STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

January 30, 2012

Ms. Sharon Cotner
FUSRAP Program Manager
U.S. Army Corps of Engineers
8945 Latty Avenue
Berkeley, MO 63134

RE: Remedial Investigation and Baseline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site, Revision B, dated November 10, 2011.

Dear Ms. Cotner:

The Missouri Department of Natural Resources has received comments from the Missouri Department of Health and Senior Services on the above referenced document. The comments are included as an enclosure to this letter.

If you or your staff have any questions or need further clarification, then please contact me at (314) 877-3251. Written correspondence can be directed to my attention at Missouri Department of Natural Resources, 917 N HWY 67, Suite 104, Florissant, MO 63031.

Sincerely,

HAZARDOUS WASTE PROGRAM

Tiffany D. Burgess

Tiffany D. Burgess
Radiological and Remediation Assessment Unit
Federal Facilities Section

Enclosure

TB

c: Mr. Brenton Barkley, U.S. Army Corps of Engineers (e-mail only)
Mr. Daniel Carey, Department of Natural Resources (e-mail only)
Mr. Branden Doster, Department of Natural Resources (e-mail only)
Mr. Eric Gilstrap, Department of Natural Resources (e-mail only)
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January 25, 2012

Tiffany Burgess, ES
Federal Facilities/Hazardous Waste Program
Missouri Department of Natural Resources
917 N HWY 67, Suite 104
Florissant, MO 63031

Re: Department of Health and Senior Services' comments on the document *Remedial Investigation and Baseline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site*, November 10, 2011.

Dear Ms. Burgess:

The Department of Health and Senior Services (DHSS) received your request to comment on the referenced remedial investigation (RI) for St. Louis Downtown Sites (SLDS). Reference will be made to the document *Remedial Investigation Work Plan for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site, St. Louis, Missouri*; November 30, 2009 (ISOU RIWP). Comments are provided below.

1. Section 2.1.1, *Inaccessible Soil Investigation*, does not clearly outline where non-radionuclide contamination was or is to be sampled. ISOU RIWP Section 3.1.2, *PCOCs*, provides a list of criteria when metals would be sampled. Specifically, areas should be included "if they were commingled with MED/AEC (Manhattan Engineering District/Atomic Energy Commission) radionuclide concentrations greater than risk-based screening levels (SLs) identified for SLDS."

   Language used throughout the RI, particularly in site-specific nature and extent descriptions (i.e. Section 4.2.1.2, *Nature and Extent of Contamination at Plant 1*) excludes analysis for metals in areas not considered a "uranium processing area". Nowhere in the ISOU RIWP is it stated that the area be considered a uranium processing area before metals analysis of soils is required. Revise Section 2.1.1 to include ISOU RIWP requiring evaluation of non-radionuclide contamination when commingled with MED/AEC radiological concentrations above SLs.

2. Section 2.2.2, *Buildings and Structures Investigations*, notes "For the purpose of the surveys conducted during this RI, any structure exhibiting fixed-point measurement(s) that exceeded the gross alpha SL of 3,900 dpm/100 cm^2 (disintegrations per minute per one hundred centimeters-squared) was subjected to additional evaluation to determine the extent of contamination."

   Note that to develop surface activity gross DCGLs that include a decay series, the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) approach includes use of fraction of alpha to total decays and the radionuclide-based derived concentration guideline levels (DCGLs) (see MARSSIM Section 4.3.2, *DCGLs and the Use of Surrogate Measurements*).

Please compare the method for developing gross alpha and beta DCGLs (as described in Section B-2.5, *Calculating Gross Alpha and Gross Beta Derived Concentration Guideline Levels*, of the document *Remedial Investigation Work Plan for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site*, May 14, 2009), with the MARSSIM approach. Specifically, the comparison should identify the method used to evaluate the ratios of alpha to total decays, to include the decay chain for each radionuclide. See MARSSIM Section 4.3.2 for further information and example calculations that address secular equilibrium within surrogate measurements.

