## RESPONSIVENESS SUMMARY

This section provides the Environmental Protection Agency's (EPA) responses to all public comments received on the Proposed Plan for the West Lake Landfill site (Site). The Proposed Plan outlined the proposed remedies for both Operable Unit 1 (OU 1) and OU 2. The first public comment period opened on June 14, 2006, and after several extensions was ended on December 29, 2006. During this period, two public meetings were held – the first on June 22, 2006, at the Bridgeton Community Center and the second on September 14, 2006, at the Bridgeton City Hall.

In response to public comment on the levee system and flood plain issues, EPA decided to reopen the public comment period and hold a third public meeting. The comment period was reopened and the public meeting was held on March 27, 2008, at the Bridgeton Community Center to present more information on flood protection issues. In addition, more information was placed in the Administrative Record regarding these issues. The second comment period was closed April 9, 2008.

Transcripts of the proceedings for all three public meetings are part of the Administrative Record, and copies are available at the Bridgton Trails Branch of the St. Louis County Library in Bridgton and at the EPA Region 7 Records Center in Kansas City, Kansas. All written comments received are also part of the Administrative Record.

Pursuant to section 113(k)(2)(B)(iv) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §9613(k)(2)(B)(iv), this section of the Record of Decision (ROD) responds to "each of the significant comments, criticisms, and new data submitted in written or oral presentation" to EPA regarding the Proposed Plan.

EPA wishes to thank all members of the community who took the time to provide comments or otherwise participate in this public process. All comments received have been thoroughly reviewed and considered by EPA in its decision-making process. To minimize redundancy, many recurrent comments are addressed once with a general response. Many of the more rigorous or unique comment letters containing comments not fully addressed by the general responses have been addressed individually. In these cases, copies of the comment letters are attached to assist readers in following the responses. All significant comments or criticisms received appear to be related to the presence of radiologically contaminated materials at the landfill and are therefore considered to be comments on OU 1 which addresses the radiologically contaminated areas. No significant comments were received on the proposal for OU 2.

**General Responses**

**1. Comment:** Many commenters make the general claim that the radiologically contaminated materials disposed in Areas 1 and 2 pose a current public health risk and that it is unsafe to manage these materials in place.

**Response:** Evaluation of the factual information does not support this claim. For toxic materials to pose a health risk to individuals or populations there must be human exposure. Exposure to toxic pollutants may occur through three primary exposure pathways: ingestion, inhalation, and absorption through the skin. In the case of radionuclides, the external (gamma) radiation pathway must also be considered. Under current conditions and current land uses, there are no complete pathways for significant exposure to the general public. The contamination that could pose an exposure concern is in soils and solid waste buried in the landfill. The Site is fenced and access controlled. There is no opportunity for members of the general public to contact materials that are disposed in the landfill, and there are no contaminated drinking water sources. Radon concentrations are elevated only in the immediate vicinity of the buried materials. There is little opportunity for unplanned earth moving activities in Areas 1 and 2 that might release fugitive dust and cause an inhalation concern. There is no opportunity to take up occupancy of Areas 1 and 2 where long-term exposure to radon and external gamma radiation might occur. As long as the Site is used in ways consistent with it being a landfill, there is no public health concern.

Significant exposure to the radionuclides at the Site could occur under potential future circumstances if no remedial action is taken. The baseline risk assessment (BRA) looked at some of these potential scenarios based on reasonably anticipated land use including groundskeepers and other workers using Areas 1 and 2 for storage or other ancillary purpose. Under the assumption that radionuclides remain at or near the ground surface, some exposure to these workers would occur. The assessment uses standard exposure factors and toxicity values to estimate the health risks to these hypothetical workers. Exposure frequencies and routes of exposure vary depending on the nature of the job. Exposure duration, or the time a worker remains in the job, was assumed to be 6.6 years. The calculated risks are expressed in terms of increased lifetime cancer risk to the exposed individual. Under two of the worker scenarios examined, the calculated risks exceed EPA's acceptable risk range defined as $1 \text{ X } 10^{-4}$ or 1 in 10,000.

To put some perspective on it, risks of this magnitude expressed in annual radiation dose to a residential receptor are in the range of 15 millirem (mrem). The average person in the United States receives about 360 mrem of radiation exposure per year, 82 percent of which is from natural sources like cosmic radiation and radon exposure. In other words, the potential radiation doses being addressed by this remedy are a small fraction of the doses people receive from normal background radiation.

The risk calculations are used to put boundaries on the problem. The methods are standardized so that comparisons against the acceptable risk range and across sites can be made. The risk assessment contains many estimates and assumptions. Generally, very

conservative assumptions are used to ensure that risks are not underestimated. Although not every possible exposure scenario was evaluated, the assessment does allow some relative judgments to be made about other hypothetical exposures. A person living as a resident on Area 2 for example would be at higher risk than a groundskeeper due to the increased exposure frequency and duration. The risk to a casual trespasser on-site would not be significant due to the very low frequency and duration of exposure.

The general conclusion is that members of the general public, i.e., people who live and work in the vicinity of the Site, are not at risk under current conditions. There are potential risks to future on-site workers or others who might come in direct contact with the contaminated material. The potential risks are not acute and can be managed by preventing direct contact with the waste materials.

**2. Comment:** Many commenters claim that radiological contaminants at the Site are migrating or will migrate to the groundwater and impact off-site water supply wells and/or water quality in the Missouri River.

**Response:** Groundwater samples obtained from a network of on-site monitoring wells over a period of years have been analyzed for a wide range of chemicals including radionuclides, trace metals, petroleum hydrocarbons, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls. Surface water samples have also been analyzed In the case of radionuclides and metals, both filtered and unfiltered samples were analyzed and evaluated. The results generally show sporadic and isolated detections of a small number of contaminants at relatively low concentration levels. The results are not indicative of on-site contaminant plumes, radial migration, or other forms of contiguous groundwater contamination that might be attributable to the landfill units being investigated. The analytical results were compared to drinking water standards referred to as Maximum Contaminant Levels (MCLs).

Based on frequency of detection and concentration level relative to its MCL, arsenic is the most noteworthy constituent found in the groundwater. However, even in the case of arsenic no evidence of contiguous radial migration was found, i.e., the elevated detections were not supported by nearby monitoring locations. Total arsenic was detected in many of the samples at concentrations ranging from 0.010 to 0.420 milligrams per liter (mg/l). Most results were nondetect or consistent with background.

The groundwater results show no evidence of significant leaching and migration of radionuclides from Areas 1 and 2. The vast majority of the results are consistent with background concentrations. Only four wells exhibited a total radium concentration above the MCL of 5 picocuries per liter (pCi/l). These exceedances ranged from 5.74 pCi/l to 6.33 pCi/l. These slight exceedances are isolated spatially. Two of the four wells with total radium exceedances are located in areas that are not downgradient of either Radiological Area 1 or Radiological Area 2. Uranium isotopes (U-238 and U-234) were generally detected in wells at 5 pCi/l or less. For comparison, the background level is about 2 pCi/l and the drinking water standard is about 20 pCi/l (converted from the

uranium MCL of 30 micrograms per liter [ug/l]). Moreover, perched water from locations in the waste material contained in Areas 1 and 2 was sampled and analyzed and elevated concentrations of radionuclides were not detected. This is the case even though the waste materials have been in place without a landfill cover for over 30 years. In other words, significant leaching and migration of radionuclides to perched water or groundwater have not occurred despite landfilled waste materials having been exposed to worst-case leaching conditions from surface water infiltration over a period of decades.

In conclusion, the results of extensive monitoring over a period of years show that the radiological contaminants have not had significant impacts on shallow groundwater underlying Areas 1 and 2. Without significant impacts to the groundwater underlying and immediately downgradient of the waste material, there can be no significant impact to the alluvial aquifer or the Missouri River. Based on the data, it is reasonable to conclude that no current or potential water supplies have been affected.

Other factors were examined to evaluate the potential for future leaching to groundwater. A dominant factor influencing the transport and environmental fate of contaminants is the sorption-desorption process. Desorption or leaching is the process whereby molecules attached to the solid phase (in this case soil) are mobilized into the dissolved phase in water. Sorption is the process by which the molecules become or remain attached to the solid phase (soil). Partitioning calculations presented in the Remedial Investigation (RI) support the conclusion that even in the absence of an infiltration barrier, e.g., landfill cover, impacts to groundwater over time may be low. The distribution coefficient values for these radionuclides are relatively high which is consistent with the tendency to remain in the soil or sediment phases rather than leaching to the water phase. The calculated radionuclide concentrations in the water phase are consistent with the groundwater sampling data collected during the RI.

Also, according to the applied chemistry that is known from the reprocessing of ore residues, the uranium in barium sulfate is insoluble in water. That is, the uranium cannot be leached from the barium sulfate using water. The Mallinckrodt process used sodium carbonate solution to recover trace uranium from barium sulfate cake. Based on this information, one would not expect to find significant levels of uranium in the water at the Site and the groundwater data bear this out.

However, as long as waste materials in the landfill are exposed to infiltrating surface water, the potential for migration to groundwater remains. To address this, the Selected Remedy calls for construction of a multi-layer engineered cover that meets sloping and permeability requirements designed to shed water and minimize the potential for water to infiltrate the waste material. This is the same kind of technology used successfully at permitted landfills. With the low leaching potential of the waste materials and an engineered cover in place, the probability of continued groundwater protection is very high.

Groundwater protection is a principal objective of the Selected Remedy. The long-term groundwater monitoring program will be designed to verify over time that the remedy is

protective of the groundwater. The objectives of the monitoring program are described in section 12 of the OU 1 ROD. The monitoring plan required as part of the remedy will specify sampling locations, sampling frequencies, analytical parameters, procedures, etc. Periodic sampling reports that include data summaries and interpretation will be published. After the baseline is established, trend analysis will be used to verify performance.

**3. Comment:** Many commenters state that the Site is in a flood plain which could affect the integrity of the remedy and could spread contamination or impact water quality in the Missouri River.

**Response:** Under current conditions, the Site is not located in a flood plain. The Site is located behind the Earth City Levee. The Earth City Levee District is protected from flooding of the Missouri River by a 500-year earthen levee and supporting flood control system. At the end of 2005, this Levee District contained 450 businesses employing 22,800 people. At one time prior to development of the Earth City area and prior to construction of the landfill, the surface elevation at the northwestern half of the Site was below the 100-year high water level. About half of the landfill is built onto a historic or geomorphic flood plain.

It is important to understand that the landfill itself has altered the topography such that the surface elevation of the Site is 20 to 30 feet or more above the level of the historic flood plain. After construction of the remedy, surface grade at the landfill will be a minimum of 25 feet above the flood plain. In the event that the levee is breached and 500-year flood waters were to encroach on the business park, it would be expected to result in about two feet of water at the northwestern toe of the landfill. As part of the Selected Remedy, the landfill toe in this area will be regraded through placement of additional clean fill and capped with an engineered landfill cover resulting in approximately 100 lateral feet of additional materials between the current landfill toe and the toe at completion of the remedial action. Only cover material and clean fill material are potentially impacted by flood water. As part of the remedial design process and in response to public comment, flood protection measures will be evaluated during remedial design and appropriate bank protection methods will be used in construction of the toe area. Any encroaching flood water would be expected to recede with no damage to the landfill cover. However, in the event any damage did occur, it will be repaired in accordance with the operation and maintenance (O&M) plan.

The information in the following paragraph was taken from the Earth City Levee District website: http://www.earthcityld.com/index.aspx

The 1,891-acre Levee District is protected on three sides with the main levee running 2.6 miles along the eastern bank of the Missouri River. The levee system is designed to exceed the 500-year flood level and ranges from 462.03 feet above mean sea level (ft/msl) at the south end to 459.34 ft/msl at the north end. The 500-year flood elevation at these locations is 459.03 ft/msl and 452.15 ft/msl, respectively. Assuming a 500-year flood, the Missouri River would be 3 to 7 feet below the top of the Earth City Levee.

Four major floods have occurred since the levee was completed in 1972 including the record level flood of August 1993 when the Missouri River crested at 14.6 feet above flood stage and remained above flood level for about 110 days. The flood control system functioned successfully in each case.

For more information on this subject, see the attached technical memorandum developed in response to congressional inquiry on the levee systems and flood plain issues as they relate to the Site.

**4. Comment:** Some commenters questioned whether EPA considered what impact an earthquake might have on the remedy.

**Response:** The Site is in St. Louis County which is located within the New Madrid seismic zone. According to the Mercalli Intensity Scale, a major earthquake (magnitude 7.0 to 7.9) in the New Madrid seismic zone affecting St. Louis County could in some locations cause severe damage to poorly built structures, cause partial collapse of ordinary substantial buildings, and shift houses on their foundations. Tall structures such as towers and chimneys might twist and fall. Damage to structures built to withstand earthquakes would be slight.

Because the Site is in a seismic zone, the remedy design will include an evaluation of potential seismic effects. The design will look at estimated horizontal acceleration of the earth materials at the Site in the event of a major earthquake and identify appropriate engineering characteristics for the materials and structural components.

Observational data on the performance of solid waste landfills during major earthquakes indicate that these structures are not particularly susceptible to earthquake-induced damage. Moreover, the Site cover is expected to be constructed entirely of earthen materials and will not contain synthetic membranes that might slip or be damaged during a seismic event. Also, there are no subsurface drainage systems or other buried structures that could be damaged. However, in the event the Site remedy is subjected to a major earthquake, the potential for damage exists, e.g., settlement or slumping of cover materials. In the event the cover system is damaged, appropriate repairs would be made in accordance with approved O&M plans required as part of the remedy. It should be understood that any potential earthquake-induced damage to the landfill cover will not result in a significant public health threat because the materials in the landfill will still not be accessible to the general public and the solubility of the contaminants would not be affected.

The alluvial materials on which the landfill is built are not the type that is vulnerable to earthquake liquefaction. Liquefaction occurs in loose, fine-grained materials that are saturated with water. When shaken by an earthquake, these loose sediments can lose their strength and behave like a liquid. The most vulnerable areas, like the San Francisco Bay region, are areas that used to be bay or marshland before being filled with pumped or dredged material. By contrast, the Site is built over compact sand and gravels at the

margin of the alluvium. These materials possess much greater frictional strength than the fine-grained materials that are vulnerable to liquefaction.

**5. Comment:** Many commenters questioned whether capping alone with no liner is sufficient to isolate the contamination from the environment.

**Response:** Capping through the use of engineered covers is a mature and routinely applied technology that forms a barrier between the contaminated media and the surface, thereby shielding humans and the environment from the contaminants and from the effects of radiation. Capping is the approach used at uranium mill tailing sites for example. The cap is designed to be sufficiently thick and impermeable to isolate the waste and restrict surface water infiltration into the subsurface. When the waste is above the water table, as in the case of the radiologically contaminated material at the Site, a properly designed cap can prevent the percolation of water from the surface to the underlying contaminated materials. The cap will be extended beyond the perimeter of the contaminated area and include side slopes to prevent any lateral infiltration. It is important to understand that it is the cover, not a liner, which prevents surface water from contacting the waste material.

**6. Comment:** Many commenters expressed concern about the ability to assure protectiveness over the long term, particularly given the long-lived nature of the radionuclides at the Site.

**Response:** In cases where the remedy results in hazardous substances remaining on-site, CERCLA requires ongoing forms of surveillance, monitoring, maintenance, institutional control, etc. The expectation is that this will continue for as long as the hazardous substances remain. In these cases, the monitoring period will extend beyond the foreseeable future. The challenge is no greater at the Site than it is at various Superfund sites or other waste sites where long-lived radionuclides, heavy metals, or other nondegradable waste materials will be permanently disposed or managed in place. If the wastes in the Site were moved to another landfill, the location would change but the ongoing stewardship requirements would remain the same.

The first objective is to make sure the engineering measures are designed for longevity. Most of the engineering measures used at the Site will continue to be effective even in the event that institutional control becomes ineffective. The conceptual design of the landfill cover identified in the Selected Remedy relies on natural materials rather than synthetics. Synthetic materials like flexible membrane liners tend to degrade over time; whereas natural materials such as rock, clay, and soil should remain effective for vastly longer periods. The thickness and properties of the materials used will be more than sufficient to shield any future users of the Site from any increased gamma exposure, and the materials will act as a barrier to radon gas emissions. The cover will also incorporate a layer of rock or concrete rubble. This feature will enhance longevity by inhibiting the potential for intrusion into the landfill and limiting the potential damage that could be done by erosion. The shallow sloping requirements for this cover will also help to minimize the potential for erosion and enhance longevity. Thus, the landfill cover will

prevent potential exposures and will remain effective for as long as the cover materials are left in place.

