DUKE COGEMA
STONE & WEBSTER

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U.S. Nuclear Regulatory Commission
Washington, DC 20555

29 October 2002
DCS-NRC-000116
Response Requested: *No*

Subject: Docket Number 070-03098
Duke Cogema Stone & Webster
Mixed Oxide Fuel Fabrication Facility
Responses to the Request for Additional Information
on the Environmental Report, Revisions 1 & 2

Reference: Cheryl Trottier (NRC) Letter to R. H. Ihde (DCS), *Request for Additional Information on the Duke Cogema Stone & Webster (DCS) Proposed Mixed Oxide Fuel Fabrication Facility Environmental Report*, 03 October 2002

As requested in your 03 October 2002 letter, please find attached our response to your request for additional information on the Mixed Oxide (MOX) Fuel Fabrication Facility Environmental Report. In this transmittal we have included the responses and a copy of the attachments referenced in the responses. DCS has consulted with DOE on responses to questions that do not specifically address the MOX Fuel Fabrication Facility but address connected actions; DOE responses are incorporated into these responses.

To facilitate your review, DCS is providing both a paper copy of the responses and compact discs containing the responses, a list of attachments, the attachments arranged by question and response, and the proposed revisions to the Environmental Report text. Adobe reader software is included to ensure that the files can be read.

If you have any questions, please contact me at (704) 373-7820 or Mary Birch at (704) 382-1401.

Sincerely,

Peter S. Hastings, P.E.
Manager, Licensing & Safety Analysis

NMSS01

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Enclosures: Responses to MFFF ER Request for Additional Information
Attachments to the Responses

xc w/CDs: Timothy E. Harris, USNRC/NMSS – 10 CDs
Edwin D. Pentecost, ANL – 2 CDs

xc w/o CDs: David Alberstein, NNSA/HQ
Timothy S. Barr, NNSA/CH
Bernard F. Bentley, DCS
Mary L. Birch, DCS
Theodore J. Bowling, DCS
Edward J. Brabazon, DCS
James R. Cassidy, DCS
Sterling M. Franks, USDOE/SR
Joseph G. Giitter, USNRC/HQ
Phillipe Guay, DCS
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Melvin N. Leach, USNRC/HQ
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Martin J. Virgilio, USNRC/HQ
PRA/EDMS: Corresp\Outgoing\NRC\Licensing\DCS-NRC-000116

RESPONSES TO
REQUEST FOR ADDITIONAL INFORMATION
FOR THE DUKE COGEMA STONE & WEBSTER (DCS)
PROPOSED MIX OXIDE (MOX) FUEL FABRICATION FACILITY
ENVIRONMENTAL REPORT (ER)

General

1. **To better define the annual impacts of construction fugitive emissions, identify the time period during which the major earthmoving activities will occur. If MOX facility construction is expected to take 3.66 years, provide the number of months that major clearing, earthmoving, grading, and excavation activities occur. It is unclear if the MOX facility, WSB, and PDCF will be constructed simultaneously or staged in time. As a conservative estimate, impacts can be simply added; however, a more realistic evaluation of impacts can be made if DCS provides specific information on the schedule of construction activities. Included should be the schedule for heavy earth moving activities for the MOX facility, PDCF, and WSB to determine whether the periods during which major construction fugitive emissions are generated during construction of the three facilities overlap or are distinct.**

RESPONSE:

In estimating fugitive emissions for the MFFF ER, the time period during which major earthmoving activities occurs is assumed to be the same for MFFF and WSB, a part of the PDCF project. The time period is consistent with the MFFF construction schedule that indicates heavy earthmoving to occur from October 2003 through March 2004. Although a detailed construction schedule for the PDCF, including the WSB, has not yet been developed, existing schedules indicate that construction is to begin in spring of 2004 for the WSB portion of the PDCF project and in 2006 for other PDCF facilities. Therefore, the soil disturbance associated with the deposition of MFFF excess soil on the 17 acres of the PDCF site and the WSB soil disturbance of five acres were included in our fugitive emission calculation. The PDCF construction disturbances, which will not occur until two years after MFFF heavy earthmoving, were not included in our calculation.

2. **Under the current configuration of the PDCF and MOX facilities, specify if gallium removal from plutonium would be conducted in both facilities or only in the MOX facility. If gallium removal would take place in the PDCF, indicate the type of process that would be used. If the process would be different from the dry, thermal process originally described in the SPD EIS, describe it.**

RESPONSE:

Gallium removal from plutonium will be conducted in the MOX facility. The PDCF will not have a gallium removal process. The SPD EIS analyzed both the MOX facility and the PDCF with gallium removal processes, but indicated that because the MOX facility would include the plutonium-polishing process, it may not be necessary to perform thermal gallium removal at the PDCF. By eliminating the thermal process from PDCF, impacts of operating the facility, in particular, electrical use and waste generation would be slightly lower than those discussed in the EIS. The discussion can be found on page 2-20 of the *Surplus Plutonium Disposition Final Environmental Impact Statement.*

3. Provide any separate design documents available (aside from Appendix G in the ER) for the WSB.

RESPONSE:

The WSB, part of the PDCF project, has recently completed conceptual design. DOE is still reviewing the conceptual design and has not yet approved the design. DCS has asked DOE to describe the changes to the conceptual design of the WSB that have occurred since the preparation of the MFFF ER. DOE provided the following list of conceptual design changes:

Process Changes

– Removed volume reduction equipment for liquid LLW sent to the SRS Effluent Treatment Facility (ETF). These included an evaporator, condenser, ETF Head Tanks and two pumps.

– Removed second 3,000 gal. PDCF waste receipt tank and increase first receiving tank to 3,000 gal.

– Deleted second low activity stripped uranium feed pump and revised receipt tanks from 6,000 gal. to 4,000 gal.

– Revised high activity large neutralization tank (1,000 gal.) to 3 small cement batch tanks (120 gal.)

– Revised low activity large neutralization tank (750 gal.) to 2 small cement batch tanks (150 gal.)

– Deleted the high activity caustic overflow tank and pump

– Moved large chemical (caustic) storage tanks from roof to ground level and added two pumps

– Reduced storage pad size by approximately 70%

– Selected dry cement (20% water vs 40-50% water) for hydrogen generation control

Final Waste Form Changes

– Changed high activity TRU waste from 55-gal drum to Standard WIPP Waste Box

– Changed low activity waste from 55-gal drum to B-12 LLW box

– Added low activity and high activity cement hoppers

Changes to Preliminary Hazards Analysis

– Added chemical hazards analysis

– Revised fire scenarios - combined process cells- justified "beyond extremely unlikely" for high activity areas and added low activity fire discussion

– Added scenarios for waste transfer lines from MFFF & PDCF

– Revised deflagration portion to remove passive vent and replace with process vessel vent and nitrogen purge (consistent with high activity evaporator)

4. **Provide the text that is missing at the bottom of page 3-10, section 3.2.3.1.**

RESPONSE:

The complete text for 3.2.3.1 follows:

3.2.3.1 Acid Recovery

Spent acid, consisting of oxalic mother liquor distillates, raffinates, calcination concentrates, and recombined acid, is mixed in a buffering tank and injected into an evaporator. The first evaporator of the acid recovery unit is a concentration step before treatment of the concentrates in the silver recovery unit [footnote: DOE is evaluating eliminating the silver recovery step as a future design change. Silver recovery is retained in the ER to provide a bounding maximum for waste volumes]. The evaporator bottom concentrates, which contain significant amounts of silver, are routed to the silver recovery unit. After an additional evaporation step, the vapor is injected into a distillation column dedicated to acid rectification. Nitric acid is recovered from the rectification evaporator bottoms and partly reused as reagent feedstock for the plutonium dissolution subprocess. Distillates from the rectification evaporator are collected and partly reused in the process. The offgas is routed to a cooler and a demister before treatment. Process ventilation offgas treatment is described in Section 3.2.5.

Any nitric acid not reused is transferred to SRS for waste treatment as the excess acid component of the liquid high alpha waste.

5. **For section 3.3.1, provide the actual emission rates instead of referencing the SPD EIS.**

RESPONSE:

In the development of the MFFF ER, conservative emission rates (the emission rates projected in the SPD EIS) were used to ensure that, as the design progressed, design changes could be made without altering the environmental impact of the facility. These emission rates yielded annual dose to maximum exposed individuals of 1.5E-03 mrem/yr and 3.0 mrem/yr to the public (at the SRS boundary) and site workers, respectively (MFFF ER Table 5-11). Because both anticipated doses are a small fraction of the 10 CFR Part 20, Subpart D standard of 100 mrem/yr and also well below the 10 mrem/yr ALARA requirement in Part 20 Subpart B for air emissions., DCS considers the conservative emissions to be appropriate for NEPA purposes. As long as the bounding emission rates remain within acceptable public dose limits, DCS believes the need for a bounding emission rate remains justified to provide some design flexibility.

Using an inventory based estimate, DCS has verified that the sum of actual expected releases from the MFFF and WSB is below the release rates used in the MFFF ER.

Facility Footprint / Land use

6. **Provide the acreage of disturbance that would be associated with construction of the PDCF/WSB complex. Also, clarify whether the 17 acres of fill to be placed on the PDCF site (listed as part of the MOX facility disturbed area in reference ER-PR-829) are within this area of disturbance or not. If it is, clarify whether the MOX facility disturbed area would be more correctly stated as 89 acres.**

RESPONSE:

The PDCF project site is approximately the same size as the MFFF site, about 40 acres. The acreage of disturbance that would be associated with construction of the PDCF project facilities is estimated from the SPD EIS estimate, the construction of the WSB, and the area to be disturbed by the movement of fill from the MFFF site.

Table 4-176 of the SPD EIS projects 12.4 acres (5 hectares) of disturbed area for the PDCF and support facilities. The SPD EIS, Tables E-2 and E-3, provide more detail on the PDCF disturbed area:

PDCF	Area Impacted
Laydown area, acres (ha)	4.94 (2)
Warehouse area, acres (ha)	0 (0)*
Staging area, acres (ha)	0 (0)*
Temporary parking, acres (ha)	0 (0)*
New road, mi (km)	1.12 (1.8)
New process facilities, acres (ha)	2.72 (1.1)
New support facilities, acres (ha)	3.71 (1.5)
Security areas, acres (ha)	0 (0)
New parking lots, acres (ha)	0.99 (0.4)
* Assumed that existing facilities would be used.	

Part of this 12.4-acre disturbed area will coincide with the 17 acres of fill. Until final site drawings are prepared, DCS is unable to specify exactly how much of the 17 acres of fill is shared with the disturbed area projected in the SPD EIS. The WSB, part of the PDCF project, will disturb five acres as noted in ER Section G.2.3.1, pg G-8. The 17-acre fill is not shared with the WSB disturbed area. A conservative estimate of disturbance would be to sum the disturbance for the PDCF, WSB and fill, approximately 35 acres total.

As noted in the response to RAI 1, the fill area disturbance will occur approximately two years before PDCF construction. Consequently this disturbance was assigned to the MFFF in the MFFF ER as a conservative estimate of MFFF impacts.

7. **Figure 4-3 in the ER shows the WSB site as being within the PDCF site. Clarify whether the 5 acres required for construction of the WSB (ER pg. G-8) is included in the area**

disturbed during PDCF construction, and provide details regarding the disturbed areas for both facilities.

RESPONSE:

The five acres required for construction of the WSB is discussed on MFFF ER pg. G-8. It is not included in the area disturbed for PDCF that was discussed in the SPD EIS. The WSB area of the PDCF site will consist of a large building and satellite areas for the generator, cooling tower, and auxiliary support equipment, which will be supported by a concrete pad.

Details for remainder of the PDCF disturbed area are provided in the response to RAI 6 above.

8. **Provide a site contour map for the PDCF/WSB area (similar to the one that was previously provided for the MOX facility area).**

RESPONSE:

Contour maps of the PDCF and WSB areas are provided as Attachments 8a and 8b.

9. **Provide the expected future land cover breakdown for the PDCF/WSB complex (i.e. during the operations phase). The information requested is similar to that which was provided for the MOX facility complex (e.g., the 41 acres MOX facility area would be comprised of 17 acres of buildings, facilities, and parking lots and 24 acres of grass or gravel).**

RESPONSE:

Site layout plans for the PDCF/WSB complex are not publicly available at this time. The expected future land cover breakdown for the PDCF can be inferred from the acres of disturbed area identified in the response to RAI 6. The WSB area of the PDCF site will consist of a large building and satellite areas for the generator, cooling tower, and auxiliary support equipment, which will be supported by a concrete pad. It is expected that most of the five-acre surrounding area will be parking lots (impervious) or graveled areas.

10. **Clarify what components contribute to the 106 acres that would be disturbed in conjunction with MOX facility construction. The following components were obtained from the revised ER: 52 acres for the MOX facility, 0.6 acre for existing stormwater basin (supposedly this basin would be reshaped), 1.5 acres for the new stormwater basin, 1.5 acres for the waste pipelines, 26 acres for road and utility upgrades, 11 acres for the transmission line reroute (we have some uncertainty as to whether this is considered a portion of the 26 acres for the road/utility upgrades), and 5 acres for the F-area perimeter roadway (again, there is uncertainty as to whether this was accounted for in the 26 acres for road/utility upgrades). The amount of land to be disturbed during construction of the**

MOX facility is presented inconsistently. The value is stated as 106 ac on page ES-4 (executive summary) but as 52 ac on page 5-1 and elsewhere.

RESPONSE:

The following table provides a breakdown of the 106-acre disturbed area reported in the Environmental Report Rev 2.

MFFF Site	41 acres
Contiguous Grading and Stormwater Basins	11 acres
Total Contiguous Disturbed Area	**52 acres**
Fill on PDCF site	17 acres
Road and Utilities consisting of	26 acres consisting of:
Misc Road Work	5 acres
Waste Pipeline to WSB	1.5 acres
Concrete Batch Plant	10 acres
Misc Utilities along perimeter road	< 9.5 acres
Relocate SCE&G 115 kV Line	11 acres
Total Disturbed area	**106 acres**

Please note that the total contiguous disturbed area is the sum of the MFFF Site and the Contiguous Grading and Stormwater Basin and is equal to 52 ac. The remaining 54-ac disturbed area is comprised of non-contiguous ancillary support areas.

Cultural and Paleontological Resources

11. Provide the location of the waste transfer pipeline from the MOX facility to the WSB.

RESPONSE:

Figures showing the location of the waste transfer pipeline are provided in Attachments 11a and 11b.

12. Provide written documentation that the archaeological work for the proposed action, including mitigation of sites within the MOX facility footprint and archaeological clearance for the PDCF, WSB, and Batch Plant sites, has been completed and concurred with by the SC SHPO and that no further work will be necessary for the project. This documentation will be needed in an Appendix on consultation in the EIS. If this documentation can not be provided, the NRC will not be able to demonstrate full compliance with Section 106 of the National Historic Preservation Act.

RESPONSE:

Field work (excavation and data recovery) for archaeological sites 38AK757and 38AK546 has been completed. Both of these mitigation plans were approved by the South Carolina State Historic Preservation Office (SC SHPO) on April 11, 2001. Based on current surveys, no additional mitigation is needed for either the MFFF or PDCF/WSB sites. The DOE issued a letter to notify the SC SHPO that the planned data recovery work has been completed and request SC SHPO concurrence that no further recovery work is required for the MFFF and PDCF/WSB sites (Attachment 12). When available, a copy of the letter form the SC SHPO will be forwarded to NRC.

Geology / Water Use and Quality

13. **For the WSB, footprints, resource needs (e.g., construction water, operation water, construction waste water, and operations waste water) are said to be "bounded" by those for the immobilization facility. Provide justification or supporting data for using PIP data to bound the impacts associated with the WSB. WSB-specific information is needed for the analysis.**

RESPONSE:

In lieu of using immobilization data as a surrogate for the WSB, the DOE provided the following WSB-specific information, based on conceptual design:

Resource	**Construction**	**Operations**
Electricity (MWh/yr)	6.6	40,000
Water (Gallons/yr)	520,000	5,000,000
Diesel Fuel (Gallons/yr)	9,600	30,000
Sanitary Wastewater (Gallons/yr)	240,000	500,000

The WSB is projected to generate less than 3,500 cubic meters of non-hazardous wastes (debris and rubble) during the approximately 18 month construction period. Construction hazardous waste is anticipated to include 2-55 gallon drums of oily wastes and 3-55 gallon drums of paint/solvent.

Refer to ER Appendix G.3.6 for details of wastes generated during operations.

Ecology

14. **Provide survey results or reports on the biota and habitats of SRS that have been completed recently (i.e., in 2001 and the first 6 months of 2002), particularly for listed species (e.g., red-cockaded woodpecker) and unique habitats (e.g., Carolina bays and set-aside areas).**

RESPONSE:

The only information concerning the F-Area is WSRC (Osteen) to U.S. Army Corps of Engineers (Veal) letter ESH-ECS-2002-00328, "Waters of the United States Walkdown on July 16, 2002," provided as Attachment 14a.

Attachment 14b provides a list of Savannah River Ecology Lab reports since the original MFFF ER was submitted. Release of these reports will require an STI review, which could be a significant cost. We, therefore, ask that NRC only request copies of those reports that NRC determines are essential to preparing the EIS.

Cumulative Impacts

15. **Provide HLW waste volumes for the PDCF and WSB in Table 5-15c. If there is no HLW generation, enter a zero.**

RESPONSE:

There is no HLW generated by either the PDCF or WSB. Table 5-15c should be revised per Attachment 16.

16. **Explain the inconsistencies between Table 5-15c and 5-12. The cumulative LLW, hazardous/mixed, TRU, and non-hazardous solid waste generation volumes presented in Table 5-15c do not seem consistent with the annual generation values presented in Table 5-12.**

RESPONSE:

Using the values in ER Table 5-12, the following tracks the calculation of the waste in cubic meters over the 10 year period:

	ER Table 5-12				**ER Table 5-15c**
	gallon/yr	**cubic yard/yr**	**cubic meter/yr**	**cubic meter/10 yr[(a)]**	**cubic meter/10 yr (rounded)**
Liquid LLW	385,800		1,458.324	17,348 92	17,400
Stripped Uranium Solidified as LLW		228	174 192		
Solid LLW		134	102 376		

	ER Table 5-12				ER Table 5-15c
	gallon/yr	cubic yard/yr	cubic meter/yr	cubic meter/10 yr(a)	cubic meter/10 yr (rounded)
Solvent LLW	3,075		11.6235	116.235	120
High Alpha solidified as Solid TRU waste		405	309.42	4,988.92	5,000
Solid TRU waste		248	189.472		
Liquid Non-hazardous Waste	4,389,710		16,593.1038	165,931.038	166,000
Solid Non-hazardous Waste		1,754	1,340 056	13,400.56	13,000

(a) All waste volumes are based on a 3.5 metric tons-plutonium annual design throughput. In a 10-yr period the projected waste would account for 35 metric tons-plutonium, bounding the anticipated 34 metric tons production.

The value of cubic meter/10-years (rounded) should be used in ER Table 5-15c. The only inconsistency in ER Table 5-15c is the value of 11,560 cubic meter for transuranic waste, which should be 5,000 cubic meters. Table 5-15c should be revised per Attachment 16.

17. **Provide additional information regarding planned industrial facilities and federal and state highway projects and projections of air emission concentrations. The statement that emissions from facilities greater than 20 miles away from the MOX facility have little opportunity to interact with those from the MOX facility is not substantiated and may not be justified. Although highway projects will be completed before the MOX facility is in operation, vehicles using those roads will affect regional air emission concentrations and contribute to cumulative impact.**

RESPONSE:

The South Carolina Department of Health and Environmental Control (SCDHEC) was contacted to determine if any Bureau of Air Quality (BAQ) construction permits or Title V Operating Permits have been recently filed by incoming industry on the South Carolina side of the Central Savannah River Area (CSRA). The South Carolina counties relevant to the MFFF location at F-Area, SRS, include the counties of Aiken, Barnwell, Allendale, and Edgefield. Attachment 17a provides the listing of recent applications for air quality permits. Additional information on the SCDHEC environmental permit status for all types of permits filed in the State of South Carolina can be obtained by referencing the following Internet url: http://www.scdhec.net/eqc/admin/html/eqspace.html. (Contact Ms. Marie Brown, SCDHEC, at 803.896.8980 for more specific information associated with particular projects.)

Both Region IV of the Environmental Protection Agency (EPA) and the Environmental Protection Division (EPD) of the Georgia Department of Natural Resources (GDNR) were contacted to determine if any construction permits or Title V Operating Permits have been recently filed by incoming industry on the Georgia side of the CSRA. The Georgia counties relevant to the MFFF location at F-Area, SRS, include Augusta-Richmond, Columbia, and Burke. Examination of the Title V permit filings indicated no recent activity for the aforementioned Georgia counties. Many attempts were made without success to obtain recently filed construction permits for these counties.

Information on road improvements is provided on the South Carolina Department of Transportation (SCDOT) State Transportation Improvement Program (STIP) web site, the address of which was provided to NRC as part of the MFFF ER References CD. According to information included in the SCDOT STIP for 2003-2007, there are a few minor road improvements in the Aiken, SC and North Augusta, SC area as part of the Augusta Regional Transportation Study (ARTS) (http: //www.co.richmond.ga.us/plan2/transportation/tip_projects_03-03,htm). The following summarizes these improvements:

- FY03: Widen Pine Log Road (SC 302), Knox Avenue (US 25); and SC 118 (Aiken By-Pass);
- FY04: Completion of SC 118 widening, and West Avenue Extension;
- FY05: Completion of West Avenue Extension, various intersection improvements in Aiken, SC, East Buena Vista Avenue, Hitchcock Parkway passing lanes, and Richardson Lake Road;
- FY06: Continuation of East Buena Vista Avenue and Richardson Lake Road improvements; and,
- FY07: Completion of East Buena Vista Avenue and Richardson Lake Road improvements and commencement of Atomic Road (SC 125).

In addition, improvements to an 8.28-mile length of US 78 from Montmorenci, SC to Windsor, SC (i.e., east of Aiken, SC) are planned but an actual construction date has not been set because of a lack of funding.

Lastly, the extension of the Bobby Jones Expressway (I-520) across the Savannah River into North Augusta is scheduled to be complete in 2 phases. The Phase I completion from Sand Bar Ferry Road to US 1 in North Augusta, SC is targeted to 2006, while the Phase II completion to complete the entire I-520 circle is targeted for 2009.

Attachment 17b provides a map of the South Carolina road projects

According to information included in the Georgia Department of Transportation (GADOT) State Transportation Improvement Program (STIP) for 2003-2005 (www.dot.state.ga.us/DOT/plan-prog/planning/programs/stip2003_2005/index.shtml), there are also a few minor road improvements in the vicinity of Augusta-Richmond County and Columbia County. The following summarizes these improvements:

- FY03-04: Widening of River Watch Parkway in Columbia County;
- FY06: Widening of SR 104 (Washington Road);

- FY05: Widening of Flowing Wells Road; and,
- FY05: The I-520 Bobby Jones Expressway interchange reconstruction at GA 56 exit.

Socioeconomics

18. **Additional annual data on construction cost and schedule for the MOX facility, PDCF and WSB facilities, and on operating costs for each facility are required to perform the analysis. Although total annual construction and operating costs are available in the *Report to Congress on the Projected Life-Cycle Costs of the U.S. and Russian Fissile Materials Disposition Program*, these costs do not provide any detail on the costs associated with the various material, equipment and labor components for the construction of each facility, or on the material and labor components during facility operations. These data are necessary for a detailed assessment of the impact of these facilities in the region-of-influence surrounding the SRS.**

RESPONSE:

The MFFF construction budget provided in *Report to Congress on the Projected Life-Cycle Costs of the U.S. and Russian Fissile Materials Disposition Program* includes the following:

Labor Dollars	$252,800,833
Material Dollars	$235,371,945
Subcontracts	$8,370,459
Equipment	$362,675,657

The equipment is specialty fabrication and will not be purchased locally. Only 4% of the material will be purchased locally.

A detailed operation budget for the MFFF is not yet developed.

Cost estimates for PDCF and WSB at a level of detail greater than that in the "Report to Congress" are currently being developed and are not yet available for release.

19. **Annual expenditure reports for three jurisdictions at SRS are still outstanding. These financial reports (there may be some variation in the actual titles used for each document) for 2000 for the following jurisdictions are required:**
Richmond County School District, GA,
School District #19 and #45, Barnwell County, SC

RESPONSE:

Financial data for South Carolina school districts may be found at the South Carolina Department of Education web site http://www.sde.state.sc.us/archive/fam98/fmindex.htm. Printouts of the pages for

Barnwell County Districts 19 and 45 are provided as Attachment 19. Richmond County School District, Georgia has not provided the information requested by DCS.

Cost-Benefit Analysis

20. **Provide more information on the financial impacts to the utilities using MOX fuel, including a comprehensive assessment of the costs and benefits of the various facilities. This information should include the annual cost of the MOX fuel to utilities using the fuel compared to the utilities' annual cost of fuel from existing non-MOX sources of supply. If the information is proprietary, submit as such, in accordance with 10 CFR 2.270.**

RESPONSE:

As noted in the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement, Surplus Plutonium Disposition Final Environmental Impact Statement,* and *Mixed Oxide Fuel Fabrication Facility Environmental Report*, the plutonium disposition program is not driven by economic benefits. This program is part of the overall United States non-proliferation program. The benefits of removing weapons-usable plutonium from the stockpile cannot be measured in purely economic terms.

The basis for utility participation in the MOX Fuel Project is that the utilities will be reimbursed for incremental costs associated with MOX fuel use, and that the utilities will receive the MOX fuel at a price that is discounted from the cost of displaced uranium fuel. Therefore, there should be no major financial impact on the utilities (positive or negative) other than fuel cost savings.

Oak Ridge National Laboratory Report ORNL/TM-1999-257 provides publicly-available information related to the question. ORNL/TM-1999-257 Section 3.3 estimates the value of low enriched uranium fuel that is displaced by MOX fuel to be $860M. Under the line item "Effective Credits to the Government – Value of LEU Reloads Adjusted for Discount," Table 5 of the report estimated a $575M contribution from fuel payments. The difference - $285M – represents the hypothetical utility nuclear fuel cost savings under this scenario. Several facts should be noted:

- These figures are FY2000 dollars.
- They represent a disposition program of 33 metric tons plutonium over 10 years.
- The report recognized that the actual discount is business sensitive, so it used a MOX fuel price multiplier value of approximately 0.7. In this context, the MOX fuel price multiplier is the multiplier applied to displaced uranium fuel cost for determining the MOX fuel price.
- The value was based on estimates of the future cost of uranium fuel material and service components as outlined in Table 3 of the report.

This report provides a reasonable estimate of any savings in fuel costs.

Reference(Attachment 20): K. A. Williams, Oak Ridge National Laboratory, ORNL/TM-1999-257, "Life Cycle Costs for the Domestic Reactor-Based Plutonium Disposition Option, October 1999.

Human Health

21. Provide the number of employees at the SRS. This information will support estimates of SRS employee impacts. Questions were raised regarding Attachment A-10 in a follow-up DCS response (June 19, 2001; DCS-NRC-000050) to the SRS site visit.

a) Area G is listed with 251 employees. Confirm our understanding that Area G is not used to denote a specific location on the SRS site, but rather indicates the general site as a whole.

b) Area T (61 employees) and Area W (6 employees) are listed. We have not been able to determine their location on the SRS site. Does Area T refer to the TNX Area? Is Area W offsite?

c) On page 3 of the attachment (after Area Z) 837 more employees are listed without a location specified. Where are these employees?

RESPONSE:

The question refers to a table showing the location of SRS employees that was provided to NRC in the June 19, 2001 letter (DCS-NRC-000050).

a) Your understanding is correct, that Area G is not used to denote a specific location on the SRS site, but rather indicates the general site as a whole. These employees are in modular offices (trailers) that are moved around the site as needed. Currently 266 employees attributed to the G Area are in Area F (74 employees), Area H (132 employees), and Area A (3 employees). In addition, SRS has two new fire stations listed as Area G: 709-1G at the intersection of Roads C and 7 (23 employees) and 709-7G at the intersection of Roads C and 5 (24 employees). The remainder are WSI facilities: ATTA Range (5 miles east of Area H) and SATA Range (1 mile east of Area A) (10 employees).

b) Area T does refer to TNX, which is being closed. Area W is offsite.

c) These employees are construction field support (craft personnel), security zone operations and law enforcement (general site security), and operations and maintenance personnel. All are mobile employees whose work locations vary with their assignments.

22. State the expected annual air emissions of radionuclides from WSB operations by isotope and amount in Ci. This information is not provided in Section G.3.4 for assessing risks to site workers and the public.

RESPONSE:

As noted in the response to RAI 5, the MFFF ER used conservative emission rates (the emission rates projected in the SPD EIS) to ensure that, as the design progressed, design changes could be made without altering the environmental impact of the facility. Because anticipated doses are a small fraction of the applicable NRC standards for the public, DCS considers the conservative emissions to be appropriate for NEPA purposes.

DCS has verified, using an inventory based estimate, that the sum of actual expected releases from the MFFF and WSB are below the release rates used in the MFFF ER. Consequently, the release data provided in MFFF ER Table D-7 can be assumed to account for releases from both the MFFF and WSB.

23. **Provide the basis for the stated collective annual dose to WSB facility workers (Section G.3.4.3) of less than 200 person-rem/yr. Also, no data are provided for either average worker or maximum worker dose at the WSB.**

RESPONSE:

The basis for the stated collective annual dose to WSB facility workers is DOE Order 5480.4, Chg 4, DOE-STD-1098-99 and 10 CFR 835.202(a)(1) in which the limit for whole body exposure is less than 5 rem/yr.

The DOE Administrative Limit is 2,000 mrem/yr for each worker. This was multiplied by 100 workers for the WSB to yield an estimate of 200 person-rem/yr.

DOE will limit average worker dose to within the Administrative Limit of 2,000 mrem/yr and maximum worker dose to within the 10 CFR 835.202 limit of 5 rem/yr. The majority of SRS facilities have an administrative facility limit to maintain worker exposures less than 200 mrem/yr.

24. **Provide an estimate of site worker doses attributable to normal operations of the WSB. It is unclear whether the statement made in Section G.3.4.2 (Radiation Doses to Site Workers) means that the doses from WSB operations would be included in the doses given for the MOX facility or that the doses from WSB would be less than the MOX facility doses.**

RESPONSE:

As noted in the responses to RAIs 5 and 22, the MFFF ER used conservative emission rates (the emission rates projected in the SPD EIS) were used to ensure that, as the design progressed, design changes could be made without altering the environmental impact of the facility. These emission rates yielded annual dose to maximum exposed individuals of 1.5E-03 mrem/yr and 3.0 mrem/yr to the public (at the SRS boundary) and site workers, respectively (MFFF ER Table 5-11). As noted below, emissions from both the MFFF and WSB are encompassed in these conservative dose estimates. Because anticipated doses are a small fraction of the applicable NRC standards for the public, DCS considers the conservative emissions to be appropriate for NEPA purposes.

DCS has verified, using an inventory based estimate, that the sum of actual expected releases from the MFFF and WSB are below the release rates used in the MFFF ER. Consequently, the dose estimates provided in MFFF ER Table 5-11 can be assumed to account for releases from both the MFFF and WSB.

25. **Provide the radionuclide source terms (by isotope and amount in Ci) for each of the accidents considered (loss of confinement, fire, and hydrogen explosion) at the WSB in Appendix G.**

RESPONSE:

Source terms were excerpted from the WSB preliminary hazard analysis (PHA). The WSB, part of the PDCF project, is in conceptual design and so the results of the PHA may change as design progresses. The PHA incorporates conservatism to bound the results.

Refer to the spreadsheets in Attachment 25. Attachment Table 25-1. "Weight Percent of Isotopes" provides the weight fraction and weight percent of each isotope used in the PHA dose calculations. It is based on the assumed gram/liter concentration of the various streams. Attachment Table 25-2. "Inventory" gives the inventory of the Material At Risk (MAR) in total grams. This is essentially a multiplication of the respective tank volume (gallons) converted to liters by the gram/liter total for the respective stream in the "Weight Percent of Isotopes" spreadsheet. Note that the inventory is given in terms of total grams of MAR and is not broken down by isotope. To get the MAR for any specific isotope simply multiply the total stream inventory for the accident of concern by the weight fraction of the isotope given in attachment Table 25-1.

26. **Provide analytical data on chemical contaminant levels for F-area soil (particularly for the MOX facility, PDCF, and WSB construction areas), and the spoils pile in the MOX facility area. It is stated that the spoils pile will be removed prior to the start of construction. These data would be used to assess potential risks to construction workers from inadvertent exposures, and to facilitate disposal of the excavated materials.**

RESPONSE:

As previously identified in RAI 48 of our 12 July 2001 transmittal (DCS-NRC-000053) and RAI Clarification 21 of our 22 October 2001 transmittal (DCS-NRC-000063) on the MFFF ER, Rev 0, *The Plutonium Disposition Program (PDP) Preconstruction and Preoperational Environmental Monitoring Plan*, ESH-EMS-2000-897, Rev. 0, 10/10/00 (Attachment 48-2 in the original response to RAIs), described the monitoring program planned for the PDP facility sites including a soil survey. The results of that study are provided in Attachment 26, "Plutonium Disposition Preconstruction Monitoring Report," which contains the most recent data on soil in the F Area. The discussion of soil data is in Section 4.2.4 of the report.

27. **On-Site Chemical Inventories: For the chemicals listed in Table 3.2 of the ER, provide the container capacities and the maximum storage amount per container for each chemical. Also, add molar concentrations or percents by volume for chemicals lacking this information (i.e., dodecane, hydroxyl amine nitrate). These values are needed to conduct accidental release modeling.**

RESPONSE:

Table 8-2a from the draft Construction Authorization Request Revision 1 is included as Attachment 27 listing the on-site chemical inventories for various buildings. (Because this is a draft of the CAR table, NRC should verify the information against the officially transmitted version of the CAR Rev 1.)

28. **Provide information on storage conditions for the gas (i.e., pressure level), and a reasonable estimate for the onsite inventory, the container capacity, the maximum storage amount per container, and molar concentration to Table 3-2. The anticipated onsite inventory for nitrogen tetroxide is listed as "not available" in ER Table 3-2. Apparently nitrogen tetroxide is stored as a gas.**

RESPONSE:

Attachment 28 provides Table 8-2d from the draft Construction Authorization Request Revision 1 listing gas storage information. (Because this is a draft of the CAR table, NRC should verify the information against the officially transmitted version of the CAR Rev 1.)

Nitrogen tetroxide is stored as a **liquid** in cylinders. In the liquid form it is 100 % N_2O_4. The maximum pressure in the cylinders is 50 Psig.
Each cylinder holds 2000 pounds. Two cylinders are kept in the Reagent Process Building. The anticipated onsite inventory is 4000 pounds.

29. **Describe how nitrogen tetroxide is used in the MOX Fuel Fabrication process (Section 3.2).**

RESPONSE:

Nitrogen tetroxide liquid is stored in one ton cylinders in the Reagent Processing Building. The Nitrogen tetroxide is vaporized in a boiler. The vapors are mixed with an equal flow of air and supplied to the Aqueous Polishing Process (KPA - Plutonium purification cycle).

Nitrogen tetroxide is supplied to :

- the oxidation column, in order to oxidize Pu III to Pu IV and to eliminate excess HAN and hydrazine. The main process stream containing Pu III is contacted with nitrogen tetroxide in a counter-current packed column.
- the recycling tank, in order to oxidize Pu III to Pu IV and to destroy HAN and hydrazine. If needed before recycling aqueous solutions to the purification cycle, nitrogen tetroxide is contacted with the solution using a bubbling ring.

30. **In Section 5.5.2.9 (Chemical Accidental Releases), the text states "a spill or leak from the largest tank or container holding the chemical was modeled." Clarify whether there are any process chemicals that will be used in the MOX processing area (BMP) in volumes**

larger than the maximum storage amount per container in the BRP (or at equal or greater concentrations)? If so, provide the larger process volume.

RESPONSE:

Storage and process volumes for all chemicals in reagent building (BRP), aqueous polishing area (BAP) and MOX fuel fabrication area (BMP) used in the accident analyses are obtained from the Construction Authorization Request and provided in Attachment 27. Because this is a draft of the CAR table, NRC should verify the information against the officially transmitted version of the CAR Rev 1. DCS used the bounding scenarios for accident analyses.

31. **Provide the technical basis for accident source terms involving uranium dioxide powder. In the Responses to NRC Request for Clarification of Additional Information for the ER (October 2001), response to #44, a table titled "Summary of Airborne Concentrations for Bounding Unmitigated Events Involving a Chemical Release" was provided. This table gave a storage quantity of 37,500 kg for uranium dioxide powder, and a release rate of 2.3 kg/hr. However, no description of the assumptions used in arriving at these values was given. Provide additional details and verification of these values.**

RESPONSE:

The secured warehouse is assumed to conservatively contain 200 drums of UO_2. This number is considered very conservative due to the needed throughput of material required to create the MOX fuel. The drums are assumed to each have a size of 30-gallons and contain 187.5 kg of UO_2. According to a sizing calculation for UO_2 storage in the secured warehouse, MFFF would receive one shipment of 4 batches (12 Tons in 64 drums, 120 liters each) every 7 weeks. This corresponds to 187.5 kg of UO_2 per drum. The total inventory would be 37500 kg of UO_2 in the secured warehouse.

The maximum inventory of a drum is assumed to be 200 kg.

For uranium dioxide powder involved in a fire, which is considered a bounding event, an Airborne Release Fraction of 0.006 and a Respirable Fraction of 0.01 are used to calculate a release rate. (See NUREG/CR-6410 (section 3.3.2.10).) A one hour release is assumed. The calculated release rate for respirable UO_2 powder is 2.3 kg/hr (i.e., 37500 kg * 0.006 * 0.01 per hour).

32. **Provide the design ventilation rates and the location of vents in the BAP area and the BRP building.**

RESPONSE:

The ventilation flow rates for Aqueous Polishing Area (BAP) are:

POE (Process Cell) exhaust = 9,050 cfm
HDE (C3) exhaust = 13,990 cfm
MDE (C2) exhaust = 26,250 cfm

The BAP exhaust is discharged through the common MFFF exhaust stack on the east side of the facility where it is combined with 142,070 cfm from BMP for a total of 191,360 cfm.

The total exhaust flow rate from the reagent storage and pump rooms is estimated to be 6000 CFM and it will be discharged through ten (10) separate roof mounted exhaust fans. The individual exhaust fans will be located above the rooms that they serve.

33. Table G.2 provides the annual consumption and onsite inventory values for the process chemicals to be used in the WSB. Provide the container capacities and the maximum storage amount per container for each chemical.

RESPONSE:

The Waste Solidification Building (WSB) will maintain a working inventory of chemicals, which will be used during normal operation and replenished periodically as inventories are depleted. The exact quantities and chemical composition of these materials is still preliminary and expected to vary as the process matures. It is anticipated the following information will be bounding.

Sodium Hydroxide (NaOH, 50%) –The primary caustic usage will be for neutralizing acidic bottoms (MOX High Alpha, MOX Stripped Uranium, and PDCF High Activity Streams) after evaporation, prior to the cementation process. The maximum storage capacity for the caustic storage tank will be 4000 gallons. It is anticipated this tank quantity will normally vary between 1000 and 3500 gallons.

Nitric Acid (HNO_3, approx. 47%) – Nitric acid will not be typically used as a process additive, but for miscellaneous process support functions (process equipment flushing, reversing a process upset, etc.). Presently, the maximum storage capacity of the nitric acid tank is 500 gallons. It is anticipated this volume will vary between 100 and 400 gallons.

Package Boiler/Cooling Tower Chemicals- These support units will provide the necessary steam and cooling for the WSB. A final decision hasn't been made at this time concerning usage of a package boiler versus F-Area steam. It is fairly certain the cooling tower package will be included in the final design.

> Boiler chemicals will not be detailed at this time because there is insufficient information concerning the final source of steam.
>
> Cooling tower chemical quantities are not fully defined at this time. Generally, these include sodium hydroxide, sodium hypochlorate, and calcium hypochlorate. These are typically added to cooling tower water for algae and pH control.

Laboratory Chemicals – The particular types and quantities of laboratory chemicals are assumed to be negligible compared to the volumes described above.

Miscellaneous Support Materials – These materials are not normally considered chemicals, but are provided as additional information.

- Portland Cement – The WSB cement silo is estimated to have a gross capacity of 1365 ft^3 and a working capacity of 1100 ft^3. A cement transport truck typically carries approximately 500 ft^3 of cement. It is anticipated the silo volume will normally vary between 1100 ft^3 and 400 ft^3. Approximately 17-20 deliveries will be received per year.

- Diesel Fuel – It is estimated the standby generator will be between 650 and 750 kW. These units normally have an operating day tank (diked) capable of holding approximately 300 gallons of diesel fuel and generally don't have a larger storage tank (buried) for this type of service. During extended service, the tank is refilled every twelve hours by a delivery truck; therefore the tank can be assumed at 80% capacity most of the time. Coolant and battery acid are negligible.

34. Provide annual usage, on-site inventory volumes, container capacities and maximum storage amounts per container for PDCF process chemicals. Appendix G, Table G-1 gives annual volumes of nitric acid waste liquids (dilute and concentrated) that would come from the PDCF (e.g., a maximum of 17,000 gal of 3% nitric acid lab liquids). The SPD EIS (Table E-7) did not indicate nitric acid as being used as a process chemical in the PDCF, so that list may be incomplete.

RESPONSE:

The PDCF is currently in the preliminary design stage. The best available published information on annual volumes of process chemicals used is available in Appendix E, Table E-7 of the SPD EIS. However, as indicated in ER Table G-1, there may be some nitric acid used in the PDCF laboratory.

35. Provide an estimate of chemical releases resulting from a fire at the WSB. If structural damage to the facility were caused by a fire initiated in the low-activity and effluent processing sections of the WSB, describe the possible chemical releases from that section, or if the entire facility is engulfed in fire. Provide the chemical composition of the effluent bottoms and the effluent overheads.

RESPONSE:

The WSB, which is part of the PDCF project, is at the conceptual design stage. The volumes provided in Attachment 35 may change in preliminary design but these values are considered bounding. Attachment 35a, Table 1 provides the inventory in gallons of all tanks and vessels in the WSB. Attachment 35a, Table 2 provides the WSB cold chemical inventory. MFFF ER Table G-1 provides the composition of the untreated wastes. Attachment 35b provides the composition of the effluent bottoms and overheads. For a conservatively postulated total facility fire, these inventories would very conservatively represent the chemicals released.

Transportation

36. Provide the average Ci content by radionuclide per waste drum or TRUCPACT-II (assuming 14 drums per TRUPACT-II unless weight restricted) for the TRU waste to be sent to WIPP from the WSB.

