8.0 REFERENCES

- 10 Code of Federal Regulations (CFR) 20, Subpart E. Standards for Protection Against Radiation.
- 40 CFR 192, Subpart A. Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites.
- 40 CFR 300.430, Subpart E. Remedial Investigation/Feasibility Study and Selection of Remedy.
- Allard, B., U. Olofsson, and B. Torstenfelt 1982. *Sorption of Actinides in Well-Defined Oxidation States on Geologic Media*, Materials Research Society Symposia Proceedings 11:775-782.
- ANL (Argonne National Laboratory) 2000. *Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes*, ANL/EAD/TM-98, NUREG/CR-6697, prepared for the U.S. Nuclear Regulatory Commission, November.
- ANL 2002. Technical Basis for Calculating Radiation Doses for the Building Occupancy Scenario Using Probabilistic RESRAD-BUILD 3.0 Code, ANL/EAD/TM/02-1, NUREG/CR-6755, prepared for the U.S. Nuclear Regulatory Commission, February.
- ATSDR (Agency for Toxic Substances and Disease Registry) 1990a. *Toxicological Profile for Thorium*, Atlanta, GA, U.S. Department of Health and Human Services, Public Health Service.
- ATSDR 1990b. *Toxicological Profile for Radium*, Atlanta, GA, U.S. Department of Health and Human Services, Public Health Service.
- ATSDR 1999. *Toxicological Profile for Uranium*, Atlanta, GA, U.S. Department of Health and Human Services, Public Health Service.
- ATSDR 2007. *Toxicological Profile for Lead*, Atlanta, GA, U.S. Department of Health and Human Services, Public Health Service.
- Benes, P., P. Strejc, and Z. Lukavec 1984. "Interaction of Radium with Freshwater Sediments and Their Mineral Components: I. Ferric Hydroxide and Quartz," *Journal of Radioanalytical and Nuclear Chemistry* 82:275-285.
- Benes, P., Z. Borovec, and P. Strejc 1985. "Interaction of Radium with Freshwater Sediments and their Mineral Components: II. Kaolinite and Montmorillonite," *Journal of Radioanalytical and Nuclear Chemistry* 89:339-351.
- Benes, P., Z. Borovec, and P. Strejc 1986. "Interaction of Radium with Freshwater Sediments and their Mineral Components: III. Muscovite and Feldspar," *Journal of Radioanalytical and Nuclear Chemistry* 98:91-103.
- Bibler, J. and D. Marson 1992. *Behavior of mercury, lead, cesium, and uranyl ions on four SRS soils (U)*. Technical Report, Westinghouse Savannah River Company Savannah River Site, WSR-RP-92-326.
- BNI (Bechtel National, Inc.) 1989a. Report on the Limited Radiological Survey of the McKinley Iron Company Property in St. Louis, Missouri, DOE/OR/20722-226, September.
- BNI 1989b. Report on the Limited Radiological Survey of the Thomas and Proetz Lumber Company Property in St. Louis Missouri, DOE/OR/20722-228, September.
- BNI 1989c. Preliminary Radiological Survey Report for the St. Louis Terminal Railroad Property in St. Louis, Missouri, DOE/OR/20722-230, May.

- BNI 1989d. Preliminary Radiological Survey Report for the Norfolk and Western Railroad Property in St. Louis, Missouri.
- BNI 1989e. Preliminary Radiological Survey Report for the Chicago, Burlington, and Quincy Railroad Property in St. Louis, Missouri.
- BNI 1989f. Report on the Limited Radiological Survey of the PVO Foods, Inc. Property in St. Louis, Missouri, DOE/OR20722-227, September.
- BNI 1990a. Radiological, Chemical, and Hydrogeological Characterization Report for the St. Louis Downtown Site, St. Louis, Missouri, DOE/OR/20722-258, September.
- BNI 1990b. Assessment of Sewers and Drains at the St. Louis Downtown Site.
- BNI 1994. Remedial Investigation Report for the St. Louis Site, St. Louis, Missouri, DOE/OR/21949-280, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, January.
- Brunskill, G. and P. Wilkinson 1987. "Annual Supply of Uranium-238, Uranium-234, Thorium-230, Radium-226, Lead-210, Polonium-210 and Thorium-232 to Lake 239, Experimental Lakes Area, Ontario, Canada from Terrestrial and Atmospheric Sources," *Canadian Journal of Fisheries and Aquatic Science* 44(Supplement 1):215-230.
- City of St. Louis 2005. City Ordinance 66777, effective August 2005.
- City of St. Louis 2012a. City of St. Louis Zoning Map. Found on the world-wide web at http://stlcin.missouri.org/zoning/map.cfm.
- City of St. Louis 2012b. "Strategic Land Use Plan of the St. Louis Comprehensive Plan." Found on the world-wide web at: http://stlouis-mo.gov/government/departments/planning/planning/adopted-plans/strategic-land-use/.
- Connell, D.W. and G.J. Miller 1984. *Chemistry and Ecotoxicology of Pollution*, John Wiley and Sons, Inc.
- DOD (U.S. Department of Defense) 2000. U.S. Department of Defense, U.S. Department of Energy, U.S. Environmental Protection Agency, and U.S. Nuclear Regulatory Commission. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*. NUREG 1575. USEPA 402-R-97-016. August.
- DOD 2006. U.S. Department of Defense, Environmental Data Quality Workgroup. *Department of Defense Quality Systems Manual for Environmental Laboratories*. Final Version 3. January.
- DOE (U.S. Department of Energy) 1990. Federal Facility Agreement in the Matter of: The United States Department of Energy, St. Louis and Hazelwood, Missouri, Docket No. VII-90-F-0005, June.
- DOE 1991. Engineering Evaluation/Cost Analysis for Decontamination at the St. Louis Downtown Site, St. Louis, Missouri, DOE/OR/23701-02.2, May.
- DOE 1992. Action Memorandum for the Removal of Contaminated Materials at the St. Louis Downtown Site, St. Louis, Missouri, Memorandum from L.K. Price (OR-FSRD) to File, CCN 086138 (February 27).
- DOE 1993. Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site, St. Louis, Missouri, DOE/OR/23701-41.1, prepared for U.S. Department of Energy, Oak Ridge Operations Office, Formerly Utilized Sites Remedial Action Program, under

- Contract W-31-109-Eng-38, prepared by Environmental Assessment Division, Argonne National Laboratory, November.
- DOE 1995. Remedial Investigation Addendum Report for the St. Louis Site, St. Louis, Missouri, DOE/OR/21950-132, September.
- DOE 1999. Guidance for Conducting Risk Assessments and Related Risk Activities for the DOE-ORO Environmental Management Program, Department of Energy Oak Ridge Operations (DOE-ORO) Environmental Management Program, Oak Ridge, TN, BJC/OR-271, April.
- DOE 2012. Risk Assessment Information System (RAIS), Department of Energy Oak Ridge Operations (DOE-ORO), on-line at http://rais.ornl.gov/.
- Erdal, B., W. Daniels, and D. Hoffman 1979. Sorption and Migration of Radionuclides in Geologic Media, Materials Research, Scientific Basis for Nuclear Waste Management 423-426.
- Garten, C.T. Jr. 1978. "A Review of Parameter Values Used to Assess the Transport of Plutonium, Uranium, and Thorium in Terrestrial Food Chains," *Environmental Research* 17:437-452.
- Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold, New York, NY.
- Harmsen, K. and F. De Haan 1980. "Occurrence and Behaviour of Uranium and Thorium in Soil and Water," *Netherlands Journal of Agricultural Science* 28:40-62.
- Hayakawa, O. and N. Watanabe 1982. "Characteristics of Arsenite and Arsenate Adsorption on Soils," *Mem Hokkaido Inst Technol*, 10:179–187.
- Hitchon, B., E.H. Perkins, and W.D. Gunter 2002. *Introduction to Ground Water Geochemistry*, Geoscience Publishing Ltd., Alberta, Canada.
- IT (IT Corporation) 2001. Pre-Design Investigation Data Summary Report Gunther Salt North Vicinity Property (DT-4), FUSRAP St. Louis Downtown Site, St. Louis, Missouri, Rev. 0, May 3.
- Korte, Nic. 1999. A Guide for the Technical Evaluation of Environmental Data, Technomic Publishing Company, Lancaster, PA.
- LaFlamme, B. and J. Murray 1987. "Solid/Solution Interaction: The Effect of Carbonate Alkalinity on Adsorbed Thorium," *Geochimica et Cosmochimica Acta* 51:243-250.
- Landa, E.R., and D.F. Reid 1982. "Sorption of Radium-226 from Oil-Production Brine by Sediments and Soils," *Environmental Geology* 5:1-8.
- Lide, D.R. 1994. Handbook of Chemistry and Physics, 74th Edition, CRC Press, Boca Raton, FL, pages 31-32.
- Mallinckrodt Chemical Works, Inc. 1945. Shipment Security Survey at Mallinckrodt Chemical Works, February.
- MassDEP (Massachusetts Department of Environmental Protection) 2003. "Best Management Practices for Controlling Exposure to Soil during the Development of Rail Trails." Massachusetts Department of Environmental Protection, Commonwealth of Massachusetts Executive Office of Environmental Affairs. Found on the World Wide Web at: http://www.mass.gov/dep/cleanup/laws/railtrai.pdf

- Mason, M.G. 1977. History and Background Relative to the Radiological Re-monitoring of Mallinckrodt by the Energy Research and Development Administration, prepared for Mallinckrodt, Inc. St. Louis, MO, August.
- McKelvey, V.E., D.L. Everhart, and R.M. Garrels 1955. *Origin of uranium deposits*, Economic Geology (50th Anniversary Volume), pp. 464–533.
- MDNR (Missouri Department of Natural Resources) 2010. *Lead in Drinking Water: Important Information on How to Protect Your Health*, Water Protection Program, PUB2409, December.
- Moulin, V., E. Ansoborlo, L. Bion, D. Doizi, C. Moulin, G. Cote, C. Madic, and J. Van der Lee, 2005. *Speciation Needs in Relation with Environmental and Biological Purposes*, Radioprotection, Vol. 40, Supplement 1, p. S11-S18, May.
- NCRP (National Council on Radiation Protection and Measurements) 1984. Exposures from the Uranium Series with Emphasis on Radon and its Daughter, NCRP Report No. 77, Bethesda, MD.
- NCRP 1995. Radiation Exposure of the U.S. Population from Consumer Products and Miscellaneous Sources. NCRP Report No. 95. Bethesda, MD: National Council on Radiation Protection and Measurements, June.
- NIST (National Institute of Standards and Technology) 2000. "Radioactivity Measurements on Glazed Ceramic Surfaces." *Journal of the National Institute of Standards and Technology* 105, no. 22, 275-283. Bethesda, MD.
- NPS (National Park Service) 1997. *Mallinckrodt Chemical Works Historic American Buildings Survey*, Great Plains Support Office, Omaha, NE, August.
- NRC (U.S. Nuclear Regulatory Commission) 1998. *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*. NUREG-1507. June.
- NRC 1999. Residual Radioactive Contamination from Decommissioning Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalent, NUREG/CR-5512, PNL-7994, Volume 1. Final Report.
- NRC 2003. Consolidated NMSS Decommissioning Guidance Characterization, Survey, and Determination of Radiological Criteria, NUREG 1757, Volume 2. Revision 1. September.
- ORNL (Oak Ridge National Laboratory) 1981. Radiological Survey of Mallinckrodt Chemical Works, St. Louis, Missouri, December.
- Platford, R., and S. Joshi 1986. "The Chemistry of Uranium and Related Radionuclides in Lake Ontario (USA, Canada) Waters," *Journal of Radioanalytical and Nuclear Chemistry* 106:333-344.
- PNL (Pacific National Laboratory) 1994. Residual Radioactive Contamination From Decommissioning, PNL-7994, NUREG/CR-5512 Volume 1, prepared for the U.S. Nuclear Regulatory Commission, June.
- Premuzic, E., A. Francis, and M. Lin 1985. "Induced Formation of Chelating Agents by Pseudomonas Aeruginosa Grown in Presence of Thorium and Uranium," *Archives of Environmental Contamination and Toxicology* 14:759-768.

- SAIC (Science Applications International Corporation) 2006. Science Applications International Corporation. *Data Validation Technical Procedures*, June.
- SAIC 2008. Quality Assurance Technical Procedures Volume II: Field Standard Operating Procedures, *FTP-400 Equipment Decontamination*, McLean, VA, Revision 2, November.
- Sheppard, M., D. Thibault, and J. Mitchell 1987. "Element Leaching and Capillary Rise in Sandy Soil Cores: Experimental Results," *Journal of Environmental Quality* 16:273-284.
- Sheppard, M., and D. Thibault 1990. *Default Soil Solid/Liquid Partition Coefficients, K_ds, For Four Major Soil Types: A Compendium.*, Health Physics 1990, Vol. 59, No. 4 pp. 471-482.
- Silva, R., L. Benson, and J. Apps 1979. "Studies of Actinide Sorption on Selected Geologic Materials," *American Chemical Society Symposium Series* 100:215-240.
- Smith, Brice and Alexandra Amonette 2006. *The Environmental Transport of Radium and Plutonium: A Review,* Institute for Energy and Environmental Research, Takoma Park, MD, June 23.
- Smith, K.S. 1999. Metal Sorption on Mineral Surfaces: An Overview with Examples Relating to Mineral Deposits, in The Environmental Geochemistry of Mineral Deposits Part A: Processes, Techniques, and Health Issues, Reviews in Economic Geology, Vol. 6A, Society of Economic Geologists, Inc., Littleton, CO, p. 161-176.
- Smith, L.A., J.L. Means, A. Chen, B. Alleman, C. Chapman, J. Tixier, S. Brauning, A. Gavaskar, and M. Royer 1995. *Remedial Options for Metals-Contaminated Sites*, Lewis Publishers, Boca Raton, FL.
- SNL (Sandia National Laboratories) 1999. *Residual Radioactive Contamination From Decommissioning*, SAND99-2148, NUREG/CR-5512 Vol. 3, prepared for the U.S. Nuclear Regulatory Commission, June.
- State of Illinois 2002. Illinois 92nd General Assembly, The McKinley Bridge Fund, Public Act 92-0679, Springfield, IL, July 16.
- Swanson, S.M. 1985. "Food chain transfer of U-Series Radionuclides in Northern Saskatchewan Aquatic System," *Health Physics* 49:747-770.
- Ticknor, K.V. 1994. "Uranium Sorption on Geological Materials," *Radiochemica Acta* 64:229-236.
- Torstenfelt, B. 1986. "Migration of the Actinides Thorium, Protactinium, Uranium, Neptunium, Plutonium, and Americium in Clay," *Radiochemica Acta* 39:105-112.
- URS 2005. Final Remedial Investigation Report for Midnite Mine, Stevens County, Washington, Final, Sept. 30, 2005.
- USACE (U.S. Army Corps of Engineers) 1998a. Record of Decision for the St. Louis Downtown Site. Final, October.
- USACE 1998b. Feasibility Study for the St. Louis Downtown Site. Final, April.
- USACE 1998c. Quality Assurance Project Plan for the St. Louis Airport and Downtown Sites. Final. June.
- USACE 1999a. Background Soils Characterization Report for the St. Louis Downtown Site. March.