The second objective is to make the long-term Site management plans as robust as possible. Long-term O&M plans will establish requirements for long-term groundwater monitoring, institutional control implementation and assurance, periodic inspection, maintenance, and community involvement. These plans will be approved by EPA and made available to the public. The institutional control strategy will use redundant mechanisms and employ enforceable proprietary controls that run with the land.

Finally, CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) require that periodic reviews, referred to as Five-Year Reviews, be conducted. At least every five years, a review will be performed to evaluate the remedy to assure it remains protective and is performing as expected. In the event the remedy is not protective or is not performing as expected, these findings will be presented in the Five-Year Review Report and corrective measures will be required to be undertaken. The Five-Year Review Report will also describe maintenance issues, recommended optimizations, identify new requirements, etc. This process also provides for community involvement.

**7. Comment:** Many commenters refer to the radiological material in the landfill as being particularly dangerous because it comes from the extremely *hot* Belgian Congo ore.

**Response:** It should be clarified that there are actually no feed materials (ore or ore concentrates) in the landfill and there is no raw Belgian Congo pitchblende in the waste materials. The radiologically contaminated material in the landfill is soil blended with residues that were the byproduct of processing the ore for its uranium content. Certainly, the most reliable way to ascertain the composition of the waste material in the landfill is through direct measurement. Therefore, as part of the RI, extensive field study was performed on the landfill and the waste materials including overland gamma surveys, surface and subsurface sampling through an extensive boring program, downhole radiological logging, radon flux measurements, perched water and landfill gas sampling, surface water and sediment investigation, etc. The data provide the primary basis for the technical judgments that have been made in the EPA decision-making process.

However, there is clearly a great interest in the origins of the material, and there appears to be a general lack of clarity on the subject. This response is designed to summarize what is known on the origins of the material based on documents kept by the various federal agencies and programs and other parties involved. Under contracts with the Manhattan Engineering District (MED) and the Atom Energy Commission (AEC), Mallinckrodt Chemical Works processed uranium feed materials for production of uranium metal from 1942 to 1957. The processing occurred at the location of the Mallinckrodt plant in downtown St. Louis. Feed materials included uranium black oxide, uranium ores, and concentrates. In 1944, pitchblende ore from the Shinkolobwe Mine in the Belgian Congo was processed. The Shinkolobwe ore is noted for its extremely high

concentrations of uranium (30 to 65 percent by weight). The plant also processed some domestic ores which were much less concentrated (< 1 percent uranium).

The first two steps of the process performed by Mallinckrodt involved digestion of the feed materials in acid and adjustment of the resulting solution. The uranium remained in solution as uranyl nitrate while the other constituents of the feed material were precipitated out as solids and removed. A condition placed on the Belgian Congo ore by the supplier required that radium, radium daughters, lead, and other valuable metals be extracted, stored, and returned to the supplier. Therefore, the Mallinckrodt process included steps to extract these materials as a separate residue apart from the bulk of the ore residue. The separated radium- and lead-bearing residue was known as *K-65* residue.

In 1946, AEC acquired a 21.7-acre tract of land in a then undeveloped area of north St. Louis County to store byproducts and scrap from the uranium processing at the downtown plant. This tract of land is now known as the St. Louis Airport Site (SLAPS), which is part of the St. Louis Formerly Utilized Sites Remedial Action Program (FUSRAP) managed by the U.S. Army Corps of Engineers, St. Louis District. The radium-bearing K-65 residues were stored in drums at the airport site from 1946 to 1948. All the K-65 residues were eventually transferred to federal facilities in Lake Ontario, New York, and Fernald, Ohio, in 1948 and 1949. There are no K-65 residues at the West Lake Site.

Other residues and scrap from the uranium processing were stored on the ground at the airport site. Ultimately the airport residues were offered for public sale in June of 1960. According to the Request for Proposal issued by AEC, the intent was to offer the purchaser the opportunity to recover valuable metals including copper, nickel, and cobalt. The following residues were included in the offer:

- AM-7 pitchblende raffinate cake – This solid residue consisted of various metal hydroxides. The approximate gross weight of this material was estimated to be 74,000 tons containing about 113 tons of uranium.
- AM-10 or Colorado raffinate cake – This solid residue consisted of various metal hydroxides. The material had an estimated gross weight of 32,500 tons containing an estimated 48 tons of uranium.
- AJ-4 barium sulfate cake (unleached) – The barium sulfate solids contained the remaining traces of radium and lead sulfates that were not removed as K-65 residue. There was an estimated 1,500 tons of this material containing approximately 22 tons of uranium.
- AJ-4 barium sulfate cake (leached) – This residue resulted from leaching the barium sulfate cake with sodium carbonate solution so that as much of the remaining traces of uranium as was feasible was recovered. There was an estimated 8,700 tons of this material containing approximately 7 tons of uranium.

Eventually, all of these residues were purchased by a private company and subsequently moved to a nearby location on Latty Avenue. All of the residues were ultimately shipped to Canon City, Colorado, for reprocessing except for the 8,700 tons of leached AJ-4 barium sulfate cake which had such low concentrations of uranium that it was considered commercially impractical to further process this material for its uranium content. The leached barium sulfate cake was reportedly mixed with 39,000 tons of soil and transported to the Site for use as daily and intermediate cover in the solid waste landfill operation.

While the Belgian Congo pitchblende ore concentrates and the radium-bearing K-65 residue might be described as extremely *hot* due to the high radium content, it is not accurate to refer to the leached barium sulfate cake, which is the material in Areas 1 and 2, as extremely hot or extremely dangerous. The unleached barium sulfate cake contained about $4 \times 10^{-9}$ grams of radium per gram of residue (0.0000004 percent) and about 0.1 percent uranium. After leaching, the residue contained even less of these constituents. The material was then blended with soil at approximately 5 to 1 before being put in the landfill. An approximate average uranium weight percentage of the soil mixture calculates at about 0.015 percent or an order of magnitude less than a common low-grade ore body. Analytical results from samples collected during the RI are consistent with these conclusions.

**8. Comment:** Polonium-210 has been in the news because it was believed to have been used to poison the former Russian intelligence officer, Alexander Litvinenko. Some commenters claim the presence of polonium-210 in the landfill material is of particular concern for public safety due to its highly radioactive nature.

**Response:** All of the radionuclides in the waste materials have been considered in the evaluation of this Site. The wastes contain naturally occurring uranium-238, thorium-232, uranium-235, and all the associated daughters in these decay series. For purposes of site characterization, the radionuclides with relatively long half lives are used as indicators for all members of their associated decay chains. Consistent with established practice, the occurrences of the short-lived daughters were inferred from the concentrations of these long-lived indicators.

Polonium-210 is one of the short-lived daughters of uranium-238. Like uranium-238, polonium-210 occurs naturally in the environment and can be found almost everywhere in soil, rock, rivers, and oceans. In fact, we all have low concentrations of polonium-210 in our bodies. Unlike uranium-238, however, polonium-210 is very radioactive compared to the same mass of uranium and has a correspondingly short half life of 138 days (meaning its activity will reduce by half every 138 days). For a given sample of material in secular equilibrium, the activity of each radionuclide in the decay series will equal the activity of every other radionuclide in the series. Therefore, the activity concentration of polonium-210 will equal the activity concentration of its long-lived progenitors, e.g., radium-226, but its relative mass concentration will be extremely small.

The polonium-210 in the radiologically contaminated soils in the Site is in equilibrium with radium-226 and they have equal activity concentrations. For site characterization purposes, sampling and analysis measures the long-lived radionuclides in the decay series and the occurrence of the short-lived daughters such as polonium-210 is inferred. The risk assessment methodology is designed to account for dose contributions from all radionuclides in the decay chain.

Polonium-210 is an intense alpha emitter but because alpha particles cannot penetrate skin, it poses no external hazard. It must be either ingested or inhaled for it to be a potential hazard. Polonium-210 is a radon daughter and contributes to the inhalation hazard associated with prolonged radon exposure and cigarette smoking.

Lethal doses of polonium-210, such as implicated in the poisoning of Alexander Litvinenko, would require a nuclear reactor to produce and any significant amounts would not persist over long periods of time because of its very short half life.

As was explained in a prior response, toxic materials present a potential health concern only in the event people are exposed to the material. The Selected Remedy is the best option for ensuring that no human exposure occurs.

**9. Comment:** A few commenters make reference to the 1988 report by the Nuclear Regulatory Commission (NRC) which contains a conclusion that on-site disposal would likely require that the material be placed in a disposal cell.

**Response:** The 1988 NRC report (NUREG-1308, Rev. 1) examines the applicability of the 1981 NRC Branch Technical Position (BTP). The NRC's BTP was established prior to the implementation of the revised NRC standards for protection against radiation (10 CFR 20) in 1996 and was intended to provide options for license termination under restricted conditions at uranium and thorium processing facilities. The BTP prescribed five acceptable options for disposal or on-site storage of materials containing low levels of uranium and thorium. Options 1 through 4 range from conditions requiring no use restrictions to conditions of on-site burial with land-use restrictions and institutional control. The appropriate option depended on the concentrations of radionuclides present. If concentrations exceeded those permitted under Option 4, the materials were to be stored on-site pending the availability of an appropriate disposal option.

The NRC concluded in the 1988 report that the future concentrations of Ra-226 would exceed the Option 4 criteria and therefore "…onsite disposal, if possible, will likely require moving the material to a carefully designed and constructed 'disposal cell.'" Construction of an on-site disposal cell is not one of the options provided for in the BTP, and the report does not describe the rationale that led to this conclusion. A reasonable interpretation is that the Site presented circumstances very different from the circumstances anticipated in the NRC's BTP. The BTP was intended to address residual contamination in soils and waste materials at uranium and thorium processing facilities. The BTP lacks any reasonable option for residual contamination that is mixed with large volumes of heterogeneous municipal refuse in an existing landfill.

The 1988 NRC report was based on very limited field investigations. No comprehensive groundwater investigation had been performed. As the NRC explained in the report, its conclusions are preliminary and field investigations must be performed to resolve major questions and allow proper evaluation of remedial alternatives. The necessary work to support the Selected Remedy has since been conducted through the Superfund RI and Feasibility Study (FS) process.

Note that the NRC's decommissioning rules and associated guidelines have undergone substantial changes since the 1981 BTP. The NRC decommissioning standards are mainly codified in 10 CFR Part 20, Subpart E, and provide radiological dose limits for termination of licenses. The standards apply to facilities decommissioned under 10 CFR Part 30 which governs byproduct materials, Part 40 which governs source material, and Part 70 which governs special nuclear material. The decommissioning standards establish criteria for license termination with unrestricted use, termination under restricted-use conditions, and allow the submission of alternative criteria for license termination.

The NRC criteria for operation of uranium mills (Appendix A to Part 40) are the most relevant to the conditions present at the Site. These criteria are derived from standards set by EPA under the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). UMTRCA directed EPA to set standards to govern the stabilization, disposal, and control of uranium and thorium mill tailings. These standards were promulgated in 40 CFR Part 192. The Selected Remedy will meet relevant and appropriate standards from 40 CFR 192. See section 12 of the OU 1 ROD for a description of these requirements.

**10. Comment:** A number of commenters are concerned about radon releases and the effectiveness of landfill caps or clay liners in containing radon releases.

**Response:** First of all, it should be clarified that any release or potential release of radon from the radiologically contaminated disposal areas (Areas 1 and 2) is only an exposure concern for someone who occupies the surface of Areas 1 and 2 and the immediate vicinity. The average radon flux from the Site under current conditions with no landfill cap in place at Areas 1 and 2 is already less than the standard that is considered safe for tailings piles at uranium mill tailing sites. The net contribution of radon to the ambient air from the Site is very small and would not be detectable at off-site locations. Even if left in its current condition, radon from the Site will not pose any sort of threat to the air in the St. Louis region and beyond as some commenters claim.

Multi-layer, natural material cover systems are effectively designed and engineered to mitigate the release of radon gas, minimize water infiltration, and remain effective for long periods of time. When caps are used to contain radium-contaminated wastes, they are typically designed to confine gaseous radon until it has essentially decayed. Such systems are used to contain long-lived radionulides at large uranium mill tailing sites where radon generation is a larger problem than at the Site due to the vast amounts of tailings involved. Since radon decays rather rapidly (Ra-222 has a half life of 3.8 days),

vertically migrating gas only needs to be detained for a relatively short period of time for the radon to decay. The typical depth of a natural materials cover necessary to accomplish this is about five feet for radon-222. When the remedy is implemented, it will be designed so that radon measurements at the surface of the cap should be indistinguishable from background.

**11. Comment:** Many commenters refer to the illegal dumping of the radiological material at the landfill.

**Response:** We assume this refers to conclusions reached by AEC inspectors in 1974 who judged that the licensee had acted improperly by mixing the barium sulfate residues with soil to achieve uranium concentrations (less than 0.05 percent) which would otherwise have made the material exempt from licensed disposal. Mixing with clean material to achieve this condition was not considered permissible. Follow-up inspections of the Site by the NRC in 1976 found no potential for significant radiological hazards to the public under the then current circumstances. They did caution that indoor radon could be an issue if structures were to be built on-site. (NRC Office of Inspection and Enforcement Region III, Investigation Report No. 76-01)

Nonetheless, regardless of whether the activity that caused the release was legal or illegal at the time it took place, CERCLA or Superfund gives EPA the authority to respond to releases of hazardous substances from a facility into the environment. Further, EPA has the statutory authority to respond to a release or to enter into settlement agreements with Potentially Responsible Parties (PRPs) requiring them to respond to the release; in many cases, this authority is used to address contamination resulting from old, uncontrolled, or abandoned waste sites. The stated purpose of CERCLA as indicated in the legislative history is to establish a comprehensive response and financing mechanism to abate and control the vast problems associated with abandoned or inactive hazardous waste sites. The NCP which can be found at 40 CFR Part 300, provides a regulatory framework for implementing the goals of CERCLA. The NCP provides specific decision-making criteria for reaching a ROD using those evaluation criteria. The legality of any historic activities that may have lead to the problem has no bearing on the decision-making process and it is not material to selecting the optimal remedial approach.

**12. Comment:** Some commenters question why the Site contamination should be managed in place while similar contamination at the nearby North St. Louis County FUSRAP sites is being excavated and shipped for commercial disposal.

**Response:** The differences in the remedies selected for each site are a function of the differing site-specific circumstances; the differences cannot be attributed to the fact that one site is FUSRAP and the other is not. The AEC established FUSRAP in March 1974 under the authority of the Atomic Energy Act (AEA) of 1954 to identify, investigate, and take appropriate cleanup action at sites where work was performed in support of MED and early AEC programs. FUSRAP provides for federal funding to designated sites. It is CERCLA, however, that provides the response authority and governs the decision-making process at both North St. Louis County FUSRAP sites and the West Lake Site.

In the case of the North St. Louis County sites, the contaminated media is generally surface soils. The contaminated soil is or was widely distributed across approximately 80 properties including SLAPS, owned by the city of St. Louis, and a variety of properties used for a variety of purposes, e.g., commercial, light industrial, recreational, open fields, and transportation facilities. The mostly private properties are criss-crossed with public roadways, railroads, and utility right-of-ways. The majority of these soils are accessible to the public. The contaminated soil is located in places where workers or members of the public might reasonably be expected to come into contact with it. Moreover, many of these properties are being used or could be used in ways that are incompatible with leaving the soil in place. These considerations were factored into the remedy which calls for the accessible contaminated soils to be excavated and shipped for commercial disposal.

A subset of the St. Louis FUSRAP contaminated soils, referred to as the inaccessible soils, are located under roads, active rail lines, buildings, and other permanent structures. There are over 69,000 cubic yards of contaminated soils in this category. The inaccessible soils do not pose an exposure concern as long as the road or other permanent structure remains in place. The Selected Remedy for the inaccessible soils at the North St. Louis County North FUSRAP sites is to manage these in place using institutional controls.

In contrast to the situation in North St. Louis County, the West Lake Site has been a landfill site since the early 1950s and will remain a dedicated landfill site into the future. The radiological contamination is disposed with other wastes in the landfill. The current use and the reasonably anticipated future use of the Site is as a landfill. In short, waste disposal is consistent with current and future land use at the West Lake Site; such is not the case for the St. Louis sites. Accordingly, land use at the Site is restricted through covenants recorded by the property owners; the restrictions cannot be terminated without the written approval of both the Missouri Department of Natural Resources (MDNR) and EPA. In addition, more comprehensive land-use restrictions are required as part of the Selected Remedy. If there is an analogy to be drawn with the St. Louis FUSRAP, it is with the inaccessible soils that, like the soils in the landfill, do not pose a health concern as long as the barrier to exposure remains in place.

