chronic (CCC) and maximum acute (CMC) limits set forth in Pennsylvania Water Qualify Criteria (WQC).

In fact, none of the claims are substantiated. Specific dates and locations are not listed in the EIP report. The report's "Chart 1" is filled with deficiencies which make verification impossible:

a. For every parameter listed in the "Contaminant" column that corresponds to a groundwater monitoring or drinking well, the specific well number(s) or location(s) is not listed. There is also no reference to whether the well(s) is hydrologically upgradient or downgradient of the facility. The "Exceedances" numbers cannot be correlated to a specific monitoring point, nor is the specific data provided.

b. In the "Medium" column, groundwater monitoring wells and drinking wells are undifferentiated, and the "Highest Exceedance Number" is not assigned to one or the other, making it ambiguous and appearing that it is attributed to both a drinking water well and a monitoring well.

c. This table also fails to reference sampling numbers, nor does it have a compendium of data to verify the summary.

4. **EIP's February 24, 2010 report, p. 163, claims:**

> Cadmium, thallium, selenium, and boron also exceeded WQC in off-site creeks, springs, and seeps.

In fact, no specific analytical data related to alleged exceedances of cadmium, thallium, selenium, and boron is provided for any of the referenced water sources. Therefore no verification can be conducted.

5. **EIP's February 24, 2010 report, p. 165, claims:**

> On-site groundwater moving "off-site" - on-site groundwater contamination includes extensive arsenic contamination, with at least 24 MCL exceedances in at least 14 different wells that were more than 150 feet away from the closest part of Little Blue. All of these samples were

> taken between 2006 and 2010, after FirstEnergy's expansion of Little Blue. See Chart 2.

In fact, EIP's chart contains no specific verifiable information (such as specific well locations and sampling dates). The Department's sampling of 28 residential wells over the past six years from around the impoundment show no MCL exceedences of arsenic.

6. **EIP's February 24, 2010 report, p. 165, claims:**

> In 1996, lead exceeded the Federal Action Level of 0.015 mg/L with readings of 2.69 mg/L (538 times the MCL) and 1.41 mg/L (282 times the MCL). There were also numerous violations of SMCLs for turbidity, chloride, iron, manganese, and sulfate, and pH was cited for showing an increasing trend at one well in 2003.

In fact, EIP's report contains no identification of the wells sampled for lead exceedances, or their physical location in reference to the impoundment. Therefore, it is impossible to make conclusions regarding hydrologic connection to the impoundment. Lead is not present in any appreciable amount in the waste within the impoundment and therefore elevated lead in an off-site well is likely from another source, such as the home's plumbing or soil.

7. **EIP's February 24, 2010 report, p. 166 ("At Risk Population") claims:**

> At least 22 private wells have already been contaminated with CCW pollutants above the primary or secondary MCLs, including the township building's well.

In fact, this statement is simply irresponsible. There are no names, dates, specific locations, or specific parameters for the 22 private water supplies alleged to be contaminated by the impoundment in the report, except an obscure reference to a township building's well. The Department has no data supporting claims that any private wells have been contaminated. However, the Department did sample the Greene Township well on October 10, 1993. The well is not hydrologically connected to Little Blue Run and no parameters associated with the impoundment were detected at elevated levels.

8. **EIP's February 24, 2010 report, p. 166, claims:**

> Because Greene Township has no public water supplies, every single resident - 2,705 people, according to 2000 census data - is drinking private well water. In addition, there are many affected citizens in West Virginia, although comprehensive well data was unavailable for this region. Water degradation may also be migrating across the Ohio River into Ohio, but the community there is on public water.

In fact, this statement is total speculation by EIP, and there is no data presented in the report to demonstrate that any West Virginia citizens' drinking well supply is contaminated by the impoundment. Recent testing by the Department of several water private water wells on September 3, 2010 in Lawrenceville, WV (Cooper and McCaughlin) indicated non-detect for Primary MCL's (including arsenic).

9. EIP's February 24, 2010 report, p.166 ("Incident and Date") claims:

> The Pennsylvania Department of Environmental Protection (PADEP) has long documented the contamination flowing from the Little Blue surface impoundment. From at least 1989 to the present day, FirstEnergy (and previously, Penn Power) has been exceeding permit limits and both State and federal drinking water and surface water standards due to the irresponsible disposal of CCW in the Little Blue impoundment.