3. For Table 4.1, *Screening Levels and Background Values for Potential Contaminants of Concern Identified for the Inaccessible Soils Operable Unit*, only Environmental Protection Agency (EPA) regional screening levels (RSLs) for non-radiological parameters are for an industrial exposure scenario. Within the ISOU RIWP Figure A-1, *Conceptual Site Model for Inaccessible Soil at the SLDS,* a future resident is identified. See Section 3.10.1, *ISOU CSM*, of the ISOU RIWP. According to the conceptual site model (CSM), residential is to be evaluated with the caveat that the evaluation is for informational purposes only. A quantitative evaluation of risk for this receptor is needed to determine long-term stewardship (LTS) for SLDS sites. Screening levels (SLs) for residential should be provided for the LTS as well as the "as low as reasonably achievable" (ALARA) evaluations.

4. For Table 4-1, a footnote is needed that acknowledges the need to ensure that the concentration of thorium-230 (Th-230) will not lend to radium-226 (Ra-226) exceeding its Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) based SLs. This issue was discussed during the most recent 5-year review for SLDS.

5. For Table 4-1, radionuclides not identified include lead-210 (Pb-210), actinium-227 (Ac-227), proactinium-231 (Pa-231), thorium-228 (Th-228), uranium-234 (U-234), and uranium-235 (U-235). Footnote "c" indicates that U-238 serves as a surrogate for these radionuclides. DHSS is unaware of any verification of surrogate ratios or modeling (i.e. RESRAD) to verify that the UMTRCA cleanup goal is protective for U-238 and all listed radionuclides. Except for U-234 and Pb-210, none of the radionuclides are decay products of U-238, which would allow for some type of decay ratio that could be assumed. Given this information was not provided in the ISOU RIWP, please provide in the RI additional discussion on how the U-238 cleanup goal is protective, and verify using RESRAD for soils and RESRAD Build for inhabitable structures.

6. For Table 4.1, before the UMTRCA SLs are used, they should be verified to be protective using the current conceptual site model (CSM), to include a residential scenario. Also, according to EPA Directive 9200.4-25, *Soil Cleanup Criteria in 40 CFR Part 192*, 15 picocuries per gram (pCi/g) in subsoil is not health protective (this value represents total acceptable risk), but a suitable detection limit for sites with potentially significant contamination levels. Therefore, whenever the 5 pCi/g and/or 15 pCi/g radium standards are used as relevant and appropriate requirements, the standards must apply to the combined activities of Ra-226 and radium-228 (Ra-228), and combined activity of their parent radionuclide thorium-230 (Th-230) and thorium-232 (Th-232). Please discuss these issues in the RI.

7. According to Section 4.1.1, *Radiological Screening Levels*, the gross alpha DCGL is based on radionuclide-specific DCGLs using average soil concentrations from the 1993 baseline risk assessment based on methods prescribed in *Derivation of Site-Specific DCGLs for North County Structures*, 2004. These values may be outdated, and should be verified in this RI.

8. For Section 4.1.1, the formula for the sum of ratio (SOR) implies that the sum of ratios only evaluates the greater of a principle radionuclide or associated radionuclide. This is of particular concern given each radionuclide presents different risk (variables include age- and gender-dependence of radionuclide intake, metabolism, dosimetry, and radiogenic risk) for each pathway. Also, as noted in comment 6 above, radium (Ra-228 and Ra-226) and thorium (Th-232 and Th-230) activities should be combined before comparing to the UMTRCA SL. This discussion was not provided in the ISOU RIWP, and for transparency should be explained in detail in the RI.