**13. Comment:** Some commenters object to the process that allows the parties responsible for the contamination to develop the RI, BRA, and other documents that support the decision-making process.

**Response:** When CERCLA was enacted in 1980, it contained a broad liability scheme which could reach the variety of people who were responsible for the contamination at the various sites. This liability scheme focused on requiring the polluters to pay for the cleanup of sites. In 1986, Congress amended CERCLA by the Superfund Amendments and Reauthorization Act which, among other provisions, authorized EPA to achieve cleanup by negotiating with potentially responsible parties (PRPs) to enter into agreements to perform response action including RIs. EPA followed this statutory

process by entering into an Administrative Order on Consent (AOC) in 1993 with the PRPs to perform the RI/FS. Various provisions of that AOC require the PRPs (who are known as Respondents in the AOC) to submit reports to EPA for approval or disapproval and to respond to EPA's comments or requests for modification of the documents. In addition, all data collected by the Respondents were subjected to a rigorous Quality Assurance/Quality Control (QA/QC) process which provides yet another safeguard. The RI report and all the documents that were submitted by the Respondents in preparation for that document were subjected to this process, thus assuring that EPA had the final approval on the contents of the documents.

When the AOC was signed in 1993, it was anticipated that EPA would perform the risk assessment; however, late in 1993, EPA changed its practice and allowed the option of having the PRPs perform the risk assessment under certain specified conditions. Since issuance of the 1993 directive, PRPs have been allowed to perform the risk assessment at most sites. EPA's experience with these risk assessments has shown that with appropriate oversight, PRPs can perform acceptable risk assessments and allowing the PRPs to perform the BRA can be the most effective and efficient way to complete the RI/FS. Subsequent to the new directive, the AOC was modified to allow the PRPs to perform the risk assessment with oversight from EPA. The AOC procedures for approval, disapproval, and modification were followed for the risk assessment as well.

Moreover, EPA has a longstanding policy to pursue "Enforcement First" throughout the Superfund cleanup process. This policy promotes the polluter pays principle and helps to conserve the resources of the Hazardous Substance Response Trust Fund for the cleanup of those sites where viable responsible parties do not exist. The process undertaken at the Site has been consistent with these requirements of sections 104, 122(a), and 122(d)(3) of CERCLA, as amended, as well as the expectations outlined in EPA guidance. At this Site, the polluters have been paying.

**14. Comment:** Many commenters make the general claim that the Site is a bad location to dispose of radiological waste and that the waste should be disposed in a federally licensed landfill.

**Response:** The objective of the CERCLA decision process for the Site is to identify the best option for existing land disposal units considering the risk-based evaluation criteria provided in the implementing regulations (NCP).

The CERCLA evaluation criteria are explained in section 10 of the ROD and can be found at 40 CFR Section 300.430(e). The information compiled during the RI/FS indicates that the waste can be safely managed in place using mature and well understood landfill techniques, while excavation of waste materials from this or any landfill introduces a variety of risks and complications. For example, there are risks associated with spills during transport and the increased risk of traffic accidents. Excavation involves many worker safety issues, both from potential exposure to toxics and from the physical hazards of having to manually excavate, sort, and sample various types of refuse, debris, and oversized objects. Excavation introduces the potential for spreading

contamination due to complicated water management issues, decontamination issues, and dust suppression concerns. Uncovering putrescible waste introduces the potential for odor emissions and bird problems. The potential to attract birds raises specific safety and administrative issues for the Site due to its proximity to the Lambert-St. Louis International Airport.

Moreover, there is no clear path to commercial disposal for the wastes in Areas 1 and 2. Currently available commercial disposal facilities for radiologically contaminated materials are not permitted to accept municipal solid wastes. Therefore, the nature of necessary waste handling or treatment prior to disposal as well as the final unit disposal cost is highly uncertain. In short, excavation options are much more difficult and time consuming to implement, much more expensive, and actually introduce unnecessary health and safety risks.

EPA has a lot of experience with CERCLA municipal landfill sites. Approximately 20 percent of the sites on the Superfund National Priorities List (NPL) are municipal landfill sites. These sites share many similar characteristics including large waste volumes and heterogeneous mixtures of municipal waste frequently co-disposed with industrial and hazardous wastes. In many cases, the hazardous chemical substances are much more toxic and more mobile in the environment than the radionuclides contained at the Site. Nevertheless, containment in place is the primary remedy selected in these cases because excavation and removal of the landfill simply does not compare favorably with containment when evaluated against the nine evaluation criteria from the NCP.

**15. Comment:** Some residents of the Spanish Village subdivision, and others who may have been living in proximity to the Site in the 1973 time frame when the radiologically contaminated soil was placed in the landfill, have expressed concern about the potential for cancer or other health effects resulting from airborne dust or other potential exposures to these materials at that time.

**Response:** While there is no specific information available that could be used to estimate potential exposures during this episode, we can make some generalizations. Based on a review of the available records, about 43,000 tons of radiologically contaminated soil was delivered to the Site from the period July 16 to October 9, 1973. Therefore, the period of time over which there could have been exposure is short – less than a few months. The soil was reportedly used as daily and intermediate cover in the landfill operation. The off-loaded soil would likely have been stockpiled, spread out with heavy equipment, and ultimately compacted under successive layers of waste and soil placement. During this period, there may have been some variable off-site air releases in the form of radon and windblown dust. The potential for off-site migration of contaminated soil particulates or radon would have varied considerably depending on the direction and velocity of the wind and the moisture content of the soil. However, any releases of this nature would have been subject to rapid wind dispersal; people would have had to be on the Site or quite near it during late summer or early fall 1973 to have become exposed to Site contaminants. It is highly unlikely that people located in Spanish Village, for example, would have been exposed to Site contaminants.

One should keep in mind that the radionuclides at the Site in the concentrations at which they occur do not pose acute health risks. A person would generally have to be in contact with the contaminated material at the Site over a period of years before significant calculated health risks would accrue. Considering the low exposure point concentrations and short duration of any potential exposures, the probability of significant public health effects from the disposal episode in 1973 is very small.

There are options available for people who continue to have health questions. Individuals can initiate a cancer cluster investigation through the Missouri Department of Health and Senior Services (MDHSS). MDHSS staff will work with individuals or communities to investigate the concern. MDHSS staff can be reached at (573) 522-2840. This information was also provided during one the of EPA public meetings.

Also, the Agency for Toxic Substances and Disease Registry (ATSDR) can look into health concerns at Superfund sites. Upon request, ATSDR will look at various site-related factors and draw some conclusions about the potential for human exposure to toxic materials at the Site. For more information, you may contact Denise Jordan-Izaguirre at (913) 551-1310 or Sue Casteel at (913) 551-1312.

If there is sufficient interest, a community meeting designed to address potential health issues associated with the Site can be arranged. EPA would be willing to organize a meeting and make public health officials available to answer questions. To discuss the possibility, please contact our community involvement coordinator, Debbie Kring, at (913) 551-7725.

**16. Comment:** Many commenters, particularly those who live or work near the Site, expressed support for the proposed remedy and objected to any plan to excavate materials from the landfill. The major concerns included the potential for airborne and waterborne releases of contaminants and the potential for accidents associated with increased truck traffic. Some are also concerned about the nuisance issues associated with trash hauling including truck traffic, noise, and odor. The potential for bird problems is also an issue particularly for the nearby Lambert Airport.

**Response:** The Selected Remedy is consistent with the remedy presented in the Proposed Plan. The concerns expressed by these commenters are consistent with some of the trade-offs identified by EPA in the evaluation of the alternatives. No extensive waste excavation and trash hauling are planned. Some excavation and relocation of contaminated soils may be necessary to address the Buffer Zone/Crossroad Property. If so, dust control measures will be used as necessary to ensure no air releases of fugitive dust. Work place air monitoring will also be employed. To implement the Selected Remedy, some additional local truck traffic will be necessary to bring in materials and equipment used to construct the landfill cover; however, the duration of the construction activities will be relatively short, i.e., one or two construction seasons.

**17. Comment:** Several commenters were of the opinion that there was inadequate public notice of the Proposed Plan and the first two public meetings held in 2006.

**Response:** EPA implemented its normal notification procedures which are designed to inform the affected community and other stakeholders. Concurrent with the release of the Proposed Plan in June 2006, display ads were placed in multiple editions of the *Hazelwood-Bridgeton Journal* of the *Post Dispatch*. Fact sheets were mailed to area residents, schools, media contacts, local government, environmental and activist groups, state and federal elected officials, and other known interested parties. The ads and fact sheets all included notice of the first public meeting in June 2006 and instructions on how to obtain Site documents. The Proposed Plan and FS were made available on the Internet and the Administrative Record was placed at the Bridgeton Trails Branch of the St. Louis County Library near the Site. EPA provided specific documents on request. In preparation for the second and third public meetings in September 2006 and March 2008, this entire notification process was repeated. EPA believes every reasonable effort was made to assure full public participation in the process.

**Specific Responses:**

Individual responses are provided for cases where the commenter submitted very specific comments, some of which are not fully covered by the general responses above. These comments are in no particular order, but are identified according to the name of the person or organization that submitted the comments. The bold headings used to organize some responses are taken from the letter submitted by the commenter. In some cases it will be necessary to read the comment letters themselves in order to fully understand the response. Therefore, copies of the comment letters addressed by these specific responses are attached.

**1. <u>Byron Clemens</u>**

1. The commenter states: The BRA should be given NO WEIGHT, etc., (pg. 1 of comment letter).

The purpose of the BRA is to establish a statutory basis for taking a response action. In other words, an unacceptable threat to human health and the environment must be established before EPA can compel a response action. Both the statute and NCP control the manner in which the BRA is prepared, no matter who prepares the document.

The BRA was prepared in accordance with EPA's Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), EPA/540/1-89/002 (RAGs). This guidance establishes a standardized conservative methodology for conducting human health evaluations at Superfund sites. Standard exposure factors and toxicity data are used. The BRA was developed using prescribed methods and verifiable data. The document was submitted to EPA and the Missouri Department of Health and was reviewed extensively before being approved. There is no basis for the commenter's claim that the BRA misrepresents the case.

The BRA draws no conclusions with respect to risk management. All risk management decisions are made by EPA with participation from the state. These risk management decisions are described in the Proposed Plan and ROD, and only alternatives that are protective of human health and the environment may be considered for selection.

The commenter has misinterpreted the reference in the BRA to the no action alternative. The NCP requires that a no action alternative be developed in the FS [40 C.F.R.300.430(e)(6)]; this alternative then serves as a benchmark for evaluating other action alternatives. As such, the BRA must also evaluate a range of risks under the condition that no mitigating action is taken. That is why it is referred to as a baseline risk assessment.

2. The commenter states: Page A.2-4 of the BRA indicates that the levels of U-235 are "higher *than one would expect*," indicates a significant lack of institutional memory, etc. (see pg. 1 - 2 of comment letter).

The commenter has misinterpreted the information. Several points should be made here. First of all as previously stated, there is no raw Belgian Congo pitchblende in the waste materials at the landfill. The leached barium sulfate residues in the waste material are byproduct material left over after a substantial amount of processing had been done to remove uranium, radium, and their daughters. Secondly, the observation in the BRA that U-235 concentrations were higher than one would expect from natural uranium is not a comment on the absolute concentrations. It is a comment on the relative concentrations with respect to the other natural isotopes of uranium. The Belgian Congo pitchblende ore had high concentrations of uranium (30 to 65 percent by weight); however, the isotopes of uranium were in their natural ratios. Concentrations in the contaminated soils average less than 0.02 percent or substantially less than would be found in a low-grade domestic ore body. Therefore, the absolute concentrations of total uranium in the Site waste material are not particularly high.

3. The commenter states: Page 15 of NUREG – 1308 lists the presence of Th-230 and Ra-226 and states, "…*indicating a significant increase in radiological hazards"*, etc. (see pg. 4 of comment letter).

As explained in the NUREG – 1308 report and the RI/FS documents, one of the effects of the ore processing is that the naturally occurring U-238 to Th-230 to Ra-226 equilibrium has been altered. The ratio of Th-230 to Ra-226 is much greater than would be the case if these radionuclides were in equilibrium. Therefore, radioactive decay of the Th-230 will increase the concentration of its decay product Ra-226 with time until these radionuclides are again in equilibrium. Ra-226 and its daughters are principal risk drivers in this decay series and therefore the radiological hazard from potential exposure to these materials will increase with time until equilibrium is reached. The buildup of a daughter radionuclide takes about 7 x the daughter's half life; in terms of Th-230 to Ra-226, this would take about 7 x 1,600 years or about 11,200 years. Also, increased Ra-226 concentrations will lead to increased radon generation. These factors were taken into

account when evaluating the remedial alternatives. The selected engineered cover system will be designed to account for future ingrowth of Ra-226 and future radon gas generation. The properties and thicknesses of the materials used to attenuate emissions will be developed according to the future composition of the waste material.

The NUREG – 1308 report states that "some low-level contamination of the groundwater is occurring." The 1988 NRC report indicates that multiple sampling events over several years identified a few sporadic detections in groundwater or borehole water at or slightly exceeding the drinking water standard of 15pCi/l gross alpha activity. This draws from the results of NRC-sponsored field investigations conducted in the early 1980s, most notably the radiological survey report developed by Radiation Management Corporation (RMC). Without any follow-up radiochemical analysis, it is difficult to draw many precise conclusions from this information; however, the tabularized results on alpha particle activity provided in the report do not indicate significant or wide-spread impacts to groundwater, and most of the sample results fall in a range consistent with background.

More extensive groundwater investigations were conducted in conjunction with the RI and included isotopic analysis for the uranium-238, uranium-235, and thorium-232 decay series over a period of years. The results produced only two detections of total radium (combined radium-226 and radium-228) exceeding the MCL (drinking water standard) of 5 pCi/l, with the maximum detected concentration of 8 pCi/l. It is clear from the RI data that there are no concentrated or wide-spread radiological impacts to groundwater from Areas 1 and 2.

The NUREG – 1308 report contains a conclusion to the effect that the long-term Ra-226 concentration will exceed the Option 4 criteria and therefore on-site disposal would likely require the material to be placed in a designed and constructed disposal cell. This conclusion needs to be looked at in context. The Option 4 reference comes from the NRC BTP on options for on-site disposal or storage of thorium or uranium wastes from past operations (46 FR 52061, October 23, 1981). The guidance sets out five progressively more restrictive options for dealing with residual contamination at former processing sites. Options 1 through 4 range from no-use restrictions necessary to burial on-site with land-use restrictions. Option 5 consists of on-site storage pending availability of a licensed disposal facility. The option of a designed and constructed on-site disposal cell is not among the options described in this guidance, so this conclusion appears to be based on site conditions not meeting any of the prescribed options. However, the NUREG -1308 report does go on to explain that this conclusion is not based on groundwater study or engineering evaluation and that investigations must be performed to develop the necessary information to resolve major questions and to provide a sound basis for evaluation of the feasibility of disposal alternatives. EPA has since performed the investigations and engineering evaluations necessary to support the Selected Remedy.

For informational purposes, the NRC's decommissioning rules and associated guidelines have undergone substantial changes since the 1981 guidance. The NRC decommissioning standards are mainly codified in 10 CFR Part 20, Subpart E, and

provide radiological-dose limits for termination of licenses. The standards apply to facilities decommissioned under 10 CFR Part 30 which governs byproduct materials, Part 40 which governs source material, and Part 70 which governs special nuclear material. The decommissioning standards establish criteria for license termination with unrestricted use, termination under restricted-use conditions, and allow the submission of alternative criteria for license termination.

Most relevant to the West Lake Site are the NRC criteria for operation of uranium mills which are derived from standards set by EPA under the UMTRCA of 1978. UMTRCA directed EPA to set standards to govern the stabilization, disposal, and control of uranium and thorium mill tailings. These standards were promulgated in 40 CFR Part 192. The Selected Remedy will meet relevant and appropriate standards from 40 CFR Part 192. See section 12 of the OU 1 ROD for a description of these requirements.

4. The commenter states: U.S. NRC NUREG/CR 2722, May 1982, characterizes the Westlake wastes….(beginning pg. 4 of the comment letter).

In August 1980, the NRC contracted with RMC to perform a radiological evaluation of the Site. The NUREG/CR 2722 report provides the results of that study. RMC used a variety of methods to evaluate the Site including gamma surveys, surface and subsurface sampling, radon flux measurements, and measurement of airborne radioactivity. The RMC concluded that radiation exposure risk to Site workers was minimal. Elevated concentrations of uranium and daughters exist in landfill soils but elevated levels were not found in off-site soils. RMC did not find any indications that groundwater movement of materials from the Site had occurred.