In fact, none of the specific monitoring wells, surface water points, and analytical data, nor dates and times are presented to substantiate this claim. The groundwater monitoring well surface points are sampled on a quarterly basis and are within the permit limits established in the PA Residual Waste regulations. The site is also in compliance with its NPDES discharge permits.

B. Allegheny Energy - Mitchell Power Station

1. EIP's February 24, 2010 report claims:

> However, the investigation found degradation of groundwater downgradient from the two lagoons by multiple parameters. Most significantly, concentrations of arsenic were measured at twice the federal primary MCL and concentrations of boron reached more than twice the EPA Child Health Advisory of 3.0 mg/l.

In fact, nowhere in the Report is there a list of the monitoring well(s) or sample date(s) or analytical data that show arsenic levels were detected at twice the federal primary MCL of 10 ug/l. Further, nowhere in the Report is the supposed monitoring well, date of sampling, or analytical data for the claim that boron reached more than twice the EPA Child Health Advisory of 3.0 mg/l. In fact, the Department's review of the data indicates no upward trends in arsenic or boron levels.

2. EIP's February 24, 2010 report claims:

> Groundwater monitoring data for the year 2007 shows that maximum levels of arsenic and boron are twice as high as the maximum levels found in 1998."

In fact, the data to make this claim is not presented in the Report. Indeed, the Department's review of the historical groundwater data submitted by the company, as required by the permit, shows no upward trends in arsenic or boron levels.

3. **EIP's February 24, 2010 report claims:**

> Demonstrated damage to groundwater moving off-site toward the Monongahela River.

In fact, the Report contains no data which supports EIP's claims.

4. **EIP's February 24, 2010 report claims:**

> Elevated levels of molybdenum and nickel were detected in some downgradient wells.

In fact, there are no monitoring well(s) or sample date(s) or value(s) listed in the Report to substantiate this statement. The Department's tracking of the groundwater data shows that the facility has been and remains in compliance for the referenced parameter.

5. **EIP's February 24, 2010 report claims:**

> Compared to surface water samples of the Monongahela River along the shoreline near the lagoons, twelve parameters were reported at consistently higher concentrations in the groundwater samples; specific conductance, total alkalinity, chemical oxygen demand, ammonia, chloride, sulfate, total dissolved solids, calcium, iron, potassium, manganese, manganese and sodium.

In fact, the groundwater monitoring wells, surface water points and analytical data are not listed to make this claim nor are the sampling periods referenced in the Report. The Department's ongoing review and tracking of the groundwater data concludes that the facility has been and remains in compliance for the referenced parameter.

6. **EIP's February 24, 2010 report claims:**

> Seepage and groundwater flowing through the lagoons. There is a possibility that upgradient monitoring wells for the lagoon receive contaminants from the ash landfill to the west.

In fact, EIP presents no hydrogeologic data to support that "seepage and groundwater" are flowing through the lagoons. There is no data presented in the Report to support the statement that the lagoons receive contaminants from the FGD landfill as well.

C. RRI Energy - Seward Generating Station

1. EIP's February 24, 2010 report claims with regard to the No. 1 Ash Disposal site:

> Recent groundwater monitoring data indicate that gross exceedances of primary and secondary MCLs and higher concentrations of ash constituents at downgradient than upgradient monitoring points continue to occur.

In fact, the only exceedances in the groundwater from around Ash Site No. 1 have been secondary, non-health based parameters. Overall, contaminant levels have shown improvement due to site remediation activities of the coal refuse piles.

D. Hatfield's Ferry Power Station

1. EIP's August 26, 2010 report, p. 174, claims:

> Demonstrated damage to groundwater moving off-site and to off-site surface water and aquatic life (in Little Whitely Creek and tributaries)"

In fact, the report fails to provide documentation or data to demonstrate that the disposal of fly ash at Hatfield is damaging the groundwater, surface water, or aquatic life.

2. EIP's August 26, 2010 report, p. 174, claims:

> Federal groundwater Maximum Contaminant Levels (MCLs) standards for arsenic, aluminum, boron, chromium, manganese, molybdenum, sulfate, and total dissolved solids (TDS) have been exceeded since at least 2001.

In fact, the report does not identify any specific sample times, dates, or monitoring locations to support the claim that CCW has contaminated the groundwater with the referenced parameters.