- USACE 1999b. *Inaccessible Soils at St. Louis Downtown Site*, Letter to Mr. Robert Boland from Sharon R. Cotner, September 2.
- USACE 2000. Sampling and Analysis Guide for the St. Louis Site. October.
- USACE 2002a. Post-Remedial Action Report for the Accessible Soils within the St. Louis Downtown Site Plant 2 Property. January.
- USACE 2002b. USACE Kansas City and St. Louis District Radionuclide Data Quality Evaluation Guidance for Alpha and Gamma Spectroscopy. December.
- USACE 2003. Final Status Survey Plan for Structures and Other Consolidated Material Left in Place at the St. Louis Site, September 22.
- USACE 2004a. Derivation of Site-Specific DCGLs for North County Structures. Final. October 18.
- USACE 2005a. Memorandum for Record: Non-Significant Change to the Record of Decision for the St. Louis Downtown Site, March 31.
- USACE 2005b. Post-Remedial Action Report for the Accessible Soils within the St. Louis Downtown Site, Heintz Steel and Manufacturing Vicinity Property (DT-6), and Midwest Waste Vicinity Property (DT-7). Rev. 0, September 22.
- USACE 2005c. U.S. Army Corps of Engineers, St. Louis District. Memorandum for the Record. SAG Implementation Guidance for Interpretation of QA Split Program. Sharon R. Cotner. November 23.
- USACE 2006. Final Status Survey Evaluation for the Accessible Soils within the St. Louis Downtown Site Vicinity Properties West of Broadway, Mallinckrodt Plants 3, 8, 9, and 11 and Parking Lots. Rev. 0, May 26.
- USACE 2009a. Remedial Investigation Work Plan for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site. Rev. 0, November 30.
- USACE 2009b. Pre-Design Investigation and Final Status Survey Evaluation for the Accessible Soils within the St. Louis Downtown Site Vicinity Properties DT-35 and DT-36. Rev. 0, May 7.
- USACE 2010a. Post-Remedial Action Report and Final Status Survey Evaluation for the Accessible Soils within the St. Louis Downtown Site Vicinity Property Thomas and Proetz Lumber Company (DT-10). Rev. 0, July 12.
- USACE 2010b. Environmental Quality Risk Assessment Handbook Volume II: Environmental Evaluation. Engineer Manual. Final. EM 200-1-4. December.
- USACE 2011. St. Louis Downtown Site Annual Environmental Monitoring Data and Analysis Report for Calendar Year 2010. July 8.
- USEPA (U.S. Environmental Protection Agency) 1985. Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites, Washington, D.C.
- USEPA 1988a. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, EPA/540/G-89/004, October.
- USEPA 1988b. Guidelines for Ground-Water Classification under the EPA Ground-Water Protection Strategy, Office of Research and Development, Washington, D.C, June.

- USEPA 1989a. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A, Office of Solid Waste and Emergency Response, EPA/540/1-89/002, Washington, D.C.
- USEPA 1989b. *Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation Manual,* Interim Final. Office of Emergency and Remedial Response, EPA/540/1-89/001, Washington, D.C. March.
- USEPA 1990. National Oil and Hazardous Substances, Pollution Contingency Plan, Final Rule, 40 *CFR* Part 300, 55 Federal Register 8666.
- USEPA 1991a. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual: Part B, Development of Risk-Based Preliminary Remediation Goals, Office of Solid Waste and Emergency Response, EPA/540/R-92/003, Washington, D.C.
- USEPA 1991b. *Radionuclides in Drinking Water Fact Sheet,* Office of Ground Water and Drinking Water, EPA-570/9-91-700, June.
- USEPA 1991c. A Guide to Principal Threat and Low Level Threat Wastes, Office of Solid Waste and Emergency Response, Publication 9380.3-06FS, NTIS Order Number PB92-963345, November.
- USEPA 1992a. *Behavior of Metals in Soils*, Groundwater Issue, EPA/540/S-92/018, Office of Research and Development, Office of Solid Waste and Emergency Response, Washington D.C., October.
- USEPA 1992b. *Guidance for Data Usability in Risk Assessment (Part A)*, Office of Solid Waste and Emergency Response, Publication 9285.7-09.A, Washington, D.C.
- USEPA 1993. Environmental Characteristics of EPA, NRC, and DOE Sites Contaminated with Radioactive Substances. Publication EPA 402-R-93-011, Washington, D.C., March.
- USEPA 1995a. National Primary Drinking Water Regulations: Contaminant Specific Fact Sheets, Inorganic Chemicals Technical Version, EPA 811-F-95-002-T, October.
- USEPA 1995b. Health Effects Assessment Summary Tables, Radionuclide Table: Radionuclide Carcinogenicity Slope Factors. Office of Radiation and Indoor Air.
- USEPA 1996a. *Soil Screening Guidance: Users Guide*, Office of Solid Waste and Emergency Response, Publication 9355-4-23, Washington, D.C., July.
- USEPA 1996b. *Radiation Exposure and Risk Assessment Manual*. EPA 402-R-96-016, Office of Air and Radiation, June.
- USEPA 1996c. Soil Screening Guidance: Technical Background Document, Office of Solid Waste and Emergency Response, EPA 540-R-95-128, Washington, D.C., May.
- USEPA 1997a. Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination, Office Solid Waste and Emergency Response, OSWER Directive No. 9200.4-18, Washington, D.C., August.
- USEPA 1997b. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final, Office Solid Waste and Emergency Response, EPA/540-R-97-006, Washington, D.C., June.
- USEPA 1999a. Understanding Variation in Partition Coefficient, Kd, Values, Volume I: The K_d Model of Measurement, and Application of Chemical Reaction Codes, EPA 402-R-99-004A, August.

- USEPA 1999b. Understanding Variation in Partition Coefficient, Kd, Values. Volume II: Review of Geochemistry and Available Kd Values for Cadmium, Cesium, Chromium, Lead, Plutonium, Radon, Strontium, Thorium, Tritium (3H), and Uranium, Office of Air and Radiation, EPA/402-R-99-004B, August.
- USEPA 1999c. Cancer Risk Coefficients for Environmental Exposure to Radionuclides, Federal Guidance Report No. 13, Office of Air and Radiation, EPA 402-R-99-001, Washington, D.C., September.
- USEPA 1999d. Background Report on Fertilizer Use, Contaminants and Regulations, United States Environmental Protection Agency, January.
- USEPA 2000. Soil Screening Guidance for Radionuclides: User's Guide, Office of Radiation and Indoor Air, Office of Solid Waste and Emergency Response, 9355.4-16A, EPA/540-R-00-007, PB2000 963307, Washington, D.C., October.
- USEPA 2002a. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites, Office of Emergency and Remedial Response, OSWER Directive 9285.6-10, Washington, D.C, December.
- USEPA 2002b. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Office of Solid Waste and Emergency Response, OSWER 9355.4-24, Washington, D.C.
- USEPA 2002c. Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, Office of Solid Waste and Emergency Response, OSWER 9285.7-41, Washington, D.C. September.
- USEPA 2003a. *Human Health Toxicity Values in Superfund Risk Assessments*, Office of Solid Waste and Emergency Response, OSWER Directive 9285.7-53, Washington, D.C. December 5.
- USEPA 2003b. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil, EPA-540-R-03-001, OSWER Directive 92857-54, January.
- USEPA 2004a. Understanding Variation in Partition Coefficient, Kd, Values, Volume III: Review of Geochemistry and Available Kd Values for Americium, Arsenic, Curium, Iodine, Neptunium, Radium, and Technetium, Office of Air and Radiation, EPA 402-R-04-002C, July 2004.
- USEPA 2004b. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual: Part E, Supplemental Guidance for Dermal Risk Assessment, Office of Solid Waste and Emergency Response, EPA/540/R/99/005, Washington, D.C.
- USEPA 2005. Guidelines for Carcinogen Risk Assessment. EPA/630/P-03/001F. Risk Assessment Forum, Washington, D.C. March.
- USEPA 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4).
- USEPA 2007. Framework for Metals Risk Assessment, EPA/120/R-07/001, Office of the Science Advisor, Washington D.C., March.
- USEPA 2008. *Child-Specific Exposure Factors Handbook*, EPA/600/R-06/096F, National Center for Environmental Assessment, Office of Research and Development, Washington, D.C., September.

- USEPA 2009a. *Radium*, Radiation Protection, accessed on November 9, found on the World Wide Web at: http://www.epa.gov/rpdweb00/radionuclides/radium.html.
- USEPA 2009b. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual: Part F, Supplemental Guidance for Inhalation Risk Assessment, Final, Office of Solid Waste and Emergency Response, EPA-540-R-070-002, Washington, D.C.
- USEPA 2010a. ProUCL Version 4.0 Technical Guide, EPA/600/R-07/041. April.
- USEPA 2010b. ProUCL Version 4.0 User Guide, EPA/600/R-07/038. May.
- USEPA 2010c. Preliminary Remediation Goals for Radionuclides, found on the world wide web at: http://epa-prgs.ornl.gov/radionuclides/download.html. Office of Solid Waste and Emergency Response. August 3rd.
- USEPA 2011. Exposure Factors Handbook: 2011 Edition. National Center for Environmental Assessment, Office of Research and Development, EPA/600/R-09/052F, Washington, D.C.
- USEPA 2012a. *Risk-Based Regional Screening Levels*, prepared by Oak Ridge National Laboratory with input from USEPA Regions 3, 6, and 9, May.
- USEPA 2012b. *Integrated Risk Information System (IRIS)*, National Center for Environmental Assessment, Cincinnati, OH, on-line database.
- USFWS (U.S. Fish and Wildlife Service) 2008. *Wetlands Digital Data and Mapping*, accessed on July 23, found on the World Wide Web at: http://wetlandsfws.er.usgs.gov/.
- Warren and Van Praag, Inc. 1980. Plants 1 and 2 Sewer System Analysis, M.C.W. Drawing No. 3121-5, 3121-6 and 3121-7, prepared for Mallinckrodt Incorporated, St. Louis, MO, January.
- WHO (World Health Organization) 2001. Arsenic and Arsenic Compounds, 2nd edition, Environmental Health Criteria 224, Geneva.
- WSU (Washington State University) 1999. Determination of the In Vitro Dissolution Rates of Selected Radionuclides in Soil and Subsequent ICRP 30 Solubility Classification for Dosimetry. Prepared by Sam Glover, Ph.D., and Steve LaMont, Department of Chemistry, Washington State University. Final Report {Draft}. August 15.

THIS PAGE INTENTIONALLY LEFT BLANK	

Remedial Investigation and Baseline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site
FIGURES

Remedial Investigation and Bas	seline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site
	THIS PACE INTENTIONALLY LEFT REANK
	THIS PAGE INTENTIONALLY LEFT BLANK

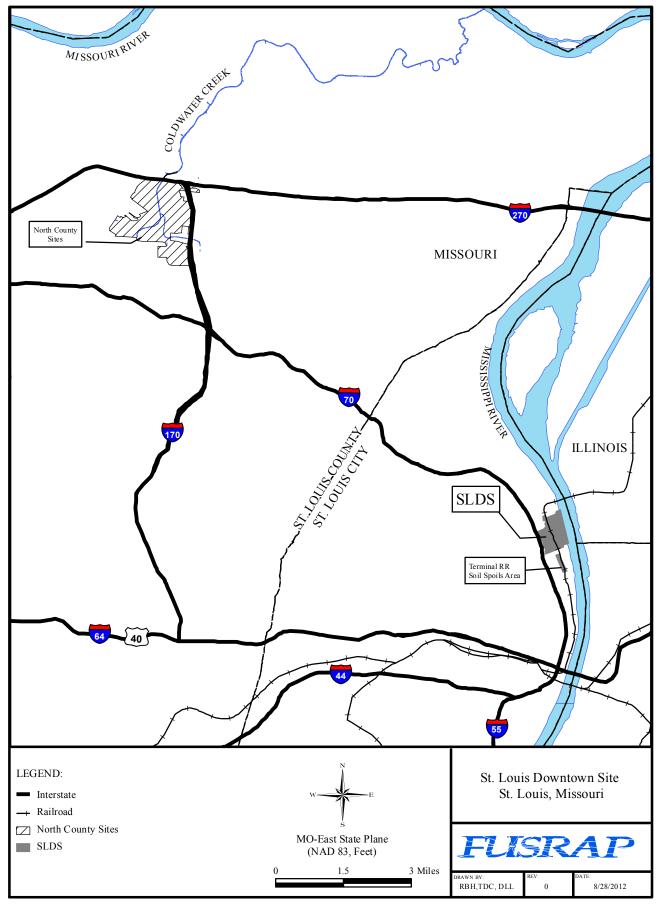
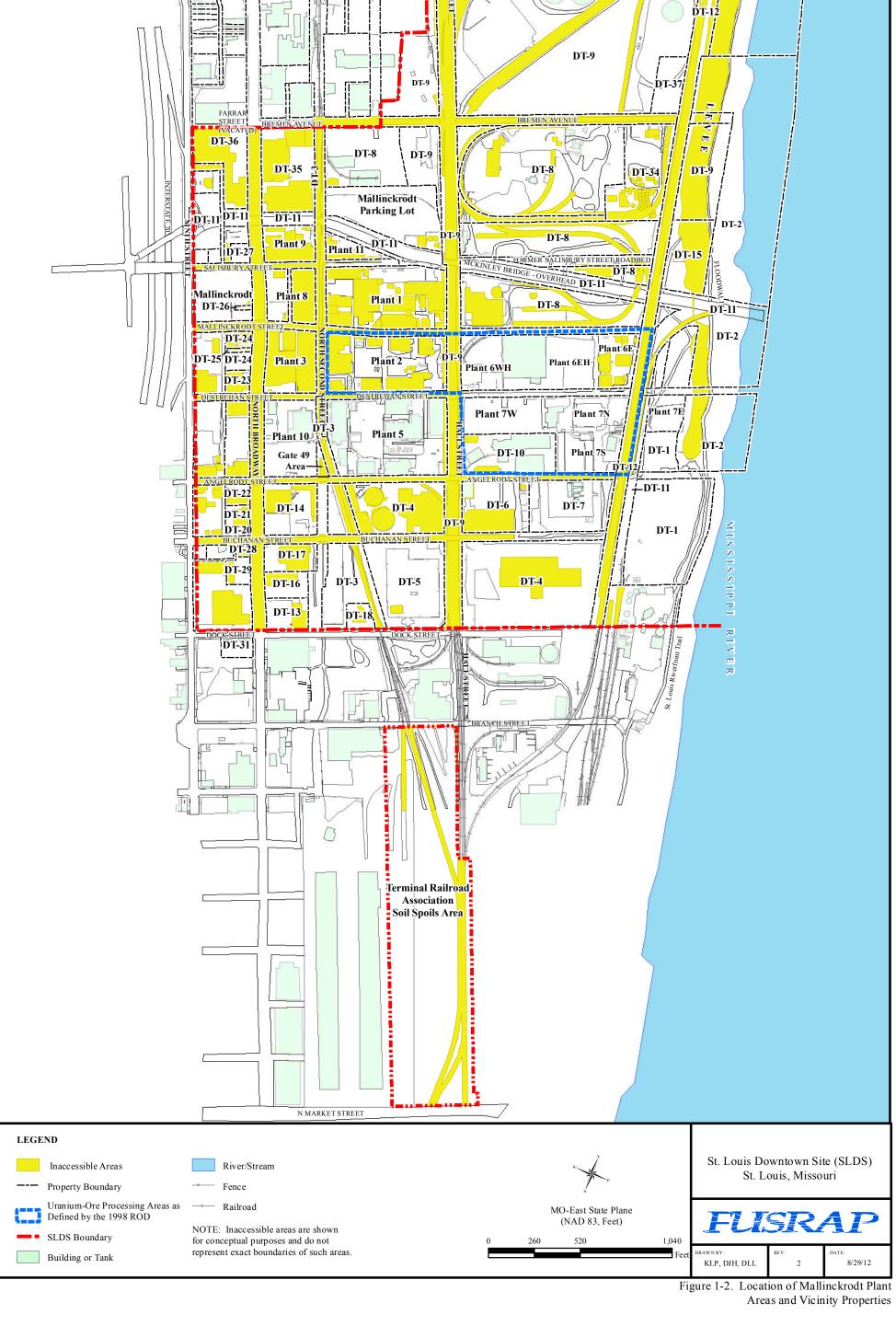