EPA takes no issue with factual representations from this report, and the findings of this study are generally consistent with the results of the CERCLA RI phase.

The commenter provides a series of excerpts and representations from the RMC report. Many statements in the comment misrepresent the information presented in the report. Some of the statements are addressed below.

- The comment says the RMC report, “states 1977 and 1978 monitoring wells showed movement of contaminants.” It needs to be clarified that the results of this U.S. Geological Survey monitoring indicated movement of leachate based on chemical (not radiological) analysis. This finding is consistent with the findings of the RI groundwater sampling which detected some limited occurrences of VOCs and SVOCs.
- The comment misquotes page 15 of the study as finding “water monitoring wells with levels of U-238 daughters at more than 19,000 pCi/g.” This section of the report is describing the results of subsurface soil analysis and perhaps this quote derives from the finding that concentrations of Bi-214 in subsurface soils ranged from less than 1 to 19,000 picocuries per gram (pCi/g). In fact, the results of water analysis summarized beginning on page 16 of the report found no significant alpha activities.

- Referring to the RMC report, the comment describes, "Westlake samples from 1980 and 1981 on Page 16 found several water samples exceeding U.S. EPA gross beta drinking water standards." It needs to be clarified as explained in the RMC report that the gross beta activity was from the leachate treatment lagoons and isotopic analysis attributed the beta activity to potassium-40, probably from potassium phosphates. The gross beta activity is unrelated to the Mallinckrodt wastes.
- Referring to radon flux measurements as high as 858 pCi/sq.m-s, the comment states that, "The maximum permissible standard is 20." Consistent with the findings of the RI, radon flux measurements at several discrete locations were relatively high. The radon flux standard for uranium and thorium mill tailings found in 40 CFR Part 192 is 20 $pCi/m^2s$. The standard is applied to an annual and a spatial average across the entire tailings pile or waste site not to a single measurement. As explained in section 12 of the OU 1 ROD, this standard, although not applicable, is considered relevant and appropriate to Areas 1 and 2 of the Site and will be met. The average radon flux for all 54 measurements was 22 $pCi/m^2s$. After the Selected Remedy has been implemented (after the cover has been constructed), the radon flux will be much lower than the standard and probably will be indistinguishable from background.

**2. <u>Kay Drey</u>**

**I.** The headings used to organize this response are not EPA's and were taken from the December 19, 2006, comment letter attached.

**A. Some of the radioactive wastes at West Lake are extremely rare and particularly dangerous.**

Many of the claims made here are not true or are misleading. The radionuclides in the waste material at Areas 1 and 2 are derived from natural uranium ore. Natural uranium ore has both U-235 and U-238. Each of these has a chain of decay products, for a total of 32 separate isotopes including the isotopes identified in this comment. The nuclides in these series are not rare or unusual. Also, the dangers posed by these radionuclides are a function of the concentration, the manner in which someone becomes exposed, and the period of time over which someone is exposed. Judgments regarding health risk cannot be made without considering these factors.

Uranium is one of the most abundant elements found in the earth's crust. The following comparison is intended to provide a general point of reference for the concentration levels found at the West Lake Site. Natural uranium occurs in soil and rock at a few parts per million (ppm). Natural uranium occurs in the contaminated soils in Areas 1 and 2 at about 150 ppm. Natural uranium occurs in a low-grade ore body (0.1 % U) at about 1,000 ppm. Natural uranium occurs in a high-grade ore body, like the Belgian Congo pitchblende, at a few hundred thousand ppm. The measured uranium concentration in the landfill is much lower than the concentration found in uranium ore. In all of these cases, the uranium exists as several isotopes in their naturally occurring proportions: primarily

U-238 (99.275 percent), U-235 (0.72 percent), and U-234 (0.0058 percent). In terms of activity concentration, natural uranium has approximately equal activity concentrations of U-234 and U-238. The activity concentration of U-235 is approximately 5 percent of the activity concentration of U-238 or U-234.

For purposes of site characterization and risk assessment, the radionuclides with relatively long half lives are used as indicators for all members of their associated decay chains. The occurrences of the short-lived daughters can be inferred from the concentrations of these long-lived indicators. It is true that the short-lived radionuclides, such as Po-210, are more highly radioactive than the long-lived members of the decay chain, but because of their short-half lives, they are present in relatively small mass concentrations.

See also the General Responses on the Belgian Congo pitchblende ore, contaminant migration to groundwater, and the safety of managing the material in place.

**B. Flood plains are for flood waters – NOT for radioactive wastes.**

If we assume some sort of catastrophic failure of the levee as the commenter suggests, high velocity water might be expected to scour the ground and spread unconsolidated material for miles. Such an event could do considerable damage to many of the buildings and structures in the business park. Fortunately, the closest portion of the Site is one and one-third mile from the river. Based on flood water elevations, the potential depth of flood waters at the Site is small and the energy of the water would be substantially dissipated. However, to address this concern, flood protection measures will be evaluated in the remedial design.

EPA has not made the claim that levees do not fail; in fact at the third public meeting, EPA arranged for presentations regarding the performance and construction of levees, and the impact of levee failures that occurred as a result of Hurricane Katrina. It is noteworthy that the vast majority of levee "failures" are actually the result of overtopping, i.e., the flood event exceeds the design criteria for the levee. In the event of overtopping, flood waters would be expected to fill the protected area behind the levee; however, such an event would generally not result in high velocity water. Under this scenario, any flood waters reaching the toe of the landfill would be shallow and low energy and would not be expected to have significant impact on the landfill cover.

See also General Response on the flood plain issue above.

See General Response on earthquake impacts.

See General Response on groundwater impacts.

**C. Longevity: West Lake's radioactive wastes will continue releasing dangerous particles and rays into the Metropolitan St. Louis environment VIRTUALLY FOREVER -- unless they are removed.**

It is certainly true that the principal isotopes of uranium and thorium at the Site are extremely long lived. The half life of U-238 is 4.5 billion years, almost as long as the earth is old. However, it is simply not true that these wastes are releasing dangerous particles and rays into the metropolitan St. Louis environment. It is a straightforward task to measure the radiological impacts of these materials, and such measurements have been made numerous times including during the RI. The data do not support this claim. See also, General Responses above.

Regarding the interrelationship of the radiological wastes with other chemical toxins at the Site, one of the primary purposes of the field studies for both the OU 1 and OU 2 was to investigate for the presence of industrial hazardous wastes. Based on extensive sampling of groundwater, leachate, soil, and waste material, no evidence of significant industrial hazardous waste disposal was found in any of the landfill units. Most of the data are consistent with typical sanitary and municipal solid waste disposal.

Shallow groundwater at the southwest corner of the Site has been significantly impacted by petroleum hydrocarbons and VOCs. The source of these impacts could be the OU 2 Inactive Sanitary Landfill, or more likely, the leaking underground storage tank site located to the east near the asphalt plant. The storage tanks which contained diesel fuel have been removed, but impacts to the groundwater in this vicinity remain. This will not have any impact on the efficacy of the Selected Remedy. The groundwater underlying Areas 1 and 2 is not significantly impacted, and the detection monitoring program can be designed to account for baseline conditions.

**D. *Hot spots* are found at and below the surface at West Lake.**

In the context of CERCLA municipal landfill sites, the term "hot spot" is a term-of-art. It is used to refer to discrete volumes of highly toxic or highly mobile wastes located within the much greater volume of heterogeneous material that makes up the landfill waste. Typical examples include buried drums containing hazardous chemicals or lagoons full of liquid industrial waste. Under the guidelines, such hot spots should be evaluated for removal. Even though the radiologically contaminated areas at the Site do not qualify as hot spots under the guidance, the presence of these long-lived radionuclides led EPA to determine that an alternative involving removal of material should be developed and evaluated. The discussion in the Proposed Plan and ROD on this subject is intended to clarify the basis for developing Alternative 6 – *Excavation of higher levels of radioactivity from Area 2 and regrading and installation of a Subtitle D cover system.* By assuming a subset of waste material with relatively higher concentrations, the objective was to define an excavation alternative that had a chance to compare favorably with containment only under the evaluation process.

Alternative 6 involves many uncertain assumptions. For example, it is not clear that identifying hot spots or subsets of more radiologically contaminated material would have practicable implementation value. Since the contaminated soil was originally distributed in layer-like fashion, it would be expected that multiple, elevated concentration levels could be found at similar depths. However, these correlations do not translate into a capacity to recover the in situ radiologically contaminated soil as some sort of discrete unit. In fact, the data indicate that the soils are variably distributed through the upper 10 or 15 feet of municipal refuse. The contaminated soils would have to be removed along with large quantities of heterogeneous bulk waste materials. The feasibility and effectiveness of separating the soils from the bulk waste are uncertain. Also, there may not be a correlation between higher radioactivity measurements and the presence of greater quantities of soil. So targeting soils that have relatively higher radionuclide concentrations might not yield large quantities of contaminated soil. In short, successful recovery of a subset of contaminated soil could be achieved; however, successful recovery of a subset of soil that truly contains a disproportionate amount of the radiological content could be difficult to achieve or verify.

The commenter questions what she characterizes as the lack of data or data gaps associated with the soil sampling conducted during the RI. While it is true that more information on the subsurface profile of the radionuclide contamination would likely be needed to effectively design and implement a response action consistent with Alternative 6, the RI data are sufficient to support comparative analysis as required in a FS.

The question goes to the purpose of the RI soil boring program which was intended to identify some of the higher radionuclide concentrations and define the general extent of the radiologically contaminated soils. In accordance with the RI Work Plan, soil samples were collected at five-foot depth intervals from the various borings and correlated with downhole gamma surveys. The plan called for laboratory analysis of two samples from each of the 50 borings. One sample was to be analyzed from the location of the radiological high as determined by the gamma logs. The second sample was collected from immediately below the base of the radiologically elevated interval or from the base of the landfill debris if elevated readings were not detected. Samples were analyzed for the range of radiological and nonradiological parameters. The general absence of radionuclides in the deeper samples from these borings shows that the radiologically contaminated soils are generally located in the upper 10 to 15 feet of the landfill material.

Some of the information contained in this comment about U-235 and its daughters is simply not the case. U-235 is not rare and occurs naturally in U.S. uranium mill tailings piles and in rock and soils everywhere. At 5 percent the activity of U-238, U-235 is present in the background soils at about 0.14 pCi/g. U-235 was not detected in the background soil samples at the Site because levels in the 0.14 pCi/g range are below the detection limit for the method that was used. The combination of U-235/236 was measured in background samples from 0.21 to 0.91 pCi/g.

**1. Some relevant federal regulations and standards:**

**a.** The reference levels used in the RI come from the soil cleanup standards found in UMTRCA, 40 CFR Part 192, Subpart B, which apply to the cleanup of inactive uranium processing sites and specify that Ra-226 concentrations should not exceed 5 pCi/g above background in the top 15 centimeter (cm) of soil and 15 pCi/g in lower 15 cm layers averaged over 100 square meters. These numbers are used in the RI as a simple reference for the purpose of putting a boundary around the significantly impacted areas. These standards are also considered relevant and appropriate to the cleanup of soils on the Crossroads Property adjacent to Area 2. Design-level investigation will need to be done to determine the extent of any necessary cleanup of that property.

The criterion for gamma exposure rates identified in the NRC's reports is used in the survey methodology to identify the limits of elevated, external gamma radiation. Gamma readings are generally taken on a grid at about 1 meter above ground surface. The background gamma exposure rate in the area of the Site and in Missouri in general is approximately 10,000 counts per minute (cpm) using a 2"x2" sodium iodide detector or about 10 Micro Roentgen per hour (uR/hr). At one meter above the ground surface, approximately half of this exposure is due to terrestrial radiation and half is due to cosmic radiation. The criterion of 20 uR/hr used in the NRC's investigation of the Site comes from the NRC's BTP (October 1981) which identified elevated, external gamma as 10uR/hr above background.

External gamma radiation levels are elevated in Areas 1 and 2. Overland gamma survey results identified some locations at several times background. Several downhole gamma readings were over 100 times background, e.g., the reading of "nearly 2,300,000 counts per minute" referenced in the comment. (Note: background readings using a 2"x2" sodium iodide detector of the sort used in this study is approximately 10,000 cpm, not 10 cpm as claimed in the comment.) This does not present a health concern because there is no reasonable way for anyone to be subjected to prolonged contact with the materials buried in the landfill. Also, direct comparison of overland gamma readings and borehole measurements cannot be made even if a similar detector is used because the geometry of the borehole is much different than a reading taken at three feet above the surface. In a borehole, the detector is physically closer to the contaminated material and is completely surrounded by the contaminated material.

**b.** EPA agrees that the radionulides at the Site derive from uranium processing and that certain UMTRCA requirements including the groundwater protection standards are relevant and appropriate to the selected remedial action. See section 12 of the ROD for a description of these applicable or relevant and appropriate requirements (ARARs).

**E. Many unanswered questions remain about the monitoring of the West Lake radioactive wastes.**

**1.** The commenter makes the claim that the RI, having been developed on behalf of the PRPs, attempts to discount elevated readings or otherwise explain-away results that might be considered unfavorable to the responsible parties.

EPA rigorously reviewed the reports submitted by the PRPs; as a result of its review of the RI reports, EPA did not identify any efforts to improperly explain-away elevated readings. Further examination of the examples provided by the commenter does not indicate anything improper. A prime example provided by the commenter points to an interpretation in the RI that certain radiologically impacted surface material is the result of sediment deposition verses original placement. The commenter gives no reason why she believes this interpretation represents a more favorable condition. We fail to understand how this could be construed as evidence to support the charge of a spurious claim.

The commenter takes particular issue with the sampling and analysis reports prepared by McLaren/Hart. As is required, these reports discuss data quality issues and draw conclusions about the representativeness of the data. All of the data obtained as part of the RI have been presented, evaluated, and considered as part of the interpretive process. No data meeting QA/QC criteria were eliminated or otherwise not considered. Any complex environmental investigation involving extensive data collection from various media, multiple sampling events, rigorous data validation procedures, etc., will result in some number of suspect data. The data validation procedures apply standard criteria for data quality that address precision, accuracy, representativeness, comparability, and completeness of analytical data sets. In the event certain analytical results do not conform to expectation, e.g., results are higher or lower than other results obtained from the same location over time, and no error is directly attributable to factors associated with the precision and accuracy of the laboratory analyses, it is incumbent on the data user to consider the representativeness and the comparability of the results relative to the body of evidence. Moreover, one of the requirements of appropriate QA/QC is that the analytical labs are independent and have no interest in the outcome of these investigations. This provides yet another control on outcomes. The RI and supporting documents contain some assessments of certain data that are considered unrepresentative; however, all of the data are presented and considered as part of the RI process.

**Data Quality Issues:**

Groundwater Results:

As explained in section 4.5.5 of the RI, the analytical lab identified a data quality issue relative to the Th-230 analytical results for the groundwater samples collected during the November 1995 sampling round. Poor analytical recoveries of the laboratory spiked tracer indicated a problem with the volume reduction step of the sample preparation. Repeat samplings using a different sample preparation procedure yielded consistent

results meeting the analytical quality assurance criteria. A comparative review of all the data indicates that the results from November 1995 are probably biased high. These results are referred to as false positive or results that are considered higher than were actually present.

There was also a problem with the analysis of radium-226 and daughters in the November 1995 and February 1996 sampling rounds. The RI Work Plan specified EPA method 903.0, an isotopic method with a minimum detectable activity (MDA) level below the MCL values for radium-226 and radium-228. However, the contractor failed to specify this method on the chain of custody forms submitted to the laboratory and the samples were analyzed using gamma spectroscopy. Gamma spectroscopy does not require chemical separation of the target nuclides and identification is made by comparing gamma energies with the instrument's software library. The method is less reliable at identifying specific nuclides and is subject to interferences. Also, the MDA levels are greater than the MCL for radium. The gamma spectroscopy results identified significant concentrations of radium-226 and/or its daughters in several wells. Subsequent rounds of sampling and analysis using the isotopic method did not produce any similar results. The gamma spectroscopy results from November 1995 and February 1996 are presented and considered, but for the reasons just described we do not have a high degree of confidence that these elevated reading were accurate. Overall, the body of groundwater analytical results is consistent with background for these nuclides.

Because of these data quality issues, EPA requested an additional sampling round be conducted in May 1996; this was completed without problems. Well D-14 was not resampled in the May 1996 and subsequent events because the well casing was found to be obstructed.