9. For Table K-10, *Input Values for Non-default Residual Radioactivity-Build Model Parameters*, the RESRAD development of gross DCGLs outlined in the ISOU RIWP should be revised as follows:

    a. The Exposure Duration (ED) variable which is set to 365 days in the RESRAD-Build modeling in this document should be revised to represent 25 years of exposure for a worker or 30 years for a residential receptor. The formula used to estimate dose (i.e. total effective dose equivalent) are the same used for risk, each requiring ED in days. Calculation of ED equals exposure days per year (i.e. 250 for worker, and 350 for resident) multiplied by years of exposure (i.e 30 years). The only exception is for the construction worker, who is estimated to work 90 days in a one year period.

    b. The only evaluation times appear to be 0 and 1 year. Dose and risk is to be assessed over 1,000-year duration. For comparison purposes, Appendix B Section B-2.2.1, *Defining the Source Term*, identifies years 0, 1, 3, 10, 30, 100, 300, and 1,000 as needing to be assessed. If an analysis has been performed and only the most conservative evaluation times are provided, please note this in text.

10. For Table 4.1, the non-carcinogenic SL for uranium is presented in mass per unit mass. Most of the analytical work for SLDS is provided in activity per unit mass. For ease of evaluating risk, DHSS recommends that the SL be provided in both units for non-carcinogenic risk. When converting the number of atoms to mass either provide screening values for each uranium isotope or discuss the effects of different atomic weights and half lives if one isotope is used. Units of activity should be expressed in picocuries (pCi).

11. For Figure 5.1, *Conceptual Site Model for St. Louis Downtown Sites, Inaccessible Soil Operable Unit*, the CSM differs from the CSM in the ISOU RIWP and should be revised as follows:

    a. The source "soil" differs from the CSM provided in the ISOU RIWP. The source, previously defined as "inaccessible soils", is now qualified as "Beneath Consolidated Ground Cover" or "Beneath Unconsolidated Cover or No Cover". Ultimately, this

partition of source results in different pathways being assessed. Please provide details on the impact, if any, of this modification.

b. No receptors are identified. Update to include receptors and pathways of exposure for each. Refer to Figure A-1, *Conceptual Site Model for Inaccessible Soil at the SLDS*, for receptors and pathway analysis.

c. The sources are not the same. The ISOU RIWP identifies "Structure Surfaces", whereas this figure identifies "Soil on Structural Surfaces". Regardless of the source terminology, do not identify contamination on buildings simply as dust, but include fixed contamination incorporated into building surfaces. Examples of incorporated soils include bituminous coatings (i.e. roofing tar) and painted surfaces.

d. A release/transport mechanism is not provided for gasses and volatilization to indoor air pathway. Soil and groundwater will be potential sources. Radon is the potential contaminant of concern (PCOC) for this pathway. See the ISOU RIWP Section A-4.2.2, *Inaccessible Soil Operable Unit Contaminant Release and Transport Mechanisms,* paragraph 3, which recognizes that the pathway may be complete given Ra-226 concentrations exceed its SL. As noted in comment 19 below, revise the CSM to include volatilization to indoor air pathway.

e. For the current SLDS Plant Employee receptor, there are site-specific exposures to inaccessible soils that need to be evaluated. For example, Section 4.2.8.2, *Nature and Extent of Contamination at DT-6*, notes that the storage building has an earthen floor. This would be inaccessible soil that has more than external exposure to radionuclide. Other exceptions may exist, which must be evaluated on a site-by-site basis. Revise to make this pathway potentially complete, with notation that site-specific exceptions to the CSM exist.

f. For the source "Inaccessible Soil Adjacent to Sewer Lines", no direct-contact pathway to soil as an exposure media is identified. Revise to include the exposure pathways ingestion, inhalation, and external exposure.

12. For the risk-based individual radionuclide DCGLs used in this document, and provided in Table B-4, *Individual Radionuclide DCGLs Equivalent to 25 mrem/year and 10-6 Risk*, DHSS' calculations indicate that the risk level for the DCGLs is equivalent to 1.0E-04, not 1.0E-06. This corresponds to a two-order-of-magnitude lesser DCGL based upon risk than currently proposed. Section 6.1, *Human Health Risk Assessment*, notes a carcinogenic risk threshold of 1.0E-05. Due to the presence of 11 radionuclide being assessed, and considering additivity of risk, the DCGLs should be reduced by a factor of 10. Therefore, to meet the proposed risk threshold and allow for additivity of risk, the DCGLs risk threshold should be set to 1.0E-06.