RESPONSE:

All packages used to transport TRU waste to WIPP will meet the NRC requirements of 10 CFR §71.47 and those limits should be used for conservative estimates of transportation radiological impacts. The following additional information is based on the current design of the WSB process:

To estimate the average activity or Curie content of the waste shipments:

- Assume 3 TRUPAK II containers per truck
- Assume 2 Standard Waste Boxes (SWB) per TRUPAK II
- Assume 6 SWB x 2850 lbs cement = 17,100 lbs cement on each truck
- Waste in concrete used:
  - Ga = 9.96 E-02 g/lb concrete
  - NaNO3 = 3.41 E+01 g/lb concrete
  - Ag = 1.06E +00 g/lb concrete
  - Am 241 = 5.78 E-02 g/lb concrete
  - Pu = 5.21 E-04 g/lb concrete
  - U = 1.47 E-02 g/lb concrete
  - Pb = 1.96 E+00 mg/lb concrete
  - Hg = 1.96 E+00 mg/lb concrete
  - Th = 1.96 E+00 mg/lb concrete
  - Tributyl phosphate = 3.30 E-04 mg/lb concrete

Using the above assumptions the following levels of radioactivity were calculated for each shipment:

- Am 241 = 3.39 E+03 Ci/truck
- Pu 238 = <0.05% =7.63 E-02 Ci/truck
- Pu 239 = 90 to 95% = 5.26 E-01 Ci/truck (at 95%)
- Pu 240 = 5 to 9% = 1.02 E-01 Ci/truck (at 5%)
- Pu 241 = <1% = 9.17 E+00 Ci/truck
- Pu 242 = <0.1% = 3.49 E-05 Ci/truck
- U 234 = 1% = 2.14 E-02 Ci/truck
- U 235 = 93 % = 4.92 E-04 Ci/truck
- U236 = 1.6 % = 3.48 E-04 Ci/truck
- U 237 = <0.01 % = 7.13 E-02 Ci/truck
- U 238 = 4.5 % = 5.04 E-06 Ci/truck

37. **For the TRU waste shipments, Section G.5 states that approximately 35 TRU waste shipments per year to WIPP will be made from the WSB. Clarify whether this assumes a fully loaded shipment (TRUPACT-II containers per truck?)**

RESPONSE:

To clarify, the 35 shipments per year assumes a fully loaded shipment of three TRUPACT II containers per truck and two Standard Waste Boxes per TRUPACT II container.

38. **34 MT of Pu is to be converted to MOX fuel. Of the 38.2 MT of surplus weapons-grade Pu identified (ref. DOE 1996p in DOE/EIS-0229), 21.3 MT are in the form of metal at the Pantex Plant, the SRS has 0.4 MT in metal form and 0.5 MT in oxide form, and Rocky Flats has 5.7 MT in metal form and 1.6 MT in oxide form (Table 15 in DOE/EIS-0229 ref. DOE 1996p). Even with the assumption that all of the metal form at Rocky Flats is non-pit Pu (which would then be shipped to the SRS according to DOE's second ROD [67 FR 19432] sending all non-pit Pu at Rocky Flats to the SRS), the total amount of Pu from Pantex and Rocky Flats/SRS is only 29.5 MT. Identify the source of the remaining 4.5 MT.**

RESPONSE:

The most recent publicly available information on the location and form of weapons grade plutonium is provided in Table 15 of the 1996 DOE report, *Plutonium: The First 50 Years –United States Plutonium Production, Acquisition, and Utilization from 1944 to 1994* and Chapter 2 of the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement*. Since the release of these data, material inventories at several of the sites have changed somewhat, as a result of cleanup, stabilization and consolidation efforts.

Excess Weapon Grade Plutonium (MT Pu)

Location	**Metal**	**Oxides**	**Reactor Fuel**	**Irradiated Fuel**	**Other Forms**	**Total**
Pantex /future dismantlements	21.3	-	-	-	-	21.3
Rocky Flats	5.7	1.6	-	-	4.6	11.9[1]
Hanford Site	<0.1	1.0	-	0.2	0.5	1.7
Los Alamos	0.5	<0.1	<0.1	-	1.0	1.5
Savannah River	0.4	0.5	-	0.2	0.2	1.3
INEL	<0.1	-	0.2	0.2	<0.1	0.4
Other Sites	<0.1	-	-	<0.1	<0.1	0.1
Total	**27.8**	**3.1**	**0.2**	**0.6**	**6.4**	**38.2[2]**

Source: *Plutonium: The First 50 Years –United States Plutonium Production, Acquisition, and Utilization from 1944 to 1994*, Table 15

Note: Totals may not add due to rounding to the nearest tenth of a metric ton

[1] Because of the closure of Rocky Flats Environmental Technology Site this material has either been moved to the Pantex Plant or is in the process of being moved to SRS

[2] Approximately 4 MT is already in the form of waste or spent nuclear fuel and therefore will not be used for MOX fuel feed DOE has determined another approximately 2 MT may not be cost-effective to purify and therefore would be replaced with a future declaration of additional surplus weapons-grade plutonium

Waste Management

39. On page 5-23, provide more detail regarding the source of the potentially contaminated water that will be tested and released to the sanitary sewer.

RESPONSE:

The statement on page 5-23 is no longer correct. Rinse water was originally intended to be tested and released if it did not exhibit radioactivity. As currently designed, the waste system does not segregate rinse water from LLW. All process water is disposed as radioactive waste. The MFFF ER Rev 1&2 waste tables correctly represent this routing of rinse water to LLW.

40. Table 5-12 presents maximum estimated MOX facility waste that would be generated. The liquid high alpha activity waste is listed only as being solidified and added to TRU waste. This appears to be inconsistent with text presented on Page 3-19 which states that the distillate portion upon evaporation of liquid high alpha waste would be managed as LLW. Clarify if this distillate-LLW portion has been accounted for in the volumes presented in Table 5-12.

RESPONSE:

Table 5-12 accounts for waste produced by the MFFF only; distillate resulting from evaporation at the WSB of high-alpha liquid waste is considered a WSB waste stream. The WSB conversion of MFFF high alpha waste and PDCF high activity waste to solid TRU waste would result in 235,000 gallons (890 m^3) per year of LLW (see MFFF ER Appendix G.3.6 page G-16). The liquid LLW generated by the WSB processes are not included in the liquid LLW reported in MFFF ER Table 5-12.

41. Provide the basis (and associated references) for the statement shown in Table 5-12 as footnote "d". Based on the volumes of TRU presented in Table 5-15c, it appears that TRU waste from the MOX facility, PDCF, and WSB would double the volume of TRU that the site has to manage. This does not appear consistent with the conclusion in footnote "d" noted above.

RESPONSE:

Please refer to MFFF ER Section 5.2.12, page 5-24. To convert 34 metric tons of Pu to MOX fuel the MFFF and WSB will generate 5,000 m^3 of TRU waste. The SRS Waste Management EIS (DOE

1995b in the MFFF references list) evaluated three waste scenarios: a minimum scenario of 5,794 m^3 TRU waste, a maximum scenario of 543,329 m^3 TRU waste, and an expected scenario of 12,564 m^3 of TRU waste) (DOE 1995b, Table A-1). The estimated MFFF and WSB lifetime TRU solid waste quantity (5,000 m^3) is about 40% (5,000/12,564) the expected SRS TRU waste forecast but only a small fraction (<1%) (5,000/543,329) of the maximum SRS TRU waste estimate.

As noted in the response to RAI 16, ER Table 5-15c should be corrected to reflect 5,000 m^3 of TRU Waste

Air Quality

42. In Table 5-15a, provide the following values for the MOX facility, PDCF, and WSB:
a)1-hour carbon monoxide concentrations;
b)3-hr and 24-hr sulfur dioxide concentrations;
c)maximum quarterly lead concentrations;
d)24-hr PM_{10} concentrations.

RESPONSE:

For the MFFF, the concentrations for the criteria pollutants and averaging periods relative to MFFF ER Table 5-15a are:

a) 1-hour carbon monoxide – 78.8 $\mu g/m^3$
b) 3-hour sulfur dioxide – 22.4 $\mu g/m^3$ and 24-hour sulfur dioxide – 4.8 $\mu g/m^3$
c) maximum quarterly lead – not applicable
d) 24-hr PM_{10} - 0.88 $\mu g/m^3$

For the PDCF the concentrations of criteria pollutants and averaging periods are provided in SPD EIS Table G-60 and are:

a) 1-hour carbon monoxide – 0.373 $\mu g/m^3$
b) 3-hour sulfur dioxide – 1.46 $\mu g/m^3$ and 24-hour sulfur dioxide – 0.56 $\mu g/m^3$
c) maximum quarterly lead – not applicable
d) 24-hr PM_{10} - 0.026 $\mu g/m^3$

For the WSB the concentrations of criteria pollutants and averaging periods are:

a) 1-hour carbon monoxide – 8.9 $\mu g/m^3$
b) 3-hour sulfur dioxide – 1.2 $\mu g/m^3$ and 24-hour sulfur dioxide – 0.26 $\mu g/m^3$
c) maximum quarterly lead – not applicable
d) 24-hr PM_{10} – 0.90 $\mu g/m^3$

43. In Table 5-15a, provide chlorine concentrations for the MOX facility, PDCF, WSB, baseline, and future facilities.

RESPONSE:

For MFFF, the concentration of chlorine for the 24-hour averaging period relative to MFFF ER Table 5-15a is 0.038 $\mu g/m^3$. This value is also applicable to Table 5-8 for the MFFF contribution.

There are no PDCF or WSB processes that result in the emission of chlorine. Chlorine emissions result solely from the MFFF aqueous polishing process.

The sources listed in the footnotes of MFFF ER Table 5-15a used for baseline and future facilities did not report any chlorine emission data.

44. Clarify whether "NA" in Tables 5-15a and 5-15b stands for "not available" or "not applicable". These tables should be revised accordingly.

RESPONSE:

NA stands for not available and is indicative that the original source material did not report a value.

45. *Table 5-2.* Table 5-2, footnote b appears to be in error. The SRS Maximum Concentrations are for SRS sources only and do not include background. See the analysis from the SCDHEC (Ross DuBose SCDHEC memo, April 3, 2001). To find a concentration for comparison with ambient standards, a background must be added to the Total increments listed in the table. For TSP, the result will exceed the standard (46.6+0.53+28 = 75.13). Same comment for Table G-6.

RESPONSE:

Footnote b of Tables 5-2 and G-6 should be revised to state that only SRS impacts are included.

46. *Table 5-1.* Table 5-1 footnote b is no longer true; as the body of the table notes, PM < PM10.

RESPONSE:

The callout for footnote b should be removed from the PM10 value for the Concrete Batch Plant.

47. *Section 5.1.4 and Tables 5-1 and 5-2.* State specifically whether the impacts in Table 5-2 include the impacts of vehicle emissions.

RESPONSE:

The vehicle emissions due to the construction worker, construction material, and waste shipment mileage are not included in the impacts listed in Table 5-2.

48. *Appendix G2.1, p. G-7.* **Justify and provide a basis for the statement that impacts of constructing and operating the WSB will be less than the projected impacts for the PIP evaluated in the SPD EIS.**

RESPONSE:

The statement on page G-7 addresses air quality impacts during construction. The immobilization facility had a planned footprint of 87,000 square feet (*Surplus Plutonium Disposition Final Environmental Impact Statement,* Table E-10) compared to the 80,000 square foot WSB footprint. The projected disturbed area for the immobilization facility was 31 acres (*Surplus Plutonium Disposition Final Environmental Impact Statement,* Table E-9) compared to the 5 acres projected to be disturbed by the WSB construction. Based on these qualitative comparisons, DCS believes the air quality impacts from construction of the WSB are bounded by the impacts projected for the immobilization facility in the *Surplus Plutonium Disposition Final Environmental Impact Statement.*

A comparison of immobilization and WSB operations emissions is provided in the following table.

Comparison of Non-Radiological Emissions (kg/yr) from Cancelled Immobilization Plant to Planned Waste Solidification Building

	Carbon monoxide	Nitrogen dioxide	Particulate Matter	Sulfur dioxide	Volatile Organic Carbon
Immobilization Plant[a]	1,350	16,630	1,260	35,800	450
WSB[b]	575	9,176[c]	480	184	64

[a] DOE, 1999, *Surplus Plutonium Disposition Final Environmental Impact Statement,* Table G-63, Sum of Boiler and Emergency Generator Emissions

[b] RAI Attachment 55, *Summary Of Waste Solidification Building Annual Non-Radiological Operating Emissions*

[c] *As noted in ER Section G 3.1, "Maximum air pollutant concentrations resulting from operation of the WSB are anticipated to be bounded by the concentrations projected for the immobilization plant in the SPD EIS, with the exception of* NO_X *. . the WSB offgas system design will include* NO_X *emission control equipment as needed to cost effectively control the WSB emissions so that SRS site boundary* NO_X *concentrations due to the WSB are less than 10% of the most stringent standard or guideline for total SRS site emissions "*

Comparison of the projected emissions in the table above reaffirms the statement made in the MFFF ER that impacts are expected to be bounded by (less than) those projected for the immobilization facility.

49. **Provide the maximum area disturbed at any one time during construction of the MOX facility and its support facilities and the emission factor used for construction fugitives. (Item 24(a), DSC, July 12, 2001, gave 31 acres as a reasonable amount disturbed on an annual average basis.)**

RESPONSE:

The maximum area disturbed at any one time during construction of the MFFF and WSB facilities is 55 acres, which represents a conservative assumption; as it is 50% of the total disturbed area of 111 acres (i.e., 106 acres for MFFF and 5 acres for WSB). The 55-acre disturbed area value was applied to the construction fugitive dust emissions calculation.

The EPA AP-42 emission factor of 2.69 metric tons of TSP/ hectare/ month of activity was used to estimate the fugitive dust from the 55-acre disturbed area.

50. Provide the maximum area disturbed at any one time during construction of the PDCF and the WSB.

RESPONSE:

Construction of the PDCF (in 2006) will require 12.4 acres (SPD EIS, Tables E-2 and E-3). Construction of the WSB (in 2004) will require approximately five acres of land. Based on the construction schedules in the response to RAI 1, disturbance for these two sites will not occur at the same time. See Appendix G, G-8, G.2.3.1.

51. Provide the following information on concrete batch plants needed for construction:
  a) Considering all three facilities (MOX, PDCF, and WSB), provide the number of concrete batch plants.
  b) The maximum annual throughput for a each plant. (Update Item 24(d), DCS, July 12,2001 and provide similar information for any other plants.)
  c) If there is more than a single batch plant, provide the proposed periods of operation to determine whether emissions could occur simultaneously.
  d) The anticipated location(s) of the batch plant(s).

RESPONSE:

a) The number of concrete batch plants will be determined during the MOX Project procurement phase. Procurement documents for the MOX Project will specify requirements for MOX and include estimated concrete quantity and schedule requirements for the PDCF and WSB Projects. The objective is to provide for MOX needs and solicit options from the concrete suppliers for combining project requirements. The MFFF ER assumed that the MFFF and WSB utilized the same concrete batch plant. The on-site location is planned for an area located approximately 1000 ft. south of the PDCF site; see MFFF ER Figures 5-2 and G-1. A decision on the batch plant location for the MOX Project will be made during the bid evaluation for the MOX concrete supply. Options for including PDCF and WSB requirements, along with MOX requirements, will also be evaluated at that time. Since PDCF construction will commence after MFFF and WSB construction, PDCF could use the same batch plant.

b) The MFFF ER assumed an average annual throughput for the MOX Project of 85,000 yd^3 for the MFFF needs and 40,000 yd^3 for the WSB needs.
c) The period of operation for supply of MOX Project concrete is May 2004 through May 2006.

Several sites are being considered for the location of the batch plant. For purposes of estimating environmental impacts assume that the plant will be located in area 5 indicated in MFFF ER Figure 5-2.

52. Provide the modeled air quality data for annual TSP concentrations and the corresponding UTM coordinates for the SRS boundary receptors modeled by Hunter.

RESPONSE:

The UTM coordinates and TSP concentrations from Hunter are provided on the enclosed disk as Attachment 52.

53. Confirm that the construction fugitive emissions were not modeled as an area source. If they were modeled as an area source, provide the ISC source path for the area source and the emission rate (g/sec).

RESPONSE:

The construction fugitive emissions were modeled as a volume source. The ISC source path used is provided in Attachment 53.

54. Provide the annual process emissions of criteria, process, trace, and hazardous pollutants from the PDCF.

RESPONSE:

The PDCF is still in preliminary design. The best publicly available information on process emissions is provided in Appendix G, Table G-59 in Volume II of the SPD EIS.

55. Section G.3.1 indicates that there are potential emissions of nitric acid, aluminum nitrate, and sodium hydroxide from the WSB. Provide the annual process emissions of criteria, process, trace, and hazardous pollutants from the WSB.

RESPONSE:

Attachment 55, "Summary of Waste Solidification Building Annual Non-Radiological Operating Emissions," provides specific emission data for the WSB with the exception of NO_X emissions which are estimated to be 20,230 lbs NO_X/yr prior to any mitigation by scrubbers or other pollution control equipment. DOE is committed to sufficient NO_X removal such that the total SRS site concentrations are less than 10% of the 'most stringent standard or guideline'. In ER Table G-6 this was estimated to result in an annual ambient impact of 10 micrograms per cubic meter.

56. Update the expected annual fuel usage for all MOX facility emergency/standby generators and the aggregate hours of operation for all generators. Provide the vendor emission factors for criteria pollutants.

RESPONSE:

The expected annual fuel usage for all seven of the MFFF emergency and standby generators is 87,450 gallons/year.

The aggregate hours of operation for all MFFF emergency and standby generators is expected to be 636 hours/year.

The vendor emission factors, in lb/hour/unit, for all criteria pollutants are as follows:

CO	NOx	PM	SO_2	HC
6.43	67.02	0.63	3.9	2.88

It should be noted that emission rates for SO_2 are from EPA AP-42.

57. Provide the maximum hourly fuel use assuming that all emergency/standby generators are operating simultaneously.

RESPONSE:

Each of the seven MFFF emergency and standby generators burns 137.5 gallons/hour of diesel fuel at full load. Conservatively assuming that all emergency and standby generators are operating simultaneously, a very unlikely operating condition, the maximum hourly fuel use calculates to be 962.5 gallons/hour.

58. Provide the number of hours per year a single generator is expected to operate for testing and maintenance.

RESPONSE:

A single standby generator is expected to operate approximately 86 hours/year to meet its testing and maintenance requirements.

Correspondingly, a single emergency generator is expected to operate approximately 97 hours/year to meet its testing and maintenance requirements.

59. Clarify whether there are additional emergency generators associated with the PDCF

and/or the WSB. If so, provide the number, the capacities, total annual fuel consumption, maximum hourly fuel consumption for all generators operating simultaneously, and the number of hours per year a single generator is expected to operate for testing and maintenance.

RESPONSE:

The PDCF is currently in the preliminary design phase. The best publicly available information is in Appendix G, Section G.4.2.1.2 and Table G-59 of the SPD EIS.

The WSB will have one generator. See Attachment 55 for emissions data.

60. Provide the length of the round trip assumed for facility workers in estimating VMT for each of the three facilities.

RESPONSE:

For each facility, the length of the round trip for facility workers in estimating VMT is assumed to be 40 miles.

61. The PDCF as presented in the SPD EIS has both boiler and process stacks.
a) Clarify whether the use of new boilers at the PDCF is still planned.
b) Provide the current stack parameters needed for modeling (temperature, diameter, exit velocity, height above grade, grade height above msl) for all PDCF stacks including, if still planned, the boiler stack.

RESPONSE:

The best publicly available information on the PDCF is in Appendix G, Section G.4.2.1.2 and Table G-59 of the SPD EIS.

62. The PIP as presented in the SPD EIS has both boiler and process stacks. The WSB contributions to ambient air concentrations presented in Table G-6 are from Table G-64 in the SPD EIS for the PIP.
a) Clarify whether the use of new boilers at the WSB is still planned
b) Provide the current stack parameters needed for modeling (temperature, diameter, exit velocity, height above grade, grade height above msl) for all WSB stacks including, if still planned, the boiler stack.

RESPONSE:

The WSB is planning to use a 10,000 lb/hr package electric boiler. Chemicals used in the boiler are included the response to RAI 33.

1. The diesel generator information is provided in Attachment 55

2. The main ventilation stack:
   80 feet high
   5 feet diameter
   velocity ~9.8 ft/sec
   temperature - ambient

3. The Concrete Silo:
   50 feet high
   1.5 feet diameter
   velocity ~0.1 ft/sec (default)
   temperature - ambient

4. Two (2)day hopper stacks on (1) the low level waste cement day hopper and (2) the high activity waste cement day hopper
   40 feet high (each)
   8 inches diameter
   velocity ~0.1 ft/sec (default)
   temperature - ambient

63. Update elevation and height data in Item 29 (b)(2), DCS, July 12, 2001, (identical to data in Item 29, DCS, October 26, 2001) for the MOX facility including the new BRW and all structures within 600 ft of the MOX facility stack.

RESPONSE:

The table from the October 26, 2001 Responses to Clarification of Item 29 is updated as follows:

Building	Finish Floor Elev (ft MSL)	Building Height (ft)	Roof Elevation (ft MSL)	CAR Figures (11.1-xx)
BMP	273	77.5	350 5	16, 17, 18
BAD	270 8	26	296 8	35, 36
BTS	273	26	299	38, 39
BSW	272	26	298	37
BRW	272	26	298	41
BRP	272	20	291	34
BEG	271	26	297	33
BSG	270.5	26	296 5	40

64. Provide plot plan and elevation and height data for all structures within 5 stack heights of the PDCF stack(s).

RESPONSE: **[Discuss this response at Red Team Meeting]**

The best publicly available information for the PDCF is in the SPD EIS Sections 2.4.1.1 and 2.7. Air quality impacts were estimated in the SPD EIS assuming ground releases.

65. Provide plot plan and elevation and height data for all structures within 5 stack heights of the WSB, if there is a stack(s).

RESPONSE: **[Discuss this response at Red Team Meeting]**

The location of the WSB is provided in Attachment 8a and 8b. An elevation of the WSB is provided in Attachment 65. The main WSB stack will be 80 ft high. The only other buildings near the WSB will be the PDCF. The best publicly available information for the PDCF is in the SPD EIS Sections 2.4.1.1 and 2.7. Air quality impacts for the WSB were estimated in the MFFF ER using ground releases.

66. Provide the following data on the modeling conducted for the 1998 update of air dispersion modeling for SRS permitted air emission sources.

a)Clarification on whether the modeled ambient boundary concentrations were based on measured 1998 emission levels for each source, or were based on maximum permitted emission levels.

b)Additional information on new sources hydrazine or hydrazine compounds permitted at SRS since the 1998 modeling effort (e.g., annual emission amounts, modeled ambient SRS boundary concentrations) because hydrazine is a MOX-related chemical.

c)Additional or updated ambient air concentration estimates for toxic air pollutants at SRS have been generated, please provide.

In the "Environmental Report for 2000", Chapter 2: Environmental Compliance, it is stated that air dispersion modeling for all site sources was completed and submitted to SCDHEC in 1993, demonstrating compliance at the site boundary line with allowable concentrations (see page 27 of Chapter 2). However, ANL has a letter describing the results of an update to the 1993 modeling (letter from M.D. Dukes, Westinghouse, to C.W. Richardson, SCDHEC, Oct 13, 1998).

RESPONSE:

The 1998 set of modeling is the latest submitted to SCDHEC.

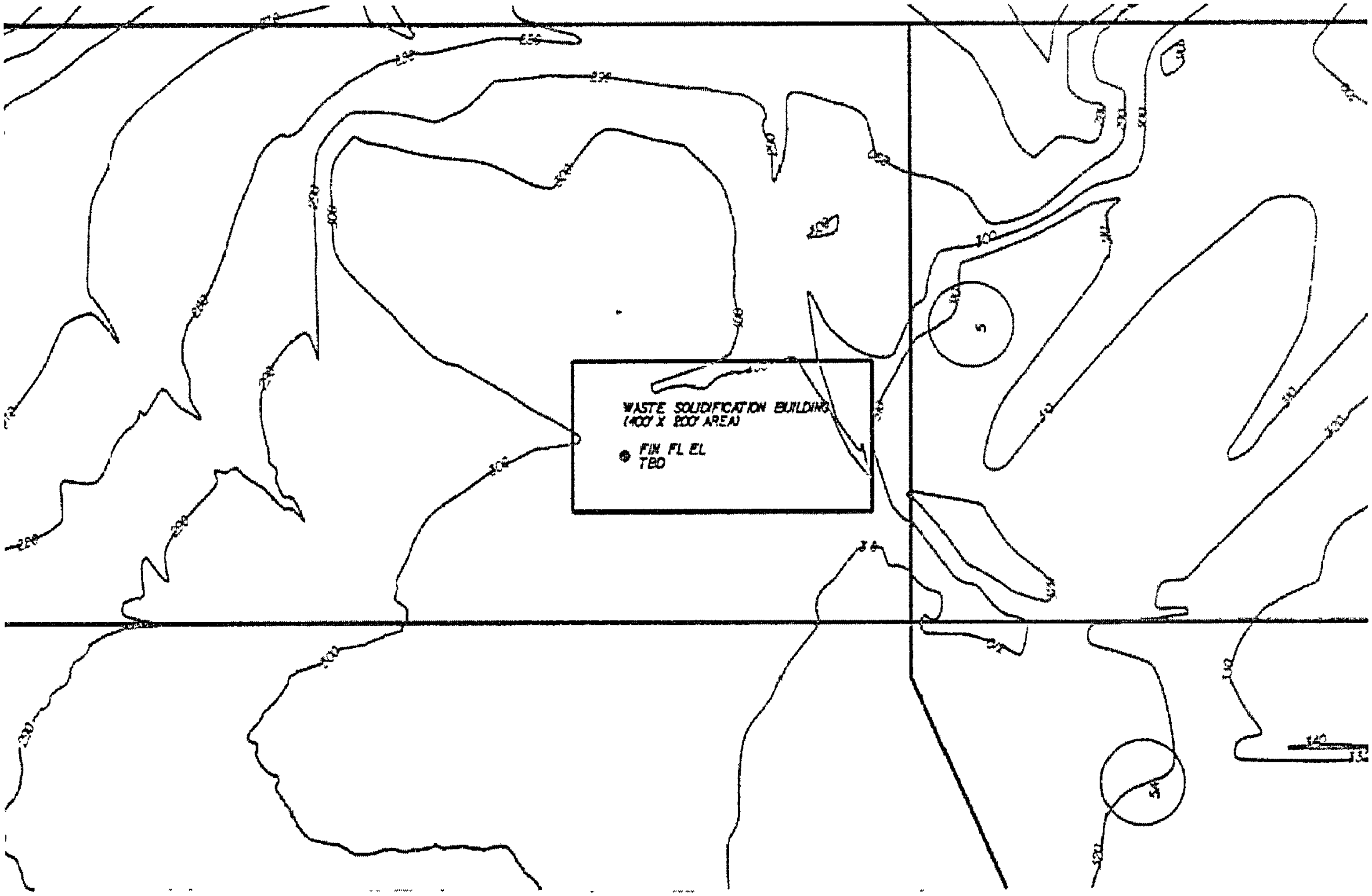
a) The 1998 modeling was based on maximum permitted levels.

b) There has been one hydrazine source permitted since the 1998 baseline modeling: 6.43 E-07 at the E-Area TRU Pads, with a maximum emission rate of 8.75E-02 lbs/yr; based on a screening analysis under SCDHEC air modeling guidance, these emissions were found to result in an insignificant impact at the SRS boundary and did not require formal air modeling

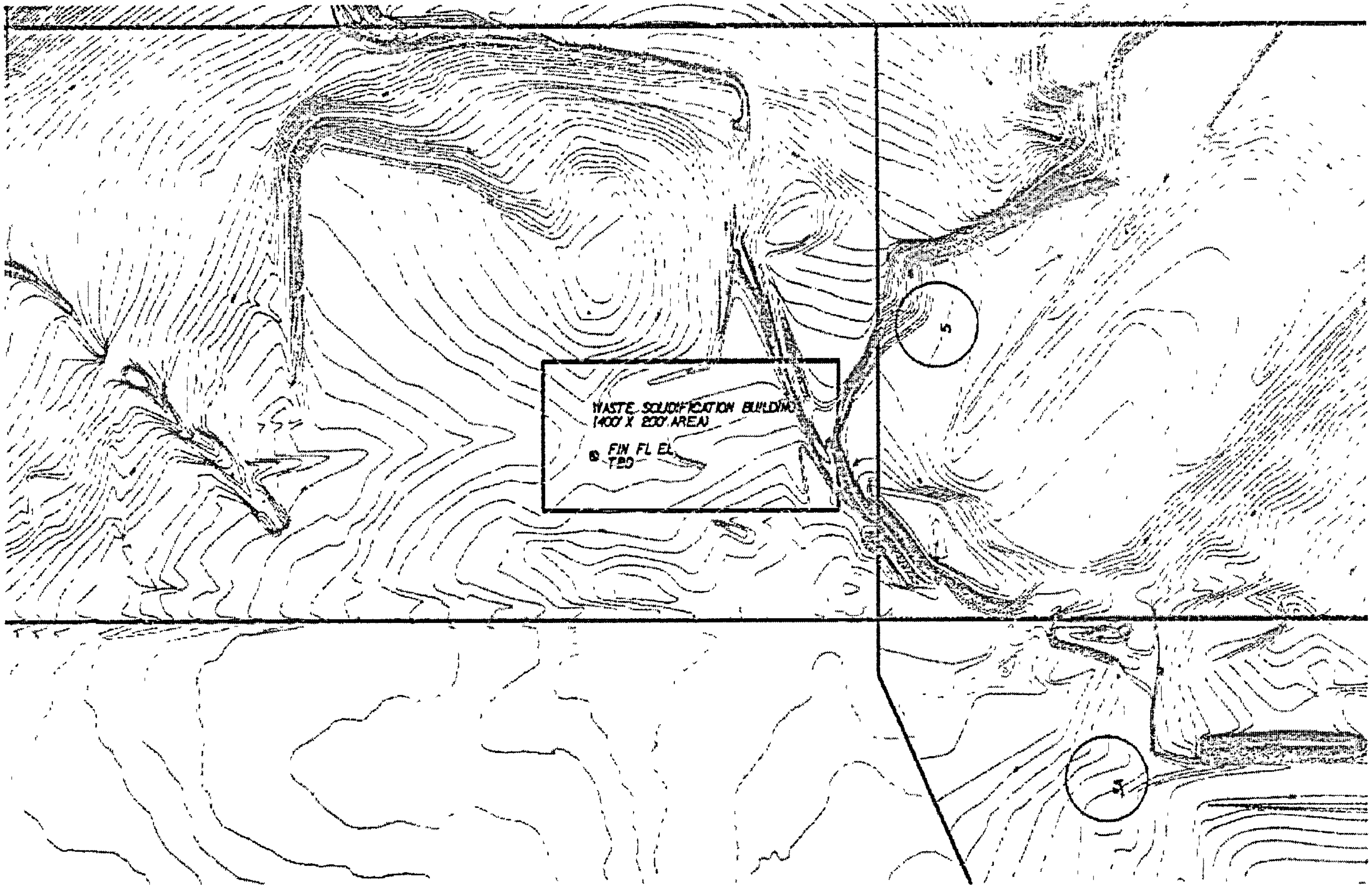
c) No additional comprehensive SRS modeling of air toxics for Clean Air Act Title V compliance has been conducted since 1998.

ATTACHMENTS TO RESPONSES TO REQUEST FOR ADDITIONAL INFORMATION

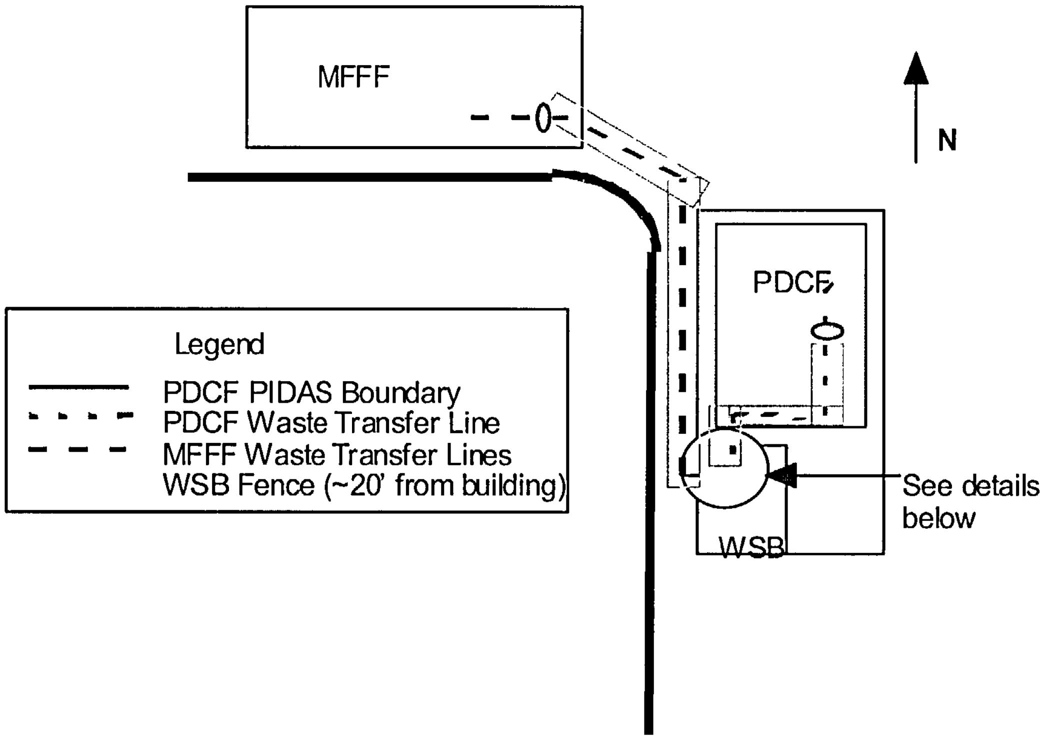
Attachment 8 a. WSB topography at 10 ft intervals



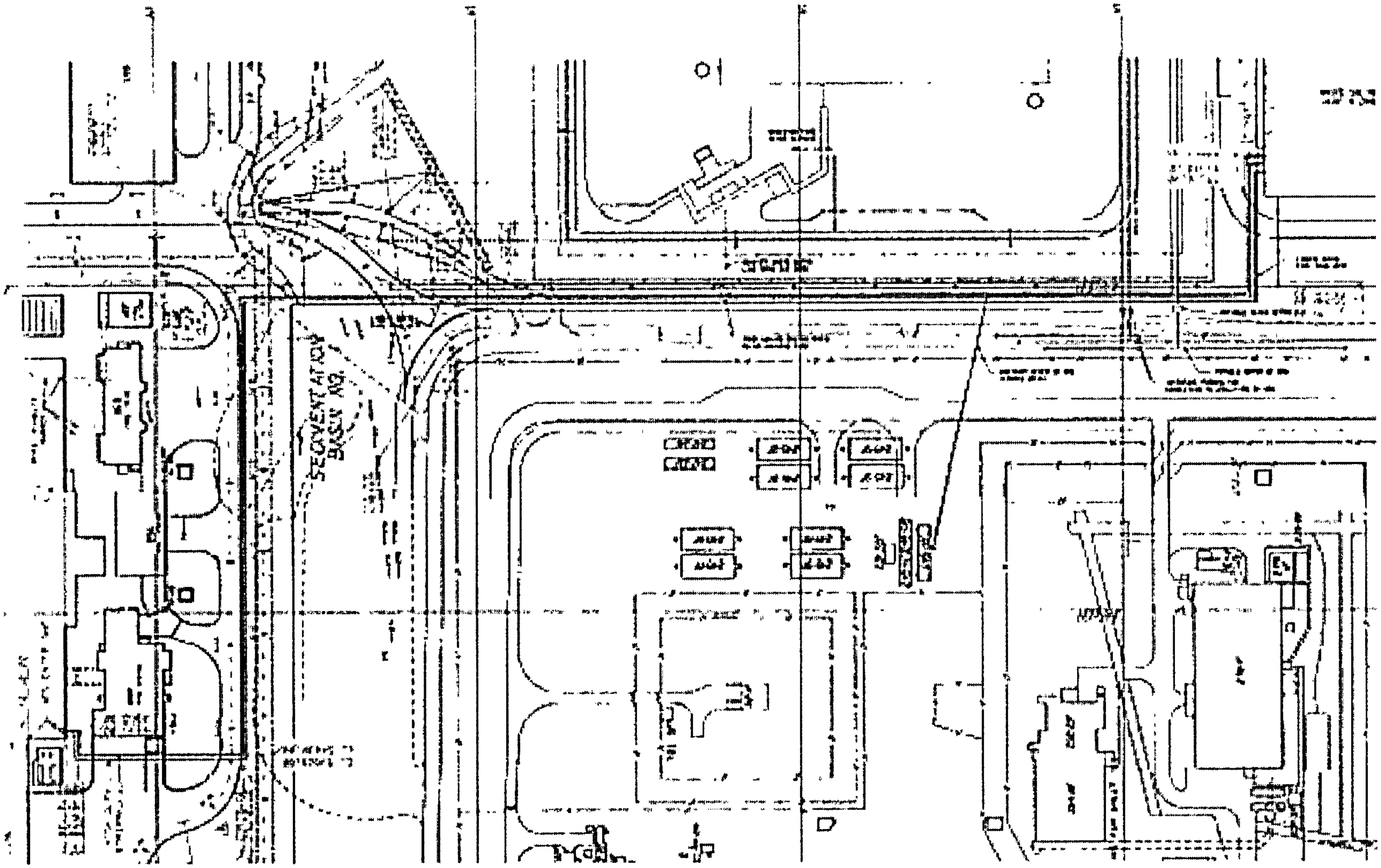
Attachment 8b. WSB topography at 1 ft intervals



Attachment 11a. Routing of high alpha and stripped uranium waste lines from MFFF to WSB.



Attachment 11b. Routing of high alpha and stripped uranium waste lines from MFFF to WSB.



Attachment 12. Letter from DOE to SC SHPO.

OCT 2 4 2002

Mr. Chad Long
South Carolina State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223

Dear Mr. Long:

SUBJECT. Data Recovery Projects 38AK546 and 38AK757 at the Savannah River Site

I am writing to inform you that the Savannah River Archaeological Research Program (SRARP) has completed the data recovery projects conducted at 38AK546 and 38AK757. The excavations were conducted to mitigate impacts caused by construction of the Mixed Oxide Fuel Facility and the Pit Disassembly and Conversion Facility on the Department of Energy's Savannah River Site.

Investigations at 38AK546 were completed on 19 April 2002 and the excavations at 38AK757 ended on 15 September 2002. Exceeding the recommendations in the data recovery plans for each site, a total of 427 square meters was excavated at 38AK546 and 300 square meters were investigated at 38AK757. Except for monitoring ground disturbing activities associated with actual construction of these facilities, all fieldwork outlined in the data recovery plans has been completed. Staff members from the SRARP will monitor the removal of fill on the site areas when construction begins late next year.

Pending environmental documentation requires that DOE-SR have written concurrence from the SC SHPO that our field obligations have been met. At your convenience please send a written concurrence or if you have questions or need addition information before sending that concurrence, then call Dennis Ryan at (803) 725-8162. Thank you for your assistance in this matter.

Sincerely,

Original Signed by
A. B. Gould

A. B. Gould, Director
Environmental Quality
Management Division

EQMD:DR:orc

OE-03-003

bc: EQMD Read File
Dennis Ryan, EQMD
A. M. Blackmon, ODNN

AMEST Read File
A. King, SRARP

Attachment 14a. WSRC (Osteen) to U.S. Army Corps of Engineers (Veal) letter ESH-ECS-2002-00328, "Waters of the United States Walkdown on July 16, 2002"

August 16, 2002

ESH-ECS-2002-00328

Mr. Fred Veal
Regulatory Branch
U. S. Army Corps of Engineers
Charleston District
69A Hagood Avenue
Charleston, SC 29403

Dear Mr. Veal:

WATERS OF THE UNITED STATES WALKDOWN ON JULY 16, 2002

As a follow-up to our July 16, 2002 walkdown of four subwatersheds on the Savannah River Site to determine where waters of the US begin, I am enclosing the additional information you requested to be able to provide confirmation of the specific locations.

The first attachment is an excerpt from the New Ellenton SW, SC USGS 7.5 minute quad map which has the GPS'ed locations for waters of the US that were flagged during the walkdown. The map includes additional features such as the watershed boundaries, NPDES outfalls, and locations of outfall ditches. The second attachment is the soils map, which was generated from the Geographic Information System (GIS) soils layer. The layer was derived from Rogers, V. A. 1990, Soil Survey of Savannah River Plant Area, Parts of Aiken, Barnwell, and Allendale Counties, South Carolina, U. S. Department of Agriculture, Soil Conservation Service, June 1990. The soils map also includes additional features overlain for reference points. Also included is the legend of soil types with descriptive names. Thirdly, the runoff calculations for peak discharge are provided by watershed. The watershed name is the subtitle and corresponds to the large numbers in each watershed on the quad maps. The onsite Natural Resource Conservation Service representative, Bobby McGee, helped me determine the watersheds and acreage for the drainages associated with the waters of the US and the peak runoff for given storm events. We used the TR-55 software program for the calculations. Lastly, a brief summary of the site visit is included as a reminder of the locations visited and the details discussed.

I would like to thank you for you cooperation and assistance in the waters of the US determination. Please review the information provided and provide your concurrence for the waters of the US locations at your earliest convenience. If you have any questions or need additional information, please do not hesitate to call me at 803 725-4734.

Yours truly,

D. V. Osteen
Environmental Compliance Section
Environmental Protection Department

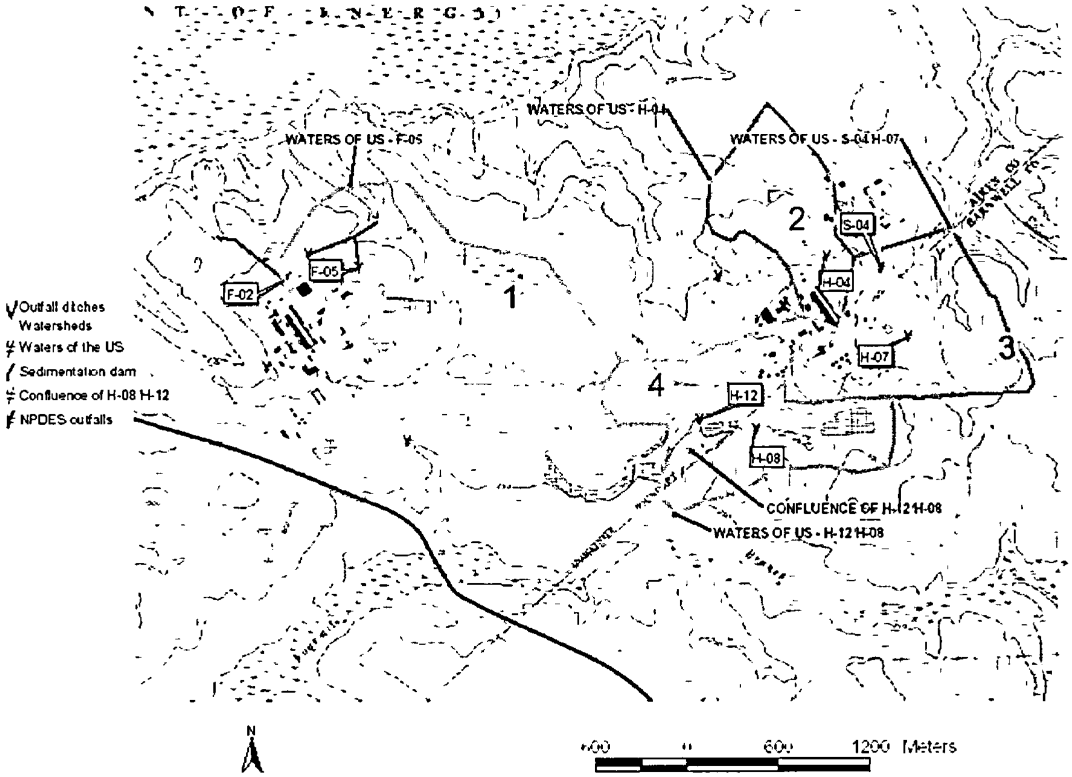
dvo/
Attachment

c:
- M. B. Hughes, 742-A*
- H. L. Davis, 703-A
- * w/o attachments

bc:
- J. E. Bolen, 703-A
- K. W. Dyer, 742-A
- G. S. Hoover, 703-A
- N. J. Lowry, 742-A
- E. Nelson, 773-42A
- W. L. Payne, 742-A
- J. R. Price, 704-15S
- S. E. Smith, 777-20A
- K. D. Steeg, 704-59F
- R. L. Geddes, 703-45A
- EPD File, 742-A
- Records Processing, 773-52A
- * w/o attachments

File Info:
Corp of Engineers, Waters of the US
10040, DOE 1-8.a(1), Permanent

WATERS OF THE US LOCATIONS



SOILS MAP - SELECTED WATERSHEDS

Attachment 14b. SREL reports.