As part of the RI site reconnaissance activities conducted in 1994, grab samples were taken from some of the pre-existing monitoring wells. These wells were not purged, and the unfiltered grab samples were analyzed for gross alpha to determine whether any special handling of purge water would be necessary when the RI wells were installed and developed. Most of the results, 28 of 31 wells sampled, indicated gross alpha concentrations were acceptable for discharge to the Metropolitan Sewer District (<15 pCi/l). The three wells exhibiting high gross alpha concentrations were resampled and analyzed as filtered groundwater samples and also analyzed for radiological isotopes. The results of re-sampling indicated the water in these three wells would be acceptable for discharge to MSD. Monitoring wells S-88 and 1206 were not sampled during subsequent RI sampling events because they were not part of the identified OU 1 monitoring network as described in the work plan. Located on property adjacent to the Site, S-80 was intended to serve as a background well because it is hydrologically upgradient and quite far removed from any potential influences from the Site. S-80 was not sampled in May 1996 or subsequent RI sampling events because the well was abandoned due to redevelopment of the property. The network of wells sampled during the RI was extensive and appropriate to characterize the groundwater in proximity to Areas 1 and 2.

It should be noted that the RI does not present a statistical evaluation of groundwater quality, and such an evaluation will be necessary as part of the long-term monitoring program to assess groundwater quality and evaluate trends. (See section 12 of the ROD.)

Soil Results:

In 1996, EPA requested split sample analysis for both soil and groundwater samples. The split samples came from archived soil samples and newly collected groundwater samples. The soil samples were therefore the equivalent of field splits rather than laboratory duplicate splits. In the summary report, McLaren/Hart concluded that comparison of the soil analytical data from the two analyzing laboratories showed overall good agreement except for the Th-230 results where the analysis of the split was consistently higher than the original results by about a factor of two. It was noted in the discussion that the higher results are consistent with results produced by the original lab prior to adding an additional cleanup column to the analytical procedure. The procedure change was initiated by the laboratory to address possible interferences, most notably from uranium-234. As indicated previously, the analytical laboratory is independent and has no knowledge of the Site background information (nor should it) and the reference to possible interference from plutonium and neptunium is a generic concern with the sample preparation methodology.

Methods and MDA Levels:

The field sampling procedures and analytical methods were specified as part of the approved RI/FS Work Plan. Laboratory sample preparation and analytical protocols are identified as part of the EPA-approved methods. The analytical laboratory may make adjustments consistent with the approved methods.

Both filtered and unfiltered groundwater samples were collected and analyzed for radionuclides and metals. Both kinds of samples are important to understanding the nature of any potential contaminant migration in groundwater, i.e., the degree to which contaminants might be partitioned to the solid phase. Filtered samples remove suspended solids in order to determine the concentration of the analyte in the water phase. Both filtered and unfiltered results are compared to the drinking water standards. Although drinking water standards apply to public water supplies, the unfiltered results may be considered a more conservative representation of water that might be consumed by a private well owner.

The MDA levels for radionuclides are determined by the analytical laboratory based on instrument response factors, analysis of laboratory standards, and other ongoing QA/QC evaluations. Variability in the MDA levels occurs as laboratory samples are analyzed in batches that correlate with specific QA/QC data and results. In addition, the MDA values are also a function of the duration of the sample analyses (termed the counting time) with MDA values varying as a function of the length of the counting times employed for each sample.

The reports regarding the Site which were prepared pursuant to the AOC with EPA do not contain monitoring incongruities; the data are accurately reported and any (anomolies) are explained or interpreted which is expected and required as part of the QA/QC process. The analysis is required to be performed by an independent laboratory according to methods and standards dictated by EPA. The scientists who tested the soil and water did not have a financial stake in the outcome of the test results, and their work was reviewed at length by qualified scientists at both EPA and MDNR.

**F. Other monitoring issues at the Site.**

EPA is the lead agency and will be responsible for tracking the Site for the federal government. MDNR will provide assistance to EPA and have lead responsibility for tracking the Site on behalf of the state of Missouri.

The specifics of the O&M program, including the long-term groundwater monitoring plan, will be developed as part of the remedial design process. See section 12 of the ROD for a description of the monitoring objectives.

It is EPA's intent to seek a settlement with the responsible parties for implementation and maintenance of the remedy as described in this ROD. This process is in accordance with section 122 of CERCLA and is consistent with EPA's "Enforcement First" and "Polluter Pays" policies. The settlement will be embodied in a Consent Decree (CD) and Remedial Design/Remedial Action Statement of Work filed with the U.S. District Court, which will maintain jurisdiction to enforce the terms of the CD. The terms of the CD are binding on the settling defendants, settling federal agency, and their successors and assigns. These parties will be required to finance and perform all remedial design/remedial action activities under the oversight of EPA and/or the state.

The O&M plan will specify the requirements for inspection, maintenance, and repair. Inspections will be performed on a periodic basis and in response to any unusual conditions. Inspectors will evaluate all the physical aspects of the remedy as well as the administrative and institutional controls. Maintenance and repair activities will be performed on a periodic basis and as identified during inspections. Reports on inspection and maintenance activities will be submitted on a periodic basis.

The long-term groundwater monitoring plan will specify the monitoring well locations, sampling frequencies, analytical parameters, procedures, etc. Periodic sampling reports that include data summaries and interpretation of the results will be published. Trend analysis will be used to verify performance.

CERCLA and the NCP require that periodic reviews, referred to as Five-Year Reviews, be conducted at every site where contamination remains above levels that do not allow for unrestricted use. At least every five years, an evaluation will be performed to ensure that the remedy remains protective and is performing as expected.

In the event of new information or if the remedy is not performing as expected, e.g., monitoring shows that groundwater quality is degrading over time, EPA may re-evaluate the remedy and select further response actions as necessary to protect human health and the environment in accordance with the requirements of CERCLA and the NCP.

**G and H.**

Containment in place consistent with the Selected Remedy is protective of human health and groundwater. It is true that safe removal of the wastes is possible. However, it is not the option that provides the best balance of trade-offs when considered against the evaluation criteria provided in the NCP. See General Responses.

**II.** Ms. Drey submitted a second comment letter dated April 9, 2008 (copy attached). The numbering for this response corresponds to the numbering in the comment letter.

1. The commenter reiterates that the Missouri River flood plain is a poor location for the waste and cites NRC rule (10 CFR Part 61) which says that a near-surface radioactive waste disposal site "must minimize to the extent practicable the contact of water with waste."

**Response:** 10 CFR Part 61 provides the licensing requirements for land disposal of certain radioactive wastes. Note that the regulations in this part do not apply to uranium mill tailings waste which are governed by Part 40 for sites under NRC license and developed consistent with health and environmental standards set by EPA pursuant to UMTRCA (40 CFR Part 192).

Keep in mind that the purpose of the Site response action is not to site a new disposal facility. The purpose is to determine the best solution for existing landfill areas consistent with the requirements of CERCLA and the NCP. Nevertheless, the landfill cover required by the Selected Remedy is designed to minimize contact of water with waste and employs the same methods used at uranium mill tailing sites.

2. The commenter notes that the Site is located directly upstream of the St. Louis City and North County public drinking water intakes.

**Response:** EPA is aware that the Missouri River is a valuable resource and a source of drinking water to St. Louis and beyond. The Site is not a threat to the Missouri River or public water supplies. The groundwater at the Site is not significantly impacted by the radiologically contaminated material in the landfill, and the Selected Remedy will ensure that this remains the case. See the response to General Comment 2.

3. The commenter notes that the radioactive materials at the Site will be radioactive for many thousands of years. The commenter claims that the radioisotopes are ranked among the most dangerous known and include some not detected in American ore residues.

**Response:** EPA is aware that the radioactive materials will be radioactive for millennia. Managing the West Lake Site over the long term poses the same sort of challenges faced at countless waste sites where long-lived radionuclides, heavy metals, or other stable toxic materials will remain. See the response to General Comments above. As explained in response to the commenter's first letter above, EPA disagrees that the radioisotopes at the Site are unusually dangerous or rare.

4. The commenter claims that the Selected Remedy would provide neither current nor lasting protection from radioactive gases and dust through cracks that develop in the cap.

**Response:** The Selected Remedy uses the same methods used at uranium mill tailing disposal sites and landfill sites with great success. See General Comment 10 above.

5. The commenter claims that all the other St. Louis sites contaminated with Mallinckrodt Chemical Works wastes have been or are being cleaned up by the U.S. Army Corps of Engineers. Why not West Lake too?

**Response:** Distinctions in cleanup decisions between the St. Louis sites and the West Lake Site have nothing to do with which federal agency is responsible for the cleanup. In both cases, the remedy selection is governed by the Superfund process and the distinctions have to do with the physical setting and the reasonably anticipated land use. In St. Louis, accessible soils are being excavated for commercial disposal because these contaminated soils would present potential exposure concerns. The inaccessible soils in St. Louis, i.e., soils under roads, buildings, and other structures, are being managed in place. Like the soils in the landfill, the inaccessible soils do not present a health concern as long as they remain where they are. At the Site, the contaminated soils are disposed in a landfill that is dedicated to use as a landfill.

6. The commenter states that the federal government is paying for the remediation of all the other Mallinckrodt nuclear weapons waste sites in metropolitan St. Louis, including one billion dollars expended at Weldon Spring. Why not West Lake too?

**Response:** Again, the remedy selection for these sites is governed by the Superfund process and is not dependent on whether the source of funding is public or private. In addition, the federal government will be asked to pay for part of the cleanup at the Site because the Department of Energy (DOE) is a PRP.

**3. <u>Great Rivers Environmental Law Center</u>**

**I.** The headings used to organize this response are not EPA's and were taken from the December 28, 2006, comment letter sent by Henry B. Robertson on behalf of the Great Rivers Environmental Law Center (copy attached).

1. We d*isagree that RCRA Subtitle C or D is ARAR. The waste is source material and byproduct material and is regulated exclusively under AEA. Can't treat West Lake like just another municipal landfill, etc.*

We disagree with the inference that AEA has exclusive jurisdiction over the wastes at the Site. CERCLA provides authority to clean up the Site. Section 104 provides the authority to respond to releases of hazardous substances, which has a very broad definition and includes those subject to the AEA. Section 106 provides the authority to issue orders and to secure injunctive relief for the cleanup of sites and section 122 provides a statutory process for settlements. In addition, CERCLA provides that if the responsible parties do not agree to perform the studies, investigations, and response actions found to be necessary by EPA, EPA may use trust fund money to clean up a site and pursue the PRPs for cost recovery. It is a very comprehensive statute which also acknowledges that specific requirements under other environmental laws may be considered relevant and appropriate if they apply to contaminants and/or activities that are sufficiently similar to that being addressed by the CERCLA action. See section 13.2 of the OU 1 ROD for a description of all ARARs.

In addition, NRC (the successor agency to AEC) by letter dated June 16, 1995, deferred its regulatory authority to EPA for the remedial actions at the Site. The letter, which can be found in the Administrative Record for OU 1, acknowledges that the materials at the Site are within the authority of CERCLA which can require the remediation of both radiological and nonradiological wastes.

The Resource Conservation and Recovery Act (RCRA) Subtitle D provides the requirements for municipal solid waste landfills. Since the disposal in Areas 1 and 2 occurred prior to the effective date of RCRA Subtitle D, these requirements are not applicable. However, like a solid waste municipal landfill unit, the Site Areas 1 and 2 are land disposal units containing large volumes of miscellaneous municipal solid waste. Most of the wastes in the Site Areas 1 and 2 are very similar to the sort of wastes to which RCRA Subtitle D regulations and corresponding state requirements are intended to apply. Therefore, in carrying out any action to close these units, it is appropriate to meet the solid waste requirements for closure and post-closure care. The mere presence of soils contaminated with long-lived radionuclides mixed in with the larger volume of municipal solid waste does not alter this fundamental conclusion. Since Areas 1 and 2 are like a municipal solid waste landfill and the Selected Remedy is containment, the various requirements for closure and post-closure care identified in the Missouri solid waste rules for sanitary landfills are considered relevant and appropriate.

RCRA Subtitle C regulations provide performance standards for the treatment, storage, and disposal of RCRA hazardous wastes. Since the disposal in Areas 1 and 2 occurred prior to the effective date of RCRA Subtitle C, these requirements are not applicable. In addition, there are no records or other evidence that RCRA hazardous wastes were disposed of in these landfill units. However, the remedy for the Site involves permanent land disposal of hazardous substances; therefore, it was considered reasonable to review various closure and post-closure care requirements. During this review, however, no RCRA Subtitle C requirements were identified as relevant and appropriate.

The radiological materials at the Site derive from the processing of uranium ore. UMTRCA (40 CFR Part 192) amended the AEA by directing EPA to set generally

applicable health and environmental standards to govern the stabilization, restoration, disposal, and control of effluents and emissions at both active and inactive uranium mill tailing sites. These requirements only apply to active and designated inactive uranium mill processing sites. The requirements are intended to apply to large tailings piles or impoundments. Areas 1 and 2 do not resemble tailings piles or impoundments. Areas 1 and 2 contain low activity radioactively contaminated soils mixed with large volumes of municipal trash and construction debris. The radionuclides at the Site are similar to those found at uranium mill tailing sites; therefore, specific requirements under 40 CFR 192 Subpart A and 40 CFR 192 Subpart B were carefully reviewed to determine which should be considered relevant and appropriate to remedial actions at OU 1. Due to the presence of the long-lived radionulcides similar to those found at uranium mill tailings sites, the state solid waste requirements have been augmented to include appropriate closure and post-closure care requirements from the UMTRCA regulations. Therefore, the Site is not being treated as just another landfill. In addition, see the discussion below relating to other ARARs.

2. *The Plan should consider as an ARAR 10 CFR Part 40, Appendix A, "Criteria relating to the operation of uranium mills…."*

These NRC requirements apply to license applicants for the design and operation of a uranium mill. Some of the requirements for the disposition of tailings piles and impoundments could be considered relevant and appropriate to the remedy for OU 1. These requirements derive from standards set by EPA under UMTRCA. UMTRCA directed EPA to set standards for the stabilization, disposal, and control of uranium and thorium mill tailings. These standards were promulgated in 40 CFR 192. The NRC decommissioning rules are excluded from application to uranium and thorium recovery facilities subject to 40 CFR 192. The Selected Remedy will meet relevant and appropriate requirements from 40 CFR 192 as described in section 13.2 of the OU 1 ROD.

The groundwater protection standards in 10 CFR Part 40 incorporate the basic groundwater protection standards imposed by EPA in 40 CFR Part 192. The groundwater protection standards under 40 CFR 192 are relevant and appropriate and will be complied with. Note that Criterion 5 applies to active surface impoundments and there is no such comparable activity for OU 1.

3. It is true that Subtitle D closures do not typically include a rock armoring layer or a radon barrier; however, the solid waste closure requirements for the Selected Remedy have been supplemented with relevant and appropriate requirements from 40 CFR 192. As such, the conceptual cover system includes a rock armoring layer to address longevity considerations and a radon barrier. EPA's Selected Remedy includes what the commenter suggested.

4. Removal and consolidation of residual radioactive material will be used to address any contaminated material on the Crossroad Property consistent with the UMTRCA soil standards and EPA guidance on the use of these standards at CERCLA sites.

5. The Site involves low activity ore processing waste which was land disposed with municipal waste. Requirements for the management of spent nuclear fuel, high level, and transuranic wastes are not relevant or appropriate to any waste materials at the Site or for activities selected for implementation of the OU 1 remedy.

6. Uranium was evaluated in the BRA as both a radiological and chemical toxin. This has been accounted for by the Selected Remedy.

7. EPA's presumptive approach to CERCLA municipal landfill sites is intended to take advantage of considerable experience with these kinds of sites. Approximately 20 percent of the sites on the NPL are municipal landfill sites. These sites share many similar characteristics including large waste volumes and heterogeneous mixtures of municipal waste, frequently co-disposed with industrial and hazardous wastes. Many of these industrial and hazardous wastes are far more toxic and mobile in the environment than the radiolocically contaminated soils in OU 1. The basic purpose of this guidance, *Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills*, is to establish that the occurrence of waste types that may differ from a typical municipal landfill does not overturn the validity of the presumptive approach.

Moreover, EPA did not rely solely on the presumptive remedy guidance to select a remedy for OU 1. Rather, the RI/FS process involved extensive characterization of the landfill waste materials and evaluation of an excavation and remote disposal alternative. EPA is not treating the Site as just another landfill. However, the results of this site-specific evaluation performed in the RI/FS confirmed the general experience forming the basis of the presumptive approach.