13. For Section 4.1.2, *Metal Screening Levels*, the statement "where background values may be used as a criterion, in conjunction with other criteria, for identifying risk driver metals as COCs" is confusing, and does not adequately describe how background will be addressed. Rephrase to

identify what are the "criteria", including reference to guidance on assessing background in risk assessment.

14. Within Table 4-6, *Sewer Soil Data: Stations with Radiological Potential Contaminant of Concern Concentrations Exceeding Remedial Investigation Screening Levels*, Ra-226 levels exceed the RI SLs at locations including Plant 6, Plant 7, and DT-12. None of these entries has been highlighted to indicate exceedance of SLs. Revise the table accordingly. Also, review the table for other exceedances that are not highlighted.

15. According to Section 5.2, *Inaccessible Soil Operable Unit Contaminant Release and Transport Mechanisms*, "direct contact exposures with inaccessible soil beneath buildings, as well as with soil adjacent to sewer lines, would not occur under existing conditions and therefore this scenario is not considered in the ISOU CSM." This appears to exclude future exposure scenarios from the RI. Note in this paragraph that both current and future exposure scenarios will be evaluated, with reference to the section(s) that addresses future exposures, to provide transparency that both scenarios will be evaluated in this report.

16. For Section 5.2, *Inaccessible Soil Operable Unit Contaminant Release and Transport Mechanisms*, decisions as to whether pathways are complete or incomplete must be based on evidence. The RI provides generic criteria in this section to categorize pathways as complete, and significant or insignificant. Credible metrics that support these criteria (i.e. soil-water partitioning coefficients) are provided in the RI (i.e. Section 5.3.4, *Partitioning and Sorption.*) However, this section only uses unsubstantiated judgment in order to derive a decision.

    Examples of comments that are judgmental and not founded by metrics include the following: According to Section 5.2.2.2 *Water Transport Pathways Sediment in Sewers and for Soil Adjacent to Sewers,* "Soil to ground-water transport pathway is considered potentially complete but insignificant for soil adjacent to sewer lines. This is because minimal concentrations reaching into ground water are **expected** to undergo immediate mixing in the aquifer, followed by dilution and attenuation during transport." This comment does not reference appropriate and site-specific evaluations based upon defensible metrics, including modeling or site-specific data. In addition to the metrics, source area and volume, aquifer characteristic, and preferential pathways are additional considerations to address PCOC movement, none of which are discussed.

    One approach may be to revise the generic criteria in Section 5.3.4 to identify specific metrics and considerations necessary to derive a site-specific decision. If metrics lead to an inconclusive decision, further investigation should be considered, or the pathway remains complete and potentially significant. Either way, additional investigation would then be required. Otherwise, propose an approach that provides similar results. Providing a decision tree may help clarify the process.

17. Section 5.2.1.1, *Air Transport Pathways for Inaccessible Soil Beneath Unconsolidated Cover or No Cover*, notes that the particulate emission of contaminants from inaccessible soil to the air is not a significant pathway due to the mitigating presence of structural barriers (e.g., buildings, walkways, roads, etc.) over most of the ISOU. This section is referring to soils that are beneath

unconsolidated or no cover, not buildings, walkways, and roads. Revise to reference only soils meeting those conditions.

18. Section 5.2.1.1 only discusses current, not future, exposure scenarios. Revise to discuss future exposures where buildings or other structures may be absent.

19. Section 5.2.1 notes that that due to relatively low levels of site related Ra-226 concentrations measured in the soil, site-related Rn-222 is not considered to be significant, and therefore, was not investigated during the RI. Several of the sites (i.e. Plants 1and 6, and DT-4) presented in Table 4-2 have sufficient quantities of Ra-226 to present a potential risk for radon. Revise the RI to address radon on a site-specific basis.

20. For Section 6.1.2.1, *Inaccessible Soil Associated with Buildings, Structures, Railroads, and Roadways*, the industrial SLs are used to determine COPC for the recreational receptor. To ensure protectiveness for this receptor, a quantitative comparison of intake and external exposure (for radionuclide) for the two receptors is recommended.