Savannah River Ecology Lab Surveys

1. Instream Biological Assessment of NPDES Point Source Discharges at the SRS, 2000. WSRC-TR-2001-00145. (Specht and Paller).
2. Ecological Half-Lives of 137 CS in Fishes. (Paller, Littrell, and Peters).
3. Comparison of Fish and Macroinvertebrate Bioassessments from South Carolina Coastal Plain Streams (Paller).
4. Temporal Variability in Fish Assemblages from Disturbed and Undistrubed Streams. (Paller)
5. Qualitative Macroinvertebrate Assessment of Crouch Branch, June 1999 and November 2000. WSRC-TR-2001-00276. (Specht).
6. Local and Regional Economic Benefits form Forest Products Production Activities at the SRS: 1955-Present. Forest Policy Center Working Paper Series No. 121. Technical Report SRI-02-02-R. January 2002. (Teeter and Blake).
7. Current and Future Dynamics of the Red-Cockaded Woodpecker Population Inhabiting the Savannah River National Environmental Research Park: Managing for Population Growth. VPI&State University and USDA Forest Service. SRI-01-15-R. (Walters et al.)
8. Restoration of a Severely Impacted Riparian Wetland System -- The Pen Branch Project. Ecological Engineering 15(2000):S3-S15. SRI-00-12-P. Barton et al.
9. Operational Restoration of the Pen Branch Bottomland Hardwood and Swamp Wetlands -- The Research Setting. Ecological Engineering 15(2000):S23-S33. SRI-00-14-P. Nelson et al.
10. The Savannah River Site: Site Description, Land Use, and Management History. Studies in Avian Biology 21:8-17. SRI-00-39-P. (White and Gaines).
11. Establishment of a Viable Population of Red-Cockaded Woodpeckers at the SRS. Technical Report FY 2001. USDA Forest Service Savannah River. SRI-02-04-R. (Johnston).
12. Rare Plants of Southeastern Hardwood Forests and the Role of Predictive Modeling. Natural Areas Journal. 21(1):36-49. SRI-01-14-P. (Imm et al).
13. Savannah River Site Environmental Report for 2001. WSRC-TR-2001-00476.

SREL Reprints

JANUARY 2001 - present

2488 Romanek, C. S., K. F. Gaines, A. L. Bryan, Jr., and J. I.L. Brisbin. 2001. Foraging ecology of the endangered wood stork recorded in the stable isotope signature of feathers. Oecologia 125:584-594.

2489 Bryan, A. L., Jr., M. C. Coulter, and I. L. Brisbin, Jr. 2000. Mitigation for the endangered wood stork on Savannah River Site. Studies in Avian Biology 21:50-56.

2490 Brisbin, I. L., Jr., and R. A. Kennamer. 2000. Long-term studies of radionuclide contamination of migratory waterfowl at the Savannah River Site: implications for habitat management and nuclear waste site remediation. Studies in Avian Biology 21:57-64.

2491 Kennamer, R. A., and G. R. Hepp. 2000. Integration of research with long-term monitoring: breeding wood ducks on the Savannah River Site. Studies in Avian Biology 21:39-49.

2492 Plague, G. R., and J. V. McArthur. 2000. Polymorphic larval retreats in the net-spinning caddishfly *Macrostemum carolina* (Trichoptera: Hydropsychidae): form and putative function. Florida Entomologist 83:497-500.

2493 DeWoody, J. A., D. E. Fletcher, M. Mackiewicz, S. D. Wilkins, and J. C. Avise. 2000. The genetic mating system of spotted sunfish (*Lepomis punctatus*): mate numbers and the influence of male reproductive parasites. Molecular Ecology 9:2119-2128.

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Implications for conservation. The Journal of the Elisha Mitchell Scientific Society 116:239-244.

2498 Medland, V. L., and B. E. Taylor. 2001. Strategies of emergence from diapause for cyclopoid copepods in a temporary pond. Arch. Hydrobiol. 150:329-349.

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2500 Ryan, T. J., and C. T. Winne. 2000. Effects of hydroperiod on metamorphosis in Rana sphenocephala. American Midland Naturalist 145:46-53.

2501 Edwards, A. L., and A. S. Weakley. 2001. Population biology and management of rare plants in depression wetlands of the southeastern coastal plain, USA. Natural Areas Journal 21:12-35.

2502 Battaglia, L. L., S. A. Fore, and R. R. Sharitz. 2000. Seedling emergence, survival and size in relation to light and water availability in two bottomland hardwood species. Journal of Ecology 88:1041-1050.

2503 Collins, B., P. S. White, and D. W. Imm. 2001. Introduction to ecology and management of rare plants of the southeast. Natural Areas Journal 21:4-11.

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2505 Imm, D. W., H. E. Shealy, Jr., K. W. McLeod, and B. Collins. 2001. Rare plants of southeastern hardwood forests and the role of predictive modeling. Natural Areas Journal 21:36-49.

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2507 Winne, C. T., and T. J. Ryan. 2001. Aspects of sex-specific differences in the expression of an alternative life cycle in the salamander *Ambystoma talpoideum.* Copeia 1:143-149.

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2509 Peles, J. D., A. L. Bryan, Jr., C. T. Garten, Jr., D. O. Ribble, and M. H. Smith. 2000. Ecological-half life of ^{137}Cs in fish from a stream contaminated by nuclear reactor effluents. Science of the Total Environment 263:255-262.

2510 Hoyle, M. E., and J. W. Gibbons. 2000. Use of marked population of diamondback terrapins (*Malaclemys terrapin*) to determine impacts of recreational crab pots. Chelonian Conservation and Biology 3:735-737.

2511 Winne, C. T., T. J. Ryan, Y. Leiden, and M E. Dorcas. 2001. Evaporative water loss in two natricine snakes, *Nerodia fasciata* and *Seminatrix pygaea*. Journal of Herpetology 35:129-133.

2512 Congdon, J. D., R. D. Nagle, O. M. Kinney, M. Osentoski, H. W. Avery, R. C. van Loben Sels, and D. W. Tinkle. 2000. Nesting ecology and embryo mortality: Implications for hatchling success and demography of Blanding's turtles (*Emydoidea blandingii*). Chelonian Conservation and Biology 3:569-579.

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2516 Seaman, J. C., J. S. Arey, and P. M. Bertsch. 2001. Immobilization of nickel and other metals in contaminated sediments by hydroxyapatite addition. Journal of Environmental Quality 30:460-469.

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2519 Tatara, C. P., M. C. Newman, and M. Mulvey. 2001. Effect of mercury and *Gpi-2* genotype on standard metabolic rate of eastern mosquitofish (*Gambusia holbrooki*). Environmental Toxicology and Chemistry 20:782-786.

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Attachment 16. Revisions to MFFF ER Table 5-15c.

MFFF ER Table 5-15c is revised to the following:

Table 5-15c. Estimated Cumulative Waste Generation from SRS Concurrent Activities (cubic meters)

Waste Type	SRS Operations [a,b]	MFFF [c]	PDCF and WSB [d]	SNF Management [e]	Tank Closure [f]	Salt Processing [g]	Environmental Restoration/ D&D [d]	Other Waste Volume [d]
High-level	14,129	0	0	11,000	97,000	45,000	0	69,552
Low-level	118,669	17,400	25,850	140,000	19,260	920	61,630	110,102
Hazardous/mixed	3,856	120	10	270	470	56	6,178	4,441
Transuranic	6,012	5,000	180[h]	3,700	0	0	0	8,820
Nonhazardous Liquid	416,000	166,000	269,000	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported
Nonhazardous Solid	6,670	13,000	28,000	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported

NOTE: LLW and TRU waste are liquid plus solid

[a] DOE 2000, *Savannah River Site Spent Nuclear Fuel Management Final Environmental Impact Statement*, DOE/EIS-0279

[b] Based on total 30-year expected waste forecast, which includes previously generated waste

[c] MFFF ER, Tables 3-3, 3-4, and 5-12

[d] MFFF ER, Section 5.2.15 and Appendix G; DOE 1999, *Surplus Plutonium Disposition Final Environmental Impact Statement*, DOE/EIS-0283; Table H-28

[e] DOE 2000, *Savannah River Site Spent Nuclear Fuel Management Final Environmental Impact Statement*, DOE/EIS-0279

[f] DOE 2000, *High-Level Waste Tank Closure Draft Environmental Impact Statement*, DOE/EIS-0303D

[g] DOE 2001, *Savannah River Sit Salt Processing Alternatives Draft Supplemental Environmental Impact Statement*, DOE/EIS-0082-S2D

[h] WSB TRU waste is derived from solidification of high alpha waste and is included in the 5,000 m^3 listed for MFFF.

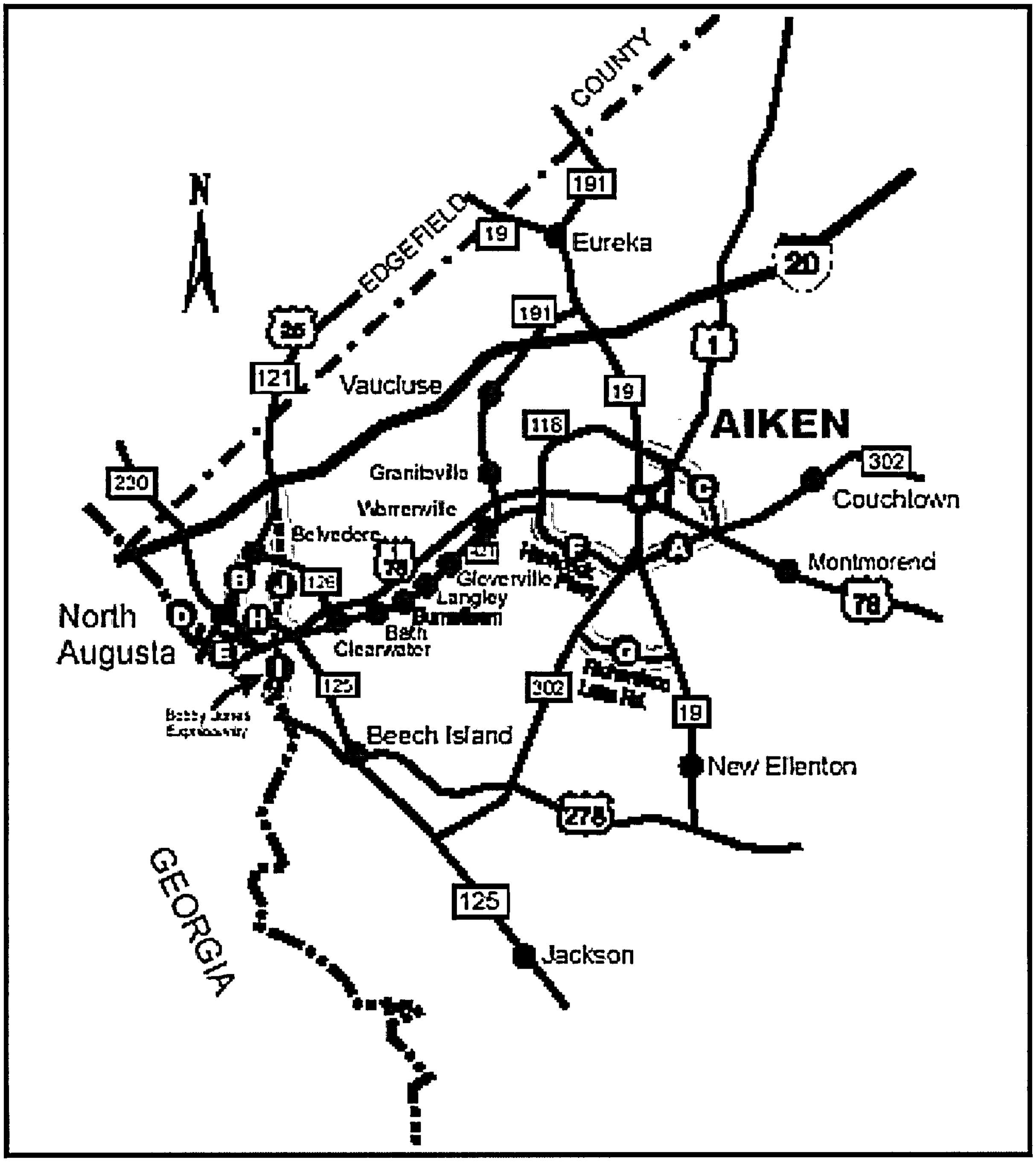
Attachment 17a

Recent Air Quality Permits filed with the South Carolina Department of Health and Environmental Control.

COUNTY	APPLICANT	PERMIT	RECEIVED	STATUS	COMPLETED
AIKEN	SHAW INDUSTRIES GROUP INC	AIR - Conditional Major Permit - New/Renewal	06-Jul-02	Approved	18-Jul-02
AIKEN	CHARTER TRIAD TERMINALS LLC	AIR - Conditional Major Permit - New/Renewal	17-Sep-02		
AIKEN	UCB CHEMICALS CORP BIOPRODUCTS LABORATORY	AIR - Construction Permit	01-Aug-02	Approved	26-Aug-02
AIKEN	THREE RIVERS LANDFILL	AIR - Construction Permit (2 Applications)	03-Oct-02		
AIKEN	UCB CHEMICALS CORP	AIR - Construction Permit	05-Jul-02	Exempted	18-Jul-02
AIKEN	SKF INDUSTRIES INC	AIR - Construction Permit	06-Aug-02		
AIKEN	PEPPERIDGE FARMS INC	AIR - Construction Permit	11-Jun-02	Approved	29-Aug-02
AIKEN	PACTIV CORPORATION	AIR - Construction Permit	13-Aug-02	Approved	06-Sep-02
AIKEN	WESTINGHOUSE SRC - M AREA	AIR - Construction Permit	16-May-02	Approved	05-Aug-02
AIKEN	WESTINGHOUSE SRC - A AREA	AIR - Construction Permit	18-Mar-02	Approved w	20-Aug-02
AIKEN	HUBBELL POWER SYSTEMS INC	AIR - Construction Permit	23-Aug-02	Approved	12-Sep-02
AIKEN	ASCO VALVE MANUFACTURING	AIR - Construction Permit	23-Sep-02		
AIKEN	UCB CHEMICALS CORP	AIR - Construction Permit	26-Aug-02		
AIKEN	WESTINGHOUSE SRC - A AREA	AIR - Construction Permit	28-Feb-02	Approved w	20-Aug-02
AIKEN	UCB CHEMICALS CORP	AIR - Construction Permit	31-Jul-02		
AIKEN	PACTIV CORPORATION	AIR - Construction Permit (6 Applications)	23-Sep-02		
AIKEN	UCB CHEMICALS CORP BIOPRODUCTS LABORATORY	AIR - State Operating Permit - New/Renewal	05-Sep-02		
AIKEN	MARTIN MARIETTA AGGREGATES - AIKEN QUAR - GRANITVL	AIR - State Operating Permit - New/Renewal	08-Jul-97	Withdrawn	18-Jul-02
AIKEN	SKF INDUSTRIES INC	AIR - State Operating Permit - New/Renewal	23-Sep-02		
AIKEN	GLAXO SMITH KLINE	AIR - State Operating Permit - New/Renewal	30-Jul-02	Approved	20-Aug-02
AIKEN	UCB CHEMICALS CORP	AIR - Title V Operating Permit - New/Renewal	05-Jul-02	Approved	18-Jul-02
AIKEN	AVONDALE MILLS INC GREGG DIVISION	AIR - Title V Operating Permit - New/Renewal	07-Jun-02	Approved	12-Jul-02
AIKEN	KIMBERLY CLARK	AIR - Title V Operating	20-Aug-02	Approved	02-Oct-02

COUNTY	APPLICANT	PERMIT	RECEIVED	STATUS	COMPLETED
	CORP	Permit - New/Renewal			
AIKEN	KENTUCKY-TENNESSEE CLAY CO - LANGLEY	AIR - Title V Operating Permit - New/Renewal	20-Sep-02	Approved	04-Oct-02
AIKEN	PACTIV CORPORATION	AIR - Title V Operating Permit - New/Renewal	20-Sep-02		
AIKEN	W R GRACE & CO - GRACE DIV - NATIONAL KAOLIN PROD	AIR - Title V Operating Permit - New/Renewal	22-Jul-02	Approved	28-Aug-02
AIKEN	SC PIPELINE CORPORATION WARRENVILLE	AIR - Title V Operating Permit - New/Renewal	30-Sep-02		
ALLENDALE	APPALACHIAN ENGINEERED HARDWOODS ALLENDALE	AIR - Construction Permit	05-Aug-02		
ALLENDALE	CLARIANT CORP MARTIN PLANT	AIR - Construction Permit	19-Aug-02		
ALLENDALE	CLARIANT CORP MARTIN PLANT	AIR - Construction Permit	15-Aug-02	Approved	12-Sep-02
ALLENDALE	CLARIANT CORP MARTIN PLANT	AIR - Construction Permit	15-Aug-02	Approved	12-Sep-02
ALLENDALE	CLARIANT CORP MARTIN PLANT	AIR - Conditional Major Permit - New/Renewal	09-Sep-02		
BARNWELL	NONE				
EDGEFIELD	COLONIAL PIPLINE CO SWEETWATER FACILITY	AIR - State Operating Permit - New/Renewal	03-Sep-02		
EDGEFIELD	EASTERN PACIFIC INTERNATIONAL LLC	AIR - Construction Permit	11-Jul-02		
EDGEFIELD	EASTERN PACIFIC INTERNATIONAL LLC	AIR - Construction Permit	11-Jul-02		
EDGEFIELD	EASTERN PACIFIC INTERNATIONAL LLC	AIR - Title V Operating Permit - New/Renewal	01-Oct-02		
EDGEFIELD	MENARDI MIKROPUL LLC	AIR - Construction Permit	04-Sep-02		
EDGEFIELD	TRANTER RADIATOR PRODUCTS INC	AIR - Construction Permit	30-Aug-02		
EDGEFIELD	US FIBERS	AIR - State Operating Permit - New/Renewal	27-Sep-02		
EDGEFIELD	WILLIAMS TERMINALS HOLDINGS LP N AUGUSTA II	AIR - Construction Permit	06-Sep-02	Exempted	23-Sep-02

Attachment 17b. Aiken County Road Projects



Attachment 19 Barnwell Districts 19 and 45 financial reports

County /							
District:		Barnwell 06 / 19	Total Barnwell School District #19		Location Code: 0619		
	# Of Students	1,208	District Total	$7,396,608			
	Total		Direct Support	$115,574		Per	% To
	Expenditures	$7,512,182	*Capital Projects*	*$367,292*	LEA Expenditures	Pupil	Total
	Function	Sub-Function	Detail Function		$7,144,890	$5,915	100.00%
	INSTRUCTION				$3,795,471	$3,142	53.12%
		Face-To-Face Teaching			$3,556,123	$2,944	49.77%
			Instructional Teachers		$3,373,248	$2,792	47.21%
			Substitutes		$31,285	$26	0.44%
			Instructional Paraprofessionals		$151,590	$125	2.12%
		Classroom Materials			$239,348	$198	3.35%
			Pupil-Use Technology & Software		$73,460	$61	1.03%
			Instructional Materials & Supplies		$106,523	$88	1.49%
			Direct Support -- Instructional Materials		$59,365	$49	0.83%

	INSTRUCTIONAL				**$869,792**	**$720**	**12.17%**
	SUPPORT	Pupil Support			$796,281	$659	11.14%
			Guidance & Counseling		$134,772	$112	1.89%
			Library & Media		$5,157	$4	0.07%
			Extracurricular		$562,620	$466	7.87%
			Student Health & Services		$93,732	$78	1.31%
		Teacher Support			$45,038	$37	0.63%
			Curriculum Development		$30,790	$25	0.43%
			In-Service & Staff Training		$14,248	$12	0.20%
		Program Support			$28,473	$24	0.40%
			Program Development		$0	$0	0.00%
			Direct Support -- Testing		$5,966	$5	0.08%
			Therapists, Psychologists, Evaluators, Personal				
			Attendants, & Social Workers		$22,507	$19	0.32%
	OPERATIONS				**$1,594,478**	**$1,320**	**22.32%**
		Non-Instructional Pupil			$681,751	$564	9.54%
		Services	Transportation		$100,278	$83	1.40%
			Direct Support -- Transportation		$50,243	$42	0.70%
			Food Service		$520,984	$431	7.29%

			Safety		$10,246	$8	0.14%
		Facilities	Building Upkeep & Maintenance		$687,314	$569	9.62%
		Business Services			$225,413	$187	3.15%
			Data Processing		$7,174	$6	0.10%
			Business Operations		$218,239	$181	3.05%
	OTHER				**$149,097**	**$123**	**2.09%**
	COMMITMENTS	Contingencies	Budgeted Contingencies		$0	$0	0.00%
		Capital			$149,097	$123	2.09%
			Debt Service		$149,097	$123	2.09%
			Capital Projects		*$367,292*	*$304*	*4.89%*
		Out-Of-District Obligations			$0	$0	0.00%
			Parochial, Private, Charter, & Public School				
			Pass Throughs		$0	$0	0.00%
			Retiree Benefits & Other		$0	$0	0.00%
		Legal Obligations	Claims & Settlements		$0	$0	0.00%
	LEADERSHIP				**$736,052**	**$609**	**10.30%**
		School			$355,391	$294	4.97%

		Management							
				Principals & Assistant Principals			$285,559	$236	4.00%
				School Office			$69,832	$58	0.98%
		Program Management					$198,488	$164	2.78%
				Deputies, Senior Administrators, Researchers &					
				Program Evaluators			$198,488	$164	2.78%
		District Management					$182,173	$151	2.55%
				Superintendent & School Board			$175,652	$145	2.46%
				Legal			$6,521	$5	0.09%

County /							
District:		Barnwell 06 / 45	Total Barnwell School District #45		Location Code: 0645		
	# Of Students	2,797	District Total	$15,692,237			
	Total		Direct Support	$275,778		Per	% To
	Expenditures	$15,968,015	*Capital Projects*	*$634,589*	LEA Expenditures	Pupil	Total
	Function	Sub-Function	Detail Function		$15,333,426	$5,482	100.00%
	INSTRUCTION				**$8,989,755**	**$3,214**	**58.63%**
		Face-To-Face Teaching			$8,431,488	$3,014	54.99%
			Instructional Teachers		$8,005,401	$2,862	52.21%
			Substitutes		$99,347	$36	0.65%
			Instructional Paraprofessionals		$326,740	$117	2.13%
		Classroom Materials			$558,267	$200	3.64%
			Pupil-Use Technology & Software		$722	$0	0.00%
			Instructional Materials & Supplies		$420,039	$150	2.74%
			Direct Support -- Instructional Materials		$137,506	$49	0.90%
	INSTRUCTIONAL				**$1,297,266**	**$464**	**8.46%**

SUPPORT	Pupil Support		$1,058,284	$378	6.90%
		Guidance & Counseling	$313,150	$112	2.04%
		Library & Media	$275,651	$99	1.80%
		Extracurricular	$305,819	$109	1.99%
		Student Health & Services	$163,664	$59	1.07%
	Teacher Support		$140,734	$50	0.92%
		Curriculum Development	$130,553	$47	0.85%
		In-Service & Staff Training	$10,181	$4	0.07%
	Program Support		$98,248	$35	0.64%
		Program Development	$0	$0	0.00%
		Direct Support -- Testing	$13,818	$5	0.09%
		Therapists, Psychologists, Evaluators, Personal			
		Attendants, & Social Workers	$84,430	$30	0.55%
OPERATIONS			$2,501,390	$894	16.31%
	Non-Instructional Pupil		$1,352,317	$483	8.82%
	Services	Transportation	$305,679	$109	1.99%
		Direct Support -- Transportation	$124,454	$44	0.81%
		Food Service	$897,076	$321	5.85%
		Safety	$25,108	$9	0.16%

	Facilities	Building Upkeep & Maintenance		$1,003,609	$359	6.55%
	Business Services			$145,464	$52	0.95%
		Data Processing		$23,326	$8	0.15%
		Business Operations		$122,138	$44	0.80%
OTHER				**$1,132,863**	**$405**	**7.39%**
COMMITMENTS	Contingencies	Budgeted Contingencies		$0	$0	0.00%
	Capital			$1,132,863	$405	7.39%
		Debt Service		$1,132,863	$405	7.39%
		Capital Projects		*$634,589*	*$227*	*3.97%*
	Out-Of-District Obligations			$0	$0	0.00%
		Parochial, Private, Charter, & Public School				
		Pass Throughs		$0	$0	0.00%
		Retiree Benefits & Other		$0	$0	0.00%
	Legal Obligations	Claims & Settlements		$0	$0	0.00%
LEADERSHIP				**$1,412,152**	**$505**	**9.21%**
	School Management			$771,386	$276	5.03%
		Principals & Assistant		$632,091	$226	4.12%

		Principals				
		School Office		$139,295	$50	0.91%
	Program Management			$217,520	$78	1.42%
		Deputies, Senior Administrators, Researchers &				
		Program Evaluators		$217,520	$78	1.42%
	District Management			$423,246	$151	2.76%
		Superintendent & School Board		$419,498	$150	2.74%
		Legal		$3,748	$1	0.02%

Attachment 20

K. A. Williams, Oak Ridge National Laboratory, ORNL/TM-1999-257, "Life Cycle Costs for the Domestic Reactor-Based Plutonium Disposition Option, October 1999.

ORNL/TM-1999-257

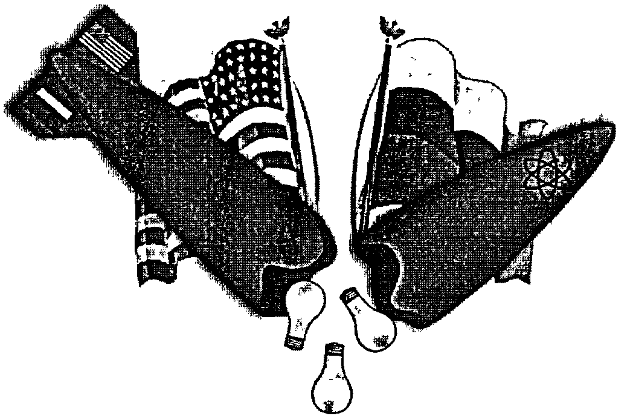
OAK RIDGE
NATIONAL
LABORATORY

LOCKHEED MARTIN

MANAGED AND OPERATED BY
LOCKHEED MARTIN ENERGY RESEARCH CORPORATION
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

Life Cycle Costs for the Domestic Reactor-Based Plutonium Disposition Option

K. A. Williams



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ORNL/TM-1999-257

Engineering Technology Division

LIFE CYCLE COSTS FOR THE DOMESTIC REACTOR-BASED PLUTONIUM DISPOSITION OPTION

K. A. Williams

Date Published: October 1999

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CONTENTS

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LIST OF ACRONYMS

ATR	Advanced Test Reactor (at INEEL)
CDR	conceptual design report
DCS	Duke/COGEMA/Stone & Webster, LLC (contractor)
DOE	U.S. Department of Energy
DP	Defense Programs (DOE)
DO-CDR	Design-Only Conceptual Design Report
DUF_6	depleted uranium hexafluoride
DUO_2	depleted uranium dioxide
EIS	environmental impact statement
EOL	end-of-life
F-D	Fluor-Daniel Group (architect-engineer)
FFF	fuel fabrication facility
FMDP	Fissile Materials Disposition Program (MD)
FY	fiscal year
GOCO	government-owned, contractor-operated
GFM	government-furnished material
GFS	government- furnished service
INEEL	Idaho National Energy and Environmental Laboratory
IGE	independent government estimate
LEU	low-enriched uranium
LANL	Los Alamos National Laboratory
LCC	life cycle cost
LWR	light-water reactor
MOX	mixed oxide
MOX FFF	MOX fuel fabrication facility
MT	metric ton
MTHM	metric ton of heavy metal (U + Pu)
NRC	Nuclear Regulatory Commission
NEPA	National Environmental Policy Act
ORNL	Oak Ridge National Laboratory
OPC	operations-funded costs
PORTS	Portsmouth Gaseous Diffusion Plant
PDCF	Pit Disassembly and Conversion Facility
PWR	pressurized-water reactor
PIE	postirradiation examination
PSAR	Preliminary Safety Analysis Report
ROD	Record of Decision
R&D	research and development
RASR	Reactor Alternative Summary Report
RW	DOE Office of Civilian Radioactive Waste Management
SRS	Savannah River Site
SST	safe, secure trailer
SWU	separative work unit (measure of uranium enrichment)
TA	technical area (at LANL)
TEC	total estimated cost (line-item)
TPC	total project cost (OPC + TEC)
TSR	technical summary report
UE	uranium enrichment
YM	Yucca Mountain
$M	millions of dollars

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LIFE CYCLE COSTS FOR THE DOMESTIC REACTOR-BASED PLUTONIUM DISPOSITION OPTION

K. A. Williams

ABSTRACT

Projected constant dollar life cycle cost (LCC) estimates are presented for the domestic reactor-based plutonium disposition program being managed by the U.S. Department of Energy Office of Fissile Materials Disposition (DOE/MD). The scope of the LCC estimate includes:

- design, construction, licensing, operation, and deactivation of a mixed-oxide (MOX) fuel fabrication facility (FFF) that will be used to purify and convert weapons-derived plutonium oxides to MOX fuel pellets and fabricate MOX fuel bundles for use in commercial pressurized-water reactors (PWRs);
- fuel qualification activities and modification of facilities required for manufacture of lead assemblies that will be used to qualify and license this MOX fuel; and
- modification, licensing, and operation of commercial PWRs to allow irradiation of a partial core of MOX fuel in combination with low-enriched uranium fuel.

The baseline cost elements used for this document are the same as those used for examination of the preferred sites described in the site-specific final environmental impact statement and in the DOE Record of Decision that will follow in late 1999. Cost data are separated by facilities, government accounting categories, contract phases, and expenditures anticipated by the various organizations who will participate in the program over a 20-year period. Total LCCs to DOE/MD are projected at approximately $1.4 billion for a 33-MT plutonium disposition mission.

1. INTRODUCTION

This report is a comprehensive update of several previous documents that provided life cycle cost (LCC) estimates for reactor-based plutonium disposition through the use of mixed-oxide (MOX) fuel. The reactor option was described in the U.S. Department of Energy Office of Fissile Materials Disposition (DOE/MD) programmatic Record of Decision (ROD)[1] published in January 1997. LCCs for the reactor option do not include costs associated with the Pit Disassembly and Conversion Facility (PDCF) nor those associated with the immobilization of any weapons-grade plutonium. PDCF and immobilization option LCCs are provided in *Plutonium Disposition Life Cycle Costs and Cost-Related Comment Resolution Document* (November 1999).[2]

This report will provide the background for the first complete public presentation of the reactor-based option LCCs since publication of two supporting documents that accompanied the 1997 ROD. These supporting documents were

- *Technical Summary Report for Surplus Weapons-Usable Plutonium Disposition* (DOE/MD-0003, October 1996),[3] and
- *FMDP Reactor Alternative Summary Report: Vol. 1—Existing LWR Alternative* (ORNL/TM-13275/V1, October 1996).[4]

An interim report, *Cost Analysis in Support of Site Selection for Surplus Weapons-Useable Plutonium Disposition* (DOE/MD-0009, July 1998),[5] presented the design, construction, licensing, and operation costs of two major facilities that would need to be constructed to support the plutonium disposition options. These facilities, the PDCF and the MOX fuel fabrication facility (FFF), were evaluated in this interim report for different candidate sites where the facilities might be located. Since the supporting contractor for the reactor-based option had not yet been chosen in 1998, costs related to fuel qualification, modification, and operation of candidate existing light-water reactors (LWRs) were not included.

The reactor-based option contractor, Duke/COGEMA/Stone & Webster (DCS), was selected and placed under DOE contract on March 22, 1999. This report, therefore, presents a more accurate and complete LCC estimate for the reactor option based on a collection, correction, and update of information from:

1. the documents cited above;
2. two design-only conceptual design reports (DO-CDRs): one for the PDCF[6] and one for the MOX FFF,[7] prepared by Fluor-Daniel (F-D) and Los Alamos National Laboratory (LANL);
3. an independent government estimate (IGE) prepared by Oak Ridge National Laboratory (ORNL) prior to negotiation of the mission base contract between DOE and DCS;* and
4. preliminary information obtained from DCS prior to completion of the contract statement of work, cost, and schedule baseline for the project.*

A preview of the cost and schedule baseline from the contractor's bid proposal* and the public *Environmental Synopsis Report*,[8] April 1999, were also used in preparation of this report.

The estimate presented here does not yet benefit from significant input from DCS or the Savannah River Site (SRS). It is an estimate derived from many sources and is constrained by the requirements of National Environmental Policy Act (NEPA) documentation, information in the DO-CDRs,[6,7] and other reference information used for preparation of the NEPA documentation. Cost data[2] for the PDCF and the Immobilization Facility were developed earlier by separate organizations within the DOE/MD. However, there has been a concerted effort to ensure that all cost-estimating categories, procedures, and guidelines were applied on a consistent basis, such that a clear picture of the overall LCCs for all activities within the plutonium disposition program is presented.

The development of this estimate has benefited from several iterations of "reasonableness review" by DOE project staff and by an independent architect/engineer firm. In this manner, the comparability of this estimate with those of other Fissile Materials Disposition Program (FMDP)-proposed plutonium-disposition facilities can be made more likely with regard to base assumptions and methods of presentation. Reviews were also done to assist in the consistent application of contingency or management reserve allowances across all projects.

An updated LCC estimate for the reactor option will be developed in the future. This new estimate will include information from the mission contractor design deliverables such as a Title I MOX FFF design and cost estimate and the project cost and schedule baseline developed from the contract statement of work. Preparation of other contract deliverables within the next 2 years, such as the reactor modification plan and the fuel qualification plan, will also contribute to refinement of the overall contract cost and schedule baseline.

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*These data sources cannot be released to the public because they contain procurement-sensitive information.

2. SCOPE OF ESTIMATE

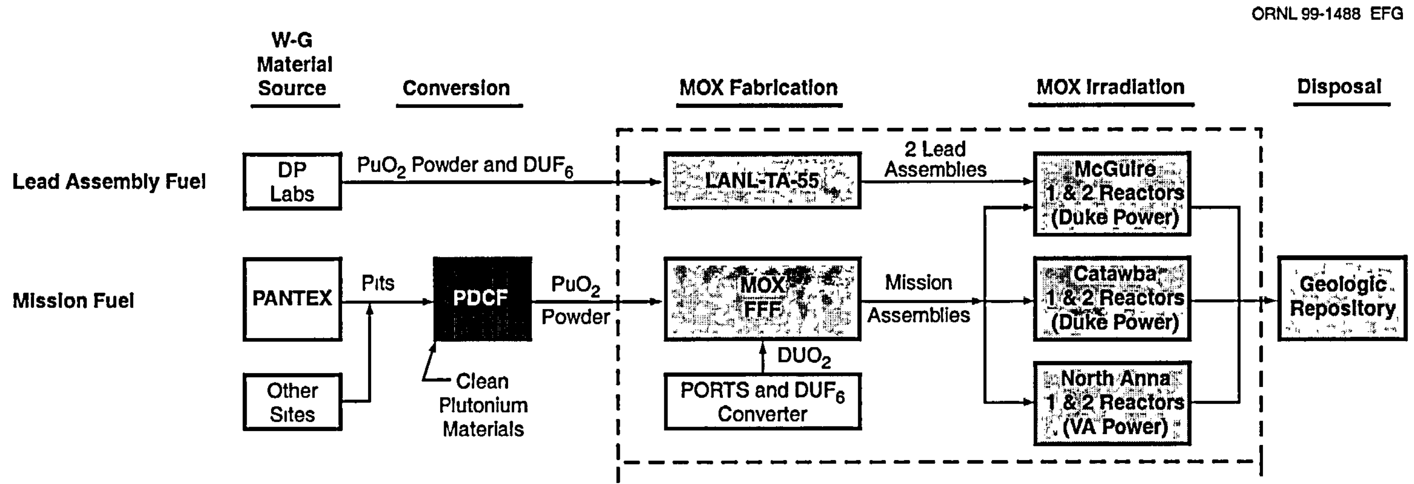
2.1 FACILITIES

The facilities and activities covered in the scope of this estimate are illustrated in Fig. 1. Both the MOX fuel qualification project (production and irradiation of two lead assemblies) and disposition of 33-MT of weapons-grade plutonium (the baseline mission) are included. Existing weapons-grade plutonium dioxide powder and new powder derived from the pit disassembly and conversion demonstration at LANL will be used for fabrication of the lead assemblies in the Technical Area 55 (TA-55) at LANL. These two assemblies will be irradiated at the McGuire Nuclear Station, owned and operated by Duke Power Corporation. Postirradiation examination (PIE) of this lead assembly fuel will take place at ORNL per the preferred PIE site decision of November 12, 1999 (DOE Press release R-99-303).

Most of the 33 MT of plutonium to be dispositioned originates as metallic metal weapons parts or "pits" stored at Defense Programs' (DP's) Pantex facility in Amarillo, Texas. The DOE nuclear material transportation system will use its "safe, secure trailer" (SST) vehicles to transport the weapons parts and any other plutonium materials to the PDCF. The DOE SRS has been chosen as the preferred site for location of the PDCF. At the PDCF, the plutonium metal is converted to a PuO_2 powder. This powder may have retained some of the residual alloying components that were not totally removed by the pyrochemical processing in the PDCF. The powder is packaged at the PDCF and sent to the closely located MOX FFF. Evaluation of the LCCs for this report begins upon arrival of the PuO_2 at the MOX FFF. The FFF initial process is an aqueous polishing step intended to remove the residual impurities to acceptable levels and to produce an acceptable PuO_2 powder for use in the MOX fuel fabrication step. The clean PuO_2 is blended with clean depleted UO_2 powder to form a mixture that averages about 4.3% PuO_2. The mixture is formed into pellets, sintered, and loaded into rods that are then bundled into MOX fuel assemblies. These assemblies appear very similar to the low-enriched uranium (LEU) assemblies. After fabrication, the MOX assemblies are packaged in a special three-bundle shipping package and transported by SST to the six pressurized-water reactors (PWRs) that DCS has designated to provide irradiation services. The reactors to be used are three two-unit plants at the McGuire Nuclear Station (Duke Power Co.) just north of Charlotte, North Carolina; the Catawba Nuclear Station (Duke Power Co.) located near Lake Wylie, South Carolina; and the North Anna Nuclear Power Station (Virginia Power Co.) northwest of Richmond, Virginia. All MOX assemblies will be irradiated to a level equivalent or greater than the "spent fuel standard" concept advanced by the National Academy of Sciences (NAS). Once the spent MOX fuel is discharged from the reactors, it will be handled in the same way as spent LEU fuel. Spent fuel disposal is covered by a 1-mill/kWh fee paid by the utilities to the DOE Office of Civilian Radioactive Waste Management (RW). No additional costs are anticipated for disposal of MOX spent fuel compared to disposal of LEU spent fuel.

2.2 TEMPORAL SCOPE

LCCs presented here are projected costs for FY 2000 and beyond. Programmatic already-spent or "sunk" costs, which are also included in the final ROD documentation,[2] are listed separately as a single estimating category. Sunk costs were determined from DOE/MD budget records. Sunk costs for DCS activities are accumulated from the time of the signing of the DCS contract in March 1999. The major LCC categories considered in this report are remaining research and development (R&D), the fuel qualification project, development of management plan deliverables, and new facility design, modification design, startup, operation, deactivation, and ultimate decommissioning. Also included are effective credits to DOE for part of the value of the LEU fuel assemblies displaced by MOX fuel assemblies.



Mission Facilities	Origin of Pits	PDCF	MOX FFF	Commercial Reactors	Spent Fuel
Activity	Amarillo, TX	SRS	SRS	SC, NC, and VA	YM
Capacity	N/A	3.5 MT/year of plutonium	3 3 MT/year of plutonium or ~75 MT/year of heavy metal	164 Assemblies/year	
Years of Operation	N/A	9-10	10	10 years for Reload Batches for Loading 12 years for MOX Operations	
Ownership/Operations	GOCO	GOCO	DOE/DCS	Duke and Virginia Power	
Operations Start		2006	2006	2007	

--------	Encloses cost estimating scope of this report	SRS	Savannah River Site	PORTS	Portsmouth Gaseous Diffusion Plant (Ohio)
N/A	Not applicable	DUO$_2$	Depleted uranium dioxide		
GOCO	Government owned, contractor operated	DP	Defense Programs	YM	Yucca Mountain
DCS	Duke/Cogema/Stone & Webster, Inc.	LANL	Los Alamos National Laboratory	W-G	Weapons-grade (Pu)

Note: In addition to MOX mission assemblies shown above, LEU assemblies will be utilized to make up a reload batch of fuel.

Fig. 1. Reference facilities for reactor-based portion of dual-track plutonium disposition option.

3. LCC SUMMARY

Tables 1(a) and 1(b) show the major LCC elements for all facilities in lump sum FY 2000 constant million dollars and also provide word descriptions of the cost elements. Fuel qualification and new fuel transportation have been listed as separate activities. Projected costs for the MOX FFF Congressional line item project have been estimated separately from other up-front costs such as those associated with the modification, licensing and operation of the mission reactors. The up-front total cost for line items is referred to as total project cost (TPC). The TPC consists of two parts depending on the type of Congressional appropriation. Operations-funded project cost (OPC), funded out of the operating budget, and total estimated cost (TEC), funded out of the capital budget, are accumulated separately.