Figure 1-1. Location Map of the St. Louis Sites



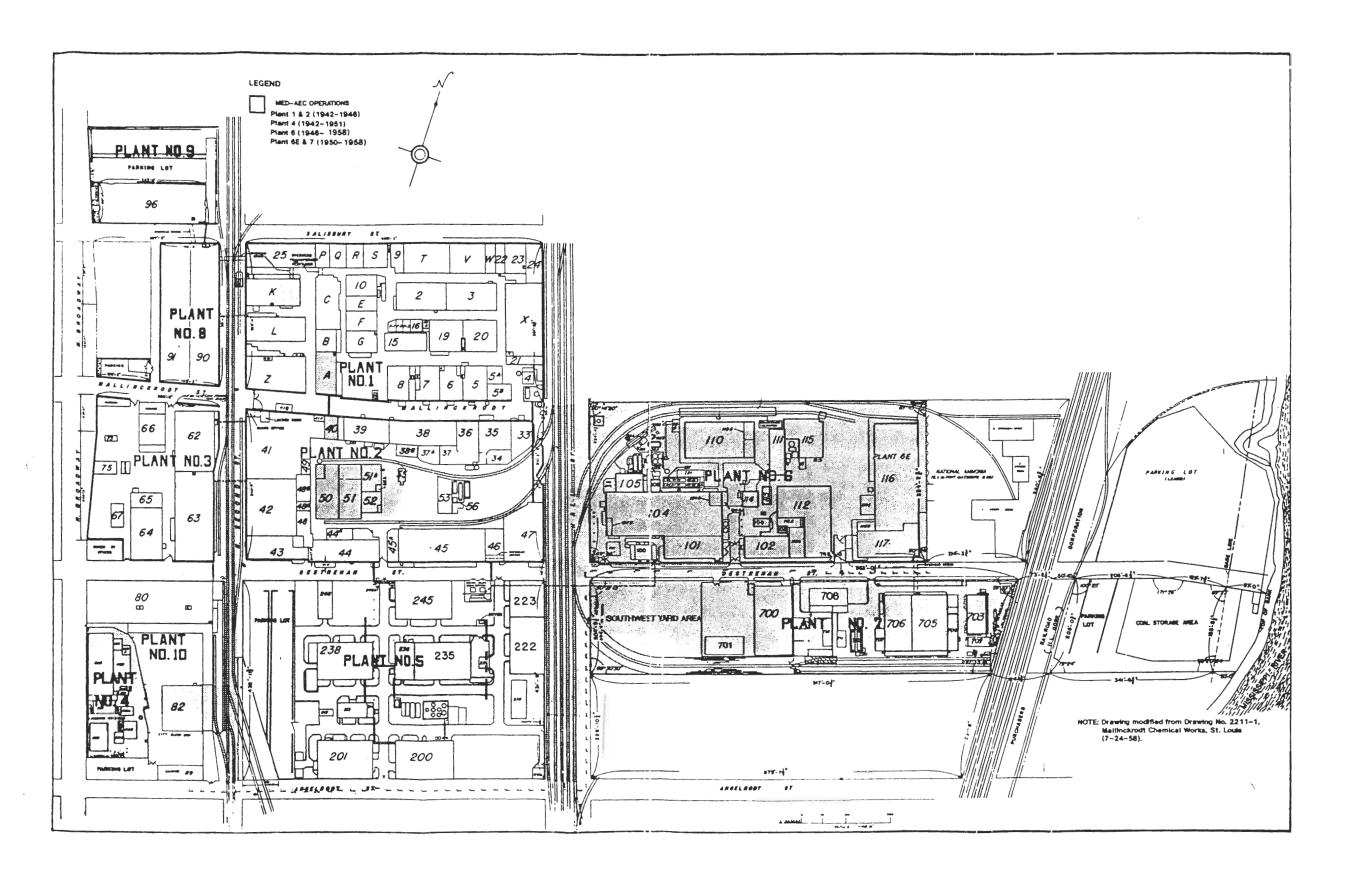


Figure 1-3. Historic Layout (1958) of the MED/AEC and Mallinckrodt Plant Facility

Figure 2-1. Typical Structure Foundation Inaccessible Soil Profile

Figure 2-2. Typical Roadway Inaccessible Soil Profile

Figure 2-3. Typical Rail Bed Inaccessible Soil Profile

Unit Designation	Approximate Thickness (ft)	Description
(HU-A)	0-25	FILL Grayish black (N2) to brownish black (5YR2/1). Dry to slightly moist, generally becoming moist at 5 to 6 ft and saturated at 10 to12 ft. Slight cohesion, variable with depth, moisture content and percentage of fines present. Consistency of relative density is unrepresentative due to large rubble fragments. Rubble is concrete, brick, glass, and coal slag. Percentage of fines as silt or clay increases with depth from 5 to 30%. Some weakly cemented aggregations of soil particles. Adhesion of fines to rubble increases with depth and higher moisture content. Degree of compaction is slight to moderate with frequent large voids.
Upper Hydrostratigraphic Unit (HU-A)	0-10	Silty CLAY (CH) Layers are mostly olive gray (5Y2/1) with some olive black (5Y2/1). Predominantly occurs at contact of undisturbed material or at boundary of material with elevated activity. Abundant dark, decomposed organics. Variable percentages of silt and clay composition.
Hydrostrat	0-5	CLAY (CL) Layers are light olive gray (5Y5/2) or dark greenish gray (5GY4/1). Slightly moist to moist, moderate cohesion, medium stiff consistency. Tends to have lowest moisture content. Slight to moderate plasticity.
Upper	0-2.5	Interbedded CLAY, silty CLAY, SILT and Sandy SILT (CL, ML, SM) Dark greenish gray (5GY4/1) to light olive gray (5Y6/1). Moist to saturated, dependent on percentage of particle size. Contacts are sharp, with structure normal to sampler axis to less than 15 degrees downdip. Layer thicknesses are variable, random in alternation, with no predictable vertical gradiation or lateral continuity. Some very fine-grained, rounded silica sand as stringers. Silt in dark mafic, biotite flakes. Some decomposed organics.
graphic	0-10	Sandy SILT (ML) Olive gray (5Y4/1). Moist with zones of higher sand content saturated. Slight to moderate cohesion, moderate compaction. Stiff to very stiff consistency, rapid dilatancy, nonplastic. Sand is well sorted, very fine, and fine-grained rounded quartz particles.
Lower Hydrostratigraphic Unit (HU-B)	0-50	Silty SAND and SAND (SM, SP, SW) Olive gray (5Y4/1). Saturated, slight cohesion, becoming noncohesive with decrease of silt particles with depth. Dense, moderate compaction. Moderate to well-graded, mostly fine- and medium-grained with some fine- and coarse-grained particles. Mostly rounded with coarse grains slightly subrounded. Gradual gradation from upper unit, silty sand has abundant dark mafic/biotite flakes. Sand is well-graded, fine gravel to fine sand. Mostly medium-grained, with some fine-grained and few coarse-grained and fine gravel.
Limestone Bedrock Unit (HU-C)	Total thickness not penetrated during drilling	Limestone Light olive gray (5Y4/1) with interbedded chert nodules. Generally hard to very hard; difficult to scratch with knife. Slightly weathered, moderately fresh with little to no discoloration or staining. Top 5 ft is moderately fractured with 99% of joints normal to the core axis. Joints are open, planar, and smooth. Some are slightly discolored with trace of hematite staining.

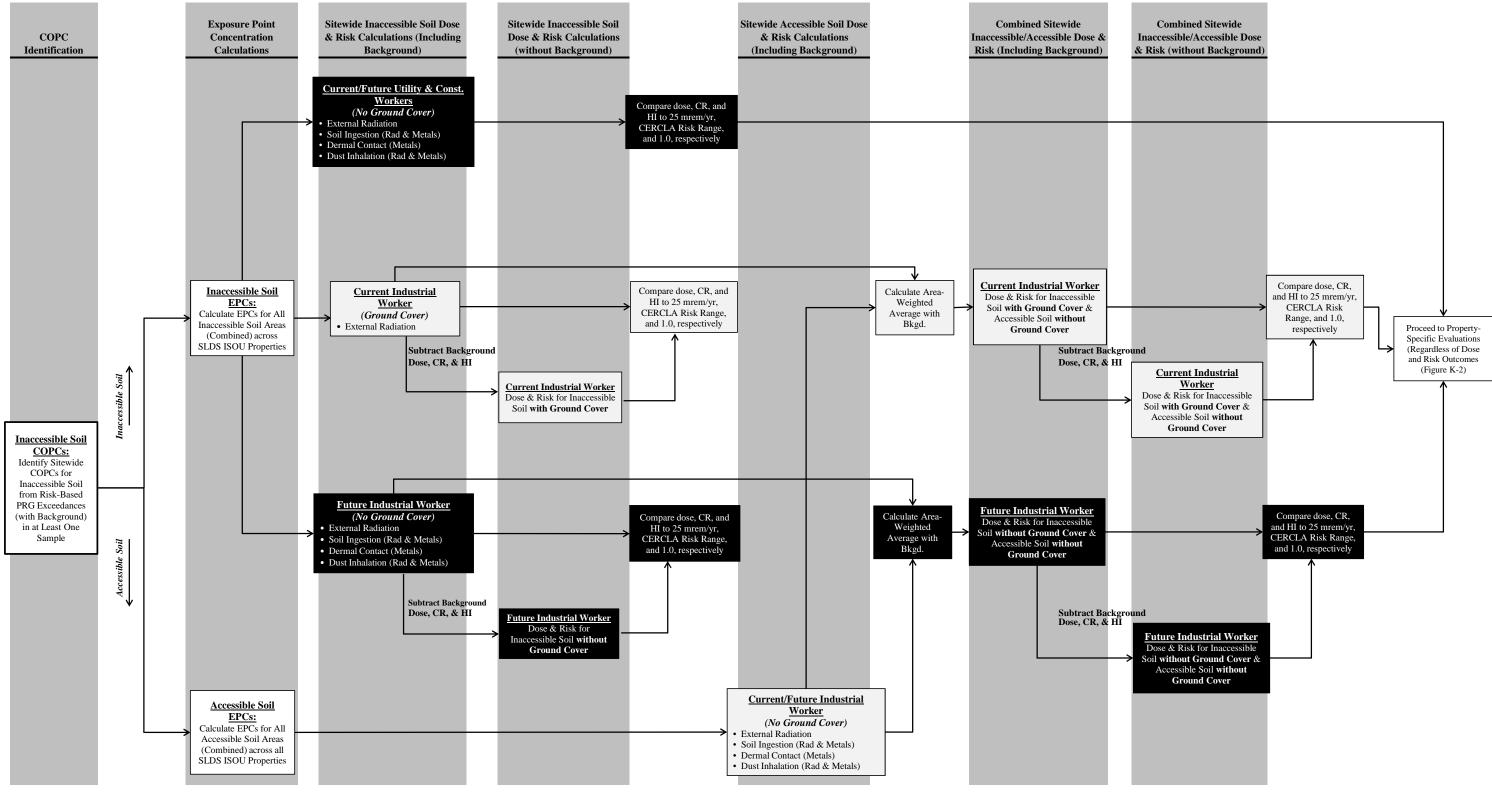
Source: Modified from BNI 1994.

NOT TO SCALE

Note: The codes in parentheses following lithologies are the Unified Soil Classification System (USCS) codes.

The codes in parentheses following the colors represent chroma, hue, and value from the Munsell soil color charts.