**II.** An additional comment letter dated April 8, 2008, was sent by Bruce A. Morrison on behalf of the Great Rivers Environmental Law Center (copy attached).

The commenter questions whether EPA should defer to the U.S. Army Corps of Engineers' and/or the Earth City Levee District's assessment that there is little risk that flood waters will reach the landfill's contaminated waste.

EPA is not deferring to the U.S. Army Corps of Engineers or the Levee District on the potential for flood waters to reach the landfill or on any other aspect of the Selected Remedy. Moreover, the U.S. Army Corps of Engineers and the Levee District have offered no such assessment. EPA invited the U.S. Army Corps of Engineers and the Levee District to present information on the levee system due to the public interest on this subject.

The protectiveness of the Selected Remedy does not rely on the levee system. Even in the event the levee failed or was overtopped, the resultant flood water would have minimal impact on the landfill.

**4. Missouri Coalition for the Environment**

**I.** The headings used to organize this response are not EPA's and were taken from the December 29, 2006, comment letter from Kathleen Logan-Smith, Executive Director, submitted on behalf of the Missouri Coalition for the Environment (copy attached).

All of the subjects covered by this comment letter have been thoroughly studied, presented, and considered in the decision process for the Site. The Coalition's comments contain many factual errors and misinterpretations of the technical information. This response is intended to provide a more accurate representation of the subject matter raised by each of these comments.

In the Coalition's introductory remarks, a request was made for an extension of the comment period. The comment period opened on June 14, 2006; was extended until August 14, 2006; was extended again to October 14, 2006; and was extended again until December 29, 2006; as requested by St. Louis County on the Coalition's behalf. Since EPA's Proposed Plan and Administrative Record had been available for review and for comment for more than six months, EPA determined that the comment period was sufficient. Initially, EPA held two public meetings (one on June 22, 2006, and another on September 14, 2006) which were attended by many local residents, public and elected officials, and many of the commenters. During the two public meetings, the attendees were provided with information about the CERCLA process, the studies, and investigations performed at the Site and the Proposed Plan. Oral comments were taken from those present including this commenter, the members of the public, and elected officials. EPA did not refuse to meet with public officials as asserted by the commenter, but EPA did not agree to have an off the record meeting with these officials during the public comment period.

In response to public comment on the levee system and flood plain issues, EPA decided to reopen the public comment period and hold a third public meeting. The comment period was reopened and the public meeting was held on March 27, 2008, at the Bridgeton Community Center to present more information on flood protection issues. In addition, more information was placed in the Administrative Record regarding these issues. The second comment period was closed on April 9, 2008.

**These Are Not Uranium Mill Tailings**

See General Response regarding Belgian Congo ore. See section 13.2 of the ROD for ARARs analysis.

**The West Lake Waste is Hot and Getting Hotter**

The 1988 NRC report (NUREG – 1308) and the RI/FS documents explain that one of the effects of the ore processing is the naturally occurring U-238 to Th-230 to Ra-226 equilibrium has been altered. The ratio of Th-230 to Ra-226 is much greater than would be the case if these radionuclides were in equilibrium. Therefore, radioactive decay of Th-230 will increase the concentration of its decay product Ra-226 with time until these

radionuclides are again in equilibrium. Ra-226 and its daughters are principal risk drivers in this decay series and therefore the radiological hazard from potential exposure to these materials will increase with time until equilibrium is reached. Also, increased Ra-226 concentrations will lead to increased radon generation. These factors were taken into account when evaluating the remedial alternatives. The engineered cover system will be designed to account for future ingrowth of Ra-226 and future radon gas generation.

It is worth noting that the NRC staff was working with limited radiochemical data from the 1982 radiological survey report prepared by RMC. Because they had such limited Th-230 data and in the interest of ensuring conservatism in estimating the long-term ingrowth of Ra-226, the NRC staff used a Th-230:Ra-226 ratio of 100:1 to estimate Th-230 activity from the mean concentration of Ra-226. The survey data indicated an average Ra-226 concentration of 90 pCi/g, which was used to estimate an average Th-230 concentration of 9,000 pCi/g.

The more extensive soil analytical results collected during the RI have allowed some better estimates. The arithmetic average values of Th-230 and Ra-226 from all of the Area 2 samples were 2,140 and 189 pCi/g, respectively. Therefore, the average Ra-226 concentration from the RI data is about double the concentration determined by RMC, but the average Th-230 concentration is about one fourth the NRC estimate. The Th-230:Ra-226 ratio is actually 11:1, or about an order of magnitude less than that used by the NRC in their calculations. Accounting for the ingrowth of Ra-226 due to the decay of 2,140 pCi/g of Th-230 results in an estimated average Ra-226 concentration of 749 pCi/g in 1,000 years. However, in that same 1,000 years, the existing 189 pCi/g of Ra-226 would decay to 123 pCi/g resulting in a total estimated average concentration of Ra-226 of 872 pCi/g after 1,000 years.

It is unclear what the commenter intends to convey by providing this partial quote from the 1988 NRC report: "….even a small concentration of Ra-226 in 1988 implies such a large concentration later that it will be necessary to employ more difficult measurement techniques to confirm that the cleanup has been satisfactory." This is merely an elaboration on the point by NRC that the controlling radionuclide (Th-230) is a weak gamma emitter and, in isolation from the other radionuclides, cannot be reliably detected at low levels using the field survey detectors.

The commenter points out conclusions in the 1988 NRC report quoting: "Under these conditions, onsite disposal, if possible, will likely require moving the material to a carefully designed and constructed 'disposal cell.' ….Any possibility of disposal on site will depend on adequate isolation of the waste from the environment, especially for protection of the groundwater."

These statements need to be looked at in context. In its 1988 report, the NRC, working with limited data, looked at the applicability of its 1981 BTP, which outlines options for residual contamination at processing sites. Since the circumstances at the Site did not fit any of the prescribed options in the BTP, they made a presumption as to the likely need for a disposal cell. As the report goes on to explain, the conclusions were not based on

comprehensive field study or engineering evaluation which should be performed before major questions can be resolved and any final judgment is made regarding the appropriate remedy. EPA has since gone on to perform the necessary study (the RI and all the studies that are comprehended within it) and evaluation (the FS). EPA agrees with the statement that the feasibility of on-site disposal depends on adequate isolation of the waste and protection of the groundwater. Data collected during the RI/FS support conclusions that the Selected Remedy meets these expectations and will provide that protection.

**Consider Other Radionuclides**

All of the radionuclides in the waste materials have been considered in the evaluation of this Site. The wastes contain naturally occurring uranium-238, thorium-232, uranium-235, and all the associated daughters in these decay series. For purposes of site characterization and risk assessment, the radionuclides with relatively long half lives, are used as indicators for all members of their associated decay chains. The occurrences of the short-lived daughters are inferred from the concentrations of these long-lived indicators and thus are considered. Also, risk assessment methodology is designed to account for dose contributions from all radionuclides in the decay chain; these were accounted for in the BRA.

As opposed to the suggestion in the comment, the remedy prevents migration of contaminants to groundwater and does not rely on dilution. See General Response on groundwater protection.

**The Radionuclides Are in the Groundwater**

Significant migration of radionuclides to groundwater or perched water within the landfill waste material has not occurred. As presented in the RI, the results of extensive groundwater monitoring indicate some isolated impacts to the shallow groundwater from the landfill activities. Radionuclides, total petroleum hydrocarbons, VOCs, SVOCs, pesticides, and trace metals have all been detected. Most of these occur sporadically and at trace levels. Most of the results for radionuclides and trace metals are consistent with background, although several detections of radium and arsenic have exceeded drinking water standards (MCL). The one leachate seep came from perched groundwater in the southwest corner of Area 2. The seep is an intermittent flow resulting from periods of extended rainfall. The seep flows over the ground for a short distance before evaporating or infiltrating back into the subsurface. The results from analysis of the seepage were consistent with the results obtained from the perched groundwater, i.e., it contained constituents from the uranium-238 decay series at levels similar to background. It also contained some VOCs, SVOCs, trace metals, pesticides and total petroleum hydrocarbons. While a single sample is considered sufficient to confirm the relationship between the seep and the perched groundwater, the seep is not considered a significant pathway for off-site migration because of its low flow and the fact that the seepage does not migrate off-site. In any event, following implementation of the Selected Remedy, the

installed landfill cover will prevent the infiltration that is the source of the perched water and the seep. See General Response on groundwater protection.

**The Groundwater is Moving**

The hydrogeologic setting, including groundwater levels and gradients, has been thoroughly investigated and evaluated. Detailed descriptions are provided in the RI reports for OU 1 and OU 2. All of this information has been factored into EPA's decision process for this Site. Based on studies conducted during the RI, groundwater movement in the alluvial aquifer is predictable and contaminant monitoring is very straightforward. There are no unusual or atypical conditions that would introduce unreasonable difficulties or uncertainties.

The alluvial aquifer has a relatively high hydraulic conductivity but the water levels show generally flat gradients that range below 0.0001 ft/ft. The site straddles the edge of the alluvial valley where the bedrock and the alluvium meet. The shallow groundwater underlying the Site is heavily influenced by the presence of the permitted sanitary landfill which operates leachate collection sumps in the upper bedrock units at the former quarry pits which create a groundwater sink that causes shallow groundwater across much of the Site to draw down toward the sanitary landfill. The alluvial water level in piezometers near the sanitary landfill is actually about 80 to 150 feet above the leachate riser level in the landfill. If pumping were to cease, water levels would return to the natural water level in the alluvial aquifer; however, this would not effect the performance of the remedy for OU 1 because the landfilled material at Areas 1 and 2 are above the natural water table. Currently, there are no alluvial pumping wells at Earth City or in the vicinity of the Site and current state regulations prohibit placement of water wells within 300 feet of a landfill. Nevertheless, assuming an alluvial pumping well was placed in close proximity to the Site, most of the inflow would be from the direction of the river but it could draw a lesser contribution from the direction of the Site. Since the natural water table has a lower elevation than the radiological waste material at Areas 1 and 2, this would have no influence on the potential for Site contaminants to migrate to groundwater and would have no influence on the performance of the landfill cover. Note that the nearest registered well is a bedrock well located one mile northeast of the Site. The closest alluvial well is about 2.5 miles south.

The alluvial aquifer consists of unconsolidated sediments including gravels and sands. It is not unusual to encounter caving sands when drilling or boring in this hydrogeologic setting. The caving sands are not caused by either water or wind and are not moving with the groundwater, but rather they are unconsolidated river deposits that move to fill the void introduced by the drilling process. This condition did present some difficulty for boring and monitoring well installation in certain locations. One of the 52 planned borings had to be re-located because caving sand prevented boring to full depth in the original location. Also, drilling additives needed to be used to counteract caving sands for three of the monitoring well installations. These alluvial sands have nothing to do with the prospect of radionuclides in the landfill migrating to groundwater.

The groundwater monitoring results collected during the RI phase address the potential for colloid-facilitated contaminant transport. The groundwater sampling and analysis included both filtered and unfiltered samples. The monitoring results include contaminants found in both the aqueous phase and the solid phase. This will be true of the long-term groundwater monitoring program as well.

**The Waste is Not Just in Water**

The RI/FS does not rely on assumptions about solubility to determine what is in the leachate/perched water and groundwater. The results of direct sampling and analysis are presented in the RI. The perched water shows some low levels of VOCs and metals. Radionuclide values from the perched water were in the background range. EPA generally agrees with the conclusion cited by the commenter from the 1988 NRC study, i.e., some low-level contamination of groundwater has occurred and the present disposition of the wastes may not be adequately protective of the groundwater over the long term. Installation of a landfill cover designed to limit surface water infiltration will address this concern.

**The Radioactive Contamination Has Already Moved Off-Site**

Most of the radionuclide occurrences at the locations cited in this comment are due to original deposition not migration. However, erosional transport of contaminated soils is a pathway of concern that will be addressed by the remedy. Some erosional transport of radionuclides has occurred in the past, e.g., the contamination on the Buffer Zone/Crossroad Property adjacent to Area 2 and contamination in the drainage ditch along the access road adjacent to Area 1. Consolidation and containment under an engineered landfill cover will prevent any soil or sediment migration from happening in the future.

**A History of Assumptions That Proved Wrong**

One of the objectives of the Selected Remedy is to put controls into place including a formal O&M plan. This will ensure that the physical remedy and institutional controls are subject to periodic surveillance, maintenance, and reporting. O&M for the Site is not an assumption but rather a requirement that can be enforced.

**State and Federal Agencies Are Not Paying Attention**

This comment refers to the erosional event that deposited contaminated soil on the adjacent Buffer Zone/Crossroads Property. Erosional transport of contaminated soils is a pathway of concern that will addressed by the remedy. The remedy requires that any contamination on the Buffer Zone/Crossroads Property be consolidated onto the disposal area prior to installation of the landfill cover. The remedy does not rely on vegetation to limit wind and water migration of contaminants. The cover will ensure that waste materials in the landfill will not be exposed to erosion in the future.

**Institutional Controls are Meaningless Over Eons**

While EPA would agree that documents from 700 A.D. would be difficult to locate on this continent, EPA has had success locating land records in Missouri dating back to the early 1800s. Modern record keeping has greatly improved, and electronic record keeping has revolutionized the availability of data once difficult to locate and read. Many historic records have been transferred to electronic media.

The Missouri legislature recently passed the Missouri Environmental Covenants Act (MECA) which provides for a better and more durable use restriction than under previously existing common law. The ROD requires land-use restrictions be implemented using the type of environmental covenants described in MECA.

**The Air We Breathe**

Air sampling was performed during the RI phase and confirmed that airborne transport of fugitive dust is not a pathway of concern under the current conditions. However, airborne transport of contaminated soil or dust may have occurred in the past, especially during the period that the material was placed in the landfill back in 1973. Given the episodic nature of the potential release and assuming typical patterns of fugitive dust dispersal, it is extremely unlikely that this process could have resulted in any measurable accumulation of contamination at off-site locations.

An extensive study of background radionuclide concentrations was not performed; however, gamma exposure rates were recorded and soil samples were collected from several locations near the Site. The results were consistent with background values from other investigations in Missouri.

There is no evidence that the 1993 flood had any impact whatsoever on the Site. Given its location inside the Earth City Levee, this event could not have resulted in any redistribution of materials.

The discussion in the Proposed Plan on National Emissions Standards for Hazardous Pollutants (NESHAP) is part of the determination as to what environmental requirements are considered ARAR. Under CERCLA, requirements under other environmental laws may be applicable if they are specifically intended to apply to the circumstance being addressed. Even if not applicable, requirements may be considered relevant and appropriate if they apply to a circumstance that is sufficiently similar to the circumstance being addressed by the CERCLA action. The Site is not a designated uranium mill tailing pile, therefore, the NESHAP standard for radon-222 emission is not applicable. However, the requirement is considered relevant and appropriate and will be met.

**Inadequate Alternative Analysis**

Most of the claims and conclusions provided in this comment are in error and simply not supported by the available information. All practicable alternatives have been considered

for the Site. The RI/FS for the Site did not rely only on EPA's presumptive remedy guidance for CERCLA municipal landfill sites. For example, the RI/FS included thorough in-situ waste characterization and evaluation of large-scale waste excavation as a remedial alternative. This extensive site-specific analysis did reconfirm many of the basic experiences and observations around which the presumptive remedy guidance is built.

CERCLA municipal landfill sites share many similar characteristics including large waste volumes and heterogeneous mixtures of municipal waste, frequently co-disposed with industrial and hazardous wastes. In many cases, the hazardous chemical substances are much more toxic and more mobile in the environment than the radionuclides contained at the Site. In some cases, these sites contain industrial wastes with radiological contents similar to the Site radiological residues, including oil and gas production wastes and water treatment plant sludges. The *Feasibility Study Analysis for CERCLA Municipal Landfill Sites* (EPA540/R-94/081), which provides a technical basis for the presumptive remedy guidance, considered full-range FSs at 30 municipal landfill sites. In all cases, containment in place was the primary remedy selected. Where containment is feasible, wholesale excavation and removal of a landfill simply does not compare favorably with containment when evaluated against the nine evaluation criteria from the NCP.

Groundwater flows in the alluvial and bedrock formations that underlie the Site. This fact was not ignored and, in fact, was studied quite extensively. No current or future sources of groundwater are contaminated. Groundwater protection is a principal goal of the Selected Remedy and remedy performance will be verified through groundwater monitoring. Active groundwater remediation options were not considered as part of the evaluation process because the data collected during the RI showed that there are no contaminant plumes or significant groundwater releases associated with the landfill areas.