The remaining up-front costs (non-OPC) are funded out of the DOE operating budget for items that are not within the scope of a particular Congressionally authorized facility. Examples are DCS fuel qualification activities and modifications to privately owned reactors. The other major LCC elements are recurring costs, which for purposes of this estimate are assumed to remain the same in constant dollars for 10–12 years of the mission facilities lifetimes, and end-of-life (EOL) costs, which include final deactivation and decontamination and decommissioning (D&D) costs.

3.1 FUEL QUALIFICATION

The goal of the fuel qualification program is to successfully design, fabricate, irradiate, and examine two prototypic MOX PWR lead assemblies. The fuel qualification project is used to confirm to the regulatory authority that it is safe to use MOX fuel in U.S. reactors. The fuel qualification effort is a joint effort between DCS, the lead assembly fabrication site, and the national laboratory that will conduct supporting PIEs. The total cost of ~$120M for qualification of MOX fuel includes DCS management and fees, the lead assembly facility (preferred site is Building TA-55 at LANL) upgrades and operations, special process equipment to be provided by DCS, PIE at a national laboratory (preferred site is ORNL), preparation of documents to support the license amendment for insertion of the two lead assemblies in McGuire Unit-2, a programmatic contingency of 38.5% recommended for TA-55 activities, and a 10% management reserve for DCS fuel qualification activities. Duke Power Company irradiation fees at the McGuire Nuclear Station are also included. Approximately $56M (with contingency) of these funds are for TA-55 personnel services and TA-55 upgrades. Approximately $22M is for TA-55 facility "rent" from DOE/DP (infrastructure). The remaining $24M in fuel qualification costs are for DCS supervision and DCS-supplied special equipment plus PIE and NRC license amendment reviews.

3.2 MOX FFF

The documented design basis for the FFF project is currently the DO-CDR,[7] which was prepared in late 1997 and updated in 1998 to consider use of the SRS site. [The MOX FFF project baseline in the DO-CDR (technical cost and schedule) will eventually be replaced by the European MELOX-based plant design proposed by DCS. This new baseline plant concept will have an adjusted cost and schedule based on the evolving DCS design.] The DO-CDR MOX FFF design was based on a generic MOX plant design that was prepared for use in NEPA documentation, site evaluation, and submission of an out-year design budget for the reactor-based disposition program. The DO-CDR MOX FFF is capable of producing up to 195 Westinghouse-type PWR MOX fuel assemblies (similar to fuel to be used by DCS) annually and, for NEPA purposes, was assigned a mission time of 10 years. To accommodate six DCS PWRs, a fuel cycle requiring 164 assemblies per year was analyzed. For this estimate, a TPC (design, construction, and cold start-up cost) of $723M has been calculated from the SRS-sited DO-CDR estimate and includes the addition of design/construction cost data for the aqueous polishing portion of the MOX FFF building not included in the DO-CDR but covered separately in the final EIS.[9] Note that all DO-CDR derived costs have been escalated from 1997 constant dollars to 2000 constant dollars.

Table 1(a). Reactor-based disposition option LCC summary (FY 2000 constant $M)

	Column	(A)	(B)	C = (A + B)	(D)	E = (C + D)	(F)	(G)	(H)	I = (E + F + G + H)
		Up-front (investment) costs[a]					Mission recurring costs		EOL costs[b]	
Row No.	Facility/activity	OPC costs	Line item (TEC) costs	TPC costs	Other up-front costs	Total up-front costs	Operations costs	Fuel displacement credit	Deactivation/ D&D costs	Total LCC
	Reactor-based (33 MT of plutonium)									
1	Fuel qualification[c]				120	120				120
2	MOX FFF	157	566	723		723	763	–568	59	977
3	Existing reactors (6 PWRs)				136	136	150			286
4	Transportation				7	7	10			17
	Total	157	566	723	263	986	923	–568	59	1400

[a] OPC = Operations-funded up-front costs for MOX FFF design/construction project ($102M in sunk costs are also included in this category)
TEC = Total estimated cost (capital or Congressional line item funded cost for MOX FFF)
TPC = Total project cost for MOX FFF
Other "up-front" costs represent government investments for reactor modification and transportation equipment.

[b] EOL = End-of-life costs.

[c] Includes DCS management of fuel qualification activities plus management reserve. See Appendix A for content of categories.

Note: Column and row numbers are provided for traceability to Table 5 detailed categories and Table 1(b).

Table 1(b). Cost elements within Table 1(a) LCCs

Column and row	Name	Cost elements (cost numbers can be found in Table 5)
D1	Fuel qualification	Lead assembly program (LANL, DCS, and PIE costs), prorated DCS fee, lead assembly license amendment preparations and support, DOE management reserve
A2	MOX FFF OPC	Sunk costs, NRC activities, host site design support
B2	MOX FFF TEC	Design, license application, equipment procurement, construction, permits, construction management and fees, host site support, design reviews, inspections (Title III), DOE management reserve, cold startup
F2	MOX FFF operations	NRC inspections and regulation, labor, fuel assembly and other consumables, utilities, DUF_6 to DUO_2 conversion, waste disposal, hot startup, fee to DCS
G2	LEU displacement credit	Discounted value of displaced LEU fuel cycle materials and services
H2	MOX FFF deactivation and D&D	DCS deactivation costs, host site D&D costs for MOX FFF
D3	Reactor up-front costs	National laboratory reactor-related R&D, DCS home office management (base contract), reactor modification design and construction, core design and reload analysis, permits, reload license amendment, and DOE management reserve
F3	Reactor operations	Fee to contractor during option 2, incremental costs to utilities (additional people, casks, boron, control rods, etc.), additional enrichment cost for MOX adjacent LEU assemblies
D4	Transportation up-front costs	MO-1 lead assembly package recertification, mission shipping package design, certification, fabrication, and procurement
F4	Transportation operations	SST shipment of MOX bundles from MOX FFF to reactor sites

Recurring costs in the SRS-adjusted DO-CDR were estimated at $57M/year in 1997 dollars for 10 years and did not include an aqueous polishing step at the front end of the facility. This cost has been adjusted for escalation, a different imbedded fee structure, the addition of more than $11M/year for aqueous polishing, increased waste treatment, and altered use of consumables. Table 2 shows how the transition from the DO-CDR operations costs to the current costs have been accomplished. If the government operated this plant in the typical management and operating (M&O) contractor manner, where all M&O costs are reimbursed to the contractor, a cost of more than $62M/year would result, not including fees to the M&O contractor. As will be seen below, option 2 of the DOE mission contract provides for a different funding concept for MOX FFF operations, that is, one in which the contractor bears most of the cost risk.

3.3 FUEL DISPLACEMENT CREDIT

The use of partial MOX reloads is projected to save $86M/year (for 10 years for a total of $860M) in LEU fuel purchase costs for the LEU assemblies which were displaced by MOX assemblies. This savings assumes that LEU fuel costs are $1127/kgU based on the following LEU component costs: $12/lb U_3O_8 (ore), $5/kgU (natural U_3O_8 to UF_6 conversion), $90/SWU (enrichment service), and $180/kgU (PWR assembly fabrication). An enrichment tails assay of 0.3% ^{235}U is assumed along with a 10% carrying charge on the LEU assembly total cost. Table 3

Table 2. Adjustment of MOX FFF recurring costs from DO-CDR values to reflect revised mission

Expense	Annual cost	Comment
Breakdown of DO-CDR MOX recurring (operations) costs (SRS revision)		
10 years of operations // 195 PWR assemblies/year	**(1997 $M/year)**	
Direct and indirect labor not including 10% fee	29.47	Based on staff of 350 without aqueous polish @ $84,200/year average
UF_6 to UO_2 conversion and transport to MOX FFF	0.50	DUF_6 to DUO_2 conversion service in $6–7/kgU range
Zirconium and stainless steel assembly hardware	11.20	Based on 195 PWR assemblies/year
Other consumables[a]	8.00	Based on 195 PWR assemblies/year
Regulation and inspection[b]	3.00	$3M/year in 1997 dollars per DO-CDR paid to NRC
Utilities (gas, water, electricity)[b,c]	0.50	Funded by DOE through site
Waste disposal[a,b,c]	1.30	Assumes no aqueous polishing
Imbedded fee (10% added to staffing by F-D)	2.95	To be replaced with consortium fee
Annual total per DO-CDR adjusted for SRS	56.92	
Adjustment of DO-CDR MOX recurring (operations) costs[c]		
10 years of operations // 164 PWR assemblies: adjusted for aqueous polish, number of assemblies, fee	**(1999 $M/year)**	
Direct and indirect labor not including 10% fee markup (SRS)	30.20	Based on staff of 350 without aqueous polish @ $86,285/year (1999$)
Additional operations for aqueous polishing (SRS)	8.10	Adds 85 additional staff plus other in-plant costs
UF_6 to UO_2 conversion and transport to MOX FFF	0.50	Conversion service in $6–7/kgU range
Zirconium and stainless steel assembly hardware	9.42	Based on 164 PWR assemblies/year
Other consumables[a]	6.73	Based on 164 PWR assemblies/year
Regulation and inspection[b]	3.11	To be paid to NRC
Utilities (gas, water, electricity)[b,c]	0.52	To be in budget of SRS as GFS
Waste disposal[b,c]	3.17	Adds handling of additional wastes[d]
Imbedded fee (10% added to staffing by FD in DO-CDR)	0.00	To be replaced with consortium fee later
Total per adjustments	61.75	
	–6.80	Annual government supplied services (utilities, regulation, infrastructure, waste disposal)
	54.95	Annual costs to DCS

[a] Chemicals, maintenance materials. etc.
[b] Indicates government supplied service.
[c] Also to be in SRS budget as GFS.
[d] Table 5 escalates these to year 2000 constant dollars.

Table 3. Material and service components of LEU fuel displaced by MOX fuel

Commercial cost basis	Unit fuel assembly basis ($M)	Component (%)	Cost ($/kg LEU)
Uranium ore component	0.136	26.06	294
Conversion (U_3O_8 to UF_6) component	0.022	4.18	47
SWU component (enrichment)	0.234	44.70	504
Bundle fabrication UF_6 to UO_2	0.084	15.97	180
Carrying charge	0.048	9.09	102
Total	0.523	100.00	1127[a]

[a] Before any discounts to utility, value of all displaced LEU is ~$860M over mission life.

shows how the LEU costs break down on a per assembly and per kilogram of enriched uranium (EU) basis. The average enrichment of the LEU assemblies for an all-LEU core is assumed to be 4.17% ^{235}U which is typical of the fuel used in Duke Power Company PWRs. Because of the significant fuel savings, DOE has specified in its contract with DCS that DCS pay the majority of the MOX plant operational (recurring) cost. DCS has in turn requested a significant discount on the projected cost of the LEU displaced, that is, a reduced effective credit to the government. This discount is perceived to compensate the DCS participating utilities for the financial risk being taken to their multibillion dollar nuclear plant assets. The actual displacement credit will depend on the following factors: (1) the LEU constituent material and service prices at the time that the core reload order is made with the LEU fabricator, (2) the actual cost of operating the MOX FFF during the preceding operating cycle, (3) the fee required by the MOX FFF licensed operator, (4) cost/benefit sharing clauses in the DCS contract, and (5) the cost of government-furnished services (GFS) such as utilities and infrastructure cost from the FFF host site that have been provided by DOE. In simplistic terms, the government pays, or is paid, the difference between the discount-adjusted value of the LEU fuel displaced and the experienced cost of producing the MOX assemblies required for the reload. This will be a continuing issue because, on average, 2.5 reload batches of MOX fuel will be needed each year of operation. For the hypothetical case presented here, a credit of $568M is assumed. This credit reduces DOE's program cost for operation of the FFF from $763M to $195M for 10 years of MOX FFF operations including the cost of the original hot startup of the MOX FFF. This hypothetical credit represents a significant discount to the utilities on the market value ($860M) of displaced LEU fuel.

The actual multiplication factor (ratio of discounted LEU fuel value to the market LEU value) was negotiated between DOE and DCS. The factor is business sensitive and cannot be publicly released but is between 0.5 and 0.9. A value of approximately 0.7 was used in this estimate.

3.4 MOX FFF END-OF-LIFE COSTS

DCS will be responsible for deactivation of the MOX FFF after 10 years of operation. This task, which involves removal of process plutonium from the glove boxes and sealing of the boxes, has been assigned a ceiling cost to DOE of $10M. The actual price will be determined when option 3 of the DOE contract is negotiated.* An additional $49M will be needed by the host site for costs associated with removal of the equipment and glove boxes from the building, radwaste disposal,

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*The DCS "base contract" covers design of the MOX FFF, design of reactor modifications, fuel qualification, and preparation and submittal of the MOX FFF license application. Contract option 1 covers MOX FFF construction and cold startup plus modification of reactors. Contract option 2 includes hot startup of the MOX FFF, "at-risk" (financial) operation of the MOX FFF, and incremental cost of operation of the six reactors on MOX fuel. Contract option 3 covers deactivation of the MOX FFF.

and return of the building to a habitable condition for possible use by other DOE missions. This amount also includes funding for the NRC to approve the deactivation plans.

3.5 IRRADIATION SERVICES

The ~\$136M in nonfuel qualification reactor-related up-front costs are for core design, reactor system modification design, and actual modification and licensing of the six PWRs for use of partial MOX cores. The modification cost estimate is based on the 1996 Reactor Alternative Summary Report (RASR) studies.[4] In the future, DCS will produce a reactor modification plan and design concept that will provide a more accurate estimate of system modification costs. A new cost, schedule, and technical baseline for irradiation services will be developed within the next 2 years.

The \$150M in projected operational costs and fees (to utilities and DCS home office) is spread over 12 years for reactor incremental operational costs, such as extra personnel, more boron chemical additions, and possible new types or additional control rods. Fuel loading costs are spread over 10 years to align with the period of MOX FFF operations and to avoid the storage of hundreds of MOX fuel assemblies; however, reactor operations, which are based upon utility commitments, etc., will probably dictate some variations from the base plan. There is also a small incremental charge related to the need to increase the amount of ^{235}U enrichment in LEU assemblies which are located adjacent to fresh MOX assemblies (4.3% ^{235}U vs 4.17% in an all-LEU core). This need is brought about to reduce neutron flux peaking at certain regions of the mixed core. This reactor physics-related difference results in additional uranium and enrichment charges to the utility from the LEU fabricator during the MOX mission.

The use of MOX in PWRs is not projected to impose any additional large facility deactivation, reactor D&D, or spent fuel disposal charges on the participating utilities. A \$9M/year incremental operations charge (part of the \$150M total above) is included to cover any additional boron chemicals, transportation or storage casks, control rods, etc., required by MOX use. Table 4 shows the fuel cycle parameters for the disposition mission assumed in this report.

3.6 TRANSPORTATION

A total mission cost of approximately \$10M is projected for SST transport of the fresh MOX fuel assemblies from the MOX FFF to the three reactor sites. SRS was assumed as the point of origin. A special three-bundle transportation package to be designed and fabricated by DCS will be used. The up-front cost of acquiring the eight mission transportation packages is estimated at approximately \$2M. The remaining \$5M in up-front costs is assumed to cover contractor, national laboratory, and NRC shipping package certification activities.

3.7 LCC TABLES

Table 5 presents the LCCs in the same format used to prepare the DOE/MD LCC document[2] supporting the ROD and is designed to show how data from the MOX FFF DO-CDR were utilized. In that study,[2] similar cost categories are utilized to present PDCF and immobilization LCCs along with those for the reactor-based option. Total reactor-based LCCs are approximately \$1.4 billion in constant FY 2000 dollars. These costs do not include the LCCs of the PDCF.

Table 6 compares the LCCs reported here to those projected in the 1996 ORNL RASR studies.[4] The reasons for the cost increases or decreases are shown on the table.

In summary, this new estimate is more accurate than the 1996 estimate because most data are now derived from conceptual design reports (the DO-CDR) and from projections made by the contractor, DCS, who will actually implement the program. It is also apparent that the risk-sharing consortium concept being implemented should result in significant savings to DOE and taxpayers over a hypothetical similar mission performed in the usual DOE GOCO contractor mode.

Table 4. Fuel cycle data on which LCCs (MOX FFF and irradiation services) are based

Attribute	Value	Comments
Total plutonium available for reactor-based disposition,[a] MT	33	Basic assumption in DO-CDR
Duration of operations for MOX FFF and initial loading of PWRs,[a] years	10	Basic assumption in DO-CDR
PWRs available[a]	6	Publicly announced by DCS[b] on March 22, 1999
HM mass of a fuel assembly, MT/assembly[a]	0.464	Typical mass of Westinghouse PWR assembly (HM)
PWR MOX assemblies/year per DO-CDR[a]	164	DO-CDR gives 195 as maximum for PWR, DCS suggests 164
Average throughput of MOX FFF, MT/year of HM	76.1	Calculated from two entries above
Annual plutonium throughput, MT/year	3.3	Calculated for 10-year campaign
Average plutonium concentration in HM (mass fraction) for MOX assemblies	0.0434	Calculated from two entries above
Average power capacity of PWR,[a] MW(e)	3411	Typical of Westinghouse reactor such as McGuire or Catawba
Fuel assemblies in PWR core (Westinghouse PWR)[a]	193	Typical of Westinghouse reactor such as McGuire or Catawba
Average time between refuelings, years	1.5	Typical of Westinghouse reactor such as McGuire or Catawba
Reloads per reactor over mission	6.67	Calculated
Total reloads for all reactors in mission	40	Calculated
Total assemblies (MOX + LEU) in a partial MOX PWR reload[a]	84	Typical of Westinghouse reactor such as McGuire or Catawba
Co-resident LEU assemblies in a partial MOX reload[a]	43	
LEU assemblies in an all-LEU reload[a]	84	
MOX assemblies available per reload (averaged)[c]	41	Calculated
Fraction of entire core that is MOX at equilibrium	0.49	Calculated (if mission load time were increased, this fraction would be lower)
Fraction of entire core that is reloaded at each refueling for MOX	0.44	Assumes MOX fuel twice burned
Fraction of all-LEU core that is reloaded at each refueling	0.44	Most fuel twice burned, some thrice burned
Average ^{235}U enrichment of all-LEU core (needed for LEU credit calculation)[a]	0.0417	Typical of Westinghouse reactor such as McGuire or Catawba
Average ^{235}U enrichment of co-resident LEU [surrounds MOX, needed for uranium enrichment (UE)-penalty calculation][a]	0.043	Typical of Westinghouse reactor such as McGuire or Catawba
LEU assemblies used in campaign if no MOX (for calculation of LEU reload value)	3360	Based on DCS data
Co-resident LEU assemblies used in MOX campaign (for calculation of UE-penalty)	1720	
LEU assemblies displaced by MOX during campaign (for calculation of displaced credit)	1640	

[a] Indicates that value is an input to model.

[b] Note: For simplicity all 6 DCS reactors are assumed to be the same size (in reality North Anna is somewhat smaller than Duke Power reactors).

[c] The actual fuel cycles will be designed by utilities to match their fuel requirements for their particular reloads. The actual reload configurations will be more complicated than represented in this illustrative example. The above idealized fuel cycle was designed to correspond to the NEPA MOX FFF 10-year operational requirement.

Table 5. Reactor program cost estimate summaries by major categories FY 2000 undiscounted dollars, including transitions from original MOX FFF DO-CDR

TITLE OF CATEGORY	ORIGINAL DO-CDR VALUE (1997$) NO AQUEOUS POLISHING (A)	TRANSFORMED DO-CDR VALUE INCLUDES ESCALATION of DO-CDR TO FY2000 (B)	MOX FFF&IRRAD CONTRACTOR (DCS VALUE) (FY2000$) (C)	VALUE SELECTED $ FOR ROD COST REPORT (FY 2000$) (D=B or C)	SOURCE OF ESTIMATE	WSRC/SRO TASKS (Reviews & Oversight) (FY2000$) (E)	LANL/LLNL/ ORNL & OTHER LAB SUPPORT (FY2000$) (F)	Federal/DOE Costs (OTHER) Include NRC (FY2000$) (G)	Total including Escalation (FY2000$) (H=D+E+F+G)	Table 1 column and row
ENGINEERING OF MOX FFF										
DESIGN TITLE I & II (Non-Aqueous Polishing Portion)	$50,371,533	$51,530,078 26	$50,400,000	$50,400,000	DCS Base No				$50,400 000	
AQUEOUS POLISHING PORTION TITLE I &II			$12,600,000	$12,600 000	DCS (KAW)				$12,600 000	
OTHER: DCS MGT RES + LIC FEES + WSRC LIC SUPPORT				$8 782,000	DCS (KAW)	$1,000,000			$9,782,000	
MD MANAGEMENT RESERVE (10%) FOR ENGINEERING ACTIVITIES					HQ Guid			$7,178 200	$7,178 200	
SUBTOTAL ENGINEERING	$50,371,533	$51 530 078	$64,130,078	$71,782 000		$1 000 000		$7,178 200	$79,960,200	
CONSTRUCTION OF MOX FFF										
EQUIPMENT (PROCUREMENT)	$88,587,740	$92,981,514 73		$92,981,515	DOCDR				$92,981,515	
SITEWORK	$9,953,508	$10,447,182 09		$10,447,182	DOCDR				$10,447,182	
PROCESS FACILITY PACKAGE	$68,851,119	$72,265,996 80		$72,265,997	DOCDR				$72,265,997	
SUPPORT FACILITY PACKAGE	$32,622,108	$34,240,099 31		$34,240,099	DOCDR				$34,240,099	
CONSTRUCTION CONTINGENCY 38.5%	$77,005,573	$80,824,895 28		$80,824,895	DOCDR				$80,824,895	
NON-NRC COMPLIANCE AND PERMITS	$1,950,000	$2,046,716 10		$2,046,716	DOCDR	$1,000,000			$3,046,716	
CONSTRUCTION LICENSING Incl PSAR			$24,000,000	$24,000,000	DCS	$480,000			$24,480,000	
TITLE III	$15 209 937	$15 964 319 46		$15,964,319	DOCDR	$1 600 000			$17 564,319	
CONSTRUCTION CONTRACT AWARD FEE (6%) (assume separate construction contractor with M&O as manager)					NA					
AQUEOUS POLISHING ADD ON			$69,300,000	$69,300,000	DOE				$69,300,000	
TITLE III - Aqueous Polishing Add-On			$3 465,000	$3 465 000	DOE				$3,465,000	
CONSTRUCTION & PROJ. MANAGEMENT	$41,751,343	$43,822,126 11		$43,822,126	DOCDR				$43,822,126	
SRS SITE M&O CONSTRUCTION & PROJECT MANAGEMENT SUPPORT				-	KAW	$4,369,326			$4,369,326	
DCS FEE FOR CONSTRUCTION MANAGEMENT (7% ESTIMATED)			$29 360 395	$29 360 395	DCS				$29 360,395	
SUBTOTAL CONSTRUCTION	$335,931,328	$352,597,847	$126,125,395	$478,718,245		$7,449,326			$486,187,571	
								TEC=	$566,127,771	[2B]
OTHER PROJECT COSTS (OPC) - MOX FFF										
SUNK COSTS (SPENT PRIOR 1QTR FY2000)					DOE			$102,296,000	$102,296,000	
NRC LICENSING ACTIVITIES					DOE			$3,500,000	$3,500,000	
SRS SUPPORT TO DESIGN (REQUIREMENTS DEFINITION)					KAW	$3,000,000			$3,000,000	
START UP (Cold) W/CONTINGENCY (Chosen ROD value DO-CDR less $50M Hot Startup via DCS Option 2)		$48 223 583		$48,223,583	DOCDR	$500,000			$48,723 583	
SUBTOTAL OPC-MOX FFF		$48,223,583		$48,223,583		$3,500,000		$105,796,000	$157,519,583	[2A]
								TPC=	$723,847,354 including sunk costs	

[ ] Indicates column/row number of Table 1 subtotal that includes Table 5 entry

Table 5. (continued)

TITLE OF CATEGORY	ORIGINAL DO-CDR VALUE (1997$) NO AQUEOUS POLISHING	TRANSFORMED DO-CDR VALUE INCLUDES ESCALATION of DO-CDR TO FY2000	MOX FFF&IRRAD CONTRACTOR (DCS VALUE) (FY2000$)	VALUE SELECTED $ FOR ROD COST REPORT (FY 2000$)	SOURCE OF ESTIMATE	WSRC/SRO TASKS (Reviews & Oversight) (FY2000$)	LANL/LLNL/ ORNL & OTHER LAB SUPPORT (FY2000$)	Federal/DOE Costs (OTHER) Include NRC (FY2000$)	Total including Escalation (FY2000$)	Table 1 column and row
OPERATING COSTS OF MOX FFF (see Table 2 for transition from DOE-CDR)										
LICENSING DURING OPERATIONS (NRC Inspections/ a Gov't supplied service to DCS)	$30,000,000	$31,487,940			DOCDR			$31,487,940	$31,487,940	
MOX FFF LABOR (including aqueous polish) includes operations & maintenance	$315,560,000	$392,879,674		$392,879,674	DOCDR				$392,879,674	
CONSUMABLES (non-rod/bundle parts) (and DOCDR Maintenance of Equip)	$88,229,200	$69,031,385		$69,031,385	DOCDR				$69,031,385	
UTILITY COSTS (a Gov't Supplied service to DCS via SRS)	$4,946,000				DOCDR	$5,309,550			$5,309,550	
TRU / LLW DISPOSAL COSTS (A Gov't supplied service to DCS, incl aq polish wst, via SRS)	$13,000,000	$13,299,000		$13,299,000	DOCDR	$19,114,380			$32,413,380	
UO2 CONVERSION	$4,950,000	$5,130,000		$5,130,000	DOCDR				$5,130,000	
ROD &ASSEMBLY PARTS PURCHASED OFF-SITE	$112,500,000	$96,643,938		$96,643,938	DOCDR				$96,643,938	
NOTE TOTAL ABOVE OPERATING COSTS FROM SRS DOCDR = $569,185,800										
9 MO MOX-FFF HOT START & OPS(INCL AQUEOUS POL & GES/C)	$50,000,000	$51,300,000		$51,300,000	DOE DCS	$7,695,000		$3,100,000	$62,095,000	
10 YR IMBEDDED "FEE" TO DCS FOR MOX OPERATIONS			$67,642,200	$67,642,200	DCS				$67 642 200	
SUBTOTAL	$619,185,200	$659,771,937		$659,771,937		$32,118,930		$34,587,940	$762,633,067	[2F]
DECOMMISSIONING (OPC) - MOX FFF										
DEACTIVATION OF MOX-FFF BY DCS			$10,000,000	$10,000,000	DCS				$10,000,000	
DECOMMISSIONING (10% CONSTRUCTION $ minus DCS DEACTIV) BY SRS	$34,011,600				DOCDR/DOE	$47,588,042			$47,588,042	
FEE TO DCS-LLC DURING DEACTIVATION ($0.25M/YR)			$500,000	$500,000	DCS			$500,000	$1,000,000	
SUBTOTAL	$34,011,600			$10,500,000		$47,588,042		$500,000	$58,588,042	[2H]
REACTOR RELATED COSTS										
NON FUEL QUAL R&D SUPPORT (Mostly ORNL Reactor-related Tasks)	•				DCS		$24,100,000		$24,100,000	[D3]
FUEL QUAL TEST FUEL PROGRAM INCL PIE AND ATR COSTS†	•								0	
FUEL QUAL LTA PROGRAM LTA FAB SITE (LANL/TA-55)	•				DCS		$78,038,500		$78,038,500	[D1]
FUEL QUAL LTA PROGRAM(DCS) INCL PIE(ORNL) & AQ POL	•		$22,100,000	$22,100 000	DCS		$2,000 000	$500 000	$24 600 000	[D1]
SUBTOTAL - ONGOING DEVELOPMENT			$22,100,000	$22,100,000			$104,138,500	$500,000	$126,738,500	

[ ] Indicates column/row number of Table 1 subtotal that includes Table 5 entry

†Zero entry assumes no ATR testing beyond samples presently being irradiated

Table 5. (continued)

TITLE OF CATEGORY	ORIGINAL DO-CDR VALUE (1997$) NO AQUEOUS POLISHING	TRANSFORMED DO-CDR VALUE INCLUDES ESCALATION of DO-CDR TO FY2000	MOX FFF&IRRAD CONTRACTOR (DCS VALUE) (FY2000$)	VALUE SELECTED $ FOR ROD COST REPORT (FY 2000$)	SOURCE OF ESTIMATE	WSRC/SRO TASKS (Reviews & Oversight) (FY2000$)	LANL/LLNL/ ORNL & OTHER LAB SUPPORT (FY2000$)	Federal/DOE Costs (OTHER) Include NRC (FY2000$)	Total Including Escalation (FY2000$)	Table 1 column and row
REACTOR RELATED COSTS (continued)										
5 YR DCS HOME OFFICE MANAGEMENT	•		$13,300,000	$13,300,000	DCS	$200,000			$13,500,000	[D3]
REACTOR MODIFICATION DESIGN & PLANNING	•		$10,500,000	$10,500,000	DCS		$200,000		$10,700,000	[D3]
REACTOR CORE DESIGN, MGT PLAN, & OPERATION PLAN	•		$3,400,000	$3,400,000	DCS		$400,000		$3,800,000	[D3]
REACTOR LIC. PLAN, LIC. AMENDMENT APPL, RL REPORT & PERMT'G	•		$2,700,000	$2,700,000	DCS		$200,000	$1,100,000	$4,000,000	[D3]
DESIGN/DEVELOPMENT/FAB/PROC OF LTA SHIPPING CASK (MO-1)	•		$500,000	$500,000	DCS		$500,000	$100,000	$1,100,000	[D4]
MISSION MOX TRANSPORTATION PLANNING & CASK CERTIFICATION	•		$100,000	$100,000	DCS		$4,000,000	$500,000	$4,600,000	[D4]
FEE TO CONTRACTOR FOR BASE CONTRACT (nonFFF related)	•		$4,189,000	$4,189,000	DCS				$4,189,000	[D1]
REACTOR MODIFICATION INCLUDING EQUIPMENT & SITE MODS	•		$75,001,207	$75,001,207	DCS				$75,001,207	[D3]
PROCUREMENT OF MISSION FRESH SHPING CASKS	•		$1,500,000	$1,500,000	DCS				$1,500,000	[D4]
REACTOR LICENSE AMENDMENT ACTIVITIES NOT IN BASE CONTRACT	•		$2,700,000	$2,700,000	DCS		$1,000,000	$4,400,000	$8,100,000	[D1]
MD MANAGEMENT RESERVE FOR DCS BASE CONTRACT ACTIVITIES	•				DOE			$4,800,000	$4,800,000	[D1]
MD MANAGEMENT RESERVE FOR DCS OPTION-1 ACTIVITIES	•				DOE			$8,400,000	$8,400,000	[D3]
"FEE" TO DCS-LLC DURING OPTION 2	•		$12,000,000	$12,000,000	DCS				$12,000,000	[F3]
TRANSPORTATION OF PuO2 FROM PDCF TO MOX-FFF (N/A)	•				DOE				0	
TRANSPORTATION OF FRESH FUEL TO REACTOR (SST OPS)	•				DOE			$9,700,000	$9,700,000	[F4]
12 YR INCREMENTAL REACTOR OPERATIONS COSTS DUE TO USE OF MOX	•		$108,000,000	$108,000,000	DCS				$108,000,000	[F3]
COST OF ADDITIONAL ENRICHMENT/ORE (ABOVE ALL LEU) IMPOSED BY MOX FOR CO-RES LEU	•		$29,600,000	$29,600,000	DCS				$29,600,000	[F3]
INCREMENTAL POOL STORAGE/ON-SITE STORAGE/REPOSITORY COSTS FOR SF	•									
SUBTOTAL			$263,490,207	$263,490,207		$200,000	$6,300,000	$29,000,000	$298,990,207	
EFFECTIVE CREDITS TO GOVERNMENT - VALUE OF LEU RELOADS ADJUSTED FOR DISCOUNT (DOE COSTS ARE AUDIT COSTS)			($574,746,192)	($574,746,192)			$2,000,000	$5,000,000	($567,746,192)	[2G]
TOTAL ESTIMATED PROJECT COST	$1,131,516 977			$979,839,781		$91 856 297	$112,438,500	$182 562,140	$1,402,850,979	

[ ] Indicates column/row number of Table 1 subtotal that includes Table 5 entry

	FROM ABOVE	ROUNDED COSTS*
SUNK COSTS	$102,296,000	$100,000,000
ONGOING DEVELOPMENT	$126,738,500	$125 000,000
DESIGN & CONSTRUCTION OF THE MOX FFF	$621 351,354	$620,000 000
OPERATIONS OF THE MOX FFF	$821,221,109	$820 000 000
EFFECTIVE VALUE OF FUEL	($567,746,192)	$565 000 000
COST TO CONSTORTIUM REACTORS	$289 290 207	$290,000,000
TRANSPORTATION	$9,700,000	$10 000 000
TOTAL	$1,402 850,979	$1,400,000 000

*Basis of numbers appearing on Table ES-1 of Ref 7

Table 6. Comparison of 1996 RASR LCCs to those in this study

Facility or activity	1996 RASR cost[a] (1996 constant $M)	This study[a] (2000 constant $M)	Explanation of increased cost (or decreased credit)
Fuel qualification (a reactor-related cost in RASR)	36	120	More extensive fuel qualification program assumed.
MOX FFF	1111	1545	Aqueous polishing step added to scope. New building rather than existing building (RASR case) assumed.
LEU displacement credit	–925	–568	LEU value discounted to compensate utilities. RASR cost was not discounted.
Modified reactors (including transportation of bundles)	528	303	RASR assumed large irradiation fee based on $5M to $13M per reactor-year. This report gives incentive to utilities with discount on LEU value rather than by large irradiation fee.
Total	750	1400	

[a] Both cases assume 33-MT reactor-based plutonium mission. RASR LCCs formed the basis for the 1996 TSR (Ref. 3).

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Attachment 25
Table 25-1. Weight Percent of Isotopes for WSB Operations

Weight percent of each isotope (wt%)

Isotope	PDCF Lab Liquid Waste (note 1)			PDCF Lab Concentrated Liquid Waste			MFFF Stripped Uranium Waste Stream			MFFF High Alpha Waste Stream (22,000 gallons per year)		
	Concentration			Concentration			Concentration			Concentration		
	grams/liter	wt fraction	wt% (note 2)	grams/liter	wt fraction	wt% (note 2)	grams/liter	wt fraction	wt% (note 2)	grams/liter	wt fraction	wt% (note 2)
Pu-238	1.480E-07	2.706E-04	2.706E-02	1.270E-02	2.857E-04	2.857E-02	5.000E-08	3.728E-09	3.728E-07	8.000E-07	4.404E-06	4.404E-04
Pu-239	2.740E-04	5.010E-01	5.010E+01	2.340E+01	5.265E-01	5.265E+01	9.000E-05	6.711E-06	6.711E-04	1.440E-03	7.927E-03	7.927E-01
Pu-240	1.930E-05	3.529E-02	3.529E+00	1.640E+00	3.690E-02	3.690E+00	9.000E-06	6.711E-07	6.711E-05	1.440E-04	7.927E-04	7.927E-02
Pu-241	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.000E-06	7.456E-08	7.456E-06	1.600E-05	8.807E-05	8.807E-03
Pu-242	2.960E-07	5.412E-04	5.412E-02	2.530E-02	5.692E-04	5.692E-02	1.000E-07	7.456E-09	7.456E-07	1.600E-06	8.807E-06	8.807E-04
Am-241	2.960E-06	5.412E-03	5.412E-01	2.530E-01	5.692E-03	5.692E-01	0.000E+00	0.000E+00	0.000E+00	1.800E-01	9.908E-01	9.908E+01
U-232	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.340E-06	9.991E-08	9.991E-06	9.540E-12	5.251E-11	5.251E-09
U-233	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.340E-02	9.991E-04	9.991E-02	9.540E-08	5.251E-07	5.251E-05
U-234	2.500E-06	4.571E-03	4.571E-01	1.910E-01	4.297E-03	4.297E-01	2.680E-01	1.998E-02	1.998E+00	1.910E-06	1.051E-05	1.051E-03
U-235	2.330E-04	4.260E-01	4.260E+01	1.780E+01	4.005E-01	4.005E+01	7.770E+00	5.794E-01	5.794E+01	5.530E-05	3.044E-04	3.044E-02
U-236	1.250E-06	2.285E-03	2.285E-01	9.550E-02	2.149E-03	2.149E-01	5.360E+00	3.997E-01	3.997E+01	3.820E-06	2.103E-05	2.103E-03
U-238	1.350E-05	2.468E-02	2.468E+00	1.030E+00	2.317E-02	2.317E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Totals	5.470E-04	1.000E+00	1.000E+02	4.445E+01	1.000E+00	1.000E+02	1.341E+01	1.000E+00	1.000E+02	1.817E-01	1.000E+00	1.000E+02

Isotope	High Activity Evaporation Feed			High Activity Evaporation Bottoms			High Activity Evaporation Overheads		
	Concentration			Concentration			Concentration		
	grams/liter	wt fraction	wt% (note 2)	grams/liter	wt fraction	wt% (note 2)	grams/liter	wt fraction	wt% (note 2)
Pu-238	1.740E-06	2.720E-05	2.720E-03	1.480E-05	2.715E-05	2.715E-03	1.990E-10	2.722E-05	2.722E-03
Pu-239	3.120E-03	4.877E-02	4.877E+00	2.660E-02	4.879E-02	4.879E+00	3.570E-07	4.883E-02	4.883E+00
Pu-240	3.120E-04	4.877E-03	4.877E-01	2.660E-03	4.879E-03	4.879E-01	3.570E-08	4.883E-03	4.883E-01
Pu-241	3.470E-05	5.424E-04	5.424E-02	2.960E-04	5.430E-04	5.430E-02	3.970E-09	5.431E-04	5.431E-02
Pu-242	3.470E-06	5.424E-05	5.424E-03	2.960E-05	5.430E-05	5.430E-03	3.970E-10	5.431E-05	5.431E-03
Am-241	5.750E-02	8.988E-01	8.988E+01	4.900E-01	8.989E-01	8.989E+01	6.570E-06	8.987E-01	8.987E+01
U-232	3.000E-10	4.689E-09	4.689E-07	2.560E-09	4.696E-09	4.696E-07	3.430E-14	4.692E-09	4.692E-07
U-233	3.000E-06	4.689E-05	4.689E-03	2.560E-05	4.696E-05	4.696E-03	3.430E-10	4.692E-05	4.692E-03
U-234	6.000E-05	9.379E-04	9.379E-02	5.120E-04	9.392E-04	9.392E-02	6.860E-09	9.384E-04	9.384E-02
U-235	1.740E-03	2.720E-02	2.720E+00	1.480E-02	2.715E-02	2.715E+00	1.990E-07	2.722E-02	2.722E+00
U-236	1.200E-03	1.876E-02	1.876E+00	1.020E-02	1.871E-02	1.871E+00	1.370E-07	1.874E-02	1.874E+00
U-238	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Totals	6.397E-02	1.000E+00	1.000E+02	5.451E-01	1.000E+00	1.000E+02	7.310E-06	1.000E+00	1.000E+02

Notes

1. Based on total Pu receipts of 7.0 grams per year and total U receipts of 5.9 grams per year.
2. Weight percent would be the isotopic fraction of the isotope of concern in percent while the weight fraction is the concentration or abundance of the isotope of concern.
3. The total inventory of a specific radionuclide would be that concentration given above mulitplied by the liters (or gallons) of Material at Risk for each accident

Table 25-2. Inventory for WSB Events

WSB Event Number	WSB Accident	Inventory Impacted Gallons	Total Inventory Impacted Grams *
	FIRES		
1 2 1	Fire MFFF High Alpha Storage	2 500E+03	1.719E+03
4 2 1	Fire High Activity Head Tank	1 500E+03	1 031E+03
9 2 5	Fire High Activity Evaporator Cell	5.280E+02	1 089E+03
10 2.1	Fire High Activity (HAW) Bottoms Cell	5 280E+02	1 089E+03
12 2 1	Fire HAW Neutralization Tank	5.280E+02	1 089E+03
14 6.1	Fire High Activity Cement Cell	1 000E+02	6 876E+01
16 1.2	Full Facility Fire Composed of 4 streams		
	*MFFF High Alpha Waste	6 500E+03	4 469E+03
	*HAW Bottoms	1.500E+03	3 095E+03
	*HAW Overheads	4 000E+03	1 107E-01
	*PDCF Lab Concentrate	1 600E+01	3 312E-02
16 1 5	Area Fire in Low Activity Areas Composed of 5 streams *Storage Tanks and Head Tank (5 tanks as follows **)	1 860E+04	6 904E+05
	**PDCF Lab Liquids 2 tanks 2,500 gal each	5 000E+03	1 035E+01
	**MFFF Stripped Uranium Receipt 2 tanks 4,000 gal each	8 000E+03	4 061E+05
	**Low Activity Head Tank	5 600E+03	2 843E+05
	*Low Activity Bottoms	1.500E+03	7 614E+04
	*Low Activity Overheads	6 000E+03	3 046E+05
	*Effluent Bottoms	1.000E+03	2 070E+00
	*Effluent Overheads	6 000E+03	1 242E+01
16 1 6	Area Fire PDCF Lab Concentrate	1 600E+01	2 692E+03
	HYDROGEN DEFLAGRATIONS		
1.9.2	H2 Deflagration in MFFF High Alpha Storage Tank	2 500E+03	1 719E+03
2 9 2	H2 Deflgration in MFFF Stripped U Storage Tank	4 000E+03	2 031E+05
3 9 2	H2 Deflagration in PDCF Lab Liquid Sorage Tank	2 500E+03	5 176E+00
4 9 2	H2 Deflagration in High Activity Head Tank	4 500E+03	3 094E+03
5 9 2	H2 Deflagration in Low Activty Head Tank	5 600E+03	2 843E+05
9 6 1 & 9 6 2	H2 Deflagration in the Evaporators	1.000E+03	2.063E+03
10 9.2	H2 Deflagration in the HAW Bottoms Tank	5 280E+02	1 089E+03
11.9.2	H2 Deflagration in the LAW Bottoms Tank	1.500E+02	7 614E+03
12 8.2	H2 Deflagration in the HAW Neutralization Tank	1 000E+03	2 063E+03
13 8 2	H2 Deflagration in the LAW Neutralization Tank	2.000E+02	1 015E+04
	ACID - BASE REACTIONS		
4.2 2 & 4 7 1	High Activity Head Tank	1 500E+03	1 031E+03
6 4 1 & 8 3.2 & 9 2 1	High Activity Evaporator	5.280E+02	1 089E+03

10 2 2 & 10 7 1	HAW Bottoms Tank	5 280E+02	1 089E+03
	RED OIL EXPLOSION		
6 5 1	HAW Evaporator	5 280E+02	1 089E+03
	OVERPRESSURIZATION EVENTS		
7 1.1 & others	HAW Evaporator Overpressurization	5 280E+02	1 089E+03
	NPH EVENTS		
16 1.1	Facility Wide Spill from NPH (composed of 6 streams)		
	*MFFF High Alpha Waste Storage	5000	3 438E+03
	*MFFF High Alpha Waste Head Tank	1500	1 031E+03
	*High Activity Evaporator	500	1 032E+03
	*HAW Bottoms Tank	500	1 032E+03
	*HAW Neutralization Tank	500	1 032E+03
	*HAW Overheads Tank	4000	1 107E-01
16 1 3	Facility Wide Spill Plus a Fire from NPH		
	*MFFF High Alpha Waste Storage	5000	3 438E+03
	*MFFF High Alpha Waste Head Tank	1500	1.031E+03
	*High Activity Evaporator	500	1 032E+03
	*HAW Bottoms Tank	500	1 032E+03
	*HAW Neutralization Tank	500	1 032E+03
	*HAW Overheads Tank	4000	1.107E-01
16 1 4	Facility Wide Explosion from NPH		
	*MFFF High Alpha Waste Storage	5000	3 438E+03
	*MFFF High Alpha Waste Head Tank	1500	1 031E+03
	*High Activity Evaporator	500	1 032E+03
	*HAW Bottoms Tank	500	1 032E+03
	*HAW Neutralization Tank	500	1 032E+03
	*HAW Overheads Tank	4000	1.107E-01

Attachment 26

Plutonium Disposition Project PreConstruction Environmental Report

ESH-EMS-2002-1141
Rev. 0
June 26, 2002

Plutonium Disposition Program (PDP)
Preconstruction
Environmental Monitoring Report

P.D. Fledderman
Environmental Monitoring Section

SRS
savannah river site
™

Plutonium Disposition Program (PDP) Preconstruction Environmental Monitoring Report

Author

Westinghouse Savannah River Co. — Peter D. Fledderman — 6/26/02 Date

Approval

Pu Disposition Program
Westinghouse Savannah River Co. — James G. Angelos — 6/27/02 Date

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Table of Contents

List of Tables

List of Figures

EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) requires a preconstruction baseline environmental monitoring survey for new sites, facilities, or processes that have the potential for significant adverse environmental impacts. Westinghouse Savannah River Company has conducted such a survey for the Plutonium Disposition Program (PDP) projects and is providing this report to fulfill the DOE requirement. The survey was conducted in several steps, as follows:

- Compilation of existing environmental data and conditions near the proposed PDP sites
- Development of a monitoring plan to supplement insufficient and/or missing data
- Implementation of sampling and analyses specified in the monitoring plan

This report presents the results of all items initially required by the plan, as well as other additions and items of note identified during the survey.