RECEPTOR SCENARIOS:

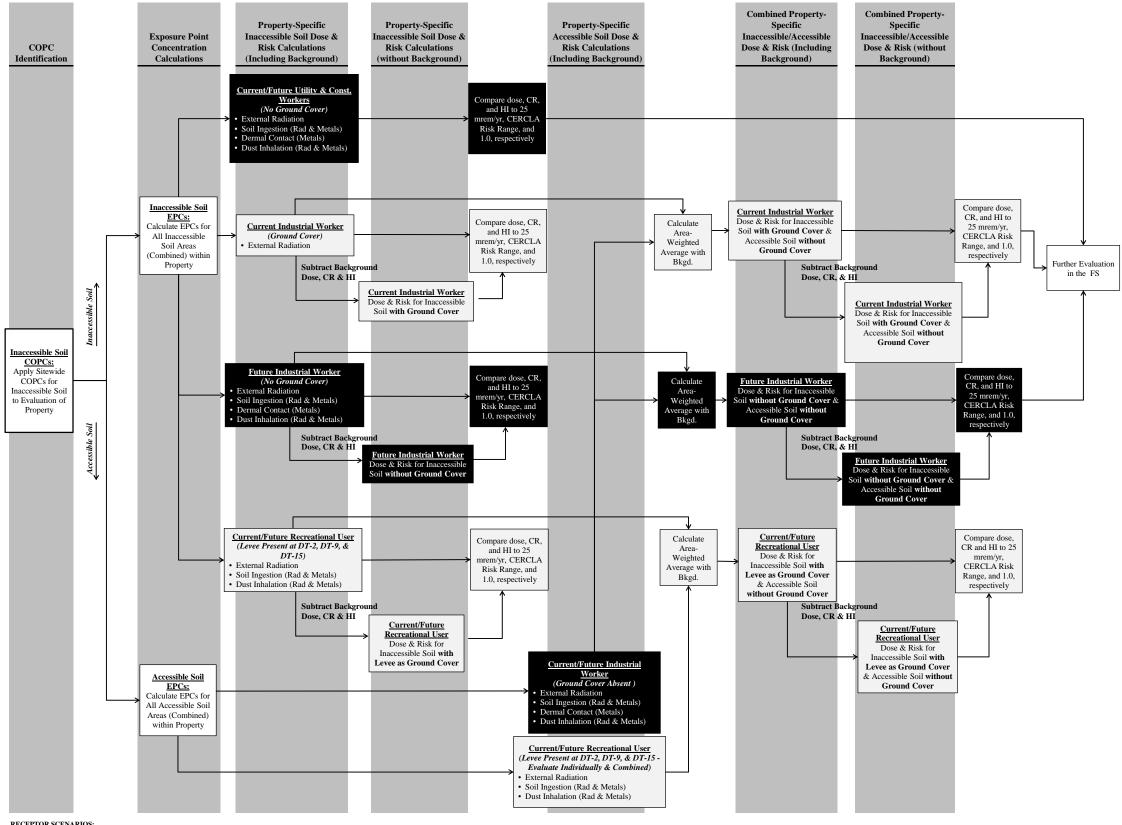
Current/Future Utility & Construction Worker - Inaccessible soil evaluations with no ground cover assumed to be present over excavated

<u>Current Industrial Worker</u> - Inaccessible soil and combined inaccessible/accessible soil evaluations, with ground cover assumed to be present over inaccessible soil areas.

<u>Future Industrial Worker</u> - Inaccessible soil and combined inaccessible/accessible soil evaluations, with no ground cover assumed to be present over inaccessible soil

<u>Current/Future Industrial Worker</u> - Accessible soil evaluations, with no ground cover assumed to be present.

Figure 6-1. Sitewide ISOU Human Health Risk Assessment Process for Soil



RECEPTOR SCENARIOS:

<u>Current/Future Utility & Construction Worker</u> - Inaccessible soil evaluations with no ground cover assumed to be present over excavated inaccessible soil.

<u>Current Industrial Worker</u> - Inaccessible soil and combined inaccessible/accessible soil evaluations, with ground cover assumed to be present over inaccessible soil areas.

Future Industrial Worker - Inaccessible soil and combined inaccessible/accessible soil evaluations, with no ground cover assumed to be present over inaccessible soil areas.

<u>Current/Future Recreational User of St. Louis Riverfront Trail</u> - Inaccessible soil and combined inaccessible/accessible soil evaluations. Levee assumed to be always present as ground cover over inaccessible soils at DT-2, DT-9, and DT-15.

<u>Current/Future Industrial Worker</u> - Accessible soil evaluations, with no ground cover assumed to be present.

<u>Current/Future Recreational User of the St. Louis Riverfront Trail</u> - Accessible soil evaluations for DT-2, DT-9, and DT-15. No ground cover assumed.

Figure 6-2. SLDS ISOU Property-Specific Human Health tisk Assessment Process for Soil

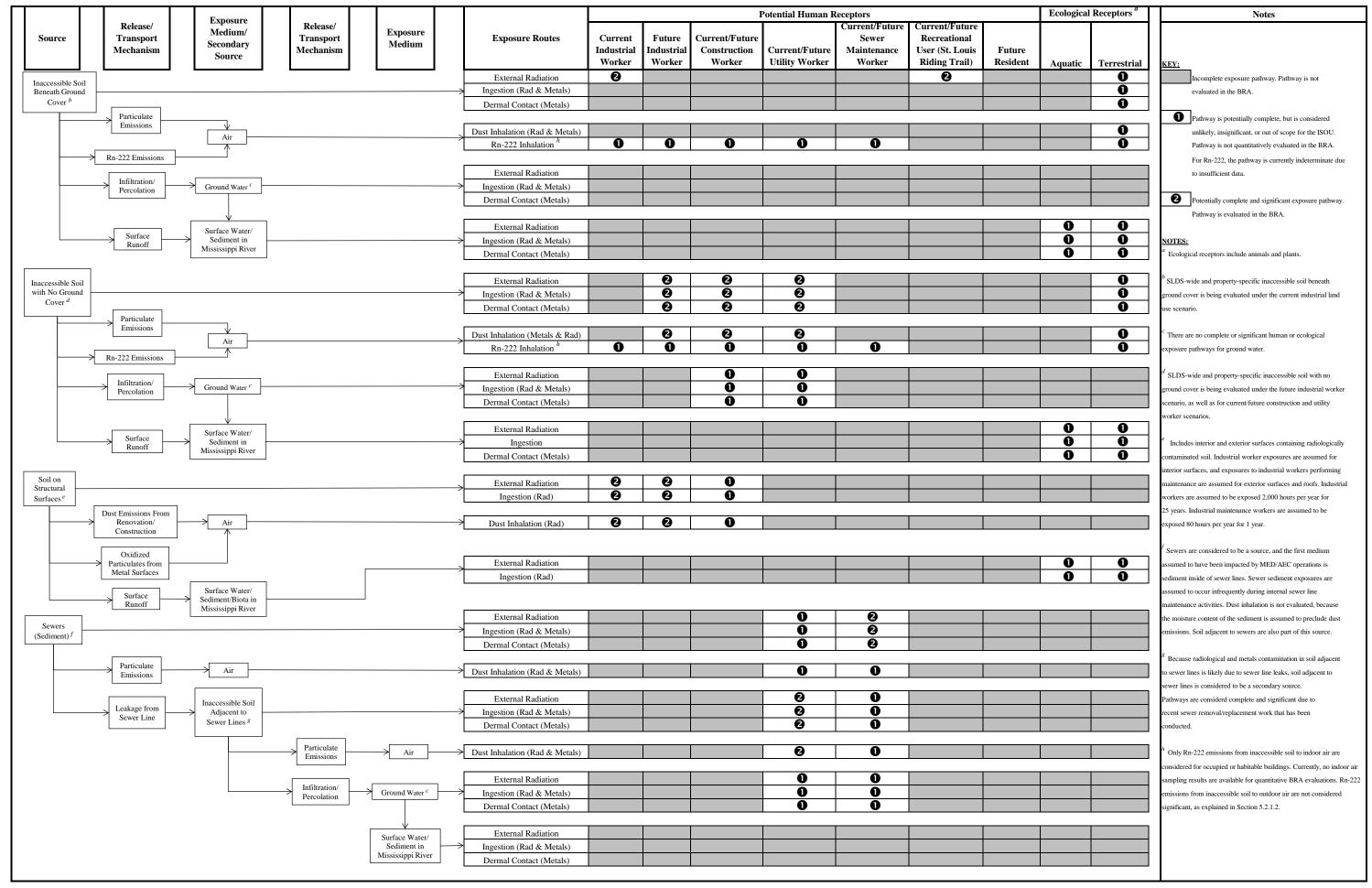


Figure 6-3. Human Health and Ecological Conceptual Site Model for St. Louis Downtown Site, Inaccessible Soil Operable Unit

Remedial Investigation and Baseline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site
APPENDIX A
Soil Daving Logg and Sawar Sadiment Manhala Logg
Soil Boring Logs and Sewer Sediment Manhole Logs
(On the DVD on the Back Cover of this Report)

Remedial Investigation and Bas	seline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site
	THIS PACE INTENTIONALLY LEFT REANK
	THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B

Quality Control Summary Report

(On the DVD on the Back Cover of this Report)

Remedial Investigation and Bas	seline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site
	THIS PACE INTENTIONALLY LEFT REANK
	THIS PAGE INTENTIONALLY LEFT BLANK

Remedial Investigation and Baseline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site	
Remedial investigation and Baseline Risk Assessment Report for the maccessible Soil Operable Unit at the St. Louis Downtown Site	
A DDENINIY C	
APPENDIX C	
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	•
	•
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	•
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	•
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	•
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	•
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	•
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	•
Figures: RI Sampling Locations for Inaccessible Soil Areas and Buildings and Extent of	

Remedial Investigation and Baseli	ine Risk Assessment Report for the Inaccessible Soil Operable	Unit at the St. Louis Downtown Site
, ,		A NI IZ
Т	THIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
1	HIS PAGE INTENTIONALLY LEFT BL	ANK
	HIS PAGE INTENTIONALLY LEFT BL	ANK
	HIS PAGE INTENTIONALLY LEFT BL	ANK
	HIS PAGE INTENTIONALLY LEFT BL	ANK
	HIS PAGE INTENTIONALLY LEFT BL	ANK
	HIS PAGE INTENTIONALLY LEFT BL	ANK

LIST OF FIGURES

Figure C-1.	Distribution of Ac-227 Exceeding the PRG in Inaccessible Soil
Figure C-2.	Distribution of Pa-231 Exceeding the PRG in Inaccessible Soil
Figure C-3.	Distribution of Ra-226 Exceeding the PRG in Inaccessible Soil
Figure C-4.	Distribution of Ra-228 Exceeding the PRG in Inaccessible Soil
Figure C-5.	Distribution of Th-228 Exceeding the PRG in Inaccessible Soil
Figure C-6.	Distribution of Th-230 Exceeding the PRG in Inaccessible Soil
Figure C-7.	Distribution of Th-232 Exceeding the PRG in Inaccessible Soil
Figure C-8.	Distribution of U-235 Exceeding the PRG in Inaccessible Soil
Figure C-9.	Distribution of U-238 Exceeding the PRG in Inaccessible Soil
Figure C-10.	Distribution of Arsenic Exceeding the PRG in Inaccessible Soil
Figure C-11.	Distribution of Cadmium Exceeding the PRG in Inaccessible Soil
Figure C-12.	Distribution of Uranium Metal Exceeding the PRG in Inaccessible Soil
Figure C-13.	Building/Structures with Surfaces Exceeding the PRGs

Remedial Investigation and Base	eline Risk Assessment Report fo	r the Inaccessible Soil Oper	able Unit at the St. Louis Do	owntown Site
	THIS PAGE INTENT	TIONALLY LEFT	BLANK	