21. For Section 6.1.2.1, the receptors differ from those described in Appendix B Section B-2.2.2, *Identification of Potential Receptors*, of the ISOU RIWP. Section 6.1.2.1 identifies an industrial worker, a construction worker and a recreational receptor: The RIWP identifies an industrial worker, a renovation worker, and a building resident. Please identify the discrepancy, and any impact on dose or risk estimates such modification may have. If the ISOU RIWP provides a more conservative approach, modify the RI to reflect the ISOU RIWP approach.

22. Section 6.1, *Human Health Risk Assessment* and Appendix K Section K2.0, *Human Health Risk Assessment*, sets cancer risk threshold to 1.0E-05. Table 6.2, *Summary of Risk Characterizaton Results for Inaccessible Soil and Soil on Exterior Surfaces of Buildings and Structures*, fails to recognize exceedance of threshold at or greater than 1.0E-05. Please explain this discrepancy.

23. For Appendix K Section K2.1, *Introduction*, note that the reference material *Exposure Factors Handbook*, (USEPA 1997a) is outdated. The current guide is *Exposure Factor Handbook: 2011 Edition*; *EPA/600/R-090/052F*; September 2011. Modify the reference accordingly. Default exposure factors may need to be revised, based upon more current guidance.

24. For Appendix K Section K2.3, *Exposure Assessment*, discuss exposure to radon and progeny.

25. For Appendix K Section K2.3.1.1, *Exposure Point Concentrations for Inaccessible Soil, Sewer Sediment, and Soil Adjacent to Sewer Lines*, use of one-half the detection or quantitation limit in the estimation of the ninety-five percent upper confidence limit (95% UCL) is not recommended when using current ProUCL software. Methodology for assessing the 95% UCL using datasets with nondetects is provided in the document *ProUCL 4.00.02 Users Guide*; EPA/600/R-07/038; April 2007.

    Prior to developing a 95% UCL, an outlier analysis must be performed on the dataset. ProUCL software can perform this function. All outliers should be considered for hotspot analysis. Hotspot analysis should evaluate whether the contamination is a principal threat waste (see EPA

guidance *A Guide to Principal Threat and Low Level Threat Wastes*; Superfund Publication 9380.3-06FS; November 1991), whether the hotspot presents excess risk for any given pathway for current and future receptors, and whether the hotspot area contains sufficient data points to determine if the area meets release criteria (i.e. 100 meters square area).

26. For Appendix K Section K2.3.1.1, it is unclear which receptors will be assessed for exposure to soils adjacent to sewers. This section references Chapter 4, which generically assesses the nature and extent, using what is assumed to be the most conservative exposure scenario or UMTRCA screening levels. UMTRCA screening values are not receptor-specific, and the subsurface screening value is not health-based (i.e. protective of unrestricted use and unlimited exposure (UUUE)). Before the UMTRCA values are used, they should be proven to be protective using the current CSM. After determining if the UMTRCA values are protective, quantitative data adjacent to sewer lines should be included in the 95 %UCL for soils to assess dose and risk for inaccessible soils and site wide soils for current and future construction workers and industrial worker.

    Also note that according to the CSM provided within the ISOU RIWP, the current and future construction worker is to be exposed not only to inaccessible soils, but to contaminated drains and sewers. Contaminated drains and sewers were assumed to include sediment. Revise exposure pathways for the RI construction worker to include soils adjacent to the sewers as well as sediment.

27. For Appendix K Section K2.3.1.2, *Radiological Exposure Point Concentrations for Soil on Building Surfaces*, activity fractions are discussed when partitioning gross alpha counts. However, the activity fractions are not provided. It is apparent that on many of the sites in this RI, Ra-226 and Th-230 exist proportionately higher in activity than other radionuclides. This is demonstrated in Table 4-2 for DT-2, DT-4, and DT-6. Given these values, DHSS recommends that either site-specific ratios using soil data be developed, or samples (i.e. quantitative analysis for removable and fixed alpha) be collected in order to properly apportion gross alpha. All results can then be compared to Table K-6A, *St. Louis Downtown Site-specific Soil Activity Fractions*, as noted in the text.