Results of the preconstruction baseline environmental monitoring survey of the PDP sites (conducted from September 2000 to March 2002) are presented in this document. A variety of environmental media in and near the PDP sites was sampled and/or analyzed—including surface water, sediment in stream bottoms, macroinvertebrates, shallow (one-foot-deep) soil, and low-lying grassy vegetation—and ambient gamma exposure was measured. Ambient air monitoring was considered, but after an evaluation of the current Savannah Rive Site (SRS) surveillance program, it was determined that additional monitoring would not be required to meet survey objectives. Groundwater monitoring originally was excluded from this survey because of on-going groundwater reviews and investigations being performed by others. However, summary information regarding groundwater conditions evaluated by the other organizations in and around the PDP sites has been included in this report, with references to applicable reports for additional details.

Survey results indicate that concentrations of radiological and nonradiological contaminants generally are low—and similar to levels observed by the SRS environmental monitoring program. These concentrations are consistent with the location of the PDP sites, near F-Area.

Two items of note were identified during the survey:

1. Contaminated groundwater is underlying portions of the PDP sites. Groundwater contamination is related to historical nuclear and industrial activities inside E-Area and F-Area. Groundwater contaminants (primarily radionuclides and volatile organic compounds) occur in the Upper Three Runs Aquifer, approximately 80 to 130 feet below ground surface. This is documented within sites 2M (MFFF), 4, and 5. The quality of the groundwater under sites X (PDCF) and 1M has not been investigated and therefore is uncertain.
2. Construction and operating activities may have an impact on beryllium concentrations in air. SRS's Environmental Monitoring Section has examined this issue and concluded that it would be advisable to conduct a follow-up study to document preconstruction levels of beryllium in air. This recommendation is based on concerns relating to beryllium toxicity and the presence of low levels of beryllium in soil and sediment, which could be mobilized during construction activities.

These items are not expected to present limitations to any known PDP plans or objectives.

Diligence should be exercised during construction to manage the potential degradation of water quality in receiving streams by erodable soil present on or near the PDP sites. Likewise, groundwater north and east of F-Area has documented contamination, will continue to be the subject of ongoing SRS studies, and will require continuing interaction with federal and state regulators.

In summary, this survey has revealed no conditions that would prevent proceeding with the PDP projects in the area studied.

1. Introduction

This report provides the results of the survey and monitoring of existing environmental and ecological conditions conducted at areas identified as potential locations for the Savannah River Site's (SRS) Plutonium Disposition Project (PDP) facilities. The structure of this survey was based on the PDP Preconstruction and Preoperational Environmental Monitoring Plan (Fledderman 2000a), which was approved by the PDP Program and implemented beginning in October 2000. The purpose of monitoring and sampling the potentially affected ecosystems at the proposed PDP site before construction (preconstruction monitoring) or facility operation (preoperational monitoring) begins is to establish a baseline of existing radiological, chemical, physical, and biological conditions in the area. These baseline conditions will serve as a reference point to distinguish preexisting environmental conditions or contamination from any contamination or impacts resulting from PDP construction activities and operations. The monitoring also can identify environmental conditions that could be of concern to workers at the PDP sites.

Another goal of the preconstruction and preoperational environmental study is to develop an understanding of the critical pathways that would transport contaminants to human and other receptors. This is important in determining the appropriate types of media to be sampled. Preconstruction and preoperational environmental monitoring for the PDP will be performed according to U.S. Department of Energy (DOE) Order 5400.1 (DOE 1988). This monitoring, along with a review of existing historical data, establishes environmental baseline conditions for the PDP sites.

This report provides only the preconstruction environmental monitoring results. A decision regarding the need for, and extent of, preoperational environmental monitoring will be made at a later date. The results of this preconstruction environmental monitoring report will help to determine what type(s) of environmental monitoring would be needed during construction (preoperational) activities. Other factors—such as the potential impact of construction on local surface water runoff, groundwater, and ambient air—will be considered when determining the type(s) of environmental monitoring needed during construction.

In general, the report is organized into three sections, based on contaminant type and exposure pathway, as follows:

- *General Information*, which provides information on the PDP project and monitoring philosophy
- *Preconstruction Environmental Monitoring Plan*, which presents a summary/overview of the preconstruction baseline environmental monitoring plan elements
- *Survey Results*, which presents the monitoring results and provides relevant discussion

This document is intended to satisfy the requirements of DOE Order 5400.1 (DOE, 1988). The primary purpose of preoperational monitoring is to define current baseline conditions. However, the monitoring also provides data expected to be required for other purposes, namely, (1) identifying any contaminants that could be a safety concern for construction personnel and (2) providing information used in applying for environmental permits.

2.0 General Information

2.1 Project Description

As a result of the cold war, which ended in 1991, significant quantities of excess plutonium exist in both domestic and foreign stockpiles. As part of its stockpile stewardship responsibility, one of DOE's missions is to reduce the threat of nuclear weapons proliferation by disposing of surplus plutonium in the United States. This disposition must be completed in a timely and environmentally safe manner to ensure that surplus plutonium is converted into proliferation-resistant forms. DOE's disposition strategy allows for the immobilization of surplus plutonium and for its use as a mixed oxide fuel (MOX) in existing domestic commercial power reactors.

During development of the preconstruction environmental monitoring plan, the PDP project consisted of the following types of facilities:

- A facility for disassembling pits (weapons components) and converting the recovered plutonium, as well as plutonium from other sources, into plutonium dioxide suitable for disposition. This facility is referred to as the Pit Disassembly and Conversion Facility (PDCF).
- A facility for fabricating plutonium dioxide into a MOX fuel. This facility will be privately operated and licensed by the Nuclear Regulatory Commission; it is referred to as the MOX Fuel Fabrication Facility (MFFF).
- A facility for immobilizing surplus plutonium for eventual disposal in a geologic repository, pursuant to the Nuclear Waste Policy Act. This facility converts nonpit plutonium materials into plutonium dioxide suitable for immobilization; it is referred to as the Plutonium Immobilization Plant (PIP). In early 2002, DOE decided that the PIP option was not required, so this part of the project was cancelled.

The proposed sites for the PDP facilities are located along the existing F-Area perimeter, on the northeast and northwest sides. Six potential areas (including two supplemental areas) were identified initially for facility construction (figure 1). The PDCF will be located in Area X, and the MFFF will be located in Area 2 and Area 2A (these sites—which were later combined, expanded, and slightly moved—are now known as Area 2M). Additional details on, and descriptions of, the site—such as waste units, hydrology, existing monitoring locations and associated results, ecological impacts, etc.—can be found in Fledderman 2000a and Fledderman 2000b.

2.2 Purpose

The purpose of monitoring and sampling the potentially affected ecosystems at the proposed PDP site before construction (preconstruction monitoring) or facility operation (preoperational monitoring) begins is to establish a baseline of existing radiological, chemical, physical, and biological conditions in the area. These baseline conditions will serve as a reference point to distinguish preexisting environmental conditions or contamination from any contamination or impacts resulting from PDP construction activities and operations. The monitoring also can identify environmental conditions that could be of concern to workers at the PDP sites.

Another goal of the preconstruction and preoperational environmental study is to develop an understanding of the critical pathways that would transport contaminants to human and other receptors. This is important in determining the appropriate types of media to be sampled. Preconstruction and preoperational environmental monitoring for the PDP will be performed according to DOE Order 5400.1 (DOE 1988). This monitoring, along with a review of existing historical data, will be used to establish environmental baseline conditions for the PDP site.

3.0 Preconstruction Environmental Monitoring Plan

3.1 Introduction

The following sections describe monitoring conducted prior to initiating PDP construction. Activities that will continue through the construction or operation phases are not included, but will be developed as required at later dates. In summary, the PDP Preconstruction and Preoperational Environmental Monitoring Plan (Fledderman 2000a) calls for several surveys in which selected measurements and analyses will be performed that will define environmental conditions at the PDP site before construction. These surveys are intended to supplement routine monitoring actions—both in and around the project area and across SRS—in order to provide the required information. Water quality, soil contaminants, the concentration of radionuclides in vegetation, and types and abundance of biota will be assessed.

To obtain baseline environmental information on physical and chemical conditions at the PDP site prior to construction and/or operation, a variety of media—such as groundwater, surface water, sediment, soil, vegetation, air, and biota—must be sampled on and around the proposed construction site. This is because these media have the ability to either transport or retain contaminants. This chapter identifies the media and locations sampled to facilitate a better understanding of the proposed PDP site's baseline conditions.

Routine F-Area manufacturing processes have released quantities of material to the environment since facility operations began in late 1954. Releases are documented in a series of technical reports issued by the Savannah River Technology Center (SRTC), in an EMS compilation of release data from 1954 to 1988, and in site environmental and groundwater reports. As previously described, a compilation detailing historical release information and routine monitoring results has been developed by EMS (Fledderman 2000a); this information was utilized to develop the preconstruction monitoring plan.

3.2 Plan Summary

Table 1 presents a summary of the preconstruction monitoring plan sampling and analytical requirements. As anticipated during plan development, several changes and modifications were implemented during the course of the monitoring program. These changes, described below, are included in the table.

3.2.1 Plan Specifics

Preconstruction monitoring examined contaminant levels in surface water, sediment, soil, and vegetation; ambient gamma radiation levels; and macroinvertebrate populations in surface water. Both radiological and nonradiological contaminants were measured; sampling frequency varied by media. Sampling was conducted either monthly, quarterly, or as a one-time event. As detailed in Fledderman 2000a, sampling of air and groundwater was considered but was determined to be unnecessary because of the significant quantity of historical data already available from monitoring in and around F-Area and SRS.

3.2.1.1 Surface Water

Four locations were identified for surface water testing, as shown on figure 2. Trib-I provides drainage for the PDP site with Trib-C as its control, and U3R-U and U3R-D are Upper Three Runs locations upstream and downstream of PDP influence. These locations were sampled monthly for five basic water quality parameters and quarterly for a more detailed suite of radiological and nonradiological analytes.

3.2.1.2 Sediment

Sediment samples from surface water stream bottoms were collected at the same four locations identified as surface water sampling sites. An additional three locations (F-02, F-03, and F-05) also were identified for sampling (figure 3). These three locations are routinely sampled as part of both the National Pollutant Discharge Elimination System (NPDES) and SRS's routine radiological effluent/surveillance programs; therefore additional surface water sampling was deemed unnecessary. Samples were collected quarterly and analyzed for a detailed suite of radiological and nonradiological analytes.

3.2.1.3 Macroinvertebrates
Samples of macroinvertebrate populations were collected at four of the seven locations identified as surface water sampling sites (Trib-I, Trib-C, U3R-U, and U3R-D). Hester-Dendy multiplate samplers were used to determine the macroinvertebrate populations and species present. Qualitative sampling of natural substrates, which provides for the collection of species that do not colonize the Hester-Dendy substrate, also was performed.

3.2.1.4 Soil
Soil sampling was conducted in the project areas identified as possible sites for PDP facilities (figure 1). Soil sampling was conducted on a statistically based sampling grid using the techniques detailed in the Multi-Agency Radiation Survey and Site Investigation Manual (EPA 1997). Details on the development of this grid can be found in Baron & Ryan 2001.

Fifty locations were identified for soil sampling (figure 4). At each location, a shallow core sample (12 inches deep) was collected and analyzed for a detailed suite of nonradiological analytes; each core also was split into 3-inch segments, and each segment was analyzed for a detailed suite of radiological analytes. Soil samples were collected as a one-time event.

3.2.1.5 Vegetation
Vegetation samples were collected from the same 50 locations identified as soil sampling sites. Samples were collected quarterly and analyzed for a detailed suite of radiological analytes.

3.2.1.6 Air
WSRC maintains a complex atmospheric transport and radiological assessment model, which could be used to predict contaminant concentrations in both air and rain from projected PDP releases. In addition to this model, WSRC maintains a comprehensive airborne radiological surveillance system, as described in the SRS Environmental Monitoring Program (WSRC 2001). The airborne surveillance system has been used to verify model predictions. As part of this system, one existing air monitoring station (Burial Ground North) is located near the proposed PDP site. Years of historical results are available from this site, as well as from three recently discontinued sites, and may be used to provide any required regional monitoring results. Based on these factors, additional air surveillance was not required for this survey.

3.2.1.7 Ambient Gamma Exposure
Integrated ambient gamma exposure was measured using thermoluminescent dosimeters (TLDs) at the same 50 locations identified as soil sampling sites. TLDs were exchanged quarterly and analyzed for integrated gamma exposure.

3.2.1.8 Groundwater
Historical groundwater monitoring results indicate that considerable groundwater contamination exists in the vicinity of separation and waste management areas, as indicted by figures 5 and 6 (Koffman 2002). Fledderman 2000b indicates that the routine SRS groundwater monitoring program will be used to provide groundwater monitoring information; therefore no additional well installation or samples from existing wells in and near the PDP site were required for this survey. However, the existence of groundwater contamination near the Old F-Area Seepage Basin (OFASB), located between sites 1M and 2A, resulted in an additional special sampling project, conducted by the Environmental Restoration Division (WSRC 2002). At each of nine locations at site 2M, shown on figure 7, two depth-discrete groundwater samples were collected from the Upper Three Runs Aquifer. The sampled zone ranged from 156 to 193 feet above sea level. Each sample was analyzed for a focused set of constituents, including radiological parameters and volatile organic compounds

3.2.2 Plan Modifications
The possibility of changes to the original preconstruction monitoring plan—resulting from the project development and/or the identification of additional data requirements—was identified during plan development. Such changes are

to be expected, and the initial plan contains the flexibility to accommodate these modifications. During the course of the survey, only one change/modification was made to the original preconstruction plan:

- As a result of additional source term information, the analysis of soil, sediment, and surface water was modified to include beryllium and gallium. The sampling and analysis of beryllium in ambient air is under consideration and, if implemented, would be initiated prior to construction of any of the PDP facilities.

4.0 Survey Results

4.1 Survey Description

The preconstruction sampling program was begun in late September 2000 and lasted for approximately 18 months, which is slightly longer that the one-year time frame initially forecasted. The additional time was required because the initiation of soil, vegetation, and ambient gamma exposure sampling was delayed for approximately four months pending development of the sampling grid (Baron & Ryan 2001). All field work was completed in early March 2002.

4.2 Results

Table 2 presents an overall summary of the survey completion status. From this table, it can be seen that a majority of the samples identified were collected and analyzed. In addition, slight differences in the number of samples collected and/or analyzed from similar media are present. These differences—which are the result of sample collection scheduling, availability of samples, collection of duplicate samples, and laboratory performance—do not compromise the data quality objectives established for this survey.

Tables 3 and 4 present a summary of various regulatory or derived concentration limits. Because of (1) the PDP site's location in a brown field impacted by past and ongoing DOE operations, (2) potential environmental impact from the construction and/or operation of one or more of the PDP facilities, and (3) likely exposure scenarios, only regulatory limits and derived guides for exposure via surface water and soil are applicable.

Because the PDP site is located on DOE property inaccessible to members of the general public, the major limit of concern for surface water is the 100 mrem dose limit specified in DOE Order 5400.5 (DOE 1990). DOE 1990 also contains nuclide-specific derived concentration guides (DCGs) to facilitate determination of compliance; consumption of water at the DCG for one year would result in a dose of 100 mrem. However, because these limits are for radionuclides only, the National Primary Drinking Water Regulations (EPA 2000a)—which are more restrictive than the DOE DCGs and which regulate both radiological and nonradiological contaminants—are considered as well. The National Secondary Drinking Water Regulations (EPA 2000b) also have been included as a reference. However, as described in EPA 1992: "National Secondary Drinking Water Regulations ... are non-enforceable, non-mandatory water quality standards for 15 contaminants. They are guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. These contaminants are not considered to present a risk to human health at the Secondary Maximum Contaminant Level." The inclusion of the primary drinking water standards and secondary drinking water standards does not indicate that SRS surface water must meet these limits; however these concentrations provide a further reference for evaluating monitoring results.

No DOE nuclide-specific limits exist for radioactive materials in soil contamination. DOE Order 5400.5 (DOE 1990) states that a RESRAD evaluation should be performed to determine the potential exposure to radioactivity in contaminated soils. Jannik 1995 presents the results of such an evaluation for a "worker exposure" scenario. Analogous to the water DCGs, the exposure of a worker to the concentrations specified would result in a dose of 100 mrem. To provide guidance when evaluating an area for potential RCRA-driven remediation, EPA Region 9 has established preliminary remediation goals for a variety of nonradiological contaminants in soil (EPA 2000c). These concentrations have been selected for use as a benchmark for nonradiological soil contamination levels.

The remaining data tables also indicate negative values for concentrations of some radionuclides. Such results occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. These results are included because DOE specifies (DOE 1991) that all analytical results—even those that are negative or less than the detection limit—should be reported.

4.2.1 Surface Water

Tables 5–8 present a summary of the analytical results from the four surface water monitoring locations, while figures 8–11 present the four water quality parameters—temperature, pH, dissolved oxygen, and conductivity—that were measured monthly.

As indicated in section 4.0, the DOE and EPA limits (DOE 1990, EPA 2000a, and EPA 2000b) have been included as a reference for comparison in tables 3 and 4. All samples had contaminant concentrations below their respective limits (where provided), which were established in DOE 1990 and EPA 2000a. With the exception of pH, aluminum, and iron, all measured contaminants with established secondary limits (EPA 2000b) were below their respective limits.

On Upper Three Runs, concentrations of both radiological and nonradiological parameters generally are similar between the unimpacted site upstream of the PDP project drainage (U3R-U) and the site downstream of the project area (U3R-D). In general, these results also are consistent with results from routine Upper Three Runs samples collected as part of the EMS environmental surveillance program, which show concentrations generally below detection or at very low levels. The one exception is isotopes of uranium, which are present in significantly higher concentrations at U3R-D. However, the uranium concentrations at this point are well below the DOE DCGs (DOE 1990). This location is upstream of the Effluent Treatment Facility (ETF) discharge into Upper Three Runs, so it is unimpacted by ETF operations. Although the site is near the confluence of Upper Three Runs and Tims Branch, which is known to be contaminated with uranium from previous site operations, it actually is above the confluence of these streams. Therefore, uranium activity from Tims Branch is not believed to be impacting the concentrations observed at U3R-D. The concentrations at U3R-D are similar to those observed at both U3R-1A, which is the EMS routine monitoring control point, and U3R-4, which is the EMS routine monitoring point near the mouth of Upper Three Runs.

Results from Trib-C generally are similar to those observed on the two Upper Three Runs sites. However, as indicated in figure 12, results from Trib-I are different from those observed at Trib-C. Although the number of samples with detectable activity is similar, both the average and maximum concentrations of most radionuclides generally are significantly higher. In particular, this is observed with gross alpha activity, gross beta activity, and many of the actinide suite radionuclides.. However, the radionuclide concentrations at this point are well below the DOE DCGs (DOE 1990). Also, several metals are present in detectable and/or higher concentrations. These results are not unanticipated, because Trib-I receives water from several outfalls impacted by F-Area operations and/or from F-Area runoff.

Overall, these surface water monitoring results indicate that the quality of the water generally is good and that no analyte is present at harmful or potentially harmful levels.

4.2.2 Sediment

Table 9 presents a summary of the overall (average) analytical results from all seven sediment monitoring locations, while tables 10–16 present a summary of results from each of the seven monitoring sites.

As indicated in section 4.0, no possible scenario exists at the PDP site in which a member of the public could be exposed to sediment, nor was a worker scenario considered. Therefore, for the purpose of this report, no contaminant-specific administrative or regulatory limits apply to sediments.

On Upper Three Runs, concentrations of both radiological and nonradiological parameters generally are similar between the unimpacted site upstream of the PDP project drainage (U3R-U) and the site downstream of the project area (U3R-D). Analytical results generally are above detection at low levels, while results from Upper Three Runs (collected at U3R-4) samples collected as part of the EMS routine environmental surveillance program typically show concentrations below detection. The increase observed in uranium in surface water between U3R-U and U3R-D was not observed in sediment collected from these sites.

Results from the Trib-I and Trib-C sites show that for radiological contaminants above detection—primarily actinide suite isotopes—concentrations generally are higher in the unimpacted Trib-C sediment than in the Trib-I sediment. For nonradiological contaminants, this trend is reversed. However, as was the case with the Upper Three Runs sample results, both radiological and nonradiological results generally are above detection at low levels, while Upper Three Runs watershed samples (from Tinker Creek) collected as part of the routine environmental surveillance program typically have concentrations below detection.

Radiological results from the three F-Area outfalls in or near the PDP site generally are higher than those observed at the four stream monitoring sites described above. This is to be expected, because these locations represent f-Area points of discharge that receive or have received process discharge and/or runoff. Nonradiological results generally are similar to the concentrations observed in stream sediment samples; the one exception is zinc, which is present in significantly higher concentrations. Although the cause of this increase is not known, a likely possibility is galvanized metal used in upstream processes/piping and/or stored in the area drained by the outfalls. Of the three outfalls, both radiological and nonradiological results from F-03 are consistently lower than those from F-02 and F-05; this is not unanticipated, because F-03 typically is dry except during storm events. Radiological results from F-02 show significantly higher concentrations of ^{234}U, ^{235}U, ^{238}U, and ^{238}Pu, while results from F-05 show higher concentrations of ^{137}Cs, ^{241}Am, and ^{244}Cm. These results generally are consistent with past and/or present discharges to the outfalls; specifically F-02 received discharges from the Naval Fuels Fabrication Facility and continues to receive runoff from the area around the facility, while F-05 receives runoff from the sandfilter and 291-F stack area.

4.2.3 Macroinvertebrates

Detailed results of the macroinvertebrate assessment are presented in Specht 2002. In summary, this study concluded the following:

- U3R-U and U3R-D "were very similar with respect to all of the parameters that were measured. Upper Three Runs supports an extremely diverse and healthy macroinvertebrate community at both locations."
- Trib-I and Trib-C "support macroinvertebrate communities that are fairly similar," but Trib-C "is of slightly better quality ... Both streams supported diverse macroinvertebrate communities that were not dominated by pollution tolerant species."

4.2.4 Soil

Table 17 presents a summary of the overall (average) analytical results from all soil samples; in this table, all locations and depths are included. Table 18 presents a summary of radionuclide depth distribution information.

As indicated in section 4.0, EPA Region 9 remediation guides (EPA 2000c) and SRS-developed scenario-specific radionuclide limits (Jannik 1995) have been included as a reference for comparison in tables 3 and 4. All samples had contaminant concentrations below their respective limits (where provided), which were established in these documents.

Concentrations of fission/activation products (^{137}Cs, ^{60}Co, and ^{90}Sr) generally were similar to those observed in samples collected as part of the routine EMS surveillance program. However, concentrations of ^{238}Pu and ^{239}Pu—currently the only actinides analyzed for by the EMS program—were significantly higher than concentrations observed in samples collected as part of the routine EMS surveillance program. Higher actinide concentrations should be expected in soil samples collected in the vicinity of F-Area.

Examination of the depth distribution indicates that most radionuclides are relatively uniformly distributed throughout the 12-inch depth examined. The distribution of ^{137}Cs is quite different, with, on average, over 55 percent of the observed activity present in the top three inches and over 75 percent of the activity in the top six inches. This phenomenon is expected based on the environmental chemistry of Cs, and is consistent with previously observed results. A similar pattern is observed with ^{239}Pu, although the distribution is not as pronounced.

To determine the potential impact to an SRS employee working at the PDP site from exposure to the soil, SRTC performed a dose evaluation (Jannik 2002). The following two scenarios were considered:

- a worker exposure using mean radionuclide concentrations
- a worker exposure using maximum radionuclide concentrations

The results indicated a potential maximum exposure of 0.255 mrem using mean concentrations and a potential maximum exposure of 3.31 mrem using maximum concentrations. These levels are well below the DOE annual public exposure limit of 100 mrem (DOE 1988).

4.2.5 Vegetation

Table 19 presents a summary of the overall (average) analytical results from all vegetation samples. Because much of the PDP site is relatively heavily forested, low-lying grassy vegetation samples were often unavailable, resulting in collection of considerably fewer vegetation samples than soil samples.

As indicated in section 4.0, no possible scenario exists at the PDP site in which a member of the public could be exposed to vegetation, nor was a worker scenario considered. Therefore, for the purpose of this report, no contaminant-specific administrative or regulatory limits apply to vegetation.

Because of the relatively small number of vegetation samples collected, a thorough evaluation of temporal variability was not possible. However, no readily apparent temporal pattern or change in the results was observed. Average radionuclide levels generally were similar to those observed in vegetation samples collected from the site perimeter as part of the routine EMS vegetation surveillance program. Maximum concentrations of most radionuclides were elevated, but in most cases were similar to concentrations observed in vegetation samples collected near the center of the site at the Burial Ground North point. These concentrations are consistent with the proximity of the PDP project area to F-Area.

4.2.6 Air

As detailed in section 3.2.1.6, air surveillance sampling was not required for this survey. However, Fledderman 2002 indicates that:

- Several U.S. Department of Energy sites monitor for beryllium as part of their routine environmental surveillance program because operations at these sites present the potential for release of this contaminant to the environment. Results from at least one site have indicated sharp increases in beryllium-in-ambient-air concentrations during activities which disturb soil.
- At SRS, no monitoring in the environment (i.e., ambient air) is conducted for beryllium. This survey included beryllium monitoring in soil, surface water, and sediment. However, as indicated in table 17, beryllium is present in low (environmental) levels in a relatively small number of soil and sediment samples collected from the PDP site, which have the potential to become airborne during construction activities.

Based on these factors, Fledderman 2002 recommends monitoring of ambient air for beryllium. This monitoring should occur prior to construction work on the MFFF or the PDCF.

4.2.7 Ambient Gamma Exposure

Table 20 presents a summary of the ambient gamma exposure levels in the PDP project area. The mean annual integrated exposure was approximately 106 mR, with a range of 80.4 to 172.8 mR. These exposures are slightly higher than ambient site perimeter levels observed in the routine EMS monitoring program, but are consistent with the slightly elevated results typically observed by the EMS program near the center of the site. The higher exposure rates are consistent with the proximity of the PDP site to F-Area and to the center of SRS.

4.2.8 Groundwater

As described in Fledderman 2000b, groundwater contamination exists in the vicinity of separation and waste management areas. Figure 5 (Koffman 2002) shows the extent of contaminated groundwater plumes, defined by tritium. As the figure shows, the most significant plume relating to the PDP project originates from the northwest portion of E-Area and has moved northwest toward Upper Three Runs, impacting PDP sites 4 and 5. Although this figure shows only the tritium-contaminated groundwater plumes, E-Area releases a variety of other contaminants as well. The extent of groundwater contamination by other materials depends on their mobility; tritium is the most mobile. As indicated on figure 6 (Koffman 2002), volatile organic compounds represent another contaminant impacting the PDP project area, although the plume extent tends to be less than that indicated by tritium. Other contaminants are present within the tritium plume area, although they do not present a defined plume.

The special sampling at site 2M indicates that shallow groundwater is contaminated with various heavy industrial and nuclear contaminants. Groundwater contamination is present at every location sampled at site 2M, but is most pronounced beneath the western edge of the site. Groundwater contaminants (primarily radionuclides and volatile organic compounds) exceed allowable limits in the lower zone of the Upper Three Runs Aquifer, approximately 80 to 130 feet below ground surface. A review of these data (WSRC 2002) concludes that the groundwater contamination at site 2M is related to historical F-Area chemical separations and waste management activities.

4.3 Conclusions

The DOE-required preconstruction baseline environmental monitoring survey of the PDP sites was conducted from September 2000 to March 2002. A variety of environmental media in and near the PDP sites were sampled and/or analyzed—including surface water, sediment in steam bottoms, macroinvertebrates, shallow (one-foot-deep) soil, and low-lying grassy vegetation—and ambient gamma exposure was measured. Results from the survey indicate that concentrations of radiological and nonradiological contaminants generally are low and similar to levels observed in the SRS environmental monitoring program. These concentrations are consistent with the location of the PDP sites, near F-Area.

Two items of note were identified during the survey:

1. Contaminated groundwater is underlying portions of the PDP sites. Groundwater contamination is related to historical nuclear and industrial activities inside E-Area and F-Area. Groundwater contaminants (primarily radionuclides and volatile organic compounds) occur in the Upper Three Runs Aquifer, approximately 80 to 130 feet below ground surface within sites 2M (MFFF), 4, and 5. The quality of the groundwater under sites X (PDCF) and 1M has not been investigated and therefore is uncertain.
2. Construction and operating activities may have an impact on beryllium concentrations in air. The Environmental Monitoring Section has examined this issue and concluded that it would be advisable to conduct a follow-up study to document preconstruction levels of beryllium in air. This recommendation is based on concerns relating to beryllium toxicity and the presence of low levels of beryllium in soil and sediment, which could be mobilized during construction activities.

In summary, this survey has revealed no conditions that would prevent proceeding with the PDP projects in the area studied.

5.0 References

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Table 1
Summary of PDP Preconstruction and Preoperational Monitoring Activities

Program	Location[1]	Frequency	Analytes
Surface Water Nonradiological	U3R-U	M[2]	temperature, pH, dissolved oxygen (DO), conductivity, total suspended solids (TSS)
Surface Water Nonradiological	U3R-U	Q[3]	temperature, pH, dissolved oxygen (DO), conductivity, chemical oxygen demand (COD), nitrogen as nitrate, nitrogen as nitrite, total suspended solids (TSS), total phosphorous, total organic carbon (TOC), aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc, pesticides, herbicides
Surface Water Nonradiological	U3R-D	M	temperature, pH, dissolved oxygen (DO), conductivity, total suspended solids (TSS)
Surface Water Nonradiological	U3R-D	Q	temperature, pH, dissolved oxygen (DO), conductivity, chemical oxygen demand (COD), nitrogen as nitrate, nitrogen as nitrite, total suspended solids (TSS), total phosphorous, total organic carbon (TOC), aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc, pesticides, herbicides
Surface Water Nonradiological	Trib-I	M	temperature, pH, dissolved oxygen (DO), conductivity, total suspended solids (TSS)

Table 1 (cont.)
Summary of PDP Preconstruction and Preoperational Monitoring Activities

Program	Location	Frequency	Analytes
Surface Water Nonradiological	Trib-I	Q	temperature, pH, dissolved oxygen (DO), conductivity, chemical oxygen demand (COD), nitrogen as nitrate, nitrogen as nitrite, total suspended solids (TSS), total phosphorous, total organic carbon (TOC), aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc, pesticides, herbicides
Surface Water Nonradiological	Trib-C	M	temperature, pH, dissolved oxygen (DO), conductivity, total suspended solids (TSS)
Surface Water Nonradiological	Trib-C	Q	temperature, pH, dissolved oxygen (DO), conductivity, chemical oxygen demand (COD), nitrogen as nitrate, nitrogen as nitrite, total suspended solids (TSS), total phosphorous, total organic carbon (TOC), aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc, pesticides, herbicides
Surface Water Radiological	U3R-U	Q	gross alpha/beta, gamma-emitting radionuclides, tritium, total Sr, actinides
Surface Water Radiological	U3R-D	Q	gross alpha/beta, gamma-emitting radionuclides, tritium, total Sr, actinides
Surface Water Radiological	Trib-I	Q	gross alpha/beta, gamma-emitting radionuclides, tritium, total Sr, actinides

Table 1 (cont.)
Summary of PDP Preconstruction and Preoperational Monitoring Activities

Program	Location	Frequency	Analytes
Surface Water Radiological	Trib-C	Q	gross alpha/beta, gamma-emitting radionuclides, tritium, total Sr, actinides
Sediment Nonradiological	U3R-U	Q	aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc, pesticides, herbicides
Sediment Nonradiological	U3R-D	Q	aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc, pesticides, herbicides
Sediment Nonradiological	Trib-I	Q	aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc, pesticides, herbicides
Sediment Nonradiological	Trib-C	Q	aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc, pesticides, herbicides
Sediment Nonradiological	F-02	Q	aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc, pesticides, herbicides
Sediment Nonradiological	F-03	Q	aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc, pesticides, herbicides
Sediment Nonradiological	F-05	Q	aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc, pesticides, herbicides
Sediment Radiological	U3R-U	Q	gamma-emitting radionuclides, total Sr, actinides

Table 1 (cont.)
Summary of PDP Preconstruction and Preoperational Monitoring Activities

Program	Location	Frequency	Analytes
Sediment Radiological	U3R-D	Q	gamma-emitting radionuclides, total Sr, actinides
Sediment Radiological	Trib-I	Q	gamma-emitting radionuclides, total Sr, actinides
Sediment Radiological	Trib-C	Q	gamma-emitting radionuclides, total Sr, actinides
Sediment Radiological	F-02	Q	gamma-emitting radionuclides, total Sr, actinides
Sediment Radiological	F-03	Q	gamma-emitting radionuclides, total Sr, actinides
Sediment Radiological	F-05	Q	gamma-emitting radionuclides, total Sr, actinides
Soil Nonradiological	Statistical	1-Time	aluminum, beryllium, cadmium, chromium, copper, gallium, iron, lead, manganese, mercury, nickel, zinc
Soil Radiological	Statistical	1-Time	gamma-emitting radionuclides, total Sr, actinides
Vegetation	Statistical, same as soil	Q	gross alpha/beta, gamma-emitting radionuclides, total Sr, actinides
Ambient Gamma	Statistical, same as soil	Q	exposure rate
Macroinvertebrate	Trib-I	Q	macroinvertebrate population and species
Macroinvertebrate	Trib-U	Q	macroinvertebrate population and species
Macroinvertebrate	U3R-U	Q	macroinvertebrate population and species
Macroinvertebrate	U3R-D	Q	macroinvertebrate population and species

[1] See figures 2, 3, and 4 for details
[2] Monthly
[3] Quarterly

Table 2
Summary Status of Preoperational Monitoring

Program	Description	Number of Samples to be Collected[1]	Collection Status[1]	Analysis Status[1]
Surface Water	• 4 locations • Monthly basic water quality parameters	48 field analysis suites and samples	Complete • 52 field analysis suites • 55 samples	Complete
Surface Water	• 4 locations • Quarterly radiological and nonradiological suite	16 samples	Complete • 19-24 samples	Complete
Sediment	• 7 locations • Quarterly sampling • Radiological and nonradiological suite	28 samples	Complete • 36 samples	Complete
Soil	• 50 locations identified • Shallow core and 3" segments • One-time event • Radiological and nonradiological suite	Radiological: 200 samples Nonradiological: 50 samples	Complete • 43 locations sampled • 172 radiological samples • 43 nonradiological samples	• Radiological analysis complete on 170 samples. One uranium and 1 actinide were not completed. • All nonradiological analyses complete.
Vegetation	• Same locations as soil • Quarterly sampling • Radiological analysis	200 samples	Complete • 50 samples	Complete
TLD	• Same locations as soil • Quarterly sampling	200 measurements	Complete • 172 measurements	Complete
Macroinvertebrate	• 4 locations • Quaterly sampling	16 samples	Complete • 16 samples	Complete

[1] Differences in the number of samples scheduled, collected and/or analyzed from similar media are present. These differences—which are the result of sample collection scheduling, availability of samples, collection of duplicate samples, and laboratory performance—do not compromise the data quality objectives established for this survey.

Table 3
Surface Water Standards

Radiological Drinking Water Standards			
Primary Drinking Water Standards (EPA 2000a)		**DOE Derived Concentration Guides (DOE 1990)**	
^{3}H	20,000 pCi/L	^{3}H	2,000,000 pCi/L
^{137}Cs	200 pCi/L	^{137}Cs	3,000 pCi/L
^{60}Co	100 pCi/L	^{60}Co	5,000 pCi/L
^{90}Sr	8 pCi/L	^{90}Sr	1,000 pCi/L
		^{234}U	500 pCi/L
		^{235}U	600 pCi/L
		^{238}U	600 pCi/L
		^{238}Pu	40 pCi/L
		^{239}Pu	30 pCi/L
		^{241}Am	30 pCi/L
		^{244}Cm	60 pCi/L
Nonradiological Drinking Water Standards			
Primary Drinking Water Standards (EPA 2000a)		**Secondary Drinking Water Standards (EPA 2000b)**	
Be	0.004 mg/L	Al	0.05–0.2 mg/L
Cd	0.005 mg/L	Cu	1 mg/L
Cr	0.1 mg/L	Fe	0.3 mg/L
Cu	1.3 mg/L	Mn	0.05 mg/L
Pb	0.015 mg/L	Zn	5 mg/L
Hg	0.002 mg/L	pH	6.5–8.5 SU
Ni	0.1 mg/L	TDS	500 mg/L
Nitrate + Nitrite	10 mg/L		
Nitrate	10 mg/L		
Nitrite	1 mg/L		

Table 4
Soil Contamination Guides

Nonradiological Soil Guides (EPA 2000c)			Radiological Soil Guides (Jannik 1995)	
	Residential	Industrial		
Al	76,100 mg/kg	100,000 mg/kg	^{137}Cs	91.6 pCi/g
Be and compounds	154 mg/kg	2,240 mg/kg	^{60}Co	21.1 pCi/g
Cd and compounds	37 mg/kg	809 mg/kg	^{90}Sr	30,500 pCi/g
Cr (total)[1]	211 mg/kg	448 mg/kg	^{234}U	1,130 pCi/g
Cu and compounds	2,910 mg/kg	75,900 mg/kg	^{235}U	348 pCi/g
Fe	2,350 mg/kg	100,000 mg/kg	^{238}U	920 pCi/g
Pb	400 mg/kg	750 mg/kg	^{238}Pu	275 pCi/g
Mn and compounds	1,760 mg/kg	32,300 mg/kg	^{239}Pu	248 pCi/g
Hg and compounds	23.5 mg/kg	613 mg/kg	^{241}Am	236 pCi/g
Ni (soluble salts)	1,560 mg/kg	40,900 mg/kg	^{244}Cm	466 pCi/g
Zn	23,500 mg/kg	100,000 mg/kg		
2,2 DDT	1.7 mg/kg	12 mg/kg		

[1] Assumes a 1:6 ratio of Cr VI : Cr III

Table 5
Surface Water–U3R-U

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Temperature (deg C)	9	23	na	13	n/a	16.62	4.43
pH (SU)	**5.41**^{3}	6.52	6.5-8.5^{4}	13	n/a	**6.19**	0.33
Dissolved Oxygen (mg/L)	6.93	10.80	na	13	n/a	8.35	1.07
Conductivity (uhos/cm)	16.8	57.7	na	13	n/a	36.1	15.4
H-3 (pCi/L)	3.16E+02	1.23E+03	2.00E+4^{5}	5 (+1 dup)	5	9.51E+02	3.33E+02
Gross Alpha (pCi/L)	-2.84E-01	6.88E-01	Na	5 (+1 dup)	0	2.68E-01	4.24E-01
Gross Beta (pCi/L)	-8.53E-02	9.91E-01	Na	5 (+1 dup)	0	2.44E-01	3.88E-01
Cs-137 (pCi/L)	-3.52E+00	2.79E+00	2.00E+2^{5}	5 (+1 dup)	0	-6.67E-01	2.06E+00
Co-60 (pCi/L)	-2.25E+00	4.04E+00	1.00E+2^{5}	5 (+1 dup)	0	2.89E-01	2.35E+00
Sr-90 (pCi/L)	-1.98E-01	4.77E-01	8.00E+00^{5}	5 (+1 dup)	0	1.19E-01	2.29E-01
U-234 (pCi/L)	-2.23E-03	4.09E-02	5.00E+02^{6}	5 (+1 dup)	4	1.81E-02	1.62E-02
U-235 (pCi/L)	-2.33E-03	9.71E-03	6.00E+02^{6}	5 (+1 dup)	0	3.34E-03	4.69E-03
U-238 (pCi/L)	7.72E-03	2.82E-02	6.00E+02^{6}	5 (+1 dup)	4	1.46E-02	7.65E-03
Pu-238 (pCi/L)	-5.00E-03	7.20E-03	4.00E+01^{6}	5 (+1 dup)	0	2.48E-03	4.29E-03
Pu-239 (pCi/L)	-3.29E-03	6.20E-03	3.00E+01^{6}	5 (+1 dup)	0	4.01E-04	3.23E-03
Am-241 (pCi/L)	-4.04E-03	3.22E-02	3.00E+01^{6}	5 (+1 dup)	0	5.10E-03	1.37E-02
Cm-244 (pCi/L)	-3.89E-03	5.21E-03	6.00E+01^{6}	5 (+1 dup)	0	6.56E-04	3.78E-03
Al (mg/L)	**0.28**	**0.75**	0.05-0.2^{4}	5 (+1 dup)	5	**0.436**	0.19321
Be (mg/L)	na	na	0.004^{5}	4	0	na	na
Cd (mg/L)	na	na	0.005^{5}	5 (+1 dup)	0	na	na
Cr (mg/L)	na	na	0.1^{5}	5 (+1 dup)	1	0.0054	na
Cu (mg/L)	na	na	1.3^{5}	5 (+1 dup)	1	0.0056	na
Fe (mg/L)	**0.38**	**1.2**	0.3^{4}	5 (+1 dup)	6	**0.59**	0.305156
Ga (mg/L)	na	na	na	4	0	na	na
Pb (mg/L)	na	na	0.015^{5}	5 (+1 dup)	0	na	na
Mn (mg/L)	0.021	0.13	5^{4}	5 (+1 dup)	6	0.047	0.041183
Hg (mg/L)	na	na	0.002^{5}	5 (+1 dup)	0	na	na
Ni (mg/L)	na	na	0.1^{5}	5 (+1 dup)	0	na	na
Zn (mg/L)	0.0061	0.054	5^{4}	5 (+1 dup)	6	0.020517	0.01708

Table 5 (cont.)
Surface Water–U3R-U

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
COD (mg/L)	na	na	na	5 (+1 dup)	1	28	na
Nitrate (mg/L)	0.12	0.15	10[5]	5 (+1 dup)	6	0.138333	0.009832
Nitrite (mg/L)	na	na	1[5]	5 (+1 dup)	0	na	na
TSS (mg/L)	2.7	27	500[4]	13 (+1 dup)	14	8.107143	6.875314
Phospahte (mg/L)	0.018	0.062	na	5 (+1 dup)	3	0.035333	0.023438
TOC (mg/L)	1.7	4.5	na	5 (+1 dup)	6	2.65	0.981326
Pesticides (µg/L)	na	na	varies	6 (+1 dup)	1[7]	na	na
Herbicides (µg/L)	na	na	varies	5 (+1 dup)	0	na	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

[3] Values in bold exceed the National Secondary Drinking Water Regulations (EPA 2000b). These are non-enforceable, non-mandatory water quality standards for 15 contaminants; these contaminants are not considered to present a risk to human health at the Secondary Maximum Contaminant Level.