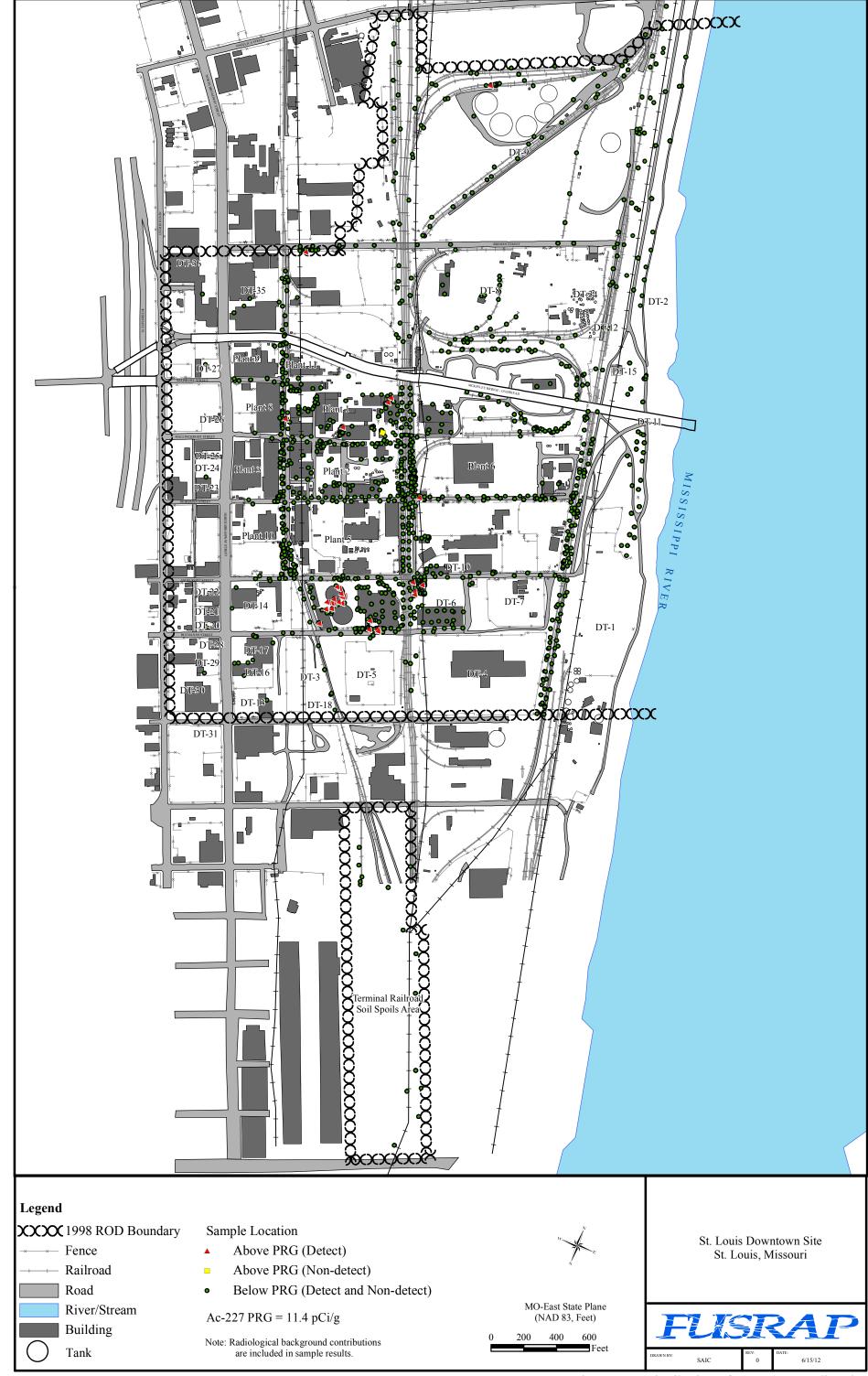


Figure C-1. Distribution of Ac-227 Exceeding the PRG in Inaccessible Soil

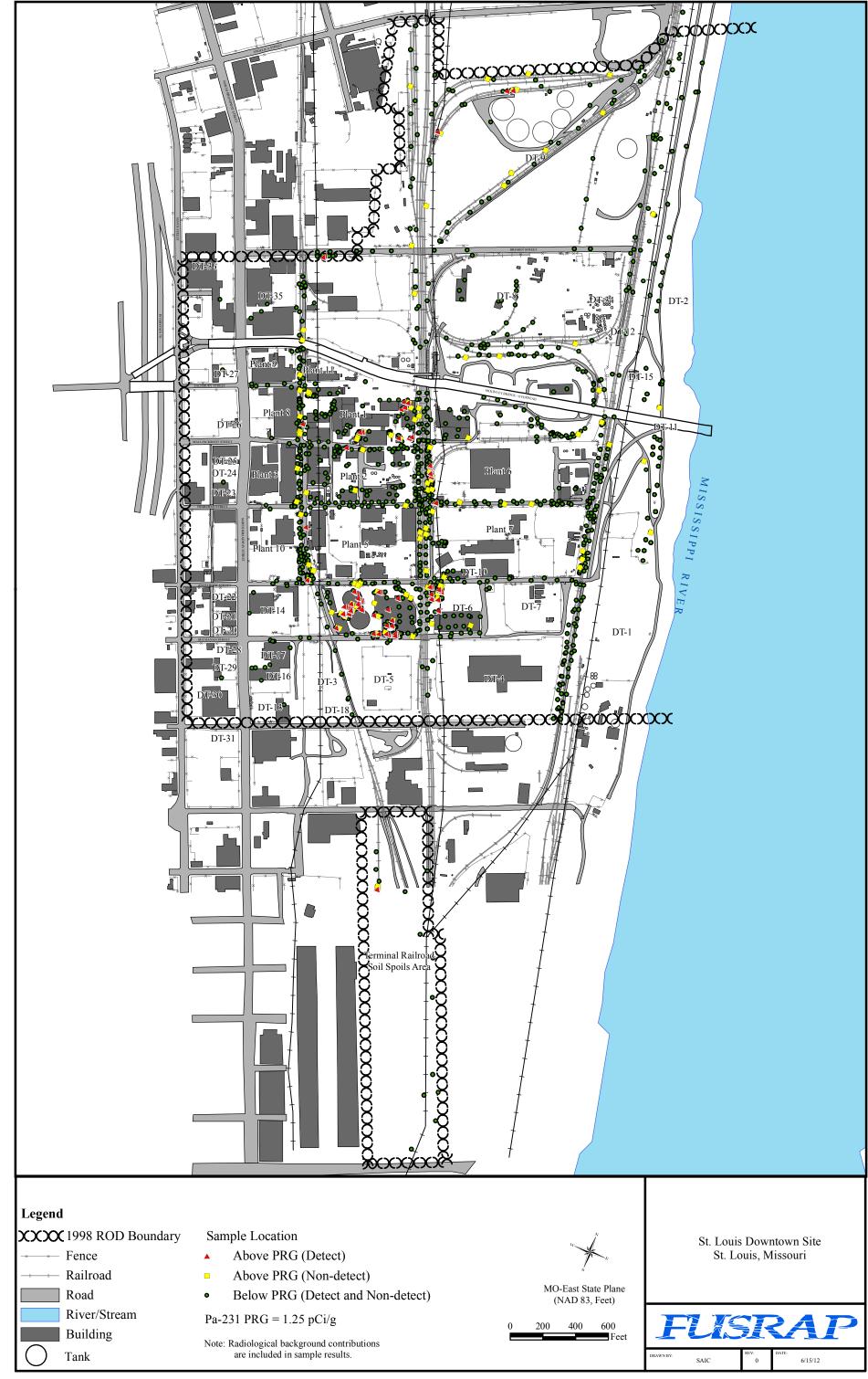


Figure C-2. Distribution of Pa-231 Exceeding the PRG in Inaccessible Soil

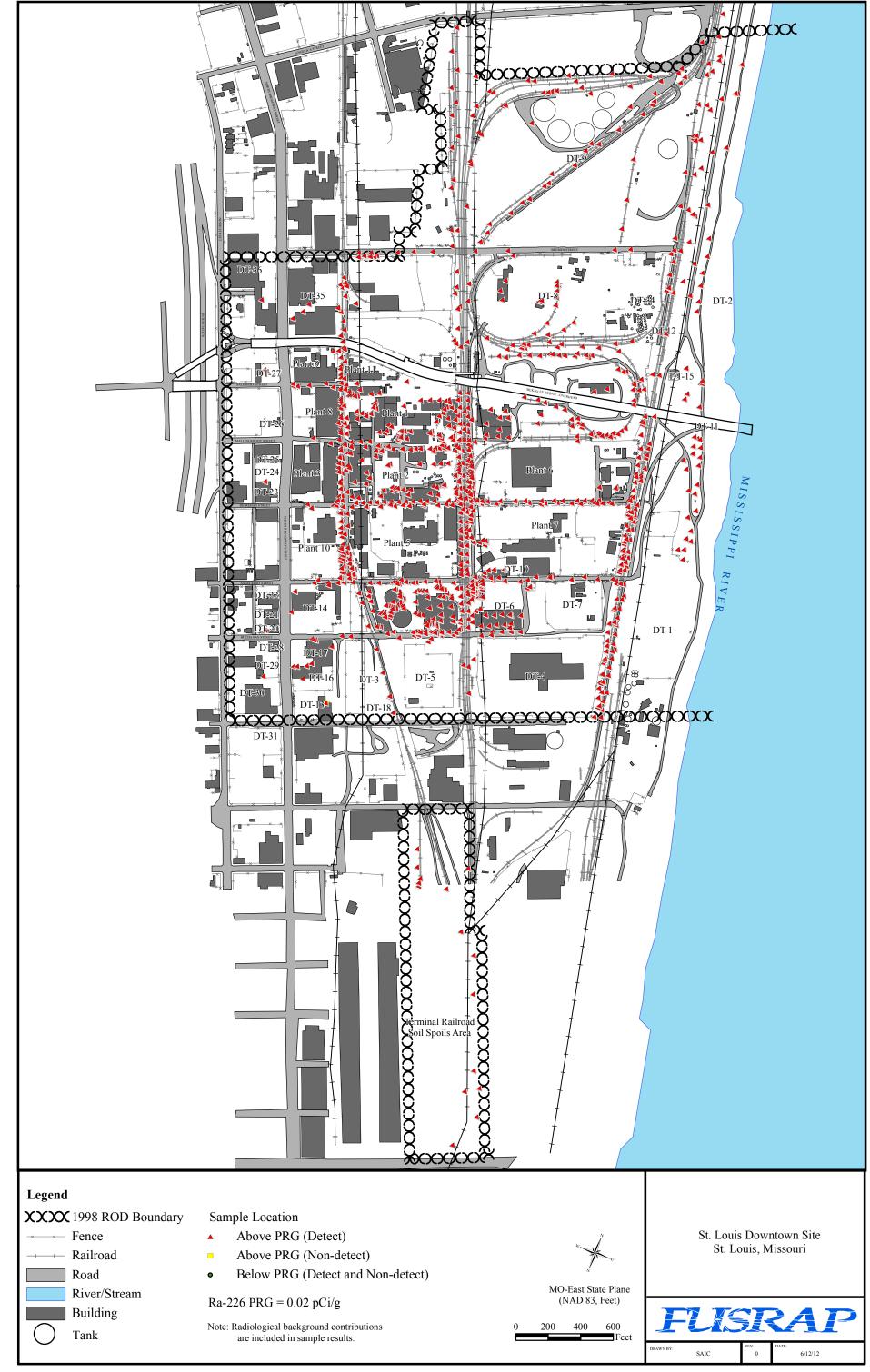


Figure C-3. Distribution of Ra-226 Exceeding the PRG in Inaccessible Soil

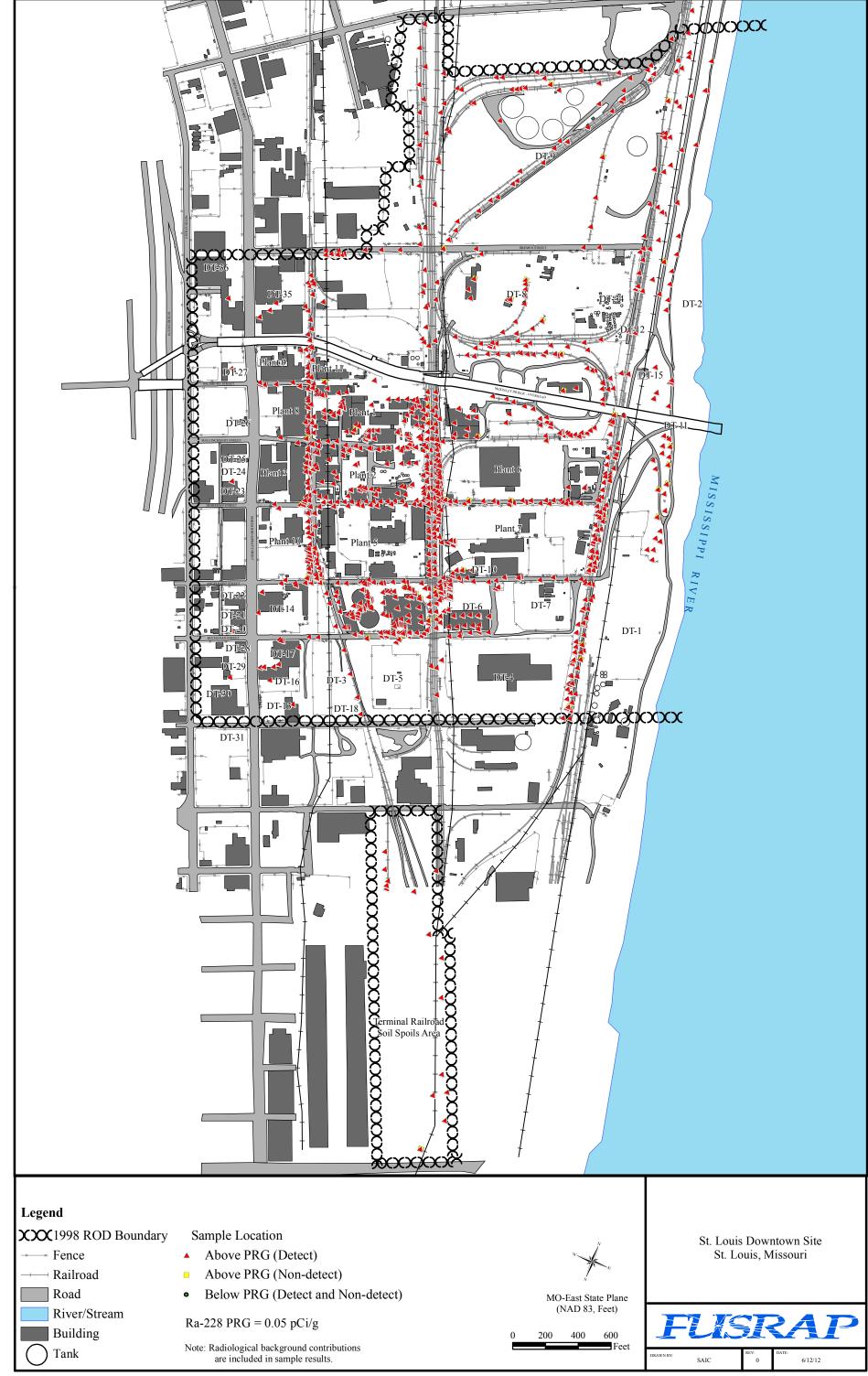


Figure C-4. Distribution of Ra-228 Exceeding the PRG in Inaccessible Soil



Figure C-5. Distribution of Th-228 Exceeding the PRG in Inaccessible Soil

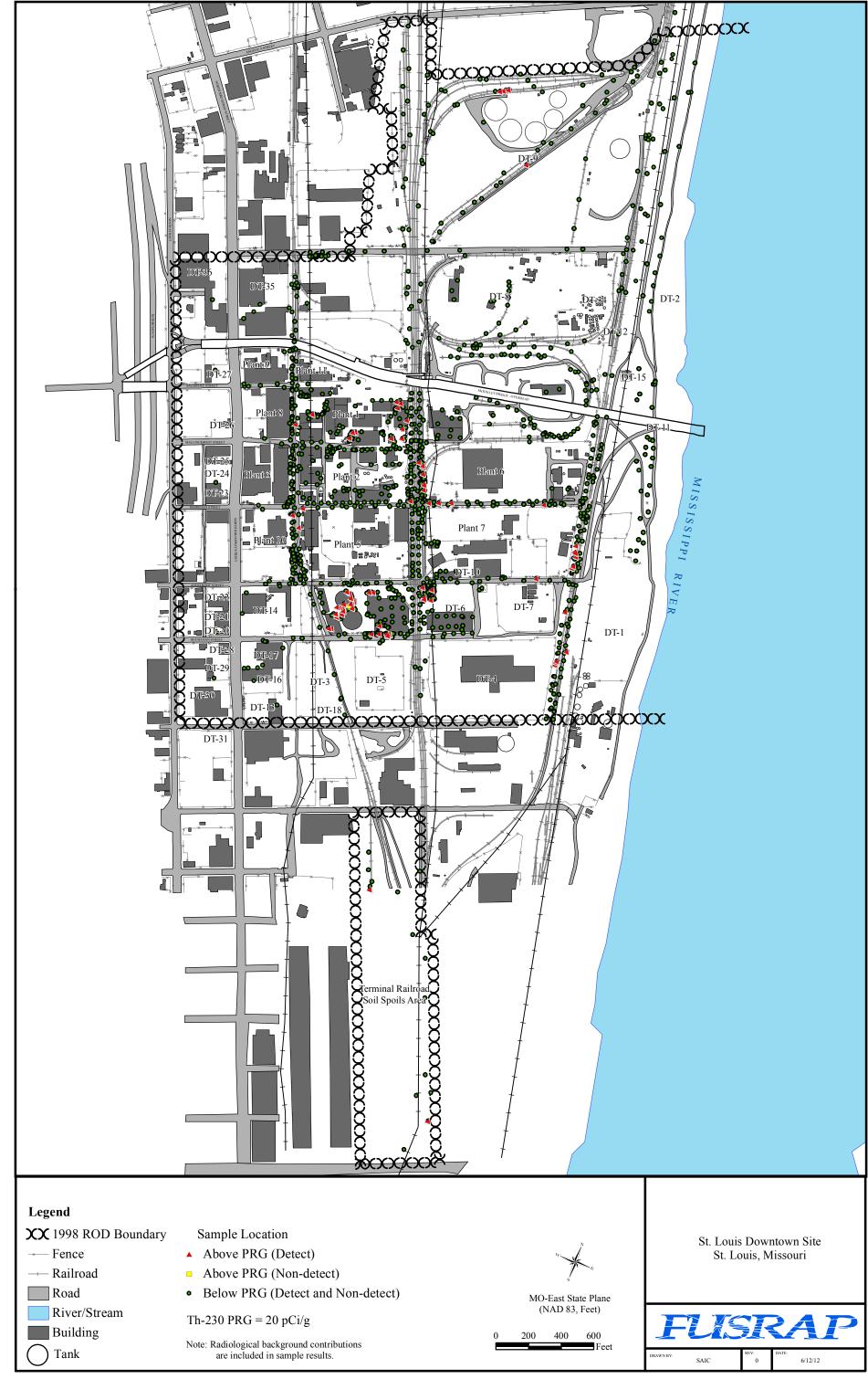


Figure C-6. Distribution of Th-230 Exceeding the PRG in Inaccessible Soil



Figure C-7. Distribution of Th-232 Exceeding the PRG in Inaccessible Soil



Figure C-8. Distribution of U-235 Exceeding the PRG in Inaccessible Soil

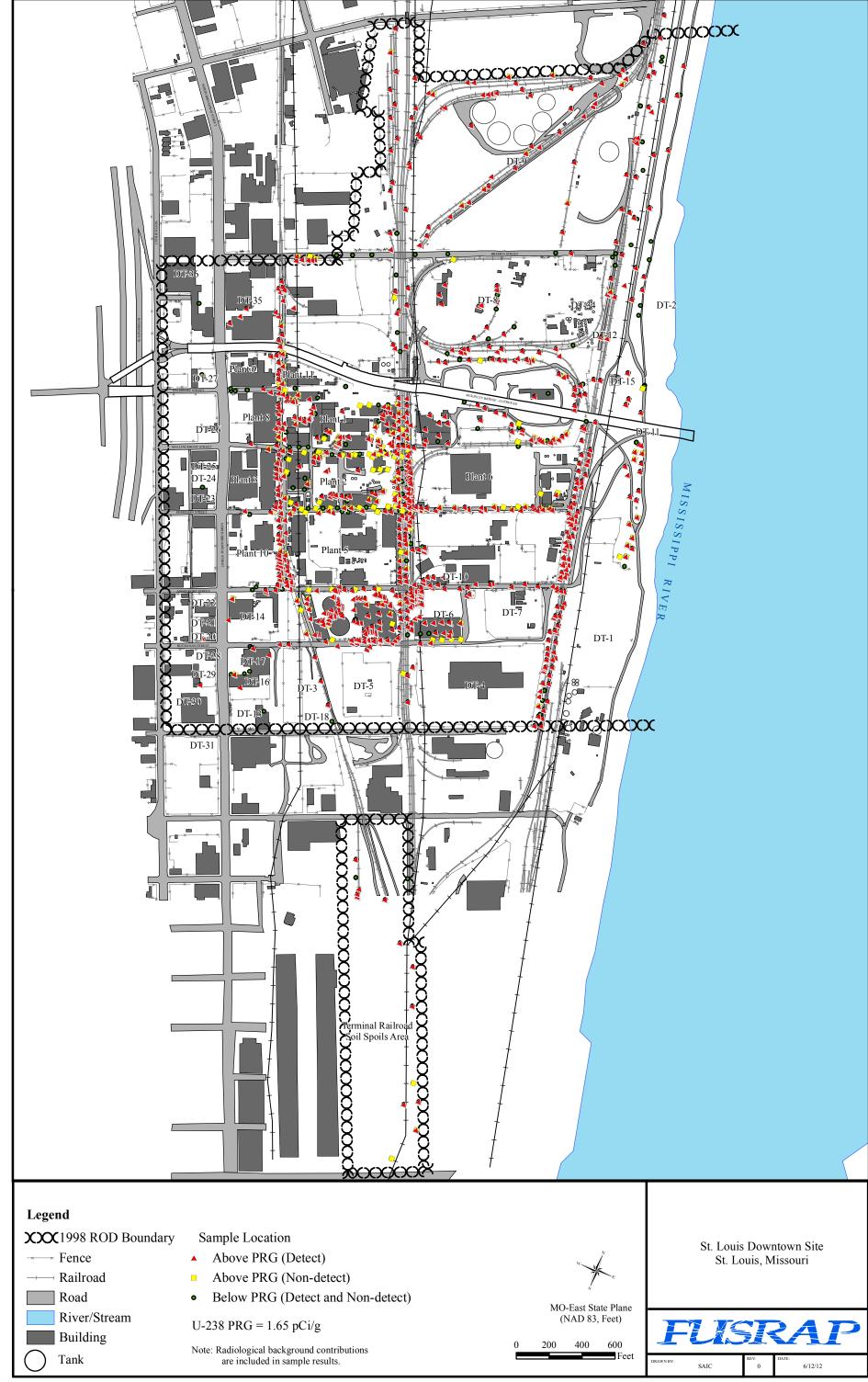


Figure C-9. Distribution of U-238 Exceeding the PRG in Inaccessible Soil

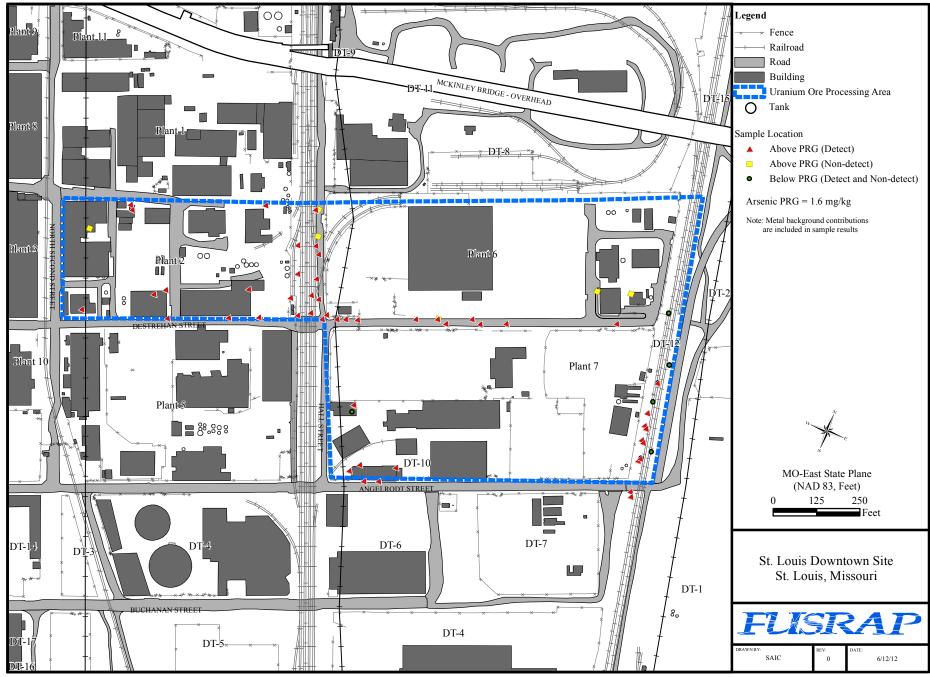


Figure C-10. Distribution of Arsenic Exceeding the PRG in Inaccessible Soil

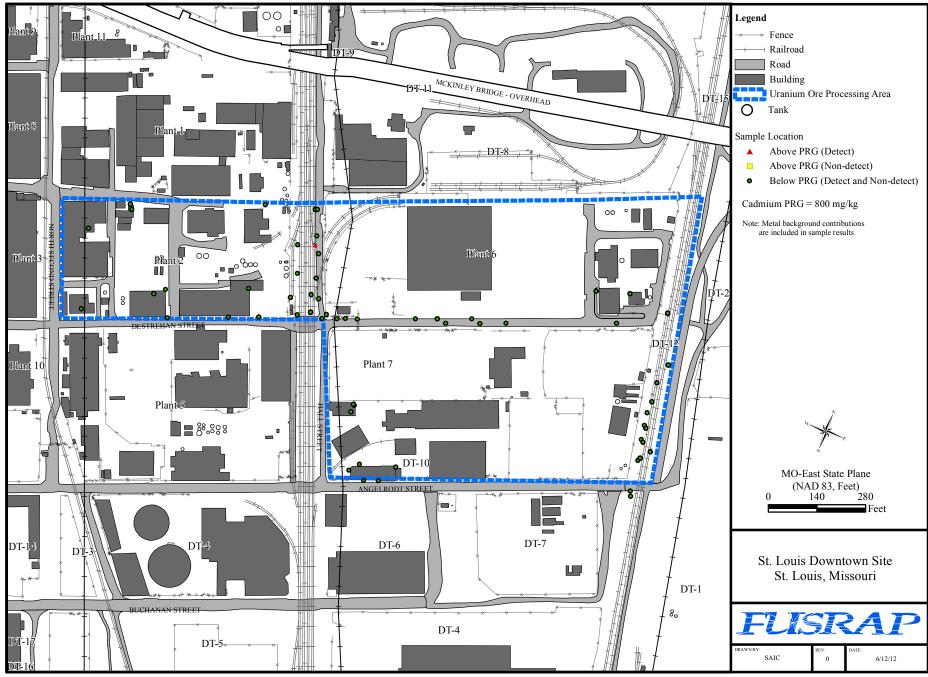