28. For Appendix K Section K2.3.2, *Identification of Land Use and Potential Exposure Scenarios*, the construction worker is projected to work on a project for no longer than 90 days. Not being familiar with the average construction duration of a St. Louis construction project, one could assume that construction of a large structure could take much longer than 90 days. This is considered uncertainty, which conceivably could be assessed using probabilistic assessment ranging from 90 days to 250 days (a typical working year). At a minimum, this may be assessed to determine if this is a candidate for ALARA evaluation.

29. For Appendix K Section K2.3.2, the recreational scenario assumes 1 foot of soil cover, which is based upon the depth to exceedance of screening values. Given radionuclides are detected above 1 foot, then the upper soil profile should be included in the dose and risk assessment. This is of particular importance given external is one of only two pathways assumed for this receptor; the other being inhalation. The total depth of evaluation for a current scenario should include all soils to a depth at which external dose/risk is minimal (i.e. 2 meters), as well as the time period

to 1,000 years to identify all possible combinations of risk resulting from the "Contamination Zone Erosion Rate" and assumptions within "Transfer Factors" values utilized for the RI in RESRAD. A future scenario should assume mixing of the entire soil profile.

30. Appendix K Section K2.3.2, *Tier 1 Evaluation*, page 13, first paragraph discusses inaccessible soils as sitewide accessible soils for the industrial worker. Previous discussion notes that both a tier 1 and 2 evaluation are to be performed for this receptor, corresponding to a tier 1 being inaccessible soils and a tier 2 being a sitewide (combined inaccessible and accessible soil.) This is a tier 2 evaluation being discussed in the tier 1 section. If this is a mistake, please revise.

31. According to Appendix K Section K2.3.2, *Tier 2 Evaluation*, a second tier evaluation involves calculation of property-wide EPCs by combining and area-weighting of inaccessible soil EPC determined during Tier 1, with corresponding accessible soil EPCs that were calculated during preparations of previous post-remediation/final status survey decision documents. The distribution may differ for the two datasets, prompting an inaccurate 95% UCL. Data for both inaccessible and accessible soils should be combined into one dataset, and run within ProUCL.

32. For Appendix K Section K2.3.2, there may be site-specific considerations that should be made prior to assuming that exceedance of tier 1 for an industrial worker is not sufficient grounds to carry a site to the Feasibility Study (FS). For example, one specific consideration that is necessary is to identify any pathway-specific exposure domains that do not adhere to a sitewide exposure scenario. For instance, the footprint of a building and contamination within 100 feet of the foundation are typically included into the vapor intrusion for radon pathway. Also, it appears that some buildings (i.e. DT-6) have earthen floors, which are directly accessible soils. Additionally, exceedance of risk and dose thresholds may occur at the tier 1 stage as a result of projected exposures to soils beneath the building itself. Therefore, the decision to carry a site into the FS based upon an inaccessible soil versus a sitewide soil evaluation should be evaluated on a site-by-site basis, and relative to the dose and risk derived at either tier.

33. For Appendix K Section K2.3.2.2 *Inaccessible Soil in Elevated Measurement Areas*, elevated measurement area was assumed to include elevated measurement sampling locations, along with immediately adjacent sampling locations where COPC concentrations are less than screening levels. Bounding elevated measurement areas to include less than screening level values may be inappropriate, as the process of selecting sample locations is arbitrary and in all likelihood will result in an artificially lower 95% UCL. Sample results to exclude are those resulting from previous removal actions, outside of the "inaccessible" boundaries, and not pathway-specific. Sample areas to consider may be bounded by 40 Code of Federal Regulations (CFR) Part 192 rules and MARSSIM survey unit areas utilized during final status surveys. The premise of utilizing the CFR and MARSSIM is to assure data density is sufficient to properly characterize the area (i.e. 100 meters square). Area weighting of samples should be considered.