[4] EPA 2000b

[5] EPA 2000a

[6] DOE 1999

[7] Gamma-BHC (Lindane): 0.058 µg/L

Table 6
Surface Water–U3R-D

	Min^{1}	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL^{2}	Mean	Standard Deviation
Temperature (deg C)	9	23	na	13	na	16 38	4.44
pH (SU)	**5.60^{3}**	6.87	6.5-8.5^{4}	13	na	**6.17**	0.34
Dissolved Oxygen (mg/L)	6.86	11.28	na	13	na	8.41	1 24
Conductivity (uhos/cm)	16.8	89.4	na	13	na	51.3	27.8
H-3 (pCi/L)	6.16E+02	1.71E+03	2.00E+4^{5}	5 (+1 dup)	5	1.09E+03	4.06E+02
Gross Alpha (pCi/L)	1.58E-01	2.61E+00	na	5 (+1 dup)	2	9.56E-01	9.84E-01
Gross Beta (pCi/L)	1.54E-01	9.93E-01	na	5 (+1 dup)	0	5.74E-01	3.71E-01
Cs-137 (pCi/L)	-1.59E+00	2.34E+00	2.00E+2^{5}	5 (+1 dup)	0	7.70E-02	1.34E+00
Co-60 (pCi/L)	1.12E+00	3.39E+00	1.00E+2^{5}	5 (+1 dup)	0	1.94E+00	8.91E-01
Sr-90 (pCi/L)	-1.95E-02	5.57E-01	8.00E+00^{5}	5 (+1 dup)	0	1.50E-01	2.21E-01
U-234 (pCi/L)	-3.70E-03	2.11E-01	5.00E+02^{6}	5 (+1 dup)	3	4.59E-02	8 27E-02
U-235 (pCi/L)	-3.31E-03	1.74E-02	6 00E+02^{6}	5 (+1 dup)	1	3.44E-03	8.53E-03
U-238 (pCi/L)	1.22E-03	1.83E-01	6.00E+02^{6}	5 (+1 dup)	4	4.38E-02	6.97E-02
Pu-238 (pCi/L)	-5.45E-03	2.04E-02	4.00E+01^{6}	5 (+1 dup)	0	3.59E-03	9.77E-03
Pu-239 (pCi/L)	-2.84E-03	5.87E-03	3.00E+01^{6}	5 (+1 dup)	0	9.46E-04	3.41E-03
Am-241 (pCi/L)	-9.87E-03	1.26E-02	3 00E+01^{6}	5 (+1 dup)	0	3.15E-04	7.68E-03
Cm-244 (pCi/L)	-5.77E-03	9.68E-03	6.00E+01^{6}	5 (+1 dup)	0	1.08E-03	5.20E-03
Al (mg/L)	0.18	**1.2**	0.05-0.2^{4}	5 (+1 dup)	6	0.488333	0 3603563
Be (mg/L)	na	na	0.004^{5}	4 (+1 dup)	0	na	na
Cd (mg/L)	na	na	0 005^{5}	5 (+1 dup)	0	na	na
Cr (mg/L)	na	na	0.1^{5}	5 (+1 dup)	0	na	na
Cu (mg/L)	na	na	1.3^{5}	5 (+1 dup)	0	na	na
Fe (mg/L)	**0.32**	**1.8**	0.3^{4}	5 (+1 dup)	6	**0.683333**	0.5563692
Ga (mg/L)	na	na	na	4 (+1 dup)	0	na	na
Pb (mg/L)	na	na	0.015^{5}	5 (+1 dup)	0	na	na
Mn (mg/L)	0.019	0 07	5^{4}	5 (+1 dup)	6	0.031833	0 0196002
Hg (mg/L)	na	na	0.002^{5}	5 (+1 dup)	1	0.0015	na
Ni (mg/L)	na	na	0.1^{5}	5 (+1 dup)	1	0.012	na
Zn (mg/L)	0.016	0 045	5^{4}	5 (+1 dup)	6	0.027	0 0117303

Table 6 (cont.)
Surface Water–U3R-D

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
COD (mg/L)	na	na	na	5 (+1 dup)	1	62	na
Nitrate (mg/L)	0.088	0.45	10[5]	5 (+1 dup)	6	0.233	0 1658373
Nitrite (mg/L)	na	na	1[5]	5 (+1 dup)	0	na	na
TSS (mg/L)	1.9	29	500[4]	12 (+1 dup)	13	7.485714	8 0614808
Phospahte (mg/L)	0.031	0.051	na	5 (+1 dup)	4	0.03825	0 0095
TOC (mg/L)	1.9	8.2	na	5 (+1 dup)	6	3 416667	2.472583
Pesticides (µg/L)	na	na	varies	5 (+1 dup)	0	na	na
Herbicides (µg/L)	na	na	varies	5 (+1 dup)	0	na	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

[3] Values in bold exceed the National Secondary Drinking Water Regulations (EPA 2000b). These are non-enforceable, non-mandatory water quality standards for 15 contaminants; these contaminants are not considered to present a risk to human health at the Secondary Maximum Contaminant Level.

[4] EPA 2000b

[5] EPA 2000a

[6] DOE 1999

Table 7
Surface Water–Trib-I

	Min^{1}	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL^{2}	Mean	Standard Deviation
Temperature (deg C)	10	22	na	13	na	16.54	3.45
pH (SU)	5.62^{3}	6.82	6.5-8.5^{4}	13	na	6.34	0.29
Dissolved Oxygen (mg/L)	7.84	11.87	na	13	na	8.89	1.10
Conductivity (uhos/cm)	46.0	180.1	na	13	na	83.2	40.9
H-3 (pCi/L)	2.36E+03	6.20E+03	2.00E+4^{5}	5	5	4.80E+03	1.48E+03
Gross Alpha (pCi/L)	-3.38E-02	2.46E+00	na	5	1	6.43E-01	1.06E+00
Gross Beta (pCi/L)	6.37E-01	2.29E+00	na	5	0	1.32E+00	7.60E-01
Cs-137 (pCi/L)	-8.72E-01	2.46E+00	2.00E+2^{5}	5	0	5.75E-01	1.27E+00
Co-60 (pCi/L)	-4.43E+00	5.24E+00	1.00E+2^{5}	5	0	-1.54E-01	4.06E+00
Sr-90 (pCi/L)	-5.98E-01	9.91E-01	8.00E+00^{5}	5	0	2.96E-01	6.28E-01
U-234 (pCi/L)	-1.43E-03	2.00E-01	5.00E+02^{6}	5	2	4.68E-02	8.64E-02
U-235 (pCi/L)	-4.87E-03	1.59E-02	6.00E+02^{6}	5	0	5.14E-03	8.91E-03
U-238 (pCi/L)	-2.69E-03	1.66E-01	6.00E+02^{6}	5	2	4.31E-02	7.02E-02
Pu-238 (pCi/L)	-6.07E-03	1.51E-02	4.00E+01^{6}	5	1	4.24E-03	7.61E-03
Pu-239 (pCi/L)	-9.24E-03	7.88E-03	3.00E+01^{6}	5	0	1.59E-03	6.51E-03
Am-241 (pCi/L)	2.64E-03	2.01E-02	3.00E+01^{6}	5	0	7.74E-03	7.12E-03
Cm-244 (pCi/L)	-9.07E-03	1.51E-02	6.00E+01^{6}	5	1	9.42E-04	8.77E-03
Al (mg/L)	0.16	14	0.05-0.2^{4}	5	5	3.088	6.101333
Be (mg/L)	na	na	0.004^{5}	4	0	na	na
Cd (mg/L)	na	na	0.005^{5}	5	0	na	na
Cr (mg/L)	na	na	0.1^{5}	5	1	0.019	na
Cu (mg/L)	na	na	1.3^{5}	5	1	0.016	na
Fe (mg/L)	0.28	34	0.3^{4}	5	5	7.196	14.98459
Ga (mg/L)	na	na	na	4	0	na	na
Pb (mg/L)	0.0026	0.003	0.015^{5}	5	2	0.0028	0.000283
Mn (mg/L)	0.026	0.15	5^{4}	5	5	0.0594	0.051072
Hg (mg/L)	na	na	0.002^{5}	5	0	na	na
Ni (mg/L)	na	na	0.1^{5}	5	0	na	na
Zn (mg/L)	0.014	0.1	5^{4}	5	5	0.0326	0.03772

Table 7 (cont.)
Surface Water–Trib-I

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
COD (mg/L)	na	na	na	5	0	na	na
Nitrate (mg/L)	0.27	0.47	10[5]	5	5	0.404	0.08735
Nitrite (mg/L)	na	na	1[5]	5	1	0.12	na
TSS (mg/L)	2.3	310	500[4]	13	12	30.3	88.11844
Phospahte (mg/L)	0.013	1.1	na	5	3	0.382667	0.621326
TOC (mg/L)	2.6	4.3	na	5	2	3.45	1.202082
Pesticides (µg/L)	na	na	varies	5	1[7]	na	na
Herbicides (µg/L)	na	na	varies	5	0	na	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

[3] Values in bold exceed the National Secondary Drinking Water Regulations (EPA 2000b). These are non-enforceable, non-mandatory water quality standards for 15 contaminants; these contaminants are not considered to present a risk to human health at the Secondary Maximum Contaminant Level.

[4] EPA 2000b

[5] EPA 2000a

[6] DOE 1999

[7] Beta-BHC: 0.13 µg/L

Table 8
Surface Water–Trib-C

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Temperature (deg C)	10	23	na	13	na	17.00	3.74
pH (SU)	**5.61**^{3}	6.78	6.5-8.5^4	13	na	**6.02**	0.37
Dissolved Oxygen (mg/L)	7.38	9.93	na	13	na	8.85	0.88
Conductivity (uhos/cm)	13.0	74.8	na	13	na	31.9	23.1
H-3 (pCi/L)	5.33E+02	1.38E+04	2.00E+4^5	5(+2 dup)	4	3.55E+03	5.07E+03
Gross Alpha (pCi/L)	-2.49E-01	1.52E+00	na	5(+2 dup)	0	3.31E-01	6.02E-01
Gross Beta (pCi/L)	-3.59E-01	1.31E+00	na	5(+2 dup)	0	3.18E-01	5.62E-01
Cs-137 (pCi/L)	-1.65E+00	2.50E+00	2.00E+2^5	5(+2 dup)	0	4.56E-01	1.49E+00
Co-60 (pCi/L)	-5.82E+00	5.46E+00	1.00E+2^5	5(+2 dup)	0	6.44E-01	4.10E+00
Sr-90 (pCi/L)	-1.38E-01	1.43E+00	8.00E+00^5	5(+2 dup)	0	4.01E-01	6.21E-01
U-234 (pCi/L)	-7.35E-03	6.22E-02	5.00E+02^6	5(+2 dup)	2	8.16E-03	2.47E-02
U-235 (pCi/L)	-3.02E-03	2.77E-02	6.00E+02^6	5(+2 dup)	0	3.59E-03	1.08E-02
U-238 (pCi/L)	-3.94E-03	2.90E-02	6.00E+02^6	5(+2 dup)	1	6.62E-03	1.16E-02
Pu-238 (pCi/L)	-2.81E-03	7.29E-03	4.00E+01^6	5(+2 dup)	0	2.88E-03	3.29E-03
Pu-239 (pCi/L)	-9.74E-03	1.45E-02	3.00E+01^6	5(+2 dup)	1	1.20E-03	8.28E-03
Am-241 (pCi/L)	-2.12E-02	1.64E-02	3.00E+01^6	5(+2 dup)	0	8.02E-04	1.21E-02
Cm-244 (pCi/L)	-3.93E-03	1.69E-02	6.00E+01^6	5(+2 dup)	0	2.26E-03	6.78E-03
Al (mg/L)	0.14	**1.2**	0.05-0.2^4	5(+2 dup)	7	**0.53**	0.410569
Be (mg/L)	na	na	0.004^5	4 (+2 dup)	0	na	na
Cd (mg/L)	na	na	0.005^5	5(+2 dup)	0	na	na
Cr (mg/L)	na	na	0.1^5	5(+2 dup)	0	na	na
Cu (mg/L)	na	na	1.3^5	5(+2 dup)	0	na	na
Fe (mg/L)	0.28	**1.6**	0.3^4	5(+2 dup)	7	**0.707143**	0.595867
Ga (mg/L)	na	na	na	4 (+2 dup)	0	na	na
Pb (mg/L)	na	na	0.015^5	5(+2 dup)	0	na	na
Mn (mg/L)	0.028	0.066	5^4	5(+2 dup)	7	0.040571	0.016247
Hg (mg/L)	na	na	0.002^5	5(+2 dup)	1	0.00019	na
Ni (mg/L)	na	na	0.1^5	5(+2 dup)	0	na	na
Zn (mg/L)	0.0059	0.14	5^4	5(+2 dup)	7	0.029886	0.048754

Table 8 (cont.)
Surface Water–Trib-C

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
COD (mg/L)	na	na	na	5(+2 dup)	0	na	na
Nitrate (mg/L)	0.076	0.27	10[5]	5(+2 dup)	7	0.195143	0.068691
Nitrite (mg/L)	na	na	1[5]	5(+2 dup)	0	na	na
TSS (mg/L)	1.2	33	500[4]	13 (+2 dup)	15	7.76	10.37034
Phospahte (mg/L)	0.023	0.069	na	5(+2 dup)	3	0.049	0.02358
TOC (mg/L)	1.6	4.8	na	5(+2 dup)	7	3.214286	1.091526
Pesticides (μg/L)	na	na	varies	5(+2 dup)	1[7]	na	na
Herbicides (μg/L)	na	na	varies	5(+2 dup)	0	na	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

[3] Values in bold exceed the National Secondary Drinking Water Regulations (EPA 2000b). These are non-enforceable, non-mandatory water quality standards for 15 contaminants; these contaminants are not considered to present a risk to human health at the Secondary Maximum Contaminant Level.

[4] EPA 2000b

[5] EPA 2000a

[6] DOE 1999

[7] Gamma-BHC (Lindane): 0.061 μg/L

Table 9
Sediment–All Locations

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Cs-137 (pCi/kg)	-2.52E+01	1.18E+04	na	32 (+ 4 dup)	17	1.03E+03	2.77E+03
Co-60 (pCi/kg)	-2.44E+01	4.90E+01	na	32 (+ 4 dup)	2	7.72E+00	1.91E+01
Sr-90 (pCi/kg)	-1.73E+02	8.47E+02	na	32 (+ 4 dup)	1	1.21E+02	2.11E+02
U-234 (pCi/kg)	2.11E+00	5.44E+03	na	32 (+ 4 dup)	33	9.08E+02	1.29E+03
U-235 (pCi/kg)	-1.12E+00	4.66E+02	na	32 (+ 4 dup)	29	6.39E+01	1.08E+02
U-238 (pCi/kg)	3.30E+00	8.60E+03	na	32 (+ 4 dup)	34	1.11E+03	1.96E+03
Pu-238 (pCi/kg)	1.09E+00	8.17E+02	na	32 (+ 4 dup)	31	6.55E+01	1.57E+02
Pu-239 (pCi/kg)	-3.31E-01	7.27E+02	na	32 (+ 4 dup)	32	1.11E+02	2 03E+02
Am-241 (pCi/kg)	-1.85E+00	2.17E+03	na	32 (+ 4 dup)	25	1.69E+02	4.47E+02
Cm-244 (pCi/kg)	-2.37E-01	7.72E+02	na	32 (+ 4 dup)	21	6 09E+01	1.61E+02
Al (mg/kg)	420	19000	na	32 (+ 4 dup)	36	5036.389	4860.878
Be (mg/kg)	0.29	48	na	35 (+ 3 dup)	14	4 568571	12.51844
Cd (mg/kg)	0.19	8.9	na	32 (+ 4 dup)	4	2.41	4.3269
Cr (mg/kg)	1.2	58	na	32 (+ 4 dup)	36	8.483333	10 60104
Cu (mg/kg)	0.34	790	na	32 (+ 4 dup)	34	34.08706	134.3892
Fe (mg/kg)	240	23000	na	32 (+ 4 dup)	36	4528 611	4642.593
Ga (mg/kg)	0.81	5.5	na	31 (+ 2 dup)	11	2.152727	1.799963
Pb (mg/kg)	0 61	150	na	32 (+ 4 dup)	36	11.5725	24.31093
Mn (mg/kg)	3.9	190	na	32 (+ 4 dup)	36	47.56667	38.48205
Hg (mg/kg)	na	na	na	32 (+ 4 dup)	0	na	na
Ni (mg/kg)	3.1	52	na	32 (+ 4 dup)	20	8.23	10.8168
Zn (mg/kg)	3.6	270	na	32 (+ 4 dup)	29	53.3	59.1836
Pesticides (µg/kg)	na	na	na	29 (+ 3 dup)	1[3]	0	na
Herbicides (µg/kg)	na	na	na	29 (+ 3 dup)	na	0	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.
[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level
[3] 4,4'-DDT: 4.3 µg/kg at F-02

Table 10
Sediment–U3R-U

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Cs-137 (pCi/kg)	9.91E+01	5.68E+02	na	5 (+1 dup)	5	2.72E+02	1.69E+02
Co-60 (pCi/kg)	-1.99E+01	4.50E+01	na	5 (+1 dup)	0	7.07E+00	2.89E+01
Sr-90 (pCi/kg)	-4.94E+00	3.95E+02	na	5 (+1 dup)	0	1.34E+02	1.54E+02
U-234 (pCi/kg)	1.02E+02	1.60E+03	na	5 (+1 dup)	6	9.76E+02	5.65E+02
U-235 (pCi/kg)	8.09E+00	7.59E+01	na	5 (+1 dup)	6	4 68E+01	2.61E+01
U-238 (pCi/kg)	1.02E+02	1.55E+03	na	5 (+1 dup)	6	9.79E+02	5.48E+02
Pu-238 (pCi/kg)	4.36E+00	6.90E+00	na	5 (+1 dup)	6	5.99E+00	9.91E-01
Pu-239 (pCi/kg)	4.36E+00	4.28E+01	na	5 (+1 dup)	6	1.55E+01	1.44E+01
Am-241 (pCi/kg)	9.10E-01	1.34E+01	na	5 (+1 dup)	2	6.18E+00	5.21E+00
Cm-244 (pCi/kg)	1.53E-01	5.98E+00	na	5 (+1 dup)	2	2.23E+00	2.03E+00
Al (mg/kg)	3500	17000	na	5 (+1 dup)	6	7433.333	4868.949
Be (mg/kg)	1	1.6	na	5	4	1.375	0.287228
Cd (mg/kg)	na	na	na	5 (+1 dup)	1	0.25	na
Cr (mg/kg)	5.7	24	na	5 (+1 dup)	6	11	6.617855
Cu (mg/kg)	2.6	11	na	5 (+1 dup)	6	6.033333	3.130282
Fe (mg/kg)	1700	11000	na	5 (+1 dup)	6	4766.667	3376.191
Ga (mg/kg)	1.04	5.5	na	4	2	3.27	3.153696
Pb (mg/kg)	4.4	19	na	5 (+1 dup)	6	9.9	5.116249
Mn (mg/kg)	19	75	na	5 (+1 dup)	6	51	23.14303
Hg (mg/kg)	na	na	na	5 (+1 dup)	0	na	na
Ni (mg/kg)	5.8	13	na	5 (+1 dup)	3	8.533333	3.900427
Zn (mg/kg)	16	38	na	5 (+1 dup)	5	26.5	8.264381
Pesticides (µg/kg)	na	na	na	5 (+1 dup)	0	na	na
Herbicides (µg/kg)	na	na	na	5 (+1 dup)	0	na	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

Table 11
Sediment–U3R-D

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Cs-137 (pCi/kg)	4.38E+01	1.57E+02	na	5 (+1 dup)	3	1.10E+02	4.53E+01
Co-60 (pCi/kg)	-2.18E+01	2 78E+01	na	5 (+1 dup)	0	5.19E+00	1.75E+01
Sr-90 (pCi/kg)	-1.98E+00	3.24E+02	na	5 (+1 dup)	0	1.26E+02	1.46E+02
U-234 (pCi/kg)	3.37E+02	1.60E+03	na	5 (+1 dup)	5	1.05E+03	4.26E+02
U-235 (pCi/kg)	2.15E+01	9.42E+01	na	5 (+1 dup)	6	6.12E+01	2.59E+01
U-238 (pCi/kg)	3.45E+02	1.60E+03	na	5 (+1 dup)	5	1.07E+03	4.34E+02
Pu-238 (pCi/kg)	3.83E+00	5.27E+01	na	5 (+1 dup)	6	2 08E+01	1.96E+01
Pu-239 (pCi/kg)	8.10E+00	3.17E+01	na	5 (+1 dup)	6	2.17E+01	8.73E+00
Am-241 (pCi/kg)	1.58E+00	2.62E+01	na	5 (+1 dup)	4	1.18E+01	8.92E+00
Cm-244 (pCi/kg)	1.39E+00	1.00E+01	na	5 (+1 dup)	4	5.43E+00	3.52E+00
Al (mg/kg)	7300	19000	na	5 (+1 dup)	6	10816 67	4199.722
Be (mg/kg)	0.72	48	na	5 (+1 dup)	6	9.333333	18.95588
Cd (mg/kg)	0.19	8.9	na	5 (+1 dup)	3	3.13	4.997269
Cr (mg/kg)	11	58	na	5 (+1 dup)	6	23	18.38478
Cu (mg/kg)	4 4	48	na	5 (+1 dup)	6	13.13333	17.1988
Fe (mg/kg)	4700	15000	na	5 (+1 dup)	6	7700	3792 624
Ga (mg/kg)	1.34	5 4	na	4 (+1 dup)	4	2.9225	1.927354
Pb (mg/kg)	7.4	18	na	5 (+1 dup)	6	12.78333	3.969089
Mn (mg/kg)	16	190	na	5 (+1 dup)	6	76.5	61.85063
Hg (mg/kg)	na	na	na	5 (+1 dup)	0	na	na
Ni (mg/kg)	5.1	52	na	5 (+1 dup)	6	15.6	18.25618
Zn (mg/kg)	12	89	na	5 (+1 dup)	6	43.5	27.2672
Pesticides (µg/kg)	na	na	na	4 (+1 dup)	0	na	na
Herbicides (µg/kg)	na	na	na	4 (+1 dup)	0	na	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

Table 12
Sediment–Trib-I

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Cs-137 (pCi/kg)	9.30E+00	3.85E+01	na	5	0	2.71E+01	1.20E+01
Co-60 (pCi/kg)	-2.34E+00	1.85E+01	na	5	0	5.47E+00	8.54E+00
Sr-90 (pCi/kg)	-1.06E+01	1.97E+02	na	5	0	1.03E+02	7.65E+01
U-234 (pCi/kg)	2.11E+00	4.49E+02	na	5	4	1.93E+02	1.63E+02
U-235 (pCi/kg)	-5.72E-01	2.83E+01	na	5	3	1.13E+01	1.07E+01
U-238 (pCi/kg)	1.28E+01	4.42E+02	na	5	5	1.59E+02	1.66E+02
Pu-238 (pCi/kg)	1.09E+00	6.80E+00	na	5	1	3.12E+00	2.27E+00
Pu-239 (pCi/kg)	2.02E+00	3.46E+01	na	5	3	1.98E+01	1.40E+01
Am-241 (pCi/kg)	-1.85E+00	6.80E+01	na	5	3	1.70E+01	2.89E+01
Cm-244 (pCi/kg)	3.79E-01	1.93E+01	na	5	1	4.42E+00	8.32E+00
Al (mg/kg)	680	7200	na	5	5	2456	2682.476
Be (mg/kg)	0.46	1.4	na	5	2	0.93	0.66468
Cd (mg/kg)	na	na	na	5	0	na	na
Cr (mg/kg)	1.2	10	na	5	5	4.22	3.715777
Cu (mg/kg)	0.54	790	na	5	5	159.968	352.2093
Fe (mg/kg)	450	23000	na	5	5	6610	9433.213
Ga (mg/kg)	na	na	na	4	0	na	na
Pb (mg/kg)	1.4	150	na	5	5	32.5	65.73135
Mn (mg/kg)	10	120	na	5	5	48.6	50.76712
Hg (mg/kg)	na	na	na	5	0	na	na
Ni (mg/kg)	3.7	5.2	na	5	2	4.45	1.06066
Zn (mg/kg)	3.8	26	na	5	4	11.775	9.817119
Pesticides (µg/kg)	na	na	na	4	0	na	na
Herbicides (µg/kg)	na	na	na	4	0	na	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

Table 13
Sediment–Trib-C

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Cs-137 (pCi/kg)	-2.52E+01	2.05E+01	na	5 (+2 dup)	0	3.25E+00	1.45E+01
Co-60 (pCi/kg)	-2.44E+01	2.82E+01	na	5 (+2 dup)	0	-2.04E+00	1.60E+01
Sr-90 (pCi/kg)	-1.73E+02	1.79E+02	na	5 (+2 dup)	0	3.83E+01	1.14E+02
U-234 (pCi/kg)	3.54E+00	1.45E+03	na	5 (+2 dup)	6	4.89E+02	5.55E+02
U-235 (pCi/kg)	-1.12E+00	1.00E+02	na	5 (+2 dup)	4	3.52E+01	4.07E+01
U-238 (pCi/kg)	3.30E+00	1.42E+03	na	5 (+2 dup)	6	4.91E+02	5.58E+02
Pu-238 (pCi/kg)	1.47E+00	7.55E+01	na	5 (+2 dup)	6	1.66E+01	2.65E+01
Pu-239 (pCi/kg)	-3.31E-01	4.33E+01	na	5 (+2 dup)	6	1.48E+01	1.75E+01
Am-241 (pCi/kg)	-1.14E+00	6.44E+01	na	5 (+2 dup)	5	1.71E+01	2.26E+01
Cm-244 (pCi/kg)	-2.37E-01	6.56E+01	na	5 (+2 dup)	3	1.70E+01	2.43E+01
Al (mg/kg)	420	1500	na	5 (+2 dup)	7	890	337.9349
Be (mg/kg)	na	na	na	5 (+2 dup)	0	na	na
Cd (mg/kg)	na	na	na	5 (+2 dup)	0	na	na
Cr (mg/kg)	1.2	3.1	na	5 (+2 dup)	7	1.957143	0.70677
Cu (mg/kg)	0.34	0.9	na	5 (+2 dup)	5	0.604	0.203052
Fe (mg/kg)	240	810	na	5 (+2 dup)	7	540	188.9444
Ga (mg/kg)	na	na	na	4 (+1 dup)	0	na	na
Pb (mg/kg)	0.61	6.5	na	5 (+2 dup)	7	2.144286	2.002764
Mn (mg/kg)	3.9	14	na	5 (+2 dup)	7	10.34286	3.801691
Hg (mg/kg)	na	na	na	5 (+2 dup)	0	na	na
Ni (mg/kg)	na	na	na	5 (+2 dup)	0	na	na
Zn (mg/kg)	3.6	4.7	na	5 (+2 dup)	3	4.3	0.608276
Pesticides (µg/kg)	na	na	na	4 (+1 dup)	0	na	na
Herbicides (µg/kg)	na	na	na	4 (+1 dup)	0	na	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

Table 14
Sediment–F-02

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Cs-137 (pCi/kg)	2.14E+02	3.97E+02	na	4	4	3.18E+02	7.80E+01
Co-60 (pCi/kg)	3.11E+00	2.80E+01	na	4	0	1.03E+01	1.19E+01
Sr-90 (pCi/kg)	8.87E+00	8.47E+02	na	4	0	2.45E+02	4.02E+02
U-234 (pCi/kg)	1.87E+02	5.44E+03	na	4	4	3.61E+03	2.34E+03
U-235 (pCi/kg)	3.45E+01	4.66E+02	na	4	4	3.11E+02	1.90E+02
U-238 (pCi/kg)	3.84E+02	8.60E+03	na	4	4	5.47E+03	3.65E+03
Pu-238 (pCi/kg)	1.06E+02	8.17E+02	na	4	4	4.25E+02	2.93E+02
Pu-239 (pCi/kg)	1.22E+02	6.58E+02	na	4	4	3.67E+02	2.30E+02
Am-241 (pCi/kg)	6.18E+01	2.79E+02	na	4	4	1.19E+02	1.07E+02
Cm-244 (pCi/kg)	1.15E+01	4.54E+01	na	4	4	2.14E+01	1.62E+01
Al (mg/kg)	6200	16000	na	4	4	9100	4626.013
Be (mg/kg)	na	na	na	5	1	0.29	na
Cd (mg/kg)	na	na	na	4	0	na	na
Cr (mg/kg)	6.7	16	na	4	4	9.8	4.268489
Cu (mg/kg)	7	19	na	4	4	10.8	5.52811
Fe (mg/kg)	3800	9800	na	4	4	5550	2847.806
Ga (mg/kg)	0.81	1.88	na	5	3	1.185333	0.60225
Pb (mg/kg)	5.3	13	na	4	4	8.225	3.418942
Mn (mg/kg)	29	72	na	4	4	46.25	18.246
Hg (mg/kg)	na	na	na	4	0	na	na
Ni (mg/kg)	3.2	7.2	na	4	4	4.725	1.746186
Zn (mg/kg)	28	100	na	4	4	70.75	33.95463
Pesticides (µg/kg)	na	na	na	4	1[3]	na	na
Herbicides (µg/kg)	na	na	na	4	0	na	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

[3] 4,4'-DDT: 4.3 µg/kg

Table 15
Sediment–F-03

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Cs-137 (pCi/kg)	-2.95E+00	4.13E+01	na	4	1	2.84E+01	2.10E+01
Co-60 (pCi/kg)	-1.14E+01	2.36E+01	na	4	0	7.09E+00	1.43E+01
Sr-90 (pCi/kg)	-5.85E+01	6.73E+01	na	4	0	1.63E+01	5.34E+01
U-234 (pCi/kg)	9.02E+01	3.17E+02	na	4	4	1.62E+02	1.05E+02
U-235 (pCi/kg)	1.20E+00	2.77E+01	na	4	4	1.45E+01	1.19E+01
U-238 (pCi/kg)	6.77E+01	2.92E+02	na	4	4	1.44E+02	1.03E+02
Pu-238 (pCi/kg)	1.58E+01	4.44E+01	na	4	4	2.70E+01	1.22E+01
Pu-239 (pCi/kg)	6.65E+00	2.67E+01	na	4	3	1.29E+01	9.31E+00
Am-241 (pCi/kg)	1.34E+00	2.23E+01	na	4	3	1.17E+01	1.01E+01
Cm-244 (pCi/kg)	8.50E-01	5.88E+00	na	4	3	2.54E+00	2.27E+00
Al (mg/kg)	1400	2400	na	4	4	1725	471.6991
Be (mg/kg)	na	na	na	5	0	na	na
Cd (mg/kg)	na	na	na	4	0	na	na
Cr (mg/kg)	2.2	5.5	na	4	4	3.325	1.512999
Cu (mg/kg)	4.4	8.9	na	4	4	7.225	2.059733
Fe (mg/kg)	1500	2500	na	4	4	2000	476 0952
Ga (mg/kg)	na	na	na	5	0	na	na
Pb (mg/kg)	3	10	na	4	4	5.95	2.999444
Mn (mg/kg)	24	81	na	4	4	43.5	25.48856
Hg (mg/kg)	na	na	na	4	0	na	na
Ni (mg/kg)	na	na	na	4	1	3 6	na
Zn (mg/kg)	45	66	na	4	4	59	9.556847
Pesticides (µg/kg)	na	na	na	4	0	na	na
Herbicides (µg/kg)	na	na	na	4	0	na	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

Table 16
Sediment–F-05

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Cs-137 (pCi/kg)	5.59E+03	1.18E+04	na	4	4	8.31E+03	3.17E+03
Co-60 (pCi/kg)	3.92E-01	4.90E+01	na	4	1	3.04E+01	2.11E+01
Sr-90 (pCi/kg)	-1.05E+02	8.35E+02	na	4	1	2.43E+02	4.15E+02
U-234 (pCi/kg)	5.12E+01	5.24E+02	na	4	4	2.64E+02	2.16E+02
U-235 (pCi/kg)	2.83E+00	2.62E+01	na	4	2	1.24E+01	1.00E+01
U-238 (pCi/kg)	6.78E+01	5.18E+02	na	4	4	2.80E+02	2.10E+02
Pu-238 (pCi/kg)	3.82E+01	1.02E+02	na	4	4	6.46E+01	2.81E+01
Pu-239 (pCi/kg)	3.05E+02	7.27E+02	na	4	4	5.14E+02	1.99E+02
Am-241 (pCi/kg)	9.18E+02	2.17E+03	na	4	4	1.31E+03	5.77E+02
Cm-244 (pCi/kg)	3.05E+02	7.72E+02	na	4	4	4.77E+02	2.03E+02
Al (mg/kg)	1900	3600	na	4	4	2500	752.7727
Be (mg/kg)	na	na	na	5	1	0.31	na
Cd (mg/kg)	na	na	na	4	0	na	na
Cr (mg/kg)	2.9	4.4	na	4	4	3.525	0.708872
Cu (mg/kg)	21	54	na	4	4	42.25	14 63728
Fe (mg/kg)	3700	9000	na	4	4	5300	2480.591
Ga (mg/kg)	0 92	0.974	na	5	2	0.947	0 038184
Pb (mg/kg)	5.9	17	na	4	4	11.575	5.734326
Mn (mg/kg)	63	75	na	4	4	68.25	5.737305
Hg (mg/kg)	na	na	na	4	0	na	na
Ni (mg/kg)	3.1	4.4	na	4	4	3.5	0 60553
Zn (mg/kg)	140	270	na	4	3	200	65.57439
Pesticides (µg/kg)	na	na	na	4	0	na	na
Herbicides (µg/kg)	na	na	na	4	0	na	na

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.
[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

Table 17
Soil–All Locations and Depths

	Min[1]	Max	Applicable Limit/Standard[3]	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Cs-137 (pCi/kg)	-3.41E+01	3.22E+03	9.16E+04[4]	172	110	2.49E+02	4.25E+02
Co-60 (pCi/kg)	-4.10E+01	5.20E+01	2.11E+04[4]	172	1	1.91E+00	1.68E+01
Sr-90 (pCi/kg)	-8.15E+01	5.79E+02	3.05E+07[4]	172	2	7.72E+01	1.01E+02
U-234 (pCi/kg)	6.73E+00	6.70E+03	1.13E+06[4]	170	152	5.54E+02	7.77E+02
U-235 (pCi/kg)	-8.59E-01	5.32E+02	3.48E+05[4]	170	142	3.78E+01	5.80E+01
U-238 (pCi/kg)	8.11E+00	8 09E+03	9.20E+05[4]	170	154	6.16E+02	1.02E+03
Pu-238 (pCi/kg)	-4.14E-01	7.35E+02	2.75E+05[4]	171	130	4.41E+01	8.37E+01
Pu-239 (pCi/kg)	-1.91E+00	4.38E+03	2.48E+05[4]	171	133	1.25E+02	4 89E+02
Am-241 (pCi/kg)	-1.41E+00	7.66E+02	2.36E+05[4]	171	111	2.61E+01	8.19E+01
Cm-244 (pCi/kg)	-7.62E-01	1.05E+02	4.66E+05[4]	171	61	5.57E+00	1.15E+01
Al (mg/kg)	80	30,000	100,000[5]	43	43	6,774 651	6,699.996
Be (mg/kg)	0.35	2.3	2,240[5]	43	2	1.325	1.378858
Cd (mg/kg)	na	na	809[5]	43	0	na	na
Cr (mg/kg)	0.058	40	448[5]	43	43	7.702209	8.972435
Cu (mg/kg)	0.018	39	75,900[5]	43	43	4.781674	8.281261
Fe (mg/kg)	31	29,000	100,000[5]	43	43	5,754.07	6,920.002
Ga (mg/kg)	2.04	8 46	na	43 / 40[6]	10	4.818	2.336697
Pb (mg/kg)	0.05	47	750[5]	43	43	5.926488	7.898009
Mn (mg/kg)	0.52	330	32,300[5]	43	43	62.67581	70.20865
Hg (mg/kg)	na	na	613[5]	43	1	0.12	na
Ni (mg/kg)	0.045	18	40,900[5]	43	24	4.997042	4.887891
Zn (mg/kg)	0 074	50	100,000[5]	43	43	7.342419	7.748098

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

[3] Industrial use assumed

[4] Jannik 1995

[5] EPA 2000c

[6] Laboratory lost three samples

Table 18
Soil–Depth Profile Information for Radionuclides

		Concentration (pCi/kg)[1]				Percent Distribution[2]			
Nuclide	**Depth**	**Mean**	**Standard Deviation**	**Max**	**Min**	**Mean**	**Standard Deviation**	**Max**	**Min**
Cs-137	0-3”	4.95E+02	4.38E+02	2.27E+03	-7.23E+00	55.56066	20.98043	100	0
	3-6”	1.94E+02	3.01E+02	1.96E+03	-2.63E+01	19.64965	10.11894	59.87884	0
	6-9”	1.59E+02	3.67E+02	2.44E+03	-3.41E+01	14.49888	10.35898	48.63732	0
	9-12”	1.42E+02	4.84E+02	3.22E+03	-3 85E+00	10.29081	8.980228	37.42567	0
Co-60	0-3”	1.24E+00	1.78E+01	3.42E+01	-4.10E+01	na	na	na	na
	3-6”	2.21E+00	1 61E+01	5.18E+01	-3.63E+01	na	na	na	na
	6-9”	2 63E+00	1.68E+01	5.20E+01	-2.99E+01	na	na	na	na
	9-12”	7.63E-01	1.59E+01	3.16E+01	-3.76E+01	na	na	na	na
Sr-90	0-3”	1.26E+02	1.22E+02	5.11E+02	-4.76E+01	na	na	na	na
	3-6”	7.73E+01	1.10E+02	5.79E+02	-8.15E+01	na	na	na	na
	6-9”	4.76E+01	7.24E+01	2.52E+02	-6.43E+01	na	na	na	na
	9-12”	5.77E+01	7.25E+01	2.89E+02	-4.26E+01	na	na	na	na
U-234	0-3”	4.89E+02	5.31E+02	3.38E+03	9.07E+00	25.65853	13 06606	75	3.816078
	3-6”	5.61E+02	6.05E+02	2.62E+03	2.20E+01	26.82922	12.7985	59.30623	2.235772
	6-9”	6.51E+02	1.08E+03	6.70E+03	6.73E+00	25.66574	13.92876	80.38786	0 436806
	9-12”	5.29E+02	7.91E+02	4.68E+03	2.59E+01	21.19202	9.051195	43.67487	0
U-235	0-3”	3.38E+01	3.21E+01	1.54E+02	1.00E+00	25.98339	13.07685	55.06515	1.765799
	3-6”	3.72E+01	4.15E+01	2.29E+02	1.96E+00	27.60139	15.10146	64.47431	1.862777
	6-9”	4.46E+01	8.52E+01	5.32E+02	-8.59E-01	25.21663	15.69174	85.66349	0
	9-12”	3.64E+01	6 00E+01	3.76E+02	9 67E-01	21.19859	11.65943	53.42486	0
U-238	0-3”	5.66E+02	7.08E+02	3.53E+03	9.24E+00	26.33932	12.95432	73.72486	3.069122
	3-6”	6.51E+02	9.79E+02	5.94E+03	1.89E+01	27.25364	12.97329	61.4786	1.697198
	6-9”	6.94E+02	1.30E+03	8.09E+03	8.11E+00	25.65358	14.15891	86.2023	0.495385
	9-12”	5.61E+02	1.02E+03	6.34E+03	3.28E+01	20.75345	9.476018	43.22479	0
Pu-238	0-3”	5.85E+01	7.75E+01	3.76E+02	1.38E+00	36.84049	19.00845	67.86503	1.187812
	3-6”	3.76E+01	5.87E+01	3.25E+02	-4.14E-01	23.56074	16.1256	84.3061	0
	6-9”	4.10E+01	7.70E+01	3.93E+02	-3.50E-01	22.97056	20.99798	90.37901	0
	9-12”	3.85E+01	1.14E+02	7.35E+02	-1.14E-01	16 62821	13.2405	52.37896	0

Table 18 (cont.)
Soil–Depth Profile Information for Radionuclides

		Concentration (pCi/g)[1]				Percent Distribution[2]			
Nuclide	Depth	Mean	Standard Deviation	Max	Min	Mean	Standard Deviation	Max	Min
Pu-239	0-3”	1.37E+02	1.58E+02	6 90E+02	-1.91E+00	45.18812	24.22862	85.84962	0
	3-6”	8.71E+01	2.45E+02	1.59E+03	-1.18E+00	21.3616	14.59629	56.44499	0
	6-9”	1.54E+02	6.78E+02	4.38E+03	5.54E-01	19 09096	17.2946	80.24356	0.580781
	9-12”	1.21E+02	6.58E+02	4.28E+03	2.35E+00	14.35932	12.39202	48 58044	0
Am-241	0-3”	1.83E+01	1.71E+01	7.96E+01	-5.58E-01	34.10715	22.17931	82.78581	0
	3-6”	2.08E+01	4.19E+01	2.20E+02	-7.86E-01	23.16474	14.9421	72.91862	0
	6-9”	2.89E+01	1.02E+02	6.52E+02	-1.41E+00	21.15302	19.3005	83.98611	0
	9-12”	3 64E+01	1.21E+02	7.66E+02	-9.77E-01	21.57509	19.1334	79.49126	0
Cm-244	0-3”	3.78E+00	4.46E+00	1.72E+01	-6.57E-01	24 32848	22.39905	87.62437	0
	3-6”	7.05E+00	1.72E+01	1 05E+02	-7.14E-01	24.94357	18.30559	67.25441	0
	6-9”	4.99E+00	1.20E+01	7.72E+01	-7.62E-01	20.20612	19.76766	90.07573	0
	9-12”	6.39E+00	8.17E+00	3.19E+01	-4.05E-01	29.96404	25.23441	99.41547	0

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] Depth distribution not calculated for Co-60 and Sr-90 because of the low number of samples with concentrations above detection

Table 19
Vegetation–All Locations

	Min[1]	Max	Applicable Limit/Standard	Number Collected	Number >MDC or PQL[2]	Mean	Standard Deviation
Gross Alpha (pCi/kg)	-9.51E+02	2.01E+03	na	50	3	5.16E+02	6 69E+02
Gross Beta (pCi/kg)	2.04E+02	2.60E+04	na	50	46	9.73E+03	5.30E+03
Cs-137 (pCi/kg)	-1.29E+01	4.07E+03	na	50	21	3.31E+02	8.02E+02
Co-60 (pCi/kg)	-4.70E+01	5.34E+01	na	50	0	6.24E+00	2.22E+01
Sr-90 (pCi/kg)	-1.13E+01	2.44E+03	na	50	32	5.24E+02	6.12E+02
U-234 (pCi/kg)	-4.03E-01	3.53E+01	na	50	32	4.67E+00	6.42E+00
U-235 (pCi/kg)	-4.64E-01	3.89E+00	na	50	3	3.83E-01	7.08E-01
U-238 (pCi/kg)	-5.88E-01	3.69E+01	na	50	37	4.98E+00	6.37E+00
Pu-238 (pCi/kg)	-2.48E+00	6.16E+01	na	50	7	1.62E+00	8.79E+00
Pu-239 (pCi/kg)	-5.41E-01	1.44E+01	na	50	11	1.54E+00	2.94E+00
Am-241 (pCi/kg)	-1.13E+01	1.81E+01	na	50	9	-1.90E-01	4.79E+00
Cm-244 (pCi/kg)	-4.27E+00	6.99E+00	na	50	6	1.08E-01	1.69E+00

[1] Negative values for radionuclides occur when the count in the sample is less than the instrument background; when the background count is subtracted from the sample count, a net count of less that zero results. From this, concentrations are mathematically calculated. DOE specifies that all analytical results—even those that are negative or less than the detection limit—should be reported.