Figure C-11. Distribution of Cadmium Exceeding the PRG in Inaccessible Soil

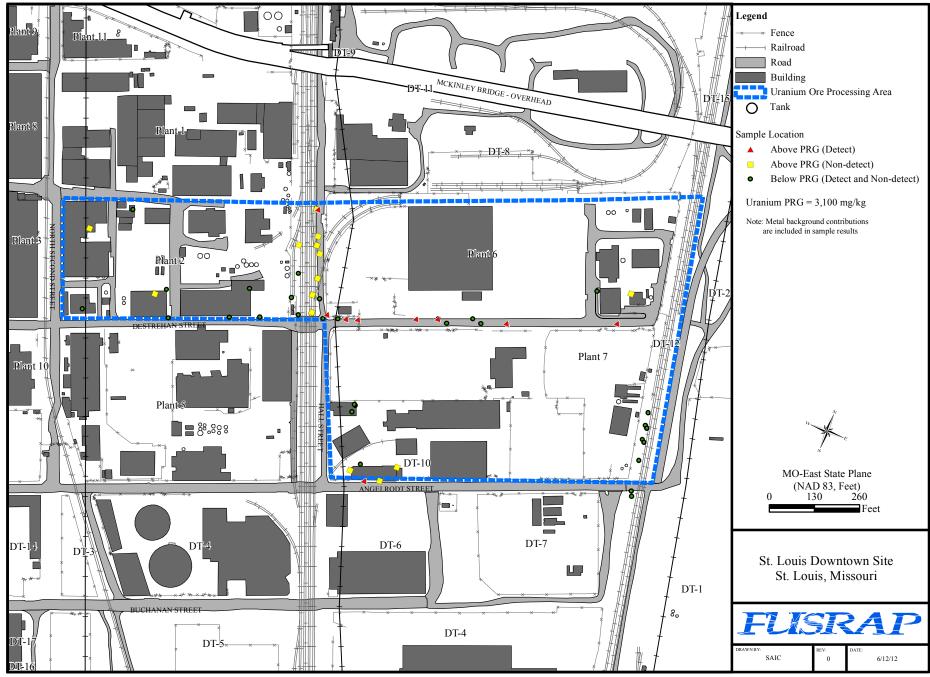


Figure C-12. Distribution of Uranium Metal Exceeding the PRG in Inaccessible Soil

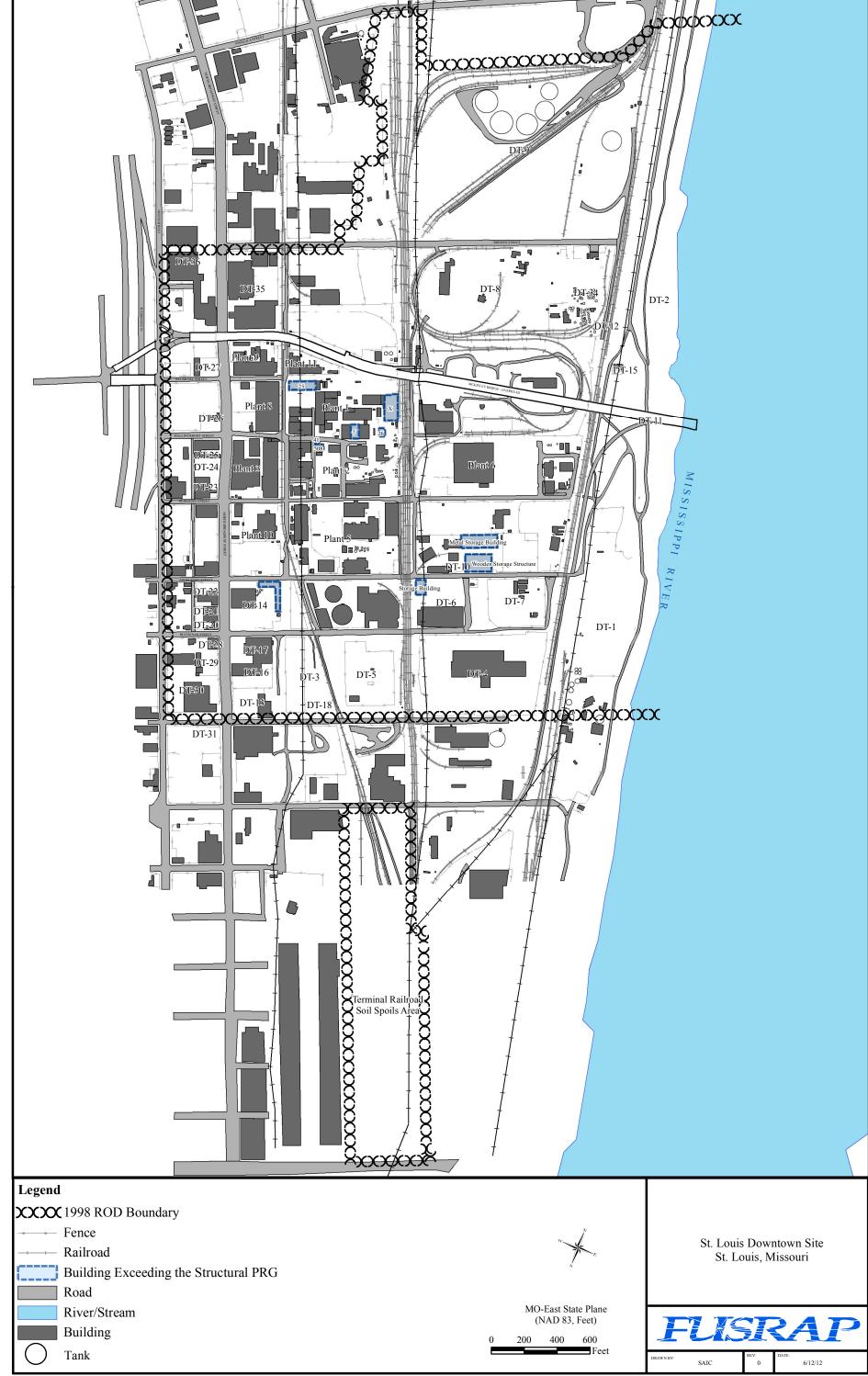


Figure C-13. Buildings/Structures with Surfaces Exceeding PRGs

Remedial Investigation and Baseline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site
APPENDIX D
Figures: Gamma Walkover Surveys of Inaccessible Soil Areas
Figures: Gamma Walkover Surveys of Inaccessible Soil Areas
Figures: Gamma Walkover Surveys of Inaccessible Soil Areas
Figures: Gamma Walkover Surveys of Inaccessible Soil Areas
Figures: Gamma Walkover Surveys of Inaccessible Soil Areas
Figures: Gamma Walkover Surveys of Inaccessible Soil Areas
Figures: Gamma Walkover Surveys of Inaccessible Soil Areas
Figures: Gamma Walkover Surveys of Inaccessible Soil Areas
Figures: Gamma Walkover Surveys of Inaccessible Soil Areas
Figures: Gamma Walkover Surveys of Inaccessible Soil Areas
Figures: Gamma Walkover Surveys of Inaccessible Soil Areas