We did not find any consideration of groundwater intercept approaches in the 1982 NRC report; however, we do generally agree with the basic conclusions provided in the report that the lack of radiological contamination found in groundwater and leachate indicates that the ore residues are not soluble and are not moving off-site via groundwater. The landfill cover system will be designed to mitigate surface water infiltration. The cover, together with long-term groundwater monitoring, ensures that the Selected Remedy will address any ongoing groundwater concerns.

The Niagra Falls Storage Site involved above ground storage silos containing the radium-bearing K-65 residues. The situation at the Site is not comparable. See general responses above on risk and Belgian Congo wastes.

**The Evaluation of Alternatives is Flawed**

The evaluation of the alternatives in the FS is comprehensive and does not focus on cost, as charged by the commenter. As indicated previously, EPA reviewed the investigations and the studies prepared by the PRPs; the Proposed Plan itself was prepared by EPA. The alternative proposed in the plan was based on consideration of all of the evaluation

criteria provided in Superfund's implementing regulations (the NCP). Many considerations beyond cost work against the excavation alternative including the greater potential for human exposures and increased physical hazards during implementation. See general response above on PRP-lead RI/FS.

**The Plan Does Not Fully Consider Human Health Risks**

The plan does fully consider human health risks. The human health risk assessment was conducted in accordance with EPA's Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual. It is true that the biological effects associated with chronic exposure to ionizing radiation in the environment may include carcinogenicity, i.e., induction of cancer; mutagenicity, i.e., induction of mutations in somatic or reproductive cells, including genetic effects; and teratogenicity, i.e., effects on growth and development of an embryo or fetus. However, the cumulative risk of cancer due to chronic exposure is considered to be many times greater than the risk of genetic or teratogenic effects. Therefore, under EPA guidance, evaluation of teratogenic and genetic effects is not required because these risks are small in comparison. Similarly, consideration of acute effects is not required since these effects occur at much higher doses than any potential doses being addressed at the Site.

Again, it should be kept in mind that the purpose of the BRA is not to evaluate each and every conceivable risk. The purpose is to determine whether acceptable risk thresholds are exceeded, in which case there is a basis for taking a response action under CERCLA and EPA reaches this conclusion in the Proposed Plan and the ROD.

The remedy selected in the ROD is designed to address all potential pathways for human exposure. In preventing human exposure to Site contaminants through these pathways, the Selected Remedy addresses all types of potential health effects. Residential use of the landfill was not evaluated because the process is designed to examine risks under current and reasonably anticipated land use. The potential health risk posed by direct consumption of the contaminated groundwater was not calculated. There are no significant offsite areas of groundwater contamination attributable to the contaminants in Areas 1 and 2. As a matter of policy, EPA generally does not calculate the risk from drinking groundwater on landfill sites because such activity is incompatible with the land use. Moreover, the remedy for CERCLA landfill sites presumes the need to protect groundwater from any ongoing or potential contaminant migration.

See sections 5 and 8 of the ROD for a discussion of migration pathways and remedial action objectives.

See general responses above on risk and groundwater.

It is not clear where the commenter's information on water wells comes from but it does not appear to be current. Based on information from the state of Missouri, there are no registered wells between the Site and the Missouri River in the direction of regional groundwater flow. The nearest registered well is about one mile northeast of the landfill

and is drilled to 245 feet indicating bedrock completion. The closest registered well that appears to be completed in the alluvium is 2.5 miles south of the landfill. A review of unregistered wells, i.e., private wells installed before the adoption of formal registration requirements, was also conducted. Field reconnaissance of unregistered wells in the area found only one existing well. The owner indicated that the well is no longer used because the property is serviced by municipal water.

**The Proposed Plan Fails to Apply Appropriate Legal and Scientific Standards**

EPA disagrees that the remedy fails to protect public health and the environment. The various environmental requirements were determined by EPA in consultation with MDNR. See ROD section 13.2 for a list of ARARs. Although operated prior to RCRA regulation, the Site Areas 1 and 2 are land disposal units containing large volumes of miscellaneous municipal solid waste. Most of the wastes in the Site Areas 1 and 2 are very similar to the sort of wastes to which RCRA Subtitle D regulations and corresponding state requirements are intended to apply. Therefore, in carrying out any action to close these units, it is appropriate to meet the solid waste requirements for closure and post-closure care. The presence of soils contaminated with long-lived radionuclides mixed in with the larger volume of municipal solid waste does not alter the fundamental conclusion that Areas 1 and 2 are similar to municipal solid waste units. Due to the presence of the long-lived radionulcides similar to those found at uranium mill tailings sites, the state solid waste landfill closure and post-closure care requirements have been augmented to include appropriate closure and post-closure care requirements from the UMTRCA regulations.

RCRA requirements that have been identified as relevant and appropriate are the Missouri solid waste regulations for closure and post-closure care. There are no requirements for risk assessment or otherwise that would limit the time frame over which the remedy must remain protective. Also, it should be pointed out again, that the Selected Remedy is a response action under CERCLA not RCRA. Under CERCLA, the remedy must be maintained for as long as hazardous substances, pollutants, or contaminants remain on-site above levels that allow for unlimited use and unrestricted exposure. A statutory review of the remedy must be conducted to confirm that the remedy remains protective no less often than every five years.

**Removal Can Be Achieved**

Removal of waste materials from the Site is feasible. That is not in question. The question is what available option for remediating the Site provides the best balance of trade-offs against the nine evaluation criteria provided in the NCP. See general responses above on FUSRAP and comparative analysis.

**There is No Better Time to Remove the Waste**

The results of various field investigations over the years, including the RI, do not support any of the statements contained in this comment. The groundwater data fully

demonstrate that contaminants are not migrating in the fashion described. There are no impacts to any current or future drinking water sources. The Selected Remedy addresses all potential migration pathways and ensures long-term protection of human health and the environment.

**II.** Additional comments were submitted on behalf of the Missouri Coalition for the Environment in an April 9, 2008, letter from Kathleen Logan-Smith, Executive Director (copy attached). These comments are addressed below.

**Comment 1:** The commenter cites the Site OU 1 FS Report which states that the RI was not designed to support definitive conclusions about the potential for contaminants to leach to groundwater over time. It also concludes that leaching of contaminants to groundwater is a potential migration pathway that must be addressed by the remedial action. The commenter proposes that these statements are evidence that the RI did not fully investigate and explore groundwater contamination and questions how EPA could therefore conclude that the groundwater is protected.

**Response 1:** The commenter has misinterpreted the meaning of these statements. The groundwater investigations conducted during the RI were designed to characterize the current nature and extent of contaminant migration to the groundwater. The results of these investigations can be used to confidently draw conclusions about the current extent of groundwater contamination and can be used to support qualitative judgments about the leaching potential of the contaminants in the source areas. However, these investigations are not considered sufficient to rule out leaching to groundwater as a pathway of concern at some point in the future if no response action is taken. It was not part of the intent of the RI to undertake the sort of studies that might be necessary to make the case that a barrier to surface infiltration is unnecessary. Consistent with this approach, the Selected Remedy requires a landfill cover designed to shed water and minimize infiltration.

**Comment 2:** The commenter questions the completeness of the groundwater data and the validity of EPA's conclusions regarding groundwater contamination given that many of the perimeter monitoring wells are identified in the FS as damaged or no longer existing.

**Response 2:** The wells that are identified as no longer existing were lost due to construction along St. Charles Rock Road and development on the Crossroad Property after the RI investigations had been completed. The fact that these wells are no longer in service does not invalidate the data collected during multiple rounds of groundwater sampling during the RI. Going forward, EPA will be relying on a long-term groundwater monitoring program that will be designed, implemented and maintained as part of the remedial design/remedial action process. Specific monitoring locations, sampling frequencies, and analytical parameters will be developed according to the objectives identified in section 12 of the ROD. New monitoring wells will be installed as necessary to accomplish these objectives.

**Comment 3:** Groundwater is present in the bedrock. What evidence does EPA rely on to conclude that bedrock aquifers are: (1) not impacted by radiotoxic materials, and (2) not likely to be impacted by radiotoxic materials?

**Response 3:** Both alluvial and bedrock aquifers are present at the Site. Alluvial deposits of varying thickness are present over most of the northern half of the Site ranging from less than 5 feet in the vicinity of Area 1 and increasing in thickness in the direction of the river to approximately 100 feet beneath Area 2. The monitoring well network was designed to give coverage across the Site at shallow, intermediate, and deep intervals. Many of the monitored intervals are in bedrock. Likewise, in the long-term monitoring program, many of the monitored intervals will be in bedrock.

The groundwater monitoring data collected to date did show the presence of radionuclides in the shallow groundwater beneath the Site, but the radiological contaminants occur at low concentrations that are generally consistent with background levels. The data do not indicate the presence of groundwater plumes or contiguous areas of groundwater contamination associated with the landfill area. Groundwater transport of contaminants to off-site areas does not appear to be significant under current Site conditions. The long-term monitoring program will be designed to detect contaminant migration to the groundwater, including the bedrock aquifer, should such a condition develop sometime in the future.

**Comment 4:** The risk assessment did not address irrigation scenarios from groundwater or the risks from flood waters carrying radionuclides onto crop fields. The risk assessment took a very short view of very long-lived wastes. Thus, it was inadequate and should not guide decisions about the Site.

**Response 4:** The Selected Remedy requires institutional controls to prevent the use of all groundwater underlying the Site. In addition, the Missouri Well Construction Code prohibits the placement of wells within 300 feet of a landfill. Because there are no sources of groundwater contaminated with radionuclides, irrigation would not result in a complete pathway for exposure to radionuclides under current conditions.

The specific purpose of the BRA is to establish a statutory basis for taking a response action. The BRA was prepared according to Superfund guidelines to estimate risks under a range of scenarios assuming reasonably anticipated land use. There is no expectation that the BRA evaluate every possible scenario. See General Response 3 on the potential for flood water impacts.

After the Selected Remedy is in place, there is no foreseeable mechanism that would result in radionuclides being carried away by flood waters.

As to the BRA taking a short view, the future exposure conditions were evaluated based on the future source term which accounts for radionuclide ingrowth and decay over a 1,000-year study period.

**Comment 5:** Referring to erosional transport of contaminated soils from the western portion of Area 2 onto the adjacent Buffer Zone/Crossroad Property, the commenter suggests that erosion of contaminated material off-site will continue to be a problem and asks what volume we can expect to erode off the site over thousands of years.

**Response 5:** As has been demonstrated through sampling and documented and explained in the FS, significant areas of radionuclide-contaminated soils in Areas 1 and 2 are currently located at or near surface. Although mostly vegetated now, these areas have been and could be subject to rainwater runoff and sediment transport as well as potential erosional events. In one erosional event, mudflow on the western portion of Area 2 transported contaminated soils to the adjacent Buffer Zone/Crossroad Property resulting in surficial contamination of the eastern edge of the property. In addition, rainwater runoff has resulted in minor amounts of sediment transport to the drainage ditches along the landfill access roads. The Selected Remedy is designed to eliminate these conditions. After the multi-layer landfill cover has been installed, the contaminants will be isolated from rainwater runoff. The plan is to inspect and maintain the cover for as long as the landfill remains; however, even without such maintenance, the cover will function in this regard long past the foreseeable future.

**Comment 6:** The commenter suggests that the contamination on the Buffer Zone/Crossroad Property will pose a threat in the future if the Earth City Levee were to fail and the flood waters were to encroach on the toe of the landfill.

**Response 6:** The data demonstrate that the contaminant concentrations on the Buffer Zone/Crossroad Property are very low, marginally above background, and may very well meet unrestricted use standards under current conditions. Neither flooding nor any other transport mechanism could redistribute these contaminants in a way that would pose any sort of health threat. More importantly, the Selected Remedy requires that any soils on this property exceeding standards for unrestricted use will be excavated and consolidated in the disposal area.

**Comment 7:** The commenter questions the FS description of the Site as being two miles from the river when the Site is actually one-half mile closer to the river and wonders whether any of EPA's assessments need to be adjusted to fit this reality, particularly relating to groundwater and the number and type of wells in range of the Site.

**Response 7:** EPA agrees that describing the Site as one and one-half miles from the river is a more precise description. The FS description was intended for general orientation purposes and is not a material factor in any of the technical assessments. A regional well survey was performed using data from MDNR. There is no current groundwater use in the vicinity of the Site. The nearest well is a deep bedrock well located about one mile northeast of the Site. Figure 2-3 of the Site OU 2 FS shows the locations of registered wells in the vicinity of the Site. For easy reference, a copy of this figure is attached.

**III.** Additional comments were submitted on behalf of the Missouri Coalition for the Environment in an April 9, 2008, letter from David Lobbig, President, Board of Directors (copy attached).

**Comment:** In summary, the commenter attempts to make the case that EPA's decision making in this case must be politically motivated. The argument is made by pointing out that long-lived radionuclides will remain toxic long after EPA, the United States Government, and civilization itself have ceased to exist. Since EPA knows that even a sincere promise to monitor the remedy must eventually come to an end, so the logic goes, EPA is engaging in delusion or falsehood by proposing to manage the waste in place.

**Response:** EPA's motivation is protection of human health and the environment in accordance with the mandates set out in the Superfund law and its implementing regulations. It is true that EPA's assurances are subject to the limits of human capacity to plan for the future. This is true at the West Lake Site as well as the countless other Superfund sites and disposal sites where waste will be permanently managed. This is a limitation that cannot be overcome by moving the waste from one location to another. The reality is that all potential remedies are ultimately reliant on the durability and adaptability of human systems, and Superfund provides the current human construct under which we must work. Many commenters have expressed concern about the ability to assure protectiveness over the long term. See the response to General Comment 6 above.

**5. <u>Daniel W. McKeel, Jr., MD</u>**

**I.** The following responds to the December 29, 2006, comment letter provided by Dr. McKeel (copy attached).

**1.** The commenter was part of a group of concerned stakeholders that met with representatives of St. Louis County to seek assistance in having the public comment period extended and arranging open dialogue meetings to discuss various issues on the Proposed Plan. The commenter is disappointed that these meetings were not arranged.

**Response:** EPA generally welcomes and encourages open dialogue on site issues; however, EPA cannot hold off the record meetings of this sort during the public comment period. The NCP § 300.430 sets out specific requirements for public participation in the remedy selection process intended to ensure that the public has a reasonable opportunity to review the plan and submit written and oral comments. The public process used by EPA, i.e., public notice, structured public meeting format, recorded transcripts, etc., was established to meet these requirements. During the public comment period, EPA may not meet off the record and may not give special access to individuals or stakeholder groups outside the public process. All timely requests to extend the public comment period were granted, and the first public comment period was held open for over six months. In addition, there will be further opportunities for public involvement during the design and implementation phases of the remedy. If the group continues to have an interest in holding meetings, EPA would be more than happy to participate.

**2.** The commenter suggests that the absence of an off-site radiological contaminant plume is not confirmed because there are no off-site monitoring wells that could detect the migrating plume.

**Response:** This comment reflects a misunderstanding of hydrogeology and the mechanisms of contaminant fate and transport. The first place to look for evidence of a groundwater contaminant plume is in the groundwater underlying and immediately downgradient of the contaminant source area. If groundwater monitoring data show no evidence of a contaminant plume underlying and immediately downgradient of the source material, then it is reasonable to conclude that there is no contaminant plume further downgradient that could be attributable to the source area of interest. The groundwater monitoring results for the Site indicate there is no radiological contaminant plume on-site; therefore, there is no radiological contaminant plume off-site. Further supporting this conclusion are the results from sampling and analysis of perched water within the landfill waste material itself, indicating no significant radiological contamination in the aqueous phase. See also the general response on groundwater study above.

**3.** The commenter states that Spanish Village immediately abuts the landfill and that these residents will be at risk by leaving the waste in place.

**Response:** The Spanish Village subdivision is located almost a mile from the southern extreme of the Site with intervening commercial development. It does not abut the landfill. Further, the residents of Spanish Village are not at risk from wastes at the Site because there is currently no reasonable pathway for exposure. See responses to General Comments above.

**II.** The following responds to written comments by Dr. McKeel dated April 9, 2008. The numbering applied here corresponds to the numbering of the comments (copy attached). Each significant comment is summarized here and followed by a response.

The commenter states that the Site is not designed to safely contain radioactive wastes by any criteria of any regulatory agency (NRC, EPA, DOE, MDNR).

**Response:** EPA is not proposing to take no action. Implementation of the Selected Remedy will safely contain the waste materials including the radiologically contaminated soils. Consistent with the Superfund law and implementing regulations, the Selected Remedy requires that ARARs be met. The Selected Remedy will meet appropriate closure and post-closure care requirements for both uranium mill tailing disposal sites and sanitary landfills. See section 13.2 of the ROD for a full description of these requirements.