[2] MDC = Minimum Detectable Concentration, PQL = Practical Quantification Level

Table 20
Ambient Gamma Exposure

	2Q, 2001		3Q, 2001		4Q, 2001		1Q, 2002		1-Year	
	Exposure[1]	Rate[2]	Exposure[1]	Rate[2]	Exposure[1]	Rate[2]	Exposure[1]	Rate[2]	Exposure[1]	Rate[2]
PDP-1	40.977	0.422443	42.152	0.376357	35.214	0.495972	54.5	0.656627	172 843	0.476152
PDP-2	33.685	0.347268	32 451	0.289741	28.071	0.395366	23.657	0.285024	117.864	0 324694
PDP-3	29.783	0.307041	28 067	0 250598	30.674	0.432028	21.088	0.254072	109.612	0 301961
PDP-4	33.274	0.343031	32.417	0.289438	27.391	0.385789	24.299	0.292759	117.381	0.323364
PDP-5	32.35	0 333505	31.174	0.278339	27.505	0.387394	23.366	0 281518	114.395	0.315138
PDP-6	35.534	0.36633	35.834	0.319946	31.806	0.447972	26.88	0.323855	130 054	0.358275
PDP-7	UNCOLLECTABLE, BRIARS									
PDP-8	26.702	0.275278	24.856	0 221929	23.015	0 324155	18.091	0.217964	92 664	0.255273
PDP-9	24.83	0.250808	22.69	0.229192	17.846	0.262441	15.57	0.185357	80.936	0.231246
PDP-10	UNCOLLECTABLE, INSIDE F-AREA FENCE									
PDP-11	44.388	0.457608	46.295	0.413348	37.352	0.526085	33.077	0.398518	161.112	0.443835
PDP-12	45.187	0 49656	47.952	0.428143	39.163	0.551592	35.325	0.425602	167.627	0.469543
PDP-13	UNCOLLECTABLE, BRIARS									
PDP-14	28.961	0.353183	27.653	0.246902	24.788	0.349127	20.66	0.248916	102.062	0.293282
PDP-15	22.594	0.228222	21.853	0.220737	20.5	0 301471	15.414	0.1835	80.361	0.229603
PDP-16	25.675	0.259343	24 546	0.247939	22.185	0.32625	17.877	0.212821	90.283	0.257951
PDP-17	UNCOLLECTABLE, INSIDE F-AREA PARKING LOT									
PDP-18	27.5	0.283505	26.513	0.27333	24.675	0.347535	19.268	0 232145	97.956	0.281483
PDP-19	28.756	0.296454	27.238	0 280804	24.901	0.350718	19.803	0.23859	100 698	0.289362
PDP-20	28 653	0.295392	27.963	0.282455	25.694	0.372377	20.339	0.245048	102 649	0.294968
PDP-21	34 507	0.448143	35.938	0.320875	39 277	0.553197	26.226	0.315976	135.948	0.39635
PDP-22	24 648	0 289976	21.231	0 214455	20 94	0.307941	15.522	0.184786	82.341	0.245063
PDP-23	25.366	0.298424	23.821	0.240616	22.26	0.327353	16.592	0.197524	88 039	0 262021
PDP-24	27.01	0.272828	25.685	0.259444	24.109	0.354544	18.84	0.224286	95 644	0.273269
PDP-25	UNCOLLECTABLE, INSIDE GRAVEL LOT									
PDP-26	29.885	0.308093	28.999	0.298959	25.807	0 363479	21.195	0.255361	105.886	0 30427
PDP-27	31.608	0.376286	29.413	0.303227	26.26	0.369859	21.302	0.256651	108.583	0.324128
PDP-28	28 447	0.360089	26.41	0.266768	24.109	0.349406	19.161	0.230855	98.127	0.297355
PDP-29	37.382	0.541768	42.256	0.377286	33.831	0.476493	31.043	0.374012	144.512	0.431379
PDP-30	28.55	0.339881	25.892	0.261535	23 656	0.347882	18.733	0.223012	96 831	0.289048

Table 20 (cont.)
Ambient Gamma Exposure

	2Q, 2001		3Q, 2001		4Q, 2001		1Q, 2002		1-Year	
	Exposure[1]	Rate[2]	Exposure[1]	Rate[2]	Exposure[1]	Rate[2]	Exposure[1]	Rate[2]	Exposure[1]	Rate[2]
PDP-31	30.296	0.285811	28.481	0.287687	26.373	0.387838	20.814	0.247786	105.964	0.296818
PDP-32	25.88	0.327595	23.303	0.237786	21.619	0.313319	16.271	0.193702	87.073	0.263858
PDP-33	UNCOLLECTABLE, INSIDE F-AREA PARKING LOT									
PDP-34	UNCOLLECTABLE, INSIDE F-AREA FENCE									
PDP-35	27.831	0.356808	25.374	0.261588	23.09	0.329857	18.091	0.215369	94.386	0.286888
PDP-36	26.599	0.341013	25.788	0.265856	23.141	0.32593	17.984	0.216675	93.512	0.284231
PDP-37	29.988	0.384462	28.539	0.288273	25.656	0.371826	20.339	0.245048	104.522	0.317696
PDP-38	33.788	0.544968	35.109	0.313473	30.334	0.433343	26.226	0.312214	125.457	0.382491
PDP-39	26.702	0.346779	24.235	0.247296	22.009	0.318971	16.913	0.201345	89.859	0.27396
PDP-40	28.961	0.376117	26.352	0.268898	23.769	0.344478	18.412	0.21919	97.494	0.297238
PDP-41	28.756	0.373455	27.158	0.274323	24.109	0.354544	19.91	0.237024	99.933	0.304674
PDP-42	27.42	0.386197	24.028	0.242707	21.958	0.322912	17.127	0.203893	90.533	0.281158
PDP-43	27.01	0.380423	24.235	0.244798	22.185	0.321522	17.127	0.206349	90.557	0.281233
PDP-44	30.604	0.5465	28.067	0.250598	25.467	0.363814	21.088	0.251048	105.226	0.326789
PDP-45	35.226	0.652333	36.939	0.329813	31.466	0.449514	27.951	0.328835	131.582	0.409913
PDP-46	26.496	0.384	23.51	0.239898	21.845	0.316594	17.02	0.202619	88.871	0.277722
PDP-47	26.496	0.384	23.432	0.236687	21.958	0.322912	16.913	0.201345	88.799	0.277497
PDP-48	27.044	0.391942	22.785	0.230152	21.506	0.316265	16.485	0.19625	87.82	0.274438
PDP-49	26.873	0.389464	24.131	0.246235	22.524	0.326435	17.662	0.210262	91.19	0.284969
PDP-50	27.42	0.397391	22.578	0.230388	21.619	0.313319	16.378	0.194976	87.995	0.274984

[1] mR
[2] mR/day

Figure 1
PDP Project Areas with Topography (20-Foot Contours)