3. EIP's August 26, 2010 report, p. 174, claims:

> Concentrations of groundwater contaminants mirror those in CCW leachate samples from the landfill collected at the same time. The horizontal extent of contamination has not yet been defined.

In fact, there is no data presented in the report to support this claim, and DEP's review of the groundwater assessment has concluded that there is no impact on the groundwater from the disposal of CCW. The assessment showed that any impact originated from past unreclaimed surface coal mining activities on site.

4. **EIP's August 26, 2010 report, p. 177, claims:**
The data show what parameters and concentrations were likely discharged continually into the unnamed tributary for the beginning of the landfill's operation in 1984 to 2001, before the wetland treatment system was installed.

In fact, there is no data presented in the report to substantiate this claim.

E. Phillips Power Plant Landfill, Duquesne Light Co.

1. **EIP's February 24, 2010 report claims that there is:**

Demonstrated off-site damage to public drinking water supply (ash ponds)

Demonstrated damage to groundwater moving off-site (ash landfill)

In fact, EIP identifies no upward trends over the past ten years for these secondary parameters which only affect the aesthetics of the water, and are not health related drinking water parameters.

2. **EIP's February 24, 2010 report claims:**

A review of quarterly groundwater monitoring data from 2006 and 2007 found the following (EarthJustice, 2008):

- Groundwater discharging from the closed landfill has noticeably higher levels of chloride, sodium, and fluoride, and generally higher manganese, aluminum, sulfates, TDS and Specific Conductance.
- Levels of chloride frequently exceeded secondary drinking water standards (DWS) and high levels of sodium (exceeding 200 mg/L) were usually found in such samples.
- Levels of manganese, aluminum, and fluoride (2.0 mg/L) exceeded secondary DWS in many samples as well as many exceedances of the secondary DWS for TDS of 500 mg.

In fact, EIP fails to disclose any specific parameter value(s), or monitoring well(s) for the years referenced, so the data cannot be verified. Moreover, DEP's review has determined that any sporadic exceedances are all of secondary, non-health related parameters.

F. Fern Valley Landfill, Orion Power Holdings, Inc.

1. EIP's February 24, 2010 report claims:

> Leachate from the CCW landfill has degraded surface quality with high levels of arsenic, boron, chloride, sulfate and TDS compared to upstream surface waters."

In fact, EIP presents no analytical data presented to substantiate this statement. The leachate being treated is discharged under an NPDES permit. The permit limits were established based on the fact that the stream in which the treated leachate flows into discharges to the Monongahela River. The facility is in compliance with its NPDES discharge permit.

2. EIP's February 24, 2010 report claims:

> While concentrations of arsenic have not exceeded water quality standards for aquatic organisms, they have been several times higher than the primary MCL in several measurements, and sulfate and TDS concentrations have commonly exceeded secondary MCLs by two or three times downstream of the landfill."

In fact, the report does not present any specific analytical data for arsenic, sulfate, and TDS.

3. EIP's February 24, 2010 report claims there has been:

> Demonstrated damage to groundwater and surface water moving off-site.

In fact, EIP has presented no data to validate this claim.

4. EIP's February 24, 2010 report claims:

> From around 1997 to 2006 chloride, sulfate and TDS levels generally ranged two to five times higher at SW-2 than at upstream sampling locations (SW-1 and SW-3), and sulfate and TDS concentrations at SW-2 commonly exceeded the secondary MCL by two or three times.

In fact, EIP's report contains no analytical data presented for the years referenced to make these claims.

5. EIP's February 24, 2010 report claims:

> In 2001 and 2002, selenium levels downstream of the landfill were six to ten times the Pennsylvania surface water quality standard for the protection of aquatic life.

In fact, there has been no specific analytical surface data for selenium for the 2 years referenced in EIP's report.

G. PPL Martins Creek Power Plant

1. EIPs February 1, 2011 report, p. 7, item 21 claims that an unlined pond at PPL Martins Creek has groundwater contamination above 100 ug/l.

In fact, the report does not identify any well or monitoring period as evidence of chromium contamination.

IV. SUMMARY

In summary, due to the inaccuracies and flaws contained in the reports identified above, they should not be used to make any findings of damage associated with the studied facilities or provide the foundation for designating Coal Combustion Residuals as a hazardous waste.