**(1)** The commenter states that violent rainstorms could relocate the radioactive soil within the confines of the landfill itself and cause runoff from the steep slopes. The commenter states that severe flooding is a danger, and EPA and MDNR understate the concern by disputing that the landfill is in a flood plain. The commenter states the Site is

protected by levees of the type that failed during Hurricane Katrina in New Orleans and that levee failure is certain at some point in the future.

**Response:** As explained and documented in the RI/FS reports, some radiologically contaminated soils are currently located at or near the surface. EPA agrees that rainstorms have in the past and could in the future cause soils and sediments to be re-suspended or eroded. The Selected Remedy is specifically designed to prevent this from occurring. After the cover has been installed, the waste materials will be isolated from rainfall runoff.

EPA does not dispute that parts of the landfill are built on the historic or geomorphic flood plain. This fact is well documented in the RI/FS reports and was presented at the third public meeting on March 27, 2008. It is also fact that the landfill is located behind the Earth City Levee system designed to exceed the 500-year flood protection level. Whether the Site is in a flood plain or not is a function of the definition being applied. There has been no intent on EPA's part to confuse anybody on this issue.

Note that Earth City is protected by an engineered levee system that is much more sophisticated and robust than the various agricultural levees and flood walls that failed or were overtopped during Hurricane Katrina. Nevertheless, the protectiveness of the Selected Remedy does not depend on the Earth City Levee system. In the unlikely event that the Earth City Levee fails or is overtopped, the resultant flooding would have little impact on the Selected Remedy. See the response to General Comment 3 for more explanation.

**(2)** The commenter states that the Site is unlined and is not a hazardous waste landfill designed to contain radioactive waste. Although some municipal landfills similar to the West Lake Site do accept radiological waste, the practice is being reduced. No U.S. hazardous waste landfills are licensed to accept radiological waste of the Site's type.

**Response:** The purpose of the Site response action is to determine what should be done with existing landfill units. The Site will not be receiving any new waste streams. If the remedy for the Site involved excavation and commercial disposal of waste, as in FS Alternative 6 for example, then the licensing and waste acceptance criteria of potential receiving facilities would become relevant.

The following is offered to help clear up some apparent confusion about what the Selected Remedy requires and how it fits in the regulatory frame work established under other environmental laws:

The Selected Remedy requires that the landfill cover, at a minimum, meets the Missouri requirements for sanitary landfills. The cover will be designed to shed water and include a low permeability barrier to surface water infiltration. It is the cover system that functions to prevent water from contacting the waste material. Consistent with the requirements for uranium mill tailing sites, the cover design will be augmented as necessary to address the radiological concerns, i.e., the cap will be of sufficient thickness

to shield the gamma radiation and the compacted clay component will also serve as a radon barrier.

The Missouri sanitary landfill requirements derive from the RCRA Subtitle D rules. Hazardous waste landfill requirements derive from the RCRA Subtitle C rules. Briefly, the conventional Subtitle D design relies on natural materials and the low permeability component in the liner and cover is a compacted clay layer. The conventional Subtitle C design uses flexible membrane liners (FML). The Subtitle C design includes a double-lined leachate collection system.

There is no RCRA hazardous waste in the Site, i.e., no listed chemicals or chemicals that are flammable, corrosive, mobile, or highly toxic. The Site is most like a municipal solid waste landfill which is why the Subtitle D design is considered more appropriate. In addition, the Subtitle D design is arguably more compatible with long-lived radioactive waste disposal which typically relies on natural material designs due to longevity considerations. The FMLs have a more limited design life than the natural materials.

The commenter is correct that RCRA landfills are not licensed to accept waste streams that are regulated for their radiological content. However, there are no technological reasons that low-level radiological waste cannot be safely managed in a RCRA-permitted landfill provided that the cover design and long-term monitoring and maintenance plans are modified accordingly.

**(3)** The commenter suggests NRC should have jurisdiction over the Site and questions the lack of NRC involvement. The commenter is interested in seeing a copy of the letter in which NRC defers oversight to EPA.

**Response:** The Site was never licensed by NRC. However, the Site was listed on NRC's Site Decommissioning Management Plan due to the radiological waste material having originated with one of its licensees. NRC followed up with some preliminary studies in the 1980s.

In 1990, EPA placed the Site on the NPL. CERCLA provides the authority to clean up the Site. Section 104 of CERCLA provides the authority to respond to releases of hazardous substances which has a broad definition and includes substances subject to the AEA. There was coordination and cooperation between the two agencies as EPA initiated its RI process. In 1995, NRC staff recommended to the Commissioners that NRC defer regulatory oversight to EPA. The basis for the recommendation is documented in a paper dated March 9, 1995. NRC concluded that the Superfund program administered by EPA will protect public health and the environment. The recommendation was approved and formally sent to EPA under a letter dated June 16, 1995. This document has been available in the Administrative Record for the Site. A copy is attached for ease of reference.

**(4)** The commenter states that capping the waste is a temporary solution. Someday the wastes will need to be removed. The cost to excavate and move off-site will rise as the

years go by. The commenter suggests that the Selected Remedy is a function of the regulatory climate being business friendly which may change after the elections.

**Response:** The Selected Remedy is intended to be a permanent solution. The Selected Remedy is not a function of regulatory climate. It is a function of the requirements established by CERCLA and NCP. If the requirements are modified in the future, EPA will adhere to the then current requirements.

EPA is required by statute to conduct periodic reviews (called Five-Year Reviews) for the purpose of certifying that the remedy continues to be protective of human health and the environment. Any changes to requirements or health standards will be factored into the evaluation. Based on significant new information, EPA can require new work and/or make changes to the remedy as necessary to protect human health and the environment.

**(5)** The commenter claims that EPA and MDNR have misrepresented the difficulty of suppressing dust and other airborne emissions were the wastes to be excavated and transported off-site. Portable buildings with negative pressure filters and other similar technologies could be used. The commenter cites FUSRAP and another example of sites where excavation of waste materials was safely done. The commenter references information circulated by Kay Drey on dust-containment technologies.

**Response:** There was no intent by EPA or MDNR to misrepresent the difficulty of suppressing airborne emissions during excavation of the wastes. However, this comment contains many inaccurate representations. As documented in the FS, it is clearly feasible to excavate waste materials from the Site. EPA has tried to convey that excavation of the wastes would come with many challenges and introduce potential risks that can be avoided by managing the material in place. Furthermore, excavation could be done using conventional dust suppression methods, work place monitoring, and personal protective equipment for the workers. It is unlikely there would be any need to resort to exotic solutions such as portable buildings.

EPA has never declared that “cost was not a factor in remedy selection” as the commenter claims. On occasion, EPA has responded to oral comments by explaining that cost was not the only factor considered in remedy selection. Cost Effectiveness is one of five primary balancing criteria enumerated in the NCP against which the feasible alternatives are compared. The objective is to assess the relative advantages and disadvantages of each alternative when evaluated against these criteria. See section 10.0 of the ROD for a summary of the comparative analysis.

It should be noted that conditions at the St. Louis FUSRAP sites are not comparable to those at this west Lake Site. Large-scale excavation of municipal trash and debris from a landfill presents much greater challenges than large-scale excavation of accessible soils from mostly surface locations.

EPA did receive an article circulated by Kay Drey about a portable shelter used at the Hanford site. This innovative shelter was used to facilitate targeted retrieval of drummed

wastes including transuranics and potentially pressurized drums, etc., from burial trenches. The primary purpose of this shelter is to protect workers from weather and temperature extremes. This allows workers in protective clothing to be more comfortable resulting in increased work time and productivity. Use of such a shelter would also protect against windblown migration of contaminants. The circumstances being addressed at the West Lake Site are not comparable to the Hanford situation. It is questionable whether this technology is useful or practicable for the circumstances at the Site where heavy excavation and earth moving equipment would be needed to perform the large-scale excavation of municipal trash from the Site.

**(6) & (7)** These comments have to do with being denied open dialogue meetings during the public comment period. See the response to the first comment in Dr. McKeel's first letter.

**(8)** The commenter continues to have questions about whether new groundwater studies are planned and why the ROD was delayed.

**Response:** As a result of EPA's review of the public comments regarding the groundwater data, EPA decided to present more extensive summary of the groundwater data and analysis in the ROD. This work required some additional time and is the primary reason for not meeting the September 2007 projection. There are no additional groundwater characterization studies planned except as they relate to the design and implementation of the long-term groundwater monitoring program.

**(9)** The commenter makes a series of points which are addressed as follows:

(a) These questions about the levee system, flood plain status, and the impact on the Selected Remedy have already been addressed.

(b) EPA developed a technical memorandum responding to Senator Bond's concerns. A copy is attached.

(c) See response to (8) above. The OU 1 ROD is the final planned ROD for the Site. There is no separate groundwater ROD planned for the Site. There is no evidence to support the commenter's claim that contaminated groundwater has migrated off-site. As indicated by the presence of radionuclides in the upgradient and background wells, these radionuclides are naturally occurring. The well that was located on the St. Louis Rams Training Center in Earth City was a background location. It is upgradient of the Site. There is no plausible hydrologic mechanism for this well to be impacted by contaminants migrating from the Site. The relatively high levels of gross alpha from this location could be indicative of shale bedrock in the area.

As has been addressed in a number of responses, the Selected Remedy will meet relevant and appropriate closure and post-closure care requirements. The landfill cover will provide the barrier to prevent water from contacting the waste material. This is the standard landfill method for limiting water percolation and preventing the ongoing

generation of leachate. As explained in Number (2) above, the Site contains no hazardous waste and hazardous waste rules are not relevant and appropriate. Long-term monitoring of the shallow groundwater underlying the waste will verify that groundwater is protected.

The OU 1 cap has not been designed yet. As explained in Number (2) above, the cap will be of sufficient thickness to shield the gamma radiation; and the compacted clay component will also serve as a radon barrier. In the same fashion as it was done at the Weldon Spring Site and mill tailing disposal sites, the landfill cover will be designed to act as a diffusion barrier for radon. Rn-222 has a half life of 3.8 days. Radon is continually produced from the radium source, but need only be detained in the cover materials for a few days before it decays to its solid progeny thereby eliminating significant emissions to the atmosphere. After the cap is in place, radon measurements at the surface of the cap will be consistent with background. The radon may also be vented or diverted to a gas control system. The commenter is mistaken about the thickness of the Weldon Spring Site disposal cell cap. The cap is actually 8.5 feet (2.6 meters) thick. The upper 3.5 feet are a limestone rip rap layer. The principal radon/infiltration barrier is a 3-foot thick layer of compacted low permeability clayey soil. Likewise, the Site will be sufficient to meet the performance objectives.

**6. City of Bridgeton**

The mayor and the city council of the city of Bridgeton, Missouri, passed a resolution asking EPA to recommend removal of the radioactive wastes from the Site. The reasons cited include: the Site being located in a flood plain, the landfill is not a location designed to store radioactive waste, institutional controls do not solve the problem, and contamination will continue to spread.

**Response:** EPA understands that the council's primary concern is for the safety of the public, and this resolution is intended to request the best solution possible for Bridgeton and the Site. We want to assure the council that protection of human health and the environment is EPA's primary concern. Based on extensive field study, we have every reason to believe that the Selected Remedy is and will be protective. Following construction of the remedy, EPA will carefully monitor the Site over the long term to verify the performance of the remedy and demonstrate to the public that the contamination is not migrating. We would like to point out that institutional controls are not being used to solve the problem but rather to augment the engineering solution.

**7. American Water Company**

American Water Company (AWC) generally supports the Selected Remedy but submits comments to emphasize the importance of conducting rigorous long-term monitoring and implementing any necessary action to protect the Missouri River, a major source of St. Louis public drinking water. AWC specifically requests the plan: (1) include measures to periodically test the Missouri River for radioactive materials, beginning with an initial test to establish baseline levels; (2) better delineate groundwater monitoring

activities and include specific plans to address any migrating contamination; and (3) include procedures for keeping the public, and specifically AWC and other drinking water purveyors in the area, informed of monitoring activities and results.

**Response:** EPA is in full agreement on the importance of rigorous long-term monitoring and taking any action necessary to protect the Missouri River. The primary objective of the Selected Remedy is to protect groundwater and surface water from ongoing or future impacts from the waste materials in the landfill. A long-term groundwater monitoring program will be designed and implemented to demonstrate that the remedy is protective of groundwater over time. The program will include a system of monitoring wells designed to intercept any potential migration to groundwater from the source materials. This will provide the best possible indicator of any potential contaminant migration. If monitoring shows any statistically significant deterioration in groundwater quality with time as a result of contaminant migration from Areas 1 and 2, appropriate response action will be taken including remedy change as necessary to protect the groundwater.

Monitoring plans and groundwater protection standards will be consistent with the requirements found in the Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40 CFR 192 Subparts A and B) and the Missouri Solid Waste Rules for Sanitary Landfills [10 CSR 80-3.010 (11)].

Detailed monitoring plans requiring specific monitoring locations, sampling frequencies, parameters, sampling and analysis procedures, and evaluation approach will be developed as part of the remedial design/remedial action process. The community relations plan will include procedures for keeping the community informed of monitoring activities and results. These plans will be made available to AWC and other stakeholders. EPA will consider any comments AWC may have on how these plans can be improved.

**8. <u>Missouri Department of Natural Resources</u>**

MDNR provides assistance to EPA in its oversight role and provides review and comment on the Site's documents as they are developed. EPA consults with MDNR during the remedy selection process. MDNR provided a statement to be included in the ROD describing state acceptance of the remedy (see section 10.8 of the ROD). MDNR supports the Selected Remedy provided that the long-term care and monitoring is robust and durable. In addition, MDNR provided specific comments during the public comment period. The comments and EPA's responses are provided below.

**1.** For risk management purposes, EPA should provide estimates of the number of years needed to reduce toxicity, i.e., radioactivity, and the volume of radiological contamination below levels of health concern (using both dose assessment and risk assessment approaches).

**Response:** EPA does not believe the requested calculations would add anything useful to the analysis. It is sufficient to understand that the principal isotopes of uranium and thorium at the Site are extremely long lived. The half life of U-238 is 4.5 billion years or almost as long as the earth is old. For all intents and purposes, the radiological contamination will remain above levels of concern and would not allow for unrestricted use for as long as the landfill remains on the Site.

**2.** Due to the extremely long half lives of the radionuclides within the landfill, plans for carrying the remedy beyond the 30-year scope for Alternative L4 should be demonstrated to cover the estimated time needed to reduce the radioactivity below levels of concern.

**Response:** The Selected Remedy does not have a "30-year scope" nor do any of the alternatives that were evaluated. The expectation from the NCP is that the remedy will remain enforce for as long as contaminants remain on-site above levels that allow for unlimited use and unrestricted exposure. The 30-year evaluation period is used in the FS only to allow for present worth cost calculations and has nothing to do with the expected duration of the remedy. This is fully explained in the description of the Selected Remedy in the ROD.

**3.** The performance of the concrete rubble used in the final landfill cover design should be evaluated and reported to ensure integrity of the cap in perpetuity.

**Response:** Specifications for the concrete rubble layer will be developed in remedial design. MDNR will have full opportunity to review and comment. The specifications will be developed with longevity in mind. Performance standards for mill tailing sites (40 CFR 192) indicate that the design life should be 200 to 1,000 years.

**4.** Trigger criteria based on long-term monitoring data such as newly detected groundwater contamination should be set forth in the ROD which potentially requires additional investigation and/or remedy modification discussions. The five-year review events would be an effective tool in the collection and evaluation process for any such future decision-making events.

**Response:** Agree. The Selected Remedy identifies the groundwater protection standards in 40 CFR 192 and the Missouri solid waste rules as relevant and appropriate requirements. The "trigger" criteria are found in these requirements. In addition, the Selected Remedy provides that groundwater quality not degrade over time due to contaminants migrating from sources at Areas 1 and 2. Specific monitoring plans will be developed in the remedial design/remedial action implementation. MDNR will have full opportunity to review and comment. The five-year review event is an appropriate tool for identifying issues that could lead to remedy re-evaluation or remedy change.

**5.** To supplement the five-year reviews, an agreement with the U.S. Army Corps of Engineers and the Earth City Levee District should be developed to perform regular inspections and maintenance of the levee system surrounding the Site.

**Response:** Surveillance and maintenance plans will be developed as part of the remedial design/remedial action process. MDNR will have full opportunity to review and comment. It seems reasonable to incorporate coordination with the U.S. Army Corps of Engineers and the Earth City Levee District on levee inspection and maintenance in these plans.