Remedial Investigation and Bas	seline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site
	THIS PACE INTENTIONALLY LEFT REANK
	THIS PAGE INTENTIONALLY LEFT BLANK

Remedial Investigation and Baseline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site
APPENDIX E
Radiological and Metals Analytical Data Summaries and Figures for Inaccessible Soil an Building Sampling Locations
(On the DVD on the Back Cover of this Report)

Remedial Investigation and Bas	seline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site
	THIS PACE INTENTIONALLY LEFT REANK
	THIS PAGE INTENTIONALLY LEFT BLANK

Remedial Investigation and Baseline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downto	own Site
remedia investigation and Buseline Risk visuossiment report for the indecession operator office the title of. Bound Bownie	7WII BILL
APPENDIX F	
Data: Radiological Building Survey Results by Property and Building	
(On the DVD on the Back Cover of this Report)	
	FINAL

Remedial Investigation and Bas	seline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site
	THIS PACE INTENTIONALLY LEFT REANK
	THIS PAGE INTENTIONALLY LEFT BLANK

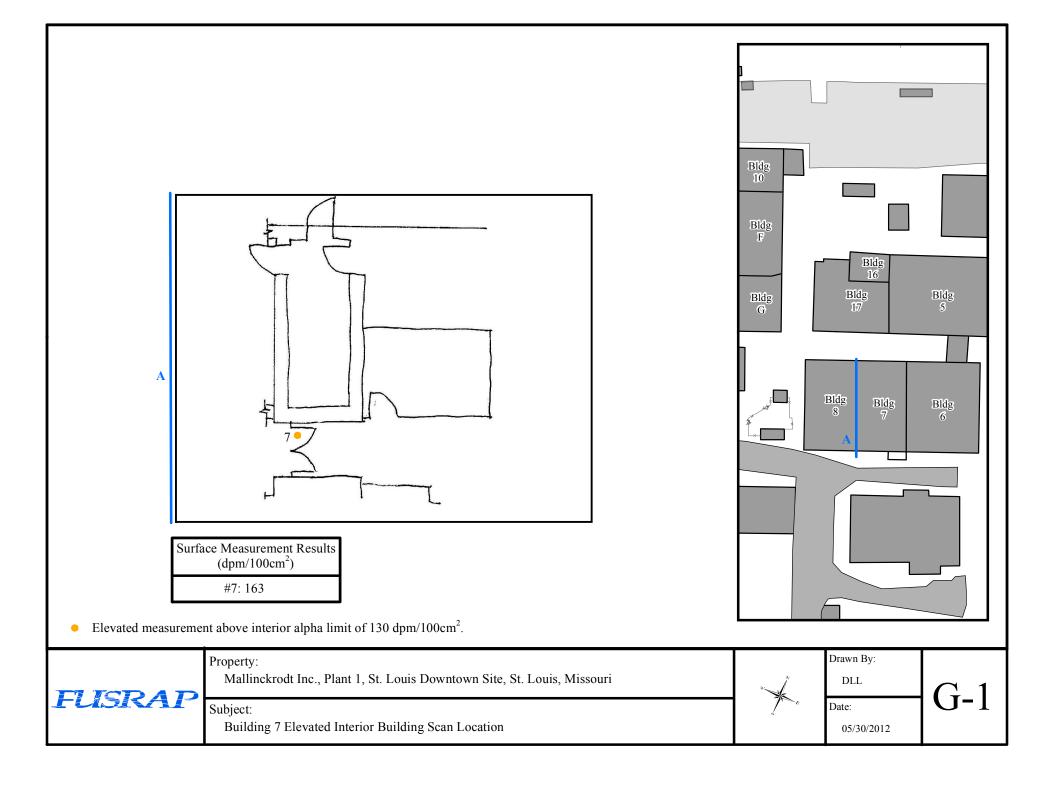
	APPENDIX G	
Figures: Ex	stent of Radiological Contamination	on for Buildings

Remedial Investigation and Bas	seline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site
	THIS PACE INTENTIONALLY LEFT REANK
	THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF FIGURES

- Figure G-1. Mallinckrodt Inc., Plant 1, St. Louis Downtown Site, St. Louis, Missouri, Building 7 Elevated Interior Building Scan Location
- Figure G-2. Mallinckrodt Inc., Plant 1, St. Louis Downtown Site, St. Louis, Missouri, Building 25 Elevated Exterior Building Scan Location
- Figure G-3. Mallinckrodt Inc., Plant 1, St. Louis Downtown Site, St. Louis, Missouri, Building 26 Elevated Interior Building Scan Locations
- Figure G-4. Mallinckrodt Inc., Plant 1, St. Louis Downtown Site, St. Louis, Missouri, Building X Elevated Exterior Building Scan Location
- Figure G-5. Mallinckrodt Inc., Plant 2, St. Louis Downtown Site, St. Louis, Missouri, Building 41 Elevated Interior Building Scan Locations
- Figure G-6. Mallinckrodt Inc., Plant 2, St. Louis Downtown Site, St. Louis, Missouri, Building 508 Elevated Interior Building Scan Locations
- Figure G-7. Heintz Steel and Manufacturing, DT-6, St. Louis Downtown Site, St. Louis, Missouri, Storage Shed Elevated Interior Building Scan Location
- Figure G-8. Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri, Metal Storage Building Elevated Interior Building Scan Location
- Figure G-9. Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri, Wood Storage Building Elevated Exterior Building Scan Locations North Wall
- Figure G-10. Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri, Wood Storage Building Elevated Exterior Building Scan Location East Wall
- Figure G-11. Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri, Wood Storage Building Elevated Exterior Building Scan Locations Roof Facing West
- Figure G-12. Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri, Wood Storage Building Elevated Exterior Building Scan Locations Roof Facing North
- Figure G-13. Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri, Wood Storage Building Elevated Exterior Building Scan Locations West Wall
- Figure G-14. Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri, Wood Storage Building Elevated Exterior Building Scan Locations Roof
- Figure G-15. Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri, Wood Storage Building Elevated Interior Building Scan Locations
- Figure G-16. Cotto Waxo, DT-14, St. Louis Downtown Site, St. Louis, Missouri, Support Beam Between Buildings Elevated Exterior Scan Location

Remedial Investigation and Base	eline Risk Assessment Report for	the Inaccessible Soil Opera	ble Unit at the St. Louis Dov	vntown Site
,	THIS PAGE INTENT	IONALLY LEFT	BLANK	



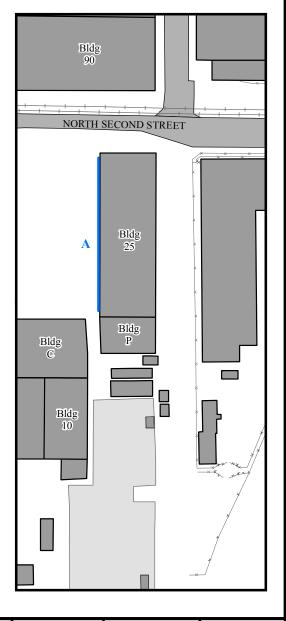


Surface Measurement Results (dpm/100cm²)

#47: 18,232

Location of Sample #47 obscured by metal shed. (See diagram above)





Elevated measurement above exterior alpha limit of 3200 dpm/100cm².

FUSRAP

Property:

Mallinckrodt Inc., Plant 1, St. Louis Downtown Site, St. Louis, Missouri

Subject:

Building 25 Elevated Exterior Building Scan Location

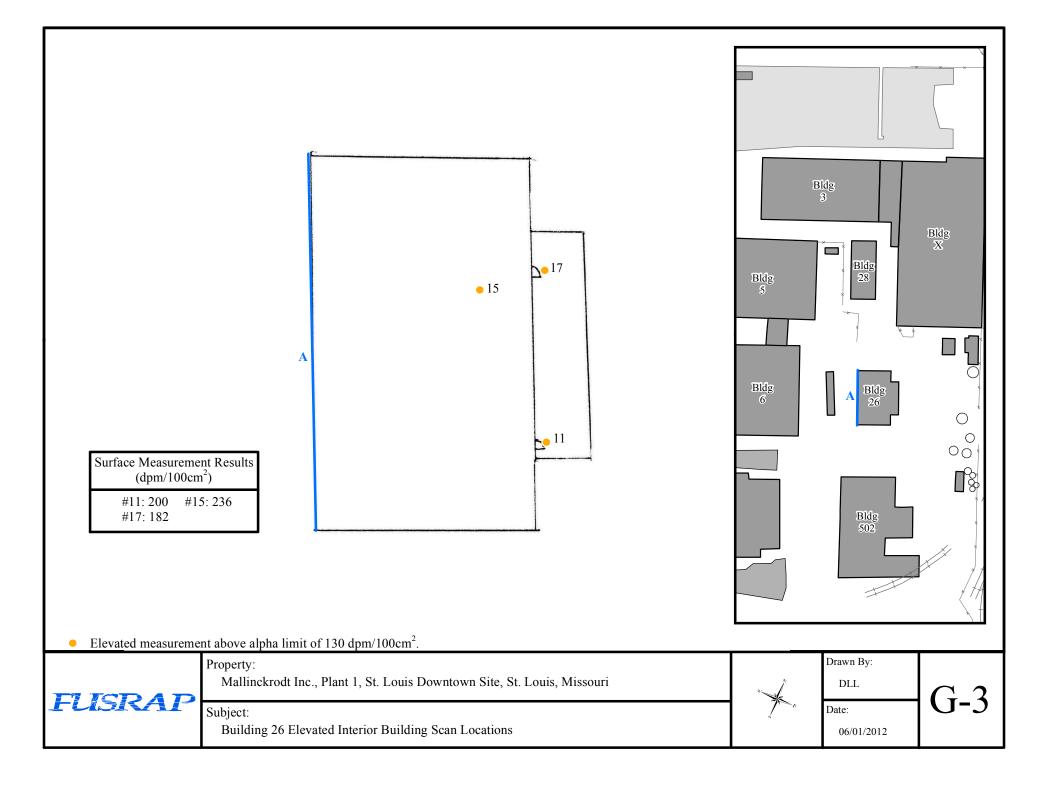


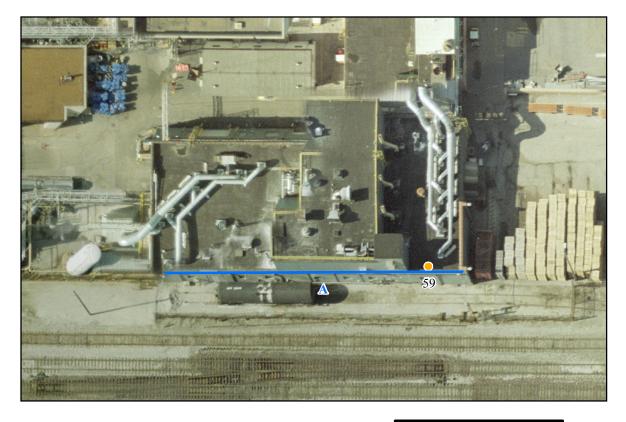
Drawn By:

DJH, DLL

Date:

05/30/2012

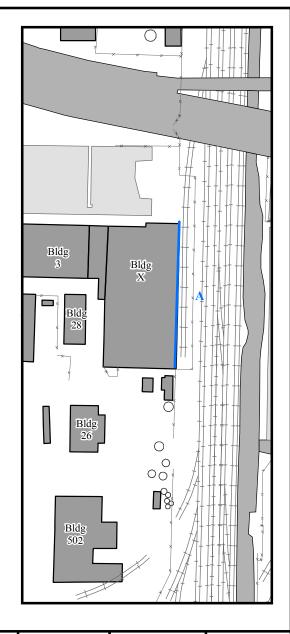




Surface Measurement Results (dpm/100cm²)

#59: 4,279

• Elevated measurement above exterior alpha limit of 3200 dpm/100cm².





Property:

Mallinckrodt Inc., Plant 1, St. Louis Downtown Site, St. Louis, Missouri

Subject:

Building X Elevated Exterior Building Scan Location

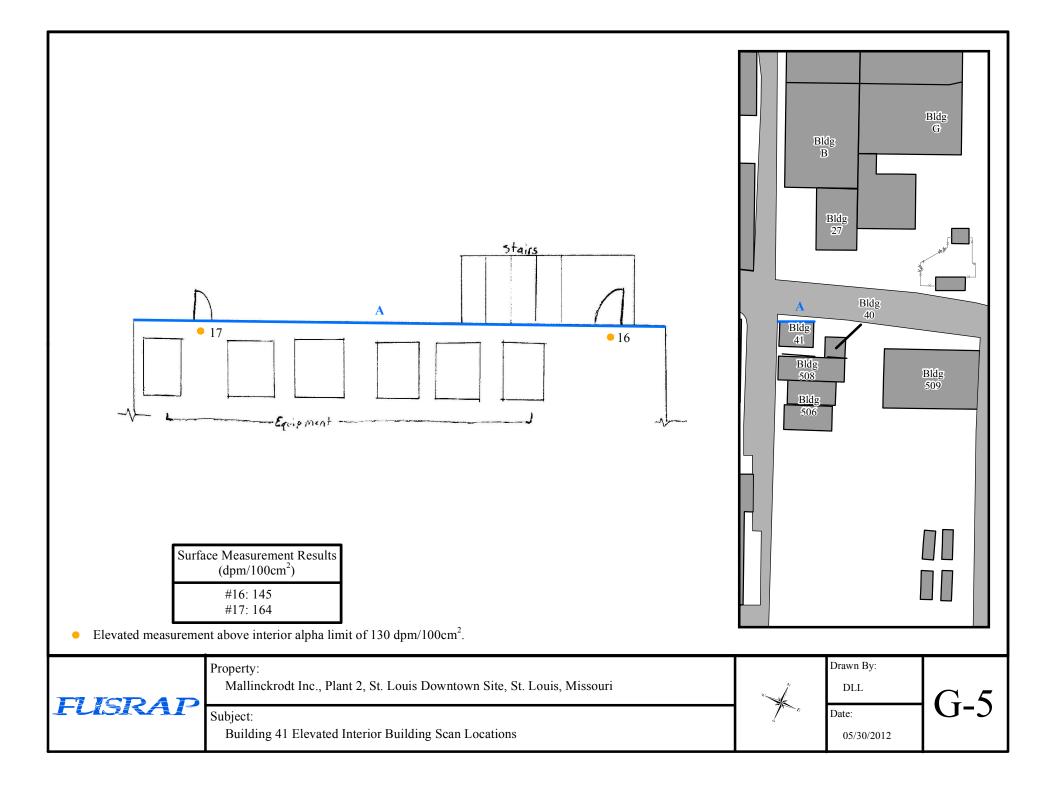


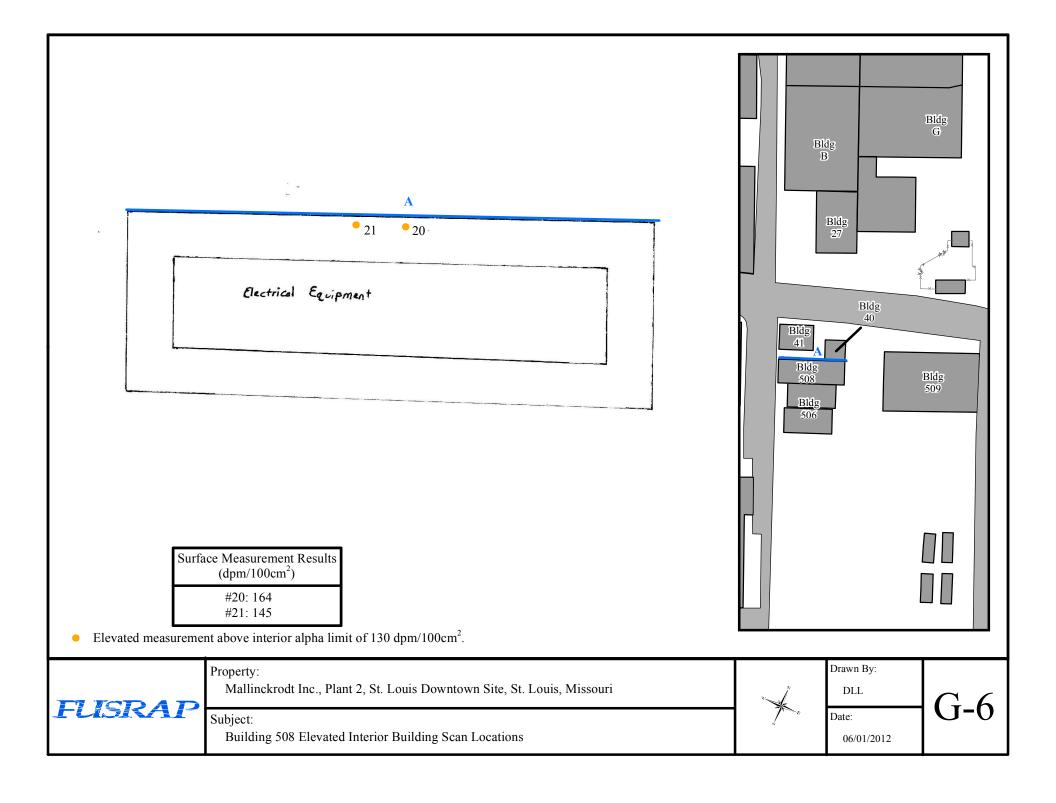
Drawn By:

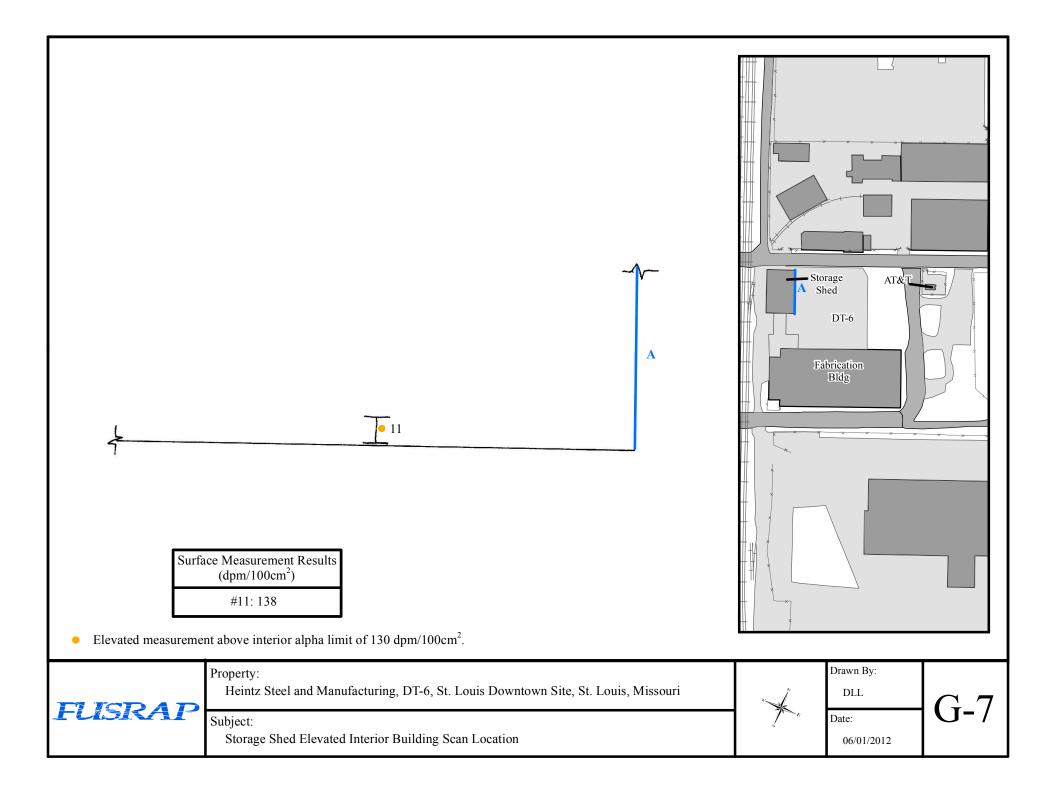
DLL

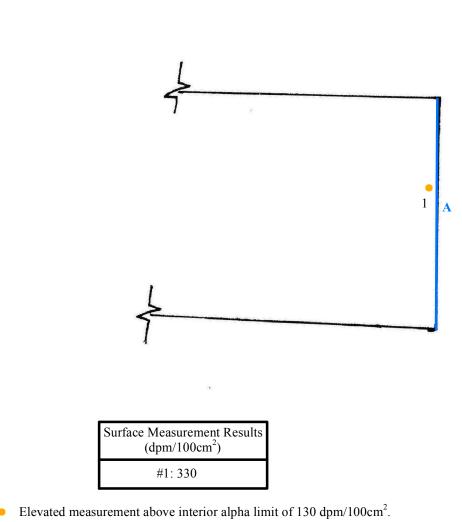
Date:

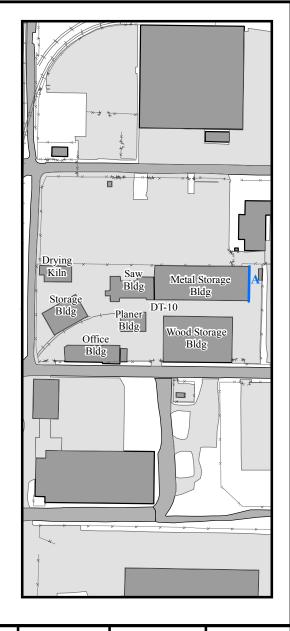
06/01/2012











FUSRAP

Property:

Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri

Subject:

Metal Storage Building Elevated Interior Building Scan Location



Drawn By:

DLL

Date:

06/01/2012



Surface Measurement Results $(dpm/100cm^2)$

#02: 17,752 #13: 16,792 #06: 18,728 #74: 22,476 #09: 16,259 #77: 19,196 #11: 15,863

Elevated measurement above exterior alpha limit of 3200 dpm/100cm².



Drawn By:

Storage Building

(Wood)

DJH, DLL

Date:

Office Building

ANGELRODT STREET

Planar

Building

A

09/30/10

FUSRAP

Property:

Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri

Subject:

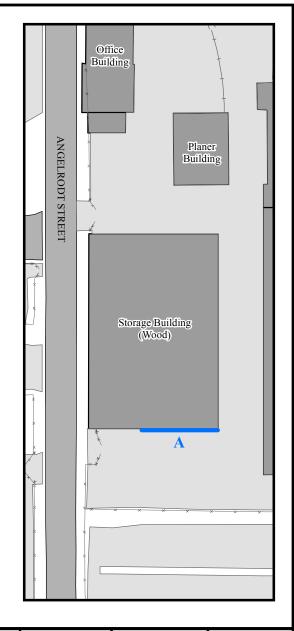
Wood Storage Building Elevated Exterior Building Scan Locations - North Wall



• Elevated measurement above exterior alpha limit of 3200 dpm/100cm².

Surface Measurement Results (dpm/100cm²)

#19: 4,419





Property:

Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri

Subject:

Wood Storage Building Elevated Exterior Building Scan Location - East Wall



Drawn By:

DJH, DLL

Date:

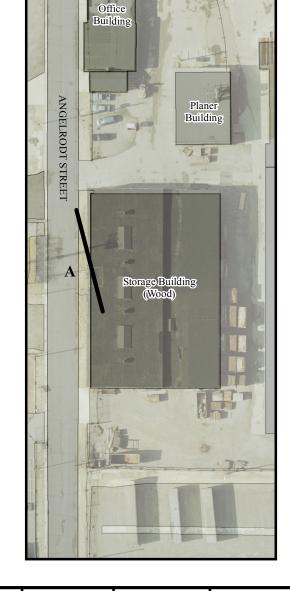
09/30/10



Surface Measurement Results (dpm/100cm²)

#40: 5,831 #48: 6,121 #45: 5,557 #51: 5,709

• Elevated measurement above exterior alpha limit of 3200 dpm/100cm².





Property:

Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri

Subject:

Wood Storage Building Elevated Exterior Building Scan Locations - Roof Facing West



Drawn By:

DJH, DLL

Date:

09/30/10



Surface Measurement Results (dpm/100cm²)

#51: 5,709 #54: 6,364 #56: 7,050

• Elevated measurement above exterior alpha limit of 3200 dpm/100cm².





Property:

Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri

Subject:

Wood Storage Building Elevated Exterior Building Scan Locations - Roof Facing North



Drawn By:

DJH, DLL

Date:

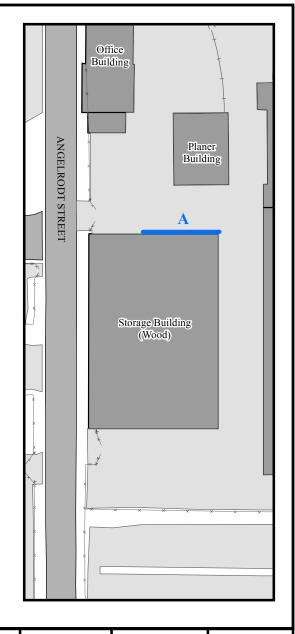
09/30/10



• Elevated measurement above exterior alpha limit of 3200 dpm/100cm².

Surface Measurement Results (dpm/100cm²)

#62: 6,609 #67: 6,329 #65: 4,116 #68: 5,809



FUSRAP

Property:

Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri

Subject:

Wood Storage Building Elevated Exterior Building Scan Locations - West Wall

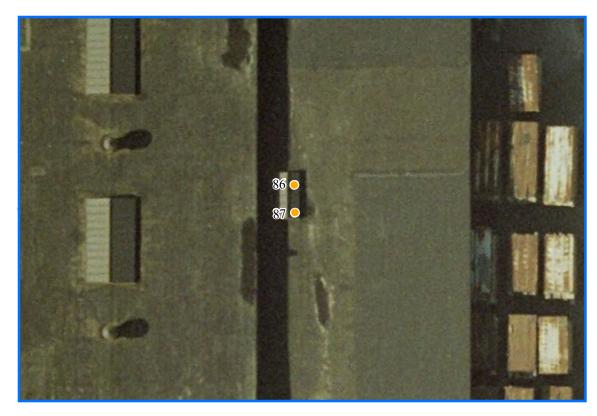


Drawn By:

DJH, DLL

Date:

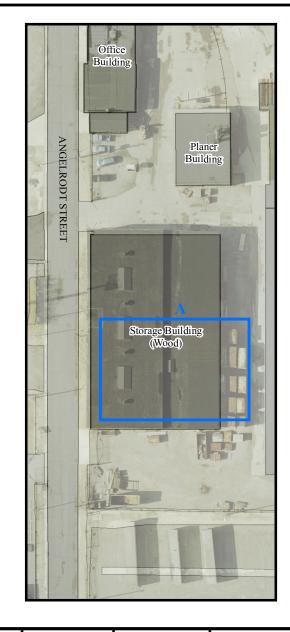
09/30/10



Surface Measurement Results (dpm/100cm²)

#86: 5,333 #87: 7,335

• Elevated measurement above exterior alpha limit of 3200 dpm/100cm².





Property:

Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri

Subject:

Wood Storage Building Elevated Exterior Building Scan Locations - Roof

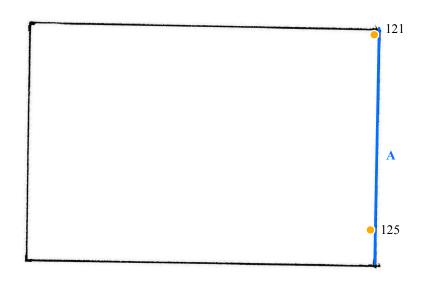


Drawn By:

DJH, DLL

Date:

09/30/10



Drying Kiln Saw_ Bldg Metal Storage Bldg Storage DT-10 Bldg Planer Bldg Wood Storage Office Bldg

Surface Measurement Results (dpm/100cm²)

#121: 172 #125: 143

• Elevated measurement above interior alpha limit of 130 dpm/100cm².



Property:

Thomas and Proetz Lumber Co., DT-10, St. Louis Downtown Site, St. Louis, Missouri

Subject:

Wood Storage Building Elevated Interior Building Scan Locations



Drawn By: DLL

Date:

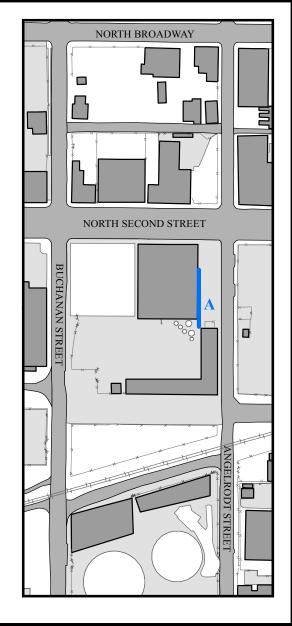
06/01/2012



Elevated measurement above exterior alpha limit of 3200 dpm/100cm².

Surface Measurement Results (dpm/100cm²)

#40: 4,760





Property:

Cotto Waxo, DT-14, St. Louis Downtown Site, St. Louis, Missouri

Subject:

Support Beam Between Buildings Elevated Exterior Scan Location



Drawn By:

DJH, DLL

Date:

09/30/10