34. For Appendix K Section K2.3.2.4, *Sediment in Sewer Lines*, the pathways of exposure lack external gamma, as identified in Figure A-1 of the ISOU RIWP. Revise accordingly.

35. For Appendix K Section K2.3.2.4, the utility worker is discussed as having exposure to sediment within the sewer lines. However, according to Table 6-1, *Property and Media-Specific Receptor*

Scenarios for Evaluation in the Human Health Risk Assessment, exposure for the same receptor is identified only to soil exterior to the sewers. Table 6-1 further identifies a sewer maintenance worker, not previously identified. This individual is being evaluated as having exposure to sediment within the sewer. Either this section or Table 6-1 needs to be revised to reflect the proper receptor and exposure media. Additional inconsistencies within the RI regarding this receptor and exposure media should be revised.

36. For Appendix K Section K2.3.2.3 *Soil of Surfaces of Buildings and Structures*, the contamination source, volumetric versus area, is not discussed. If volume is eliminated, is there laboratory data that provides verification? If laboratory samples were not collected, provide justification as to why.

37. For Appendix K Section K2.3.3.1, *Estimation of Radiological Dose and Risk*, the listed reference *Reassessment of Radium and Thorium Soil Concentrations and Annual Dose Rates*, is cited in EPA Directive 9200.4-25, *Soil Cleanup Criteria in 40 CFR Part 192*. The EPA directive does not indicate that UMTRCA subsoil cleanup goals are protective (see comment 6 above). Revise the bullet point item to reflect actual findings, as noted in the EPA directive.

38. For Appendix K, Section K2.3.3, *Methodology for Quantifying Dose*, chemical intake is described as exposure to a chemical constituent with a receptor per unit body weight per unit of time. Technically, inhalation intake for non-radionuclide constituents is not normalized to body weight. The RI does acknowledge this in Appendix K, but should be recognized here for technical accuracy.

39. For Appendix K, Section K2.4.1, *Radiological Toxicity Assessment*, bullet point one notes that the radiological endpoint is fatal cancer. Radionuclide slope factors are provided for cancer mortality (fatal cancers) or morbidity (fatal plus nonfatal cancers). DHSS and EPA both support use of the morbidity slope factors. Revise this bullet point item to reflect the non-fatal endpoint, and use the Health Effects Assessment Summary Table (HEAST) morbidity slope factors for risk assessment.

40. For Appendix K Section K2.6.5.1, *Toxicity Assessment for Radiological Contaminants of Potential Concern*, uncertainty regarding RESRAD's use of the most conservative dose conversion factor (DCF) does not address the lack of speciation. Nuclear Regulatory Commission guidance (NUREG) (i.e. NUREG/CR-5512, *Residual Radioactive Contamination from Decommissioning*) requires use of the most conservative DCF when speciation is not performed. Please acknowledge the lack of speciation in the uncertainty.

41. For Table K-6A, the activity fractions are different from the site-specific laboratory data for some of the sites provided in this RI. Comment 27 above provides redress regarding use of the St. Louis downtown specific activity fractions. The potential impact to radionuclide-specific alpha exposure point concentrations would be to underestimate concentrations of external risk-drivers including radium-226, (with a projected fraction of 0.056), in relation to U-238 and U-235 (with a combined fraction of 0.654). Given the RI assumes significant contributions to building-related alpha is removable (soil dust), and laboratory data is not available to

quantitatively assess radionuclides, then site soil ratios apply. Therefore, activity fractions should be calculated for each site, and Table K-6A revised to include the calculations.

Thank you for the opportunity to comment on the RI. If you have questions or comments, please contact Andrew McKinney at (314) 751-6102.

Sincerely,

Donna Luebbert for Cherri Baysinger

Cherri Baysinger, Chief
Bureau of Environmental Epidemiology

CB:CC:JG:AM:mp

Cc: Branden Doster, Unit Chief
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AR-010