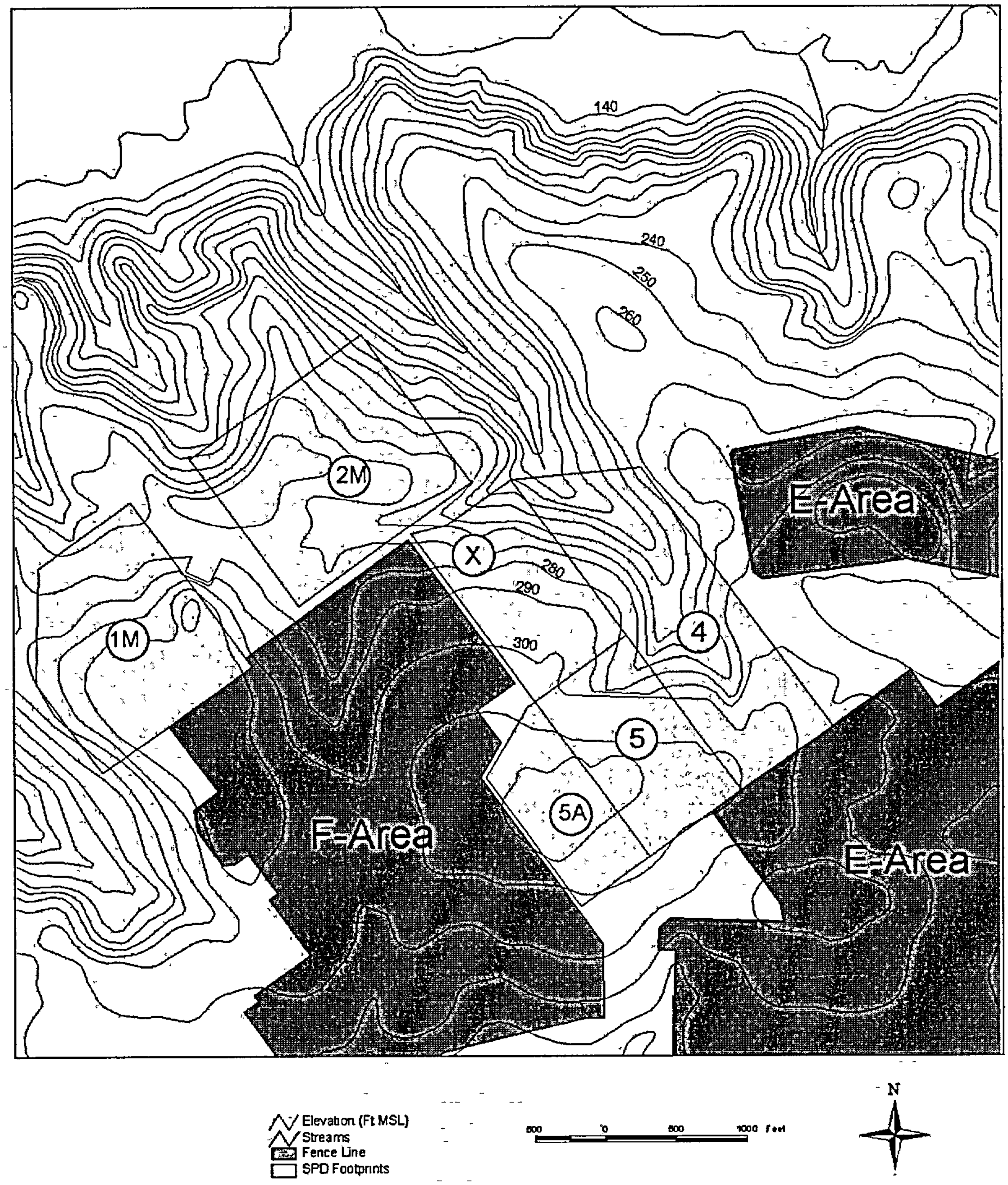


Figure 2
Preconstruction Surface Water and Sediment Monitoring Sites

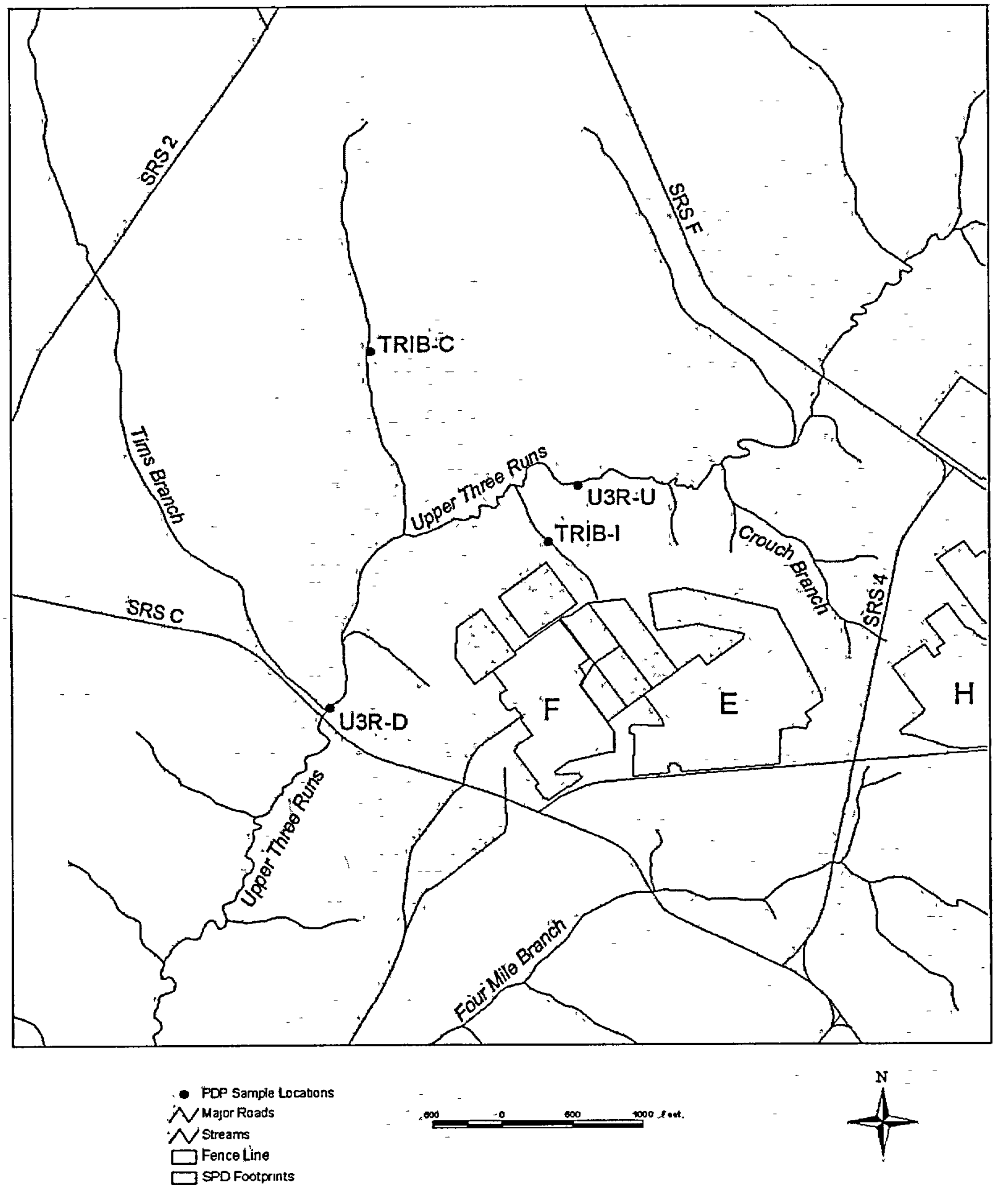


Figure 3
Preconstruction Sediment Monitoring Sites

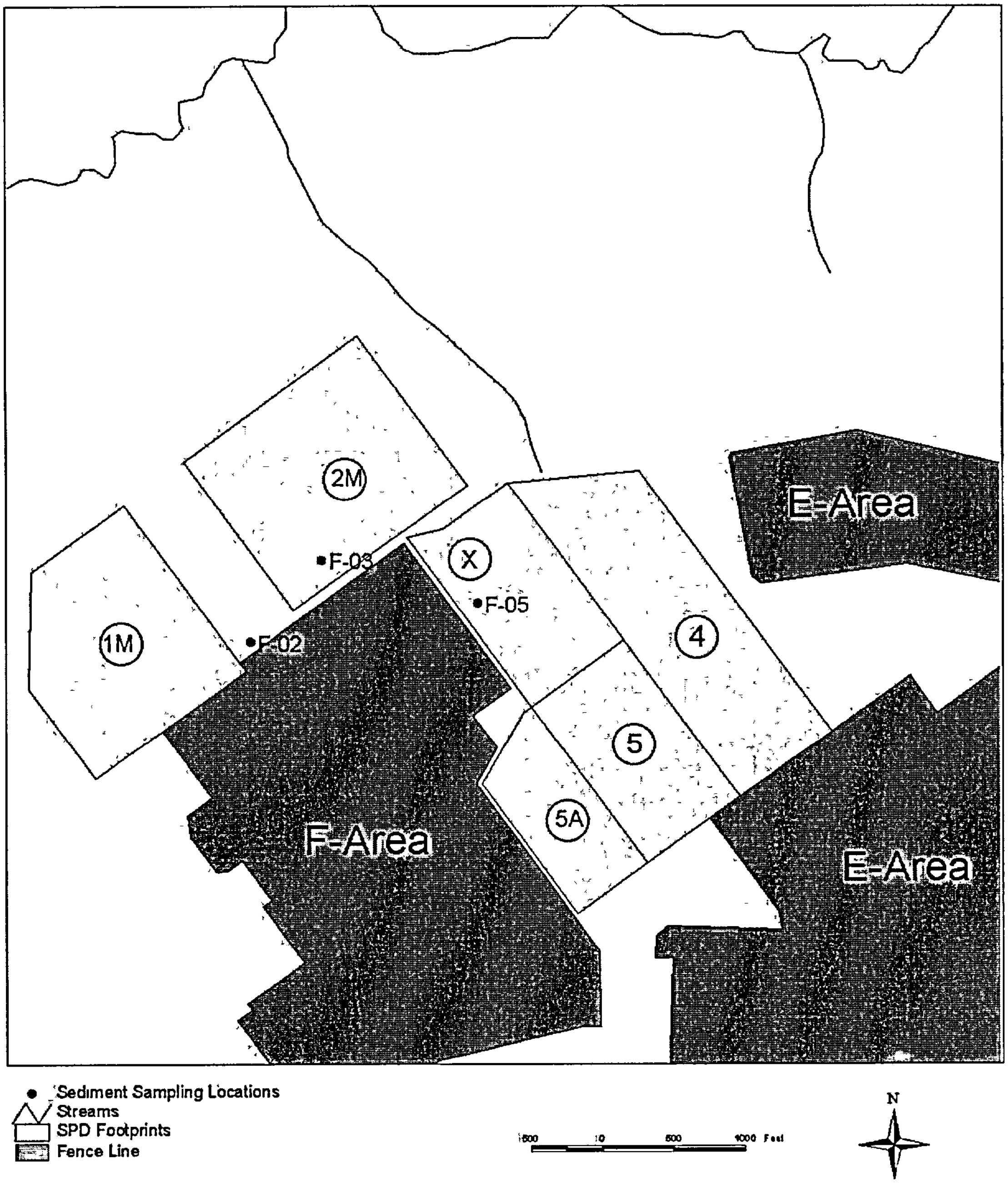


Figure 4
MARSSIM-Based Soil & Vegetation Sampling and TLD Placement Grid

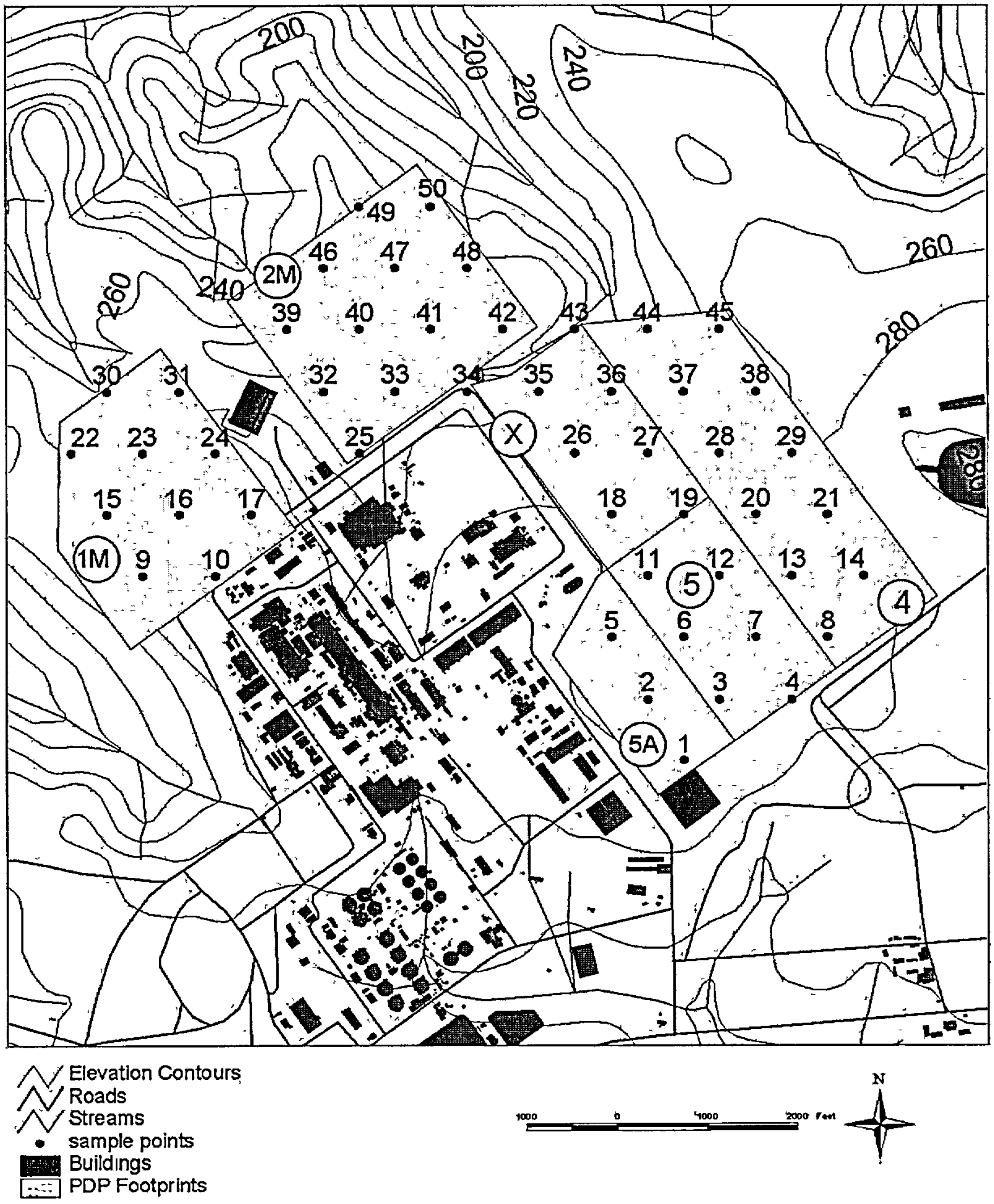


Figure 5
Groundwater Plumes Near the PDP Site

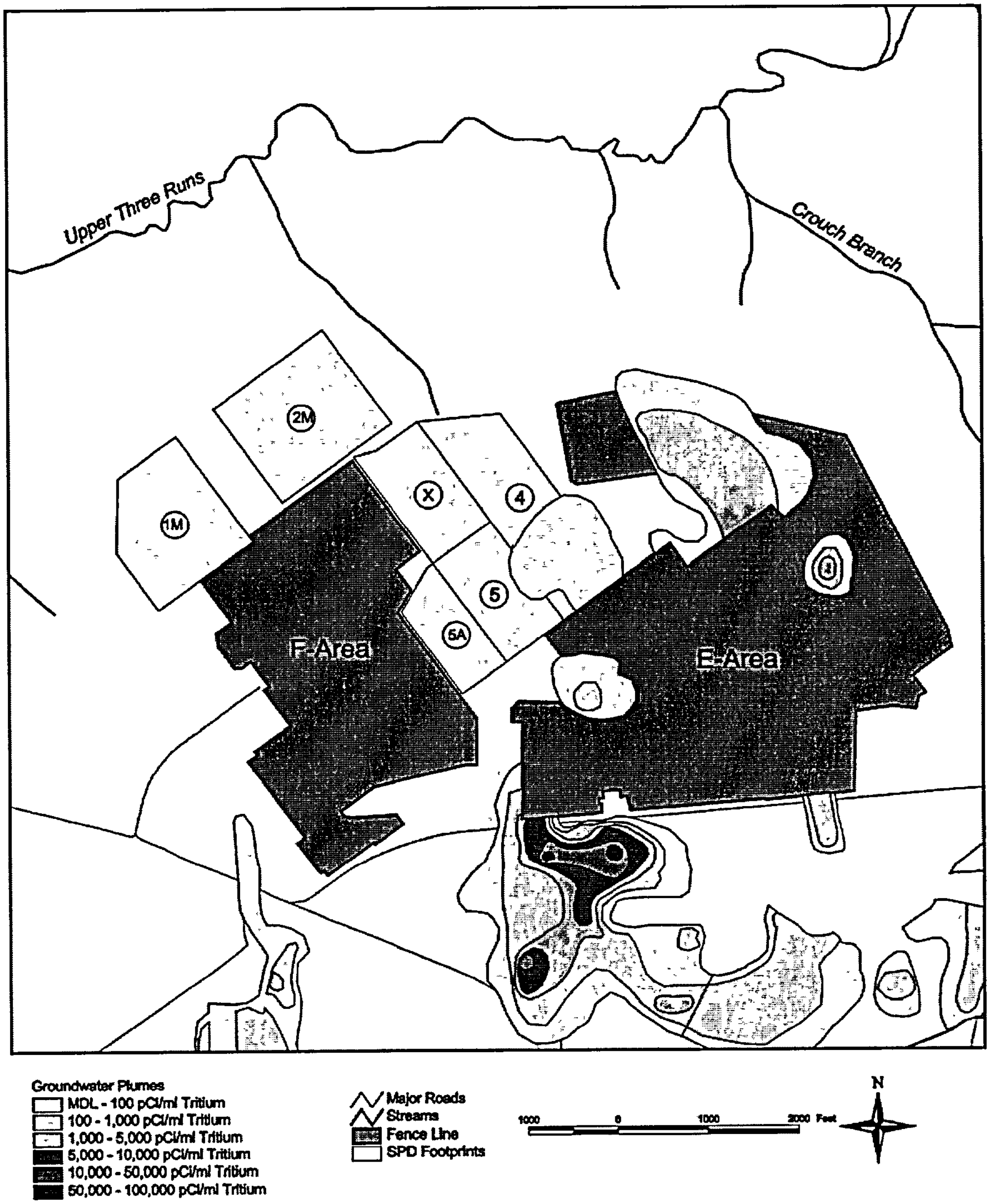


Figure 6
TCE-in-Groundwater Results Near the PDP Site

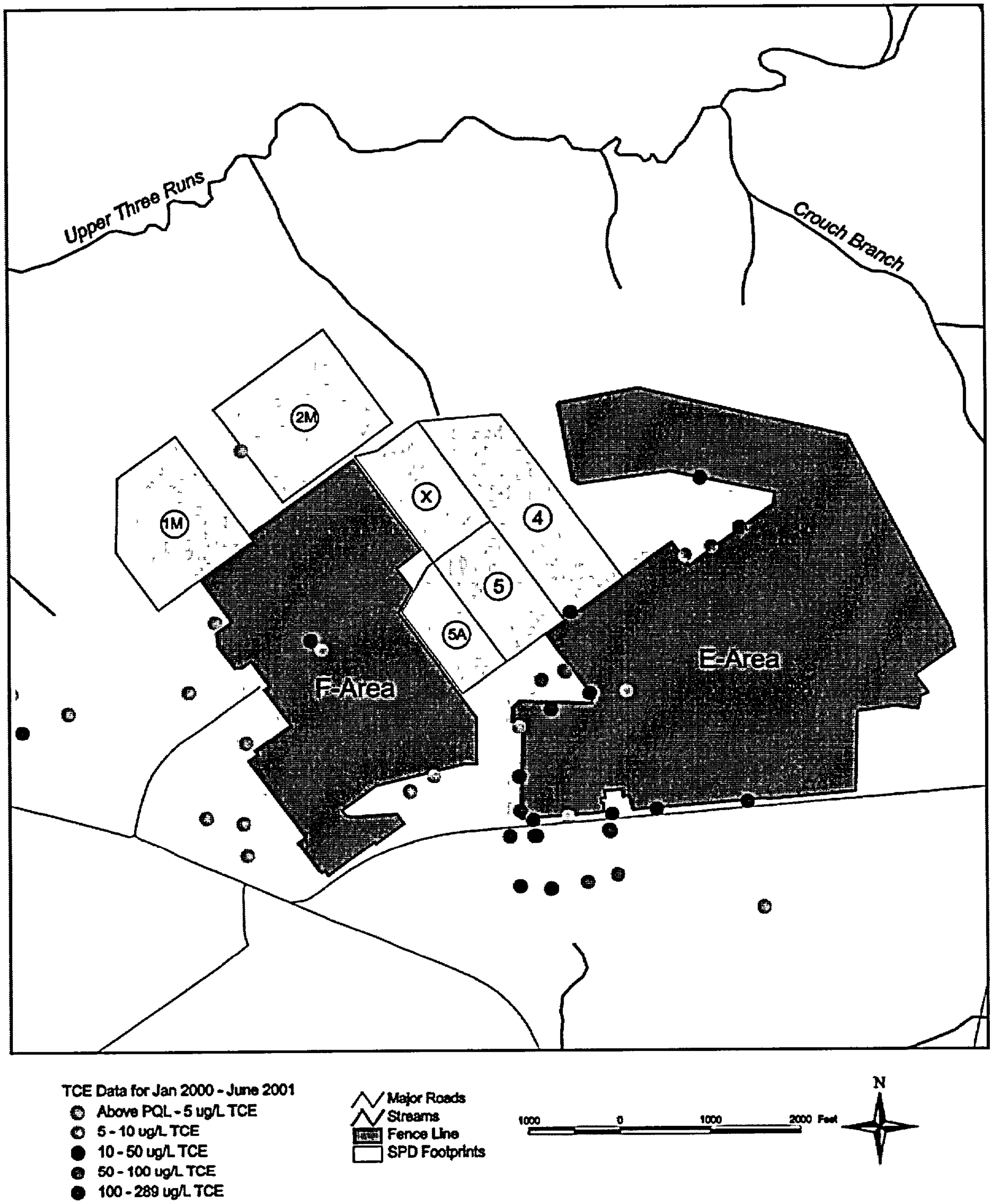


Figure 7
Groundwater Sampling Locations at Site 2M

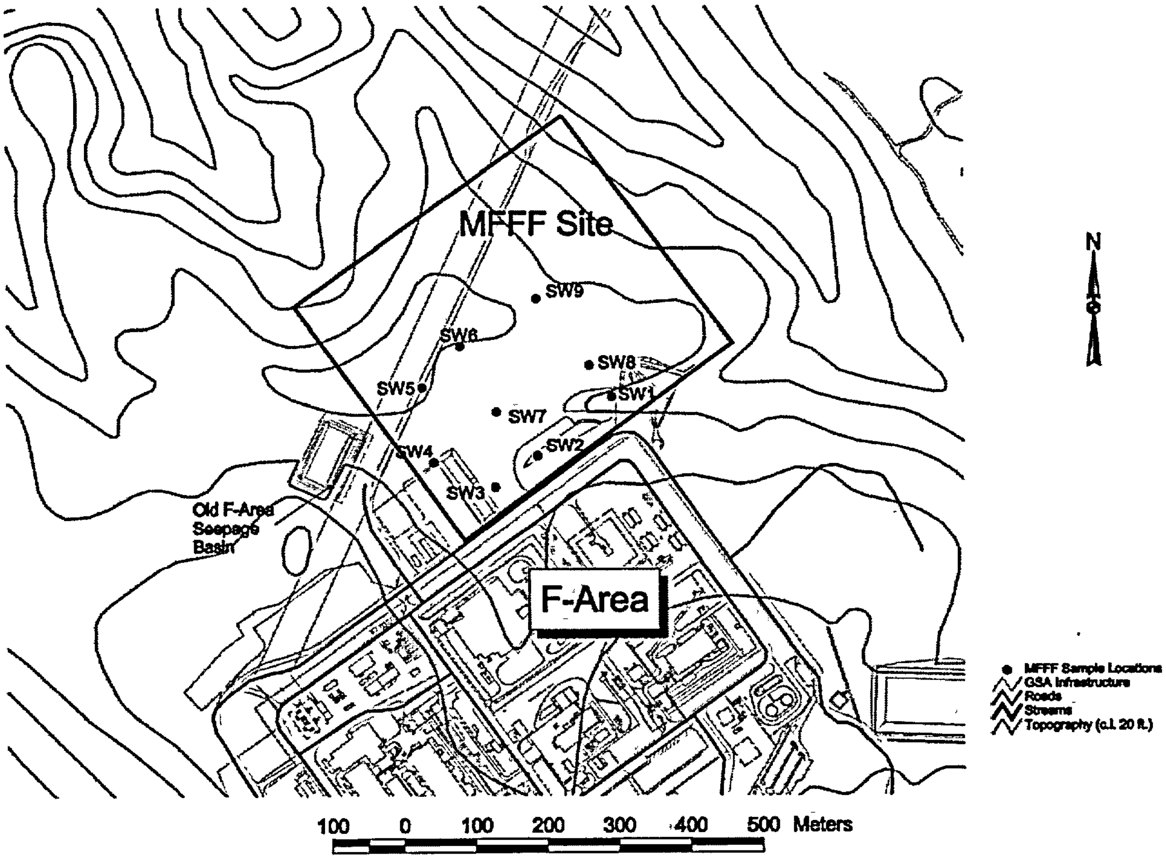


Figure 8
Water Quality at U3R-U

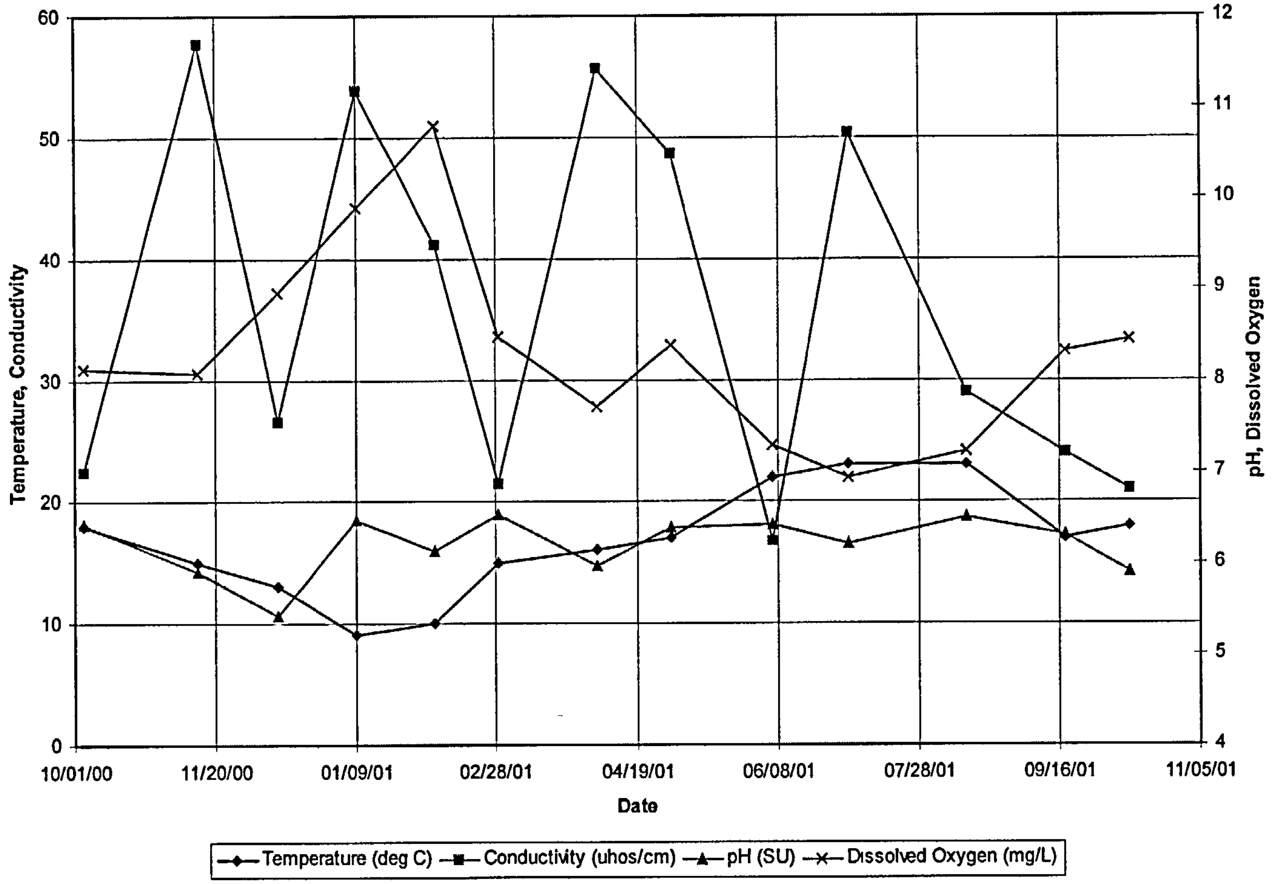


Figure 9
Water Quality at U3R-D

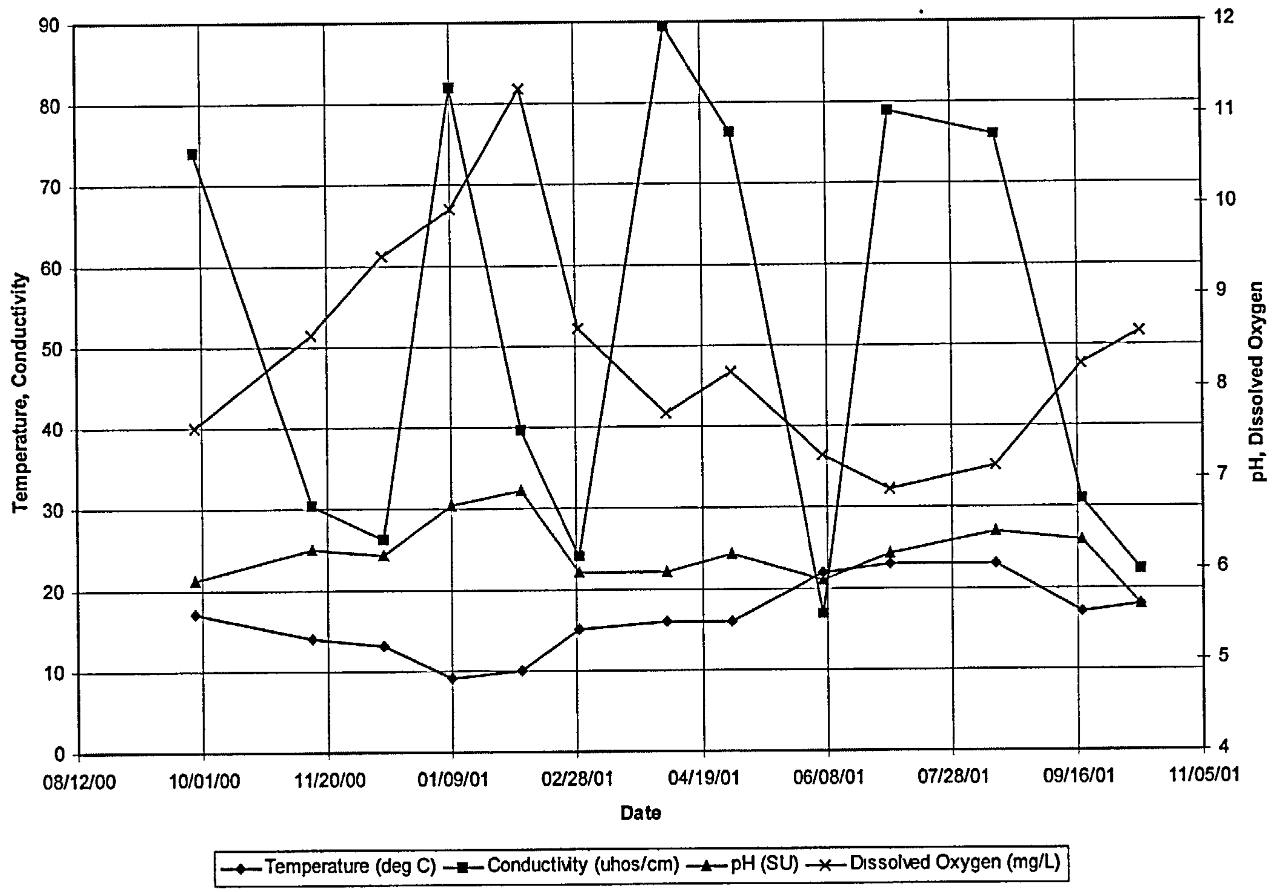


Figure 10
Water Quality at Trib-I

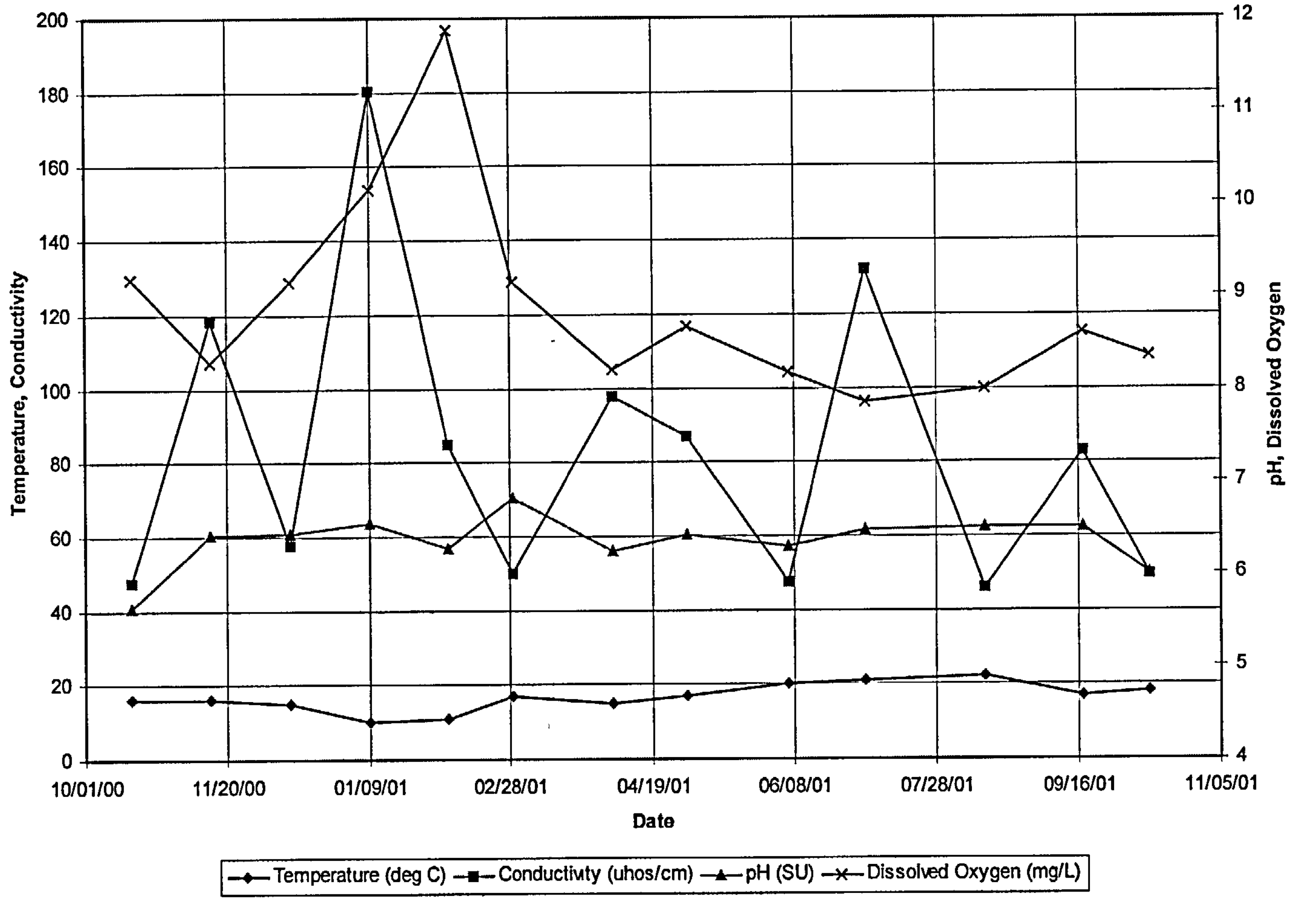


Figure 11
Water Quality at Trib-C

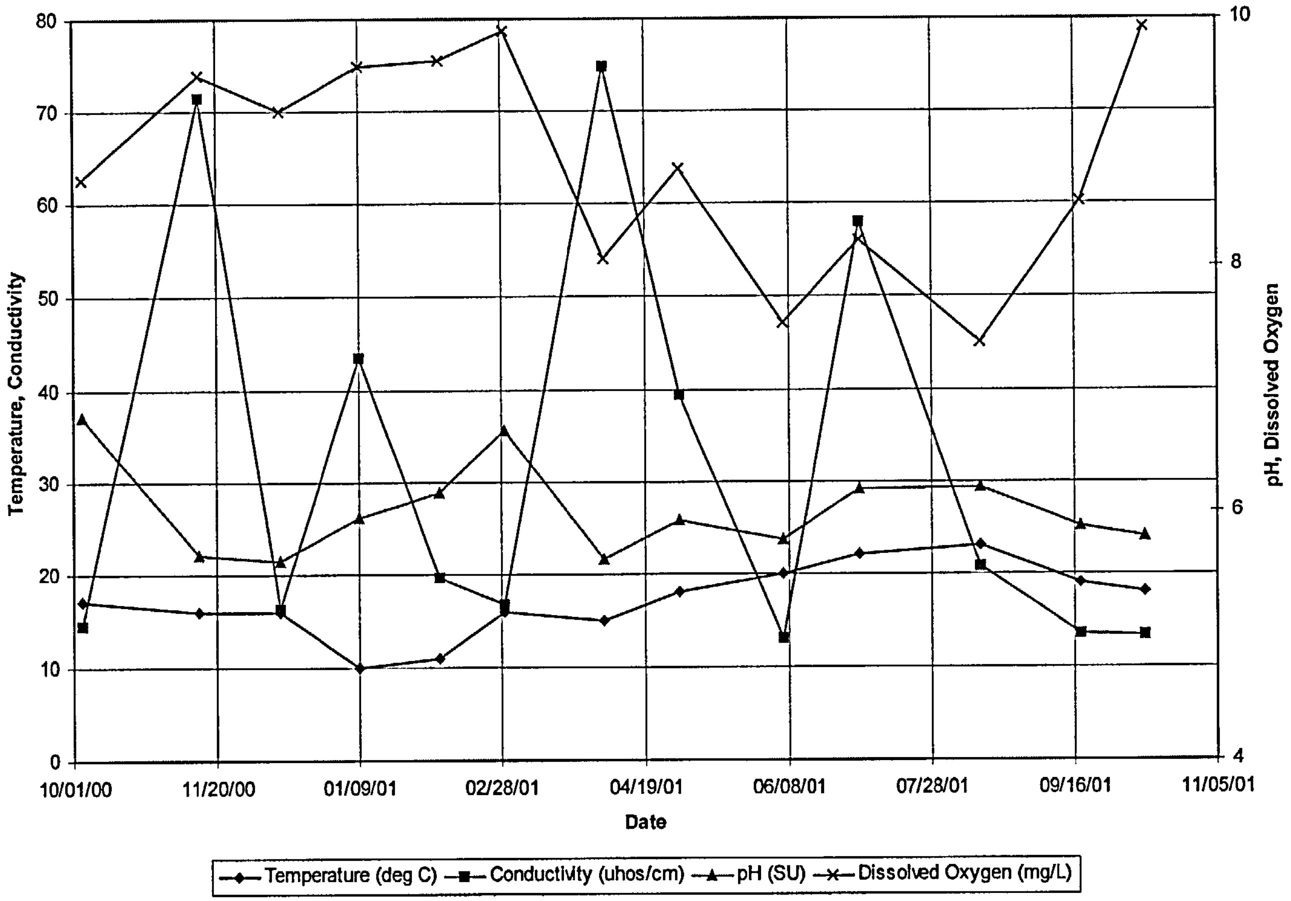
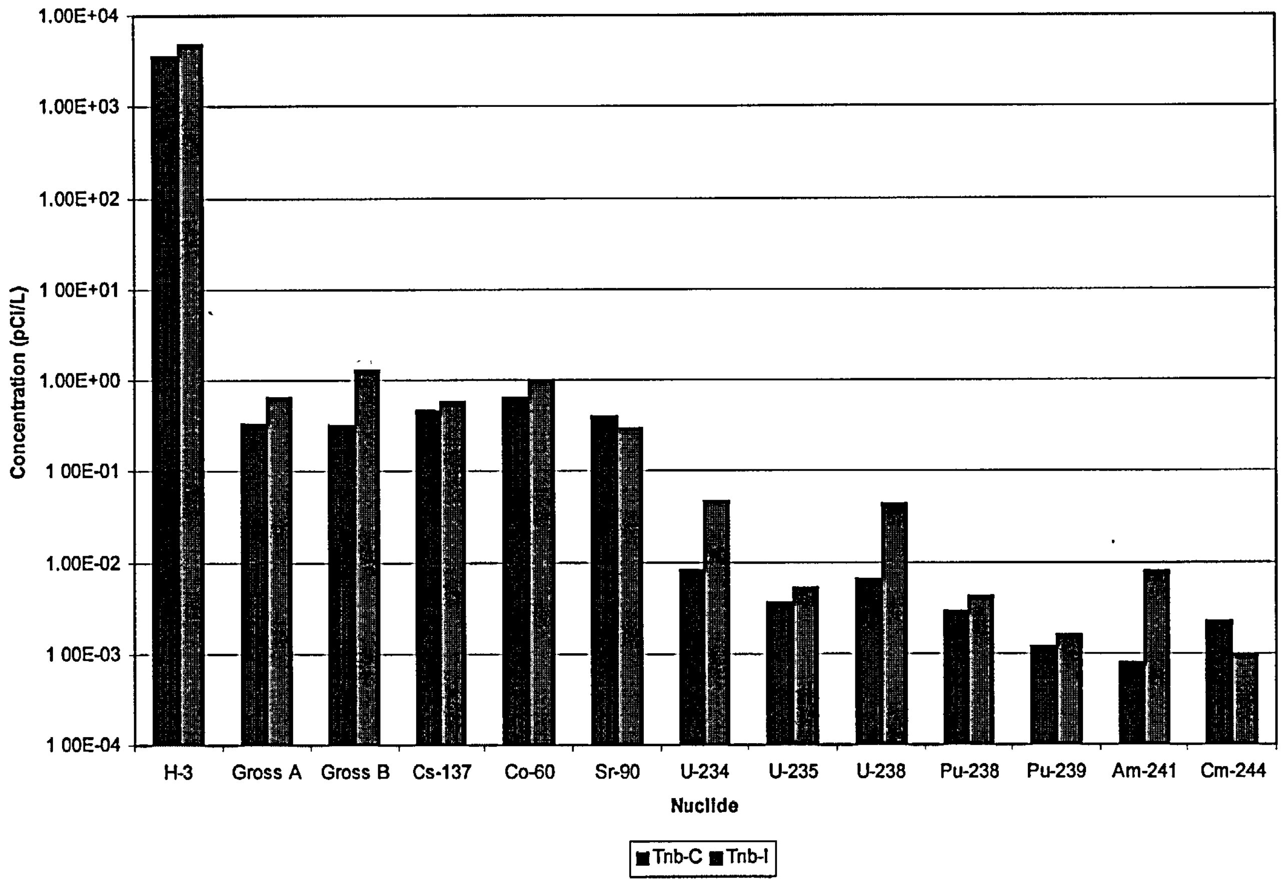


Figure 12
Mean Radionuclide Concentrations at Trib-C and Trib-I



Attachment 27. MFFF CAR Table listing volumes of process and storage tanks

Draft CAR Table 8-2a. Chemicals and Chemical Tanks or Containers in the BRP, BAP, and BMP (Note 3)

Chemical	Form	Symbol, Usage	Concentration		BRP		BAP		BMP
			Quantity	Units	Tank	Capacity (gal, U.N.O.)	Tank	Capacity (gal, U.N.O.)	Capacity
Aluminum Nitrate	L	$Al(NO_3)_3 * 9H_2O$	1	g(Al)/l	N/A	N/A	RAN-TK1480	6	N/A
Azodicarbonamide	S	poreformer	100	%	N/A	N/A	N/A	N/A	1.2-kg (bag)
	S	poreformer	100	%	N/A	N/A	N/A	N/A	4-L (hopper)
Diluent (Note 1)	L	diluent	100	%	Tote Tank	180	N/A	N/A	N/A
	L	TBP + diluent	70	%	N/A	N/A	RTP-TK1020	30	N/A
	L	diluent	100	%	RDO-TK1000	80	RDO-TK1005	50	N/A
Hydrazine Monohydrate and Hydrazine Nitrate	L	N_2H_4-(H_2O)	35	%	Tote Tank	126	N/A	N/A	N/A
	L	N_2H_4-H_2O	35	%	RHZ-TK1150	80	N/A	N/A	N/A
	L	N_2H_4-HNO_3	4	M	RHZ-REV1160	15	N/A	N/A	N/A
	L	N_2H_4-HNO_3	4	M	RHZ-REV1170	15	N/A	N/A	N/A
	L	N_2H_4-HNO_3	4	M	RHZ-REV1180	30	N/A	N/A	N/A
	L	N_2H_4-HNO_3	4	M	RHZ-TK1181	5	N/A	N/A	N/A
Hydrazine and Sodium Hydroxide	L	N_2H_4-NaOH	0.16	N	RHZ-TK1182	384	RHZ-TK1183	384	N/A
Hydrogen Peroxide	L	H_2O_2	35	%	Drums	TBD	N/A	N/A	N/A

Draft CAR Table 8-2a. Chemicals and Chemical Tanks or Containers in the BRP, BAP, and BMP (Note 3)

Chemical	Form	Symbol, Usage	Concentration		BRP		BAP		BMP
			Quantity	Units	Tank	Capacity (gal, U.N.O.)	Tank	Capacity (gal, U.N.O.)	Capacity
	L	H_2O_2	10	%	RHP-TK1200	40	RHP-TK1205	40	N/A
Hydroxylamine Nitrate/ Hydroxylamine Nitrate and Hydrazine	L	HAN	1.9	M	Tote Tank	180	N/A	N/A	N/A
	L	HAN	1.9	M	RHN-TK1060	200	RHN-TK1090	55	N/A
	L	HAN-N_2H_2-HNO_3	0.15	M	RHN-TK1070	627	RHN-TK1080	320	N/A
	L	HAN-N_2H_4- HNO_3	0.15	M	N/A	N/A	RHN-TK1081	5	N/A
	L	HAN-N_2H_4- HNO_3	0.15	M	RHN-TK1110	150 Note 2	RHN-TK1082	60 Note 2	N/A
Isopropanol	L	$(CH_3)_2CHOH$	100	%	N/A	N/A	N/A	N/A	0.5-L (bottle)
Manganese Nitrate	L	Mn^{+2}	1	%	N/A	N/A	Bottles	TBD	N/A
	L	HNO_3-Mn^{+2}	0.01	M	N/A	N/A	RMN-TK1050	15	N/A
	L	HNO_3-Mn^{+2}	0.01	M	N/A	N/A	RMN-TK1051	5	N/A
	L	HNO_3-Mn^{+2}	0.011	M	N/A	N/A	KCD-TK4000	100 liters	N/A
	L	HNO_3-Mn^{+2}	0.011	M	N/A	N/A	KCD-TK4100	100 liters	N/A
	L	HNO_3-Mn^{+2}	0.011	M	N/A	N/A	KCD-TK4200	100 liters	N/A
	L	HNO_3-Mn^{+2}	9.90E-05	M	N/A	N/A	KCD-TK1000	1000 liters	N/A

Draft CAR Table 8-2a. Chemicals and Chemical Tanks or Containers in the BRP, BAP, and BMP (Note 3)

Chemical	Form	Symbol, Usage	Concentration		BRP		BAP		BMP
			Quantity	Units	Tank	Capacity (gal, U.N.O.)	Tank	Capacity (gal, U.N.O.)	Capacity
	L	HNO_3-Mn^{+2}	9.90E-05	M	N/A	N/A	KCD-TK1500	1000 liters	N/A
	L	HNO_3-Mn^{+2}	9.90E-05	M	N/A	N/A	KCD-TK2000	1000 liters	N/A
Nitric Acid (Note 1)	L	HNO_3	13.6	N	Tote Tank	126	N/A	N/A	N/A
	L	HNO_3	13.6	N	RNA-TK1260	142	RNA-TK1265	161	N/A
	L	HNO_3	13.6	N	RNA-TK1261	5	N/A	N/A	N/A
	L	HNO_3	13.6	N	N/A	N/A	RNA-TK1262	5	N/A
	L	HNO_3	13.6	N	N/A	N/A	RNA-TK1263	5	N/A
	L	HNO_3	13.6	N	N/A	N/A	KDD-TK1500	60 liters	N/A
	L	HNO_3	13.6	N	N/A	N/A	KDD-TK2500	60 liters	N/A
	L	HNO_3	13.6	N	N/A	N/A	KPC-TK4000	500 liters	N/A
	L	HNO_3	13.6	N	N/A	N/A	KPC-TK4500	500 liters	N/A
	L	HNO_3	6	N	N/A	N/A	RNA-TK1330	8	N/A
	L	HNO_3	2.1	N	N/A	N/A	KPC-TK1000	5000 liters	
	L	HNO_3	1.5	N	N/A	N/A	RNA-TK1030	350	N/A
	L	HNO_3	1.5	N	N/A	N/A	RNA-TK1040	400	N/A

Draft CAR Table 8-2a. Chemicals and Chemical Tanks or Containers in the BRP, BAP, and BMP (Note 3)

Chemical	Form	Symbol, Usage	Concentration		BRP		BAP		BMP
			Quantity	Units	Tank	Capacity (gal, U.N.O.)	Tank	Capacity (gal, U.N.O.)	Capacity
	L	HNO_3	1.5	N	N/A	N/A	RNA-TK1041	5	N/A
	L	HNO_3	Variable	N	RNA-TK1421	150 Note 2	N/A	N/A	N/A
Nitrogen Tetroxide	L	N_2O_4	100	%	Cylinders	1 Ton (240 gal)	N/A	N/A	N/A
	L	N_2O_4	100	%	GNO-TK1300	1 Ton (240 gal)	N/A	N/A	N/A
	L	N_2O_4	100	%	GNO-TK1310	1 Ton (240 gal)	N/A	N/A	N/A
Oxalic Acid	S	$H_2C_2O_4$	100	%	Bags and HOPPER 1120	TBD	N/A	N/A	N/A
	L	$H_2C_2O_4$	0.7	M	ROA-TK1120	416	ROA-TK1130	459	N/A
	L	$H_2C_2O_4$	0.7	M	N/A	N/A	ROA-TK1131	5	N/A
	L	$H_2C_2O_4$-HNO_3	0.05	M	N/A	N/A	ROA-TK1140	162	N/A
	L	$H_2C_2O_4$-HNO_3	0.05	M	N/A	N/A	ROA-TK1141	5	N/A
Plutonium Dioxide (polished)	S	PuO_2	100	%	N/A	N/A	KCC–Pot	2.2 kg	997.5 kg (2.5 kg /pot 399 pots)
	S	PuO_2	100	%	N/A	N/A	KCB-HPPR1000	17.6 kg	N/A
	S	PuO_2	100	%	N/A	N/A	KCB-HPPR2000	17.6 kg	N/A
Plutonium Dioxide (unpolished)	S	PuO_2	100	%	N/A	N/A	KDA-HPPR9000	6 kg	8640 kg (5 kg (max)/ container*1728 containers)

Draft CAR Table 8-2a. Chemicals and Chemical Tanks or Containers in the BRP, BAP, and BMP (Note 3)

Chemical	Form	Symbol, Usage	Concentration		BRP		BAP		BMP
			Quantity	Units	Tank	Capacity (gal, U.N.O.)	Tank	Capacity (gal, U.N.O.)	Capacity
	S	PuO_2	100	%	N/A	N/A	KDA-HPPR9100	6 kg	N/A
Plutonium Oxalate	L	$Pu(C_2O_4)_2$	25.1	g(Pu)/liter	N/A	N/A	KCA-PREC5000	5	N/A
	L	$Pu(C_2O_4)_2$	25.1	g(Pu)/liter	N/A	N/A	KCA-PREC6000	5	N/A
Plutonium Nitrate	L	$Pu(NO_3)_3$ + $Pu(NO_3)_4$	40	g(Pu)/liter	N/A	N/A	KPA-TK1000	1000 liters	N/A
	L	$Pu(NO_3)_4$	39.9	g(Pu)/liter	N/A	N/A	KPA-TK7000	1000 liters	N/A
	L	$Pu(NO_3)_4$	40.9	g(Pu)/liter	N/A	N/A	KDB-TK7000	700 liters	N/A
	L	$Pu(NO_3)_4$	40.9	g(Pu)/liter	N/A	N/A	KDB-TK5000	400 liters	N/A
	L	$Pu(NO_3)_4$	40.9	g(Pu)/liter	N/A	N/A	KDB-TK6000	400 liters	N/A
	L	$PuO_2(NO_3)_2$	229	g(Pu)/liter	N/A	N/A	KDB-EZR1000	52 liters	N/A
	L	$PuO_2(NO_3)_2$	229	g(Pu)/liter	N/A	N/A	KDB-EZR2000	52 liters	N/A
	L	$PuO_2(NO_3)_2$ + $Pu(NO_3)_4$	95.2	g(Pu)/liter	N/A	N/A	KDB-TK3000	150 liters	N/A
	L	$PuO_2(NO_3)_2$ + $Pu(NO_3)_4$	95.2 (R25)	g(Pu)/liter	N/A	N/A	KDB-TK4000	150 liters	N/A
	L	$Pu(NO_3)_4$	39.9 (R25)	g(Pu)/liter	N/A	N/A	KCA-TK1000	600 liters	N/A
	L	$Pu(NO_3)_4$	39.9 (R25)	g(Pu)/liter	N/A	N/A	KCA-TK2000	600 liters	N/A

Draft CAR Table 8-2a. Chemicals and Chemical Tanks or Containers in the BRP, BAP, and BMP (Note 3)

Chemical	Form	Symbol, Usage	Concentration		BRP		BAP		BMP
			Quantity	Units	Tank	Capacity (gal, U.N.O.)	Tank	Capacity (gal, U.N.O.)	Capacity
Silver Nitrate	L	$AgNO_3$	2	N	N/A	N/A	Bottles	TBD	N/A
	L	Ag^+-HNO_3	1	N	N/A	N/A	RSN-TK1210	30	N/A
Sodium Carbonate	S	Na_2CO_3	100	%	Bags	TBD	N/A	N/A	N/A
	L	Na_2CO_3	0.3	M	RSC-TK1240	46	RSC-TK1250	46	N/A
Sodium Hydroxide	L	NaOH,Soda	10	N	Tote Tank	126	Bottles	TBD	N/A
	L	NaOH,Soda	0.1	N	N/A	N/A	RSH-TK1280	40	N/A
	L	NaOH,Soda	0.1	N	N/A	N/A	RSH-TK1290	40	N/A
Tributyl Phosphate	L	solvent, TBP	100	%	Tote Tank	126	RTP-TK1011	5	N/A
	L	solvent, TBP	100	%	RTP-TK1010	80	RTP-TK1015	40	N/A
	L	TBP+diluent	30	%	N/A	N/A	KPB-TK2000	500 liters	N/A
	L	TBP+diluent	30	%	N/A	N/A	RTP-TK1020	30	N/A
Uranium Dioxide	S	UO_2	100	%	N/A	N/A	N/A	N/A	1 drum 200 kg (max) /drum
	S	UO_2	100	%	N/A	N/A	N/A	N/A	1 drum 200 kg (max) /drum

Draft CAR Table 8-2a. Chemicals and Chemical Tanks or Containers in the BRP, BAP, and BMP (Note 3)

Chemical	Form	Symbol, Usage	Concentration		BRP		BAP		BMP
			Quantity	Units	Tank	Capacity (gal, U.N.O.)	Tank	Capacity (gal, U.N.O.)	Capacity
	S	UO_2	100	%	N/A	N/A	N/A	N/A	2 drums 200 kg (max) /drum
Uranyl Nitrate	L	$UO_2(NO_3)_2$	0.64	g(U)/liter	N/A	N/A	KDB-TK5000	400 liters	N/A
	L	$UO_2(NO_3)_2$	0.64	g(U)/liter	N/A	N/A	KDB-TK6000	400 liters	N/A
	L	$UO_2(NO_3)_2$	0.64	g(U)/liter	N/A	N/A	KDB-TK7000	700 liters	N/A
	L	$UO_2(NO_3)_2$	200	g(U)/liter	N/A	N/A	KDC-TK2000	300 liters	N/A
	L	$UO_2(NO_3)_2$	200	g(U)/liter	N/A	N/A	KDC-TK4000	750 liters	N/A
Zinc Stearate	S	Dry lubricant	100	%	N/A	N/A	N/A	N/A	TBD
	S	Dry lubricant	100	%	N/A	N/A	N/A	N/A	16-L (hopper)
Zirconium Nitrate	L	$Zr(NO_3)_2{*}5H_2O$	10	g(Zr)/liter	TBD	40	TBD	40	N/A

Table 8-2a Notes:

1. Diluent and nitric acid are recovered in the Aqueous Polishing process. The preparation of these reagents will be drastically reduced, once the AP process is in operation, as recovered reagents will become available.
2. Drain tanks are normally empty.
3. Tank sizes are subject to change based on the ongoing design process.

Attachment 28. MFFF Gas storage volumes

Draft CAR Table 8-2d. Anticipated Gas Storage Area Inventory

Chemical	Anticipated Gas Storage Area Inventory
Argon	Two (2) 3,000 gallon liquefied gas storage tanks
Argon-Hydrogen	One tube trailer - 56,000 scf
Argon-Methane (P10)	One tube trailer - 45,000 scf
Helium	One large tube trailer – 140,494 scf
Hydrogen	Two (2) tube trailers – 43,000 scf each
Nitrogen	Two (2) buffer tanks – 1209 and 11 cu ft Liquid nitrogen storage tank – 9000 gallons
Oxygen	Two (2) cylinders – 6250 scf each

Attachment 35a. WSB process tank volumes

Table 1 – Volume of WPB Tanks and Vessels

Tank/Vessel	Number of Tanks/Vessels	Contents	Volume (gal)
PDCF Lab Liquids Storage Tank	2	Unprocessed Waste	2500
MFFF Stripped Uranium Storage Tank	2	Unprocessed Waste	4000
MFFF High Alpha Storage Tank	2	Unprocessed Waste	2500
PDCF Lab Concentrate	TBD	Unprocessed Waste	16
High Activity Head Tank (Evaporator Feed)	1	Unprocessed Waste	4500
High Level Evaporator	1	HA Bottoms	528
High Activity Bottoms Collection Tank	1	HA Bottoms	528
High Activity Neutralization Tank	1	HA Bottoms	1000
High Activity Condensate Hold Tank (Overheads)	1	HA Overheads	4000
Low Activity Head Tank (Evaporator Feed)	1	Unprocessed Waste	5600
Low Level Evaporator	1	LA Bottoms	1000
Low Activity Bottoms Collection Tank	1	LA Bottoms	150
Low Activity Neutralization Tank	1	LA Bottoms	200
Effluent Head Tank	1	LA Overheads	6000
Effluent Polishing Evaporator	1	Effluent Bottoms	1000
Effluent Holding Tank	1	Effluent Overheads	6000
High Activity Cement Process Mixer	1	HA Bottoms	100
High Activity Waste Drum	1200 drums/year	HA Bottoms	20 gallons of waste/cement
Low Activity Cement Process Mixer	1	LA Bottoms	100
Low Activity Waste Drum	800 drums/year	LA Bottoms	20 gallons of waste/cement

Table 2. WSB Cold Chemical Inventory

Chemical	Capacity	Specific Gravity	Inventory (lbs.)
Sodium Hydroxide (50%)	4000gal	1.53	51041
Nitric Acid (47%)	500gal	1.3	5421
Portland Cement	1365ft^3	3.15	268238
Diesel Fuel	300gal	0.9	2252
Nitrogen	TBD	0.967	TBD

Note: These values reflect design refinements since the issuance of the MFFF ER. Aluminum nitrate, listed in MFFF ER Table G-1 is no longer planned for use at the WSB.

Attachment 35b. WSB overheads and bottoms composition

High Activity Evaporator

MOX High Alpha (feed)

Volume (gal)	3622
SpG	1.04
Constituents	
Ga (g/L)	1.23E-01
NaNO3 (M)	7.01E-02
Ag (g/L)	1.31E+00
Am (g/L)	7.14E-02
Pu (g/L)	6.44E-04
U (g/L)	1.06E-02
Acid M	1.00E+00
Lead (mg/L)	2.43E+02
Mercury (mg/L)	2.43E+02
Thalium (mg/L)	2.43E+02
TBP (mg/L)	5.37E+01
dpm/ml alpha	5.44E+08

MOX High Alpha (bottoms)

Volume (gal)	272
SpG	1.26
Constituents	
Ga (g/L)	1.64E+00
NaNO3 (M)	9.36E-01
Ag (g/L)	1.75E+01
Am (g/L)	9.53E-01
Pu (g/L)	8.59E-03
U (g/L)	1.41E-01
Acid M	5.95E+00
Lead (mg/L)	3.24E+03
Mercury (mg/L)	3.24E+03
Thalium (mg/L)	3.24E+03
TBP (mg/L)	5.74E-03
dpm/ml alpha	7.26E+09

MOX High Alpha (Overheads)

Volume (gal)	3,350
SpG	1.02
Constituents	
Ga (g/L)	1.37E-06
NaNO3 (M)	7.78E-07
Ag (g/L)	1.45E-05
Am (g/L)	7.93E-07
Pu (g/L)	7.15E-09
U (g/L)	1.17E-07
Acid M	5.98E-01
Lead (mg/L)	2.70E-03
Mercury (mg/L)	2.70E-03
Thalium (mg/L)	2.70E-03
TBP (mg/L)	5.81E+01
dpm/ml alpha	6.04E+03

Low Activity Evaporator

PDCF HAW (Feed)

Volume (gal)	3,784
SpG	1.02
Constituents	
Acid M	0.50
Ga (g/L)	3.93E-09
NaNO3 (M)	2.24E-09
Ag (g/L)	4.18E-08
Lead (mg/L)	7.76E-06
Mercury (mg/L)	7.76E-06
Thalium (mg/L)	7.76E-06
Sulfates (mg/L)	1.75E+00
Chloride (mg/L)	4.36E+01
Fluoride (mg/L)	5.82E+00
Chromium (mg/L)	2.91E-01
Barium (mg/L)	3.20E-01
Beryllium (mg/L)	1.45E-04
Acetone (mg/L)	4.07E+00
TBP (mg/L)	5.14E+01
Am (g/L)	2.06E-07
Pu (g/L)	2.04E-05
U (g/L)	1.72E-05
dpm/ml alpha	6.77E+03
TRU alpha (dpm/ml)	6.77E+03

PDCF HAW (overheads)

Volume (gal)	3,537
SpG	1.01
Constituents	
Acid M	0.17
Ga (g/L)	6.00E-12
NaNO3 (M)	3.42E-12
Ag (g/L)	6.39E-11
Lead (mg/L)	1.19E-08
Mercury (mg/L)	1.19E-08
Thalium (mg/L)	1.19E-08
Sulfates (mg/L)	2.67E-03
Chloride (mg/L)	6.67E-02
Fluoride (mg/L)	8.89E-03
Chromium (mg/L)	4.44E-04
Barium (mg/L)	4.89E-04
Beryllium (mg/L)	2.22E-07
Acetone (mg/L)	4.36E+00
TBP (mg/L)	5.50E+01
Am (g/L)	3.15E-10
Pu (g/L)	3.11E-08
U (g/L)	2.62E-08
dpm/ml alpha	1.04E+01
TRU alpha (dpm/ml)	1.03E+01

PDCF HAW (bottoms)

Volume (gal)	248
SpG	1.16
Constituents	
Acid M	5.2
Ga (g/L)	6.00E-08
NaNO3 (M)	3.42E-08
Ag (g/L)	6.39E-07
Lead (mg/L)	1.19E-04
Mercury (mg/L)	1.19E-04
Thalium (mg/L)	1.19E-04
Sulfates (mg/L)	2.67E+01
Chloride (mg/L)	6.67E+02
Fluoride (mg/L)	8.89E+01
Chromium (mg/L)	4.44E+00
Barium (mg/L)	4.89E+00
Beryllium (mg/L)	2.22E-03
Acetone (mg/L)	4.36E-04
TBP (mg/L)	5.50E-03
Am (g/L)	3.15E-06
Pu (g/L)	3.11E-04
U (g/L)	2.62E-04
dpm/ml alpha	1.04E+05
TRU alpha (dpm/ml)	1.03E+05

Low Activity Evaporator

MOX Stripped Uranium (Feed)

Volume (gal)	2,190
SpG	1.03
Constituents	
Acid M	0.107
U (g/L)	16
Pu (mg/L)	0.1
TBP (mg/L)	20
dpm/ml alpha	3.14E+04
TRU alpha (dpm/ml)	1.26E+04

MOX Stripped Uranium (bottoms)

Volume (gal)	200
SpG	1.27
Constituents	
Acid M	1.1
U (g/L)	175
Pu (mg/L)	1.1
dpm/ml alpha	3.44E+05
TRU alpha (dpm/ml)	1.38E+05
TBP (mg/L)	2.20E-02

MOX Stripped Uranium (overheads)

Volume (gal)	1,990
SpG	1.00
Constituents	
Acid M	0.007225
U (g/L)	1.75E-02
Pu (mg/L)	1.10E-04
TBP (mg/L)	22
dpm/ml alpha	3.44E+01
TRU alpha (dpm/ml)	1.38E+01

Attachment 52. Receptor locations and concentrations for SRS total suspended particulates modeling

Refer to Enclosed Disk

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
442693	661806	2.137	22.9	ANNUAL	ALL
441442	661706	2.275	24.4	ANNUAL	ALL
440510	661564	2.258	24.4	ANNUAL	ALL
439596	661770	2.450	24.4	ANNUAL	ALL
438830	662469	2.678	24.4	ANNUAL	ALL
438048	662946	2.976	24.4	ANNUAL	ALL
437108	663351	3.312	24.4	ANNUAL	ALL
436269	663749	3.655	24.4	ANNUAL	ALL
435473	664030	4.329	24.4	ANNUAL	ALL
434794	664233	4.889	24.4	ANNUAL	ALL
434021	664408	4.974	24.4	ANNUAL	ALL
433633	664786	5.099	24.4	ANNUAL	ALL
432985	665123	5.478	24.4	ANNUAL	ALL
432558	665468	5.963	24.4	ANNUAL	ALL
432301	665783	6.395	24.4	ANNUAL	ALL
431949	666114	6.893	24.4	ANNUAL	ALL
431444	666492	7.466	24.4	ANNUAL	ALL
430713	666984	7.976	24.4	ANNUAL	ALL
429952	667692	9.661	24.4	ANNUAL	ALL
429403	668329	12.088	25.9	ANNUAL	ALL
428868	668932	13.605	25.9	ANNUAL	ALL
428752	669454	16.036	25.9	ANNUAL	ALL
428330	669995	18.100	25.9	ANNUAL	ALL
428335	670625	20.629	25.9	ANNUAL	ALL
428487	671062	23.122	25.9	ANNUAL	ALL
428530	671478	24.220	27.4	ANNUAL	ALL
428436	671926	25.473	27.4	ANNUAL	ALL
428922	672236	32.327	27.4	ANNUAL	ALL
429152	672783	36.557	27.4	ANNUAL	ALL
429421	673321	44.575	27.4	ANNUAL	ALL
428921	673761	26.089	27.4	ANNUAL	ALL
428724	674354	23.397	27.4	ANNUAL	ALL
428450	675048	21.672	27.4	ANNUAL	ALL
428003	675695	16.747	27.4	ANNUAL	ALL
427515	675945	14.855	27.4	ANNUAL	ALL
427458	675295	15.169	27.4	ANNUAL	ALL
427442	674707	14.161	27.4	ANNUAL	ALL
426321	674449	10.985	27.4	ANNUAL	ALL
425398	674830	9.420	27.4	ANNUAL	ALL
424667	675152	8.517	27.4	ANNUAL	ALL
424592	675897	8.285	27.4	ANNUAL	ALL
424015	676267	7.473	27.4	ANNUAL	ALL
422865	676729	6.271	27.4	ANNUAL	ALL
422502	677246	5.986	27.4	ANNUAL	ALL
422927	677845	6.330	29	ANNUAL	ALL
423294	678370	6.239	29	ANNUAL	ALL
423866	678818	6.516	29	ANNUAL	ALL
424387	679104	7.143	30.5	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
424894	679454	7.281	30.5	ANNUAL	ALL
425750	679936	8.377	33.5	ANNUAL	ALL
426507	680419	8.270	36.6	ANNUAL	ALL
427602	681075	8.434	42.7	ANNUAL	ALL
427277	681559	7.789	36.6	ANNUAL	ALL
426952	682043	7.625	36.6	ANNUAL	ALL
427646	682829	8.033	39.6	ANNUAL	ALL
427059	683333	7.433	39.6	ANNUAL	ALL
427683	684134	8.475	44.2	ANNUAL	ALL
427337	684693	8.197	48.8	ANNUAL	ALL
426991	685253	8.004	51.8	ANNUAL	ALL
427052	685959	7.476	54.9	ANNUAL	ALL
427309	686821	7.309	61	ANNUAL	ALL
427654	687573	7.645	64	ANNUAL	ALL
428056	688063	8.188	76.2	ANNUAL	ALL
428524	688825	7.923	91.4	ANNUAL	ALL
429135	689616	8.848	100.6	ANNUAL	ALL
429520	690223	9.258	106.7	ANNUAL	ALL
430089	689934	10.736	91.4	ANNUAL	ALL
430592	690413	10.320	97.5	ANNUAL	ALL
430882	690209	11.957	106.7	ANNUAL	ALL
431139	690692	10.769	112.8	ANNUAL	ALL
431458	691214	9.887	118.9	ANNUAL	ALL
432061	691687	8.575	121.9	ANNUAL	ALL
432003	692172	7.885	112.8	ANNUAL	ALL
432988	692305	7.199	91.4	ANNUAL	ALL
433076	692811	6.852	94.5	ANNUAL	ALL
434057	693210	6.665	125	ANNUAL	ALL
434423	693630	6.355	120.4	ANNUAL	ALL
435106	693761	6.506	112.8	ANNUAL	ALL
435285	694374	6.296	123.4	ANNUAL	ALL
436079	694640	6.211	121.9	ANNUAL	ALL
436873	694550	6.385	121.9	ANNUAL	ALL
437511	694372	6.628	112.8	ANNUAL	ALL
437780	694855	6.303	106.7	ANNUAL	ALL
438047	695337	5.959	102.1	ANNUAL	ALL
438913	695534	5.639	97.5	ANNUAL	ALL
439396	695293	5.390	94.5	ANNUAL	ALL
440084	695789	5.065	94.5	ANNUAL	ALL
441145	695862	5.057	82.3	ANNUAL	ALL
442641	695962	4.192	73.2	ANNUAL	ALL
443598	695969	4.234	59.4	ANNUAL	ALL
443608	695480	4.405	57.9	ANNUAL	ALL
444387	695522	4.852	82.3	ANNUAL	ALL
445417	695282	4.251	64	ANNUAL	ALL
446715	695568	4.185	100.6	ANNUAL	ALL
447455	695946	4.032	106.7	ANNUAL	ALL
448519	695973	3.821	103.6	ANNUAL	ALL

• ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
448696	695324	4.044	112.8	ANNUAL	ALL
449455	695363	3.934	100.6	ANNUAL	ALL
449836	695088	3.873	91.4	ANNUAL	ALL
450317	694674	3.810	100.6	ANNUAL	ALL
450978	694822	3.518	103.6	ANNUAL	ALL
451360	694263	3.553	100.6	ANNUAL	ALL
451684	693758	3.797	86.9	ANNUAL	ALL
452408	693295	3.701	82.3	ANNUAL	ALL
452871	693003	3.546	79.2	ANNUAL	ALL
453673	692791	3.352	85.3	ANNUAL	ALL
453629	692249	3.431	91.4	ANNUAL	ALL
453726	691708	3.544	102.1	ANNUAL	ALL
454435	691242	3.593	100.6	ANNUAL	ALL
454842	690640	3.735	99.1	ANNUAL	ALL
454673	690121	3.850	94.5	ANNUAL	ALL
454998	689750	3.682	91.4	ANNUAL	ALL
455255	689384	3.613	91.4	ANNUAL	ALL
455732	689035	3.764	97.5	ANNUAL	ALL
456185	688722	4.090	89.9	ANNUAL	ALL
456124	688078	3.996	76.2	ANNUAL	ALL
456004	687390	3.871	70.1	ANNUAL	ALL
456174	687033	4.038	82.3	ANNUAL	ALL
456146	686475	4.092	86.9	ANNUAL	ALL
456037	685816	4.249	88.4	ANNUAL	ALL
456126	685150	4.295	76.2	ANNUAL	ALL
455872	684710	4.799	83.8	ANNUAL	ALL
455965	684206	4.737	82.3	ANNUAL	ALL
456102	683854	4.586	79.2	ANNUAL	ALL
456320	683286	4.064	76.2	ANNUAL	ALL
455806	683277	4.223	70.1	ANNUAL	ALL
454693	683204	4.988	80.8	ANNUAL	ALL
454676	682843	4.894	79.2	ANNUAL	ALL
454652	682272	4.507	76.2	ANNUAL	ALL
454626	681697	4.644	76.2	ANNUAL	ALL
454600	681146	5.027	85.3	ANNUAL	ALL
454310	680635	5.056	85.3	ANNUAL	ALL
454023	680151	4.978	82.3	ANNUAL	ALL
453592	679429	4.928	79.2	ANNUAL	ALL
453423	678922	4.604	73.2	ANNUAL	ALL
453351	678468	4.662	70.1	ANNUAL	ALL
453417	677702	4.596	64	ANNUAL	ALL
454385	677975	4.302	70.1	ANNUAL	ALL
455144	678067	4.043	70.1	ANNUAL	ALL
455981	677965	3.816	76.2	ANNUAL	ALL
455753	677380	3.732	51.8	ANNUAL	ALL
455610	677053	3.694	48.8	ANNUAL	ALL
455540	676590	3.726	61	ANNUAL	ALL
455383	675780	3.869	64	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
455818	675370	3.702	57.9	ANNUAL	ALL
455354	674982	3.759	50.3	ANNUAL	ALL
455492	674298	3.605	47.2	ANNUAL	ALL
455640	673510	3.523	64	ANNUAL	ALL
455060	673248	3.516	45.7	ANNUAL	ALL
455072	672606	3.291	42.7	ANNUAL	ALL
455048	671927	3.181	45.7	ANNUAL	ALL
455114	671567	3.183	45.7	ANNUAL	ALL
455331	670966	3.108	42.7	ANNUAL	ALL
455007	670473	3.019	39.6	ANNUAL	ALL
453759	670423	3.456	70.1	ANNUAL	ALL
452880	670634	3.777	76.2	ANNUAL	ALL
452542	670204	4.089	80.8	ANNUAL	ALL
452563	669456	3.440	71.6	ANNUAL	ALL
451956	669125	3.666	79.2	ANNUAL	ALL
451882	668818	3.325	64	ANNUAL	ALL
451076	668435	3.689	91.4	ANNUAL	ALL
450620	668097	3.629	97.5	ANNUAL	ALL
450125	667599	3.467	82.3	ANNUAL	ALL
449237	667231	3.820	88.4	ANNUAL	ALL
448339	666862	3.753	80.8	ANNUAL	ALL
448415	666406	3.695	85.3	ANNUAL	ALL
447377	666418	3.884	76.2	ANNUAL	ALL
446340	666418	3.466	51.8	ANNUAL	ALL
445670	666051	3.335	48.8	ANNUAL	ALL
446118	665773	3.183	48.8	ANNUAL	ALL
445740	665202	3.314	65.5	ANNUAL	ALL
445423	665493	3.338	42.7	ANNUAL	ALL
444738	664718	3.261	36.6	ANNUAL	ALL
443783	664919	3.254	48.8	ANNUAL	ALL
443070	665102	3.238	44.2	ANNUAL	ALL
443015	664656	3.096	45.7	ANNUAL	ALL
442957	664168	2.972	44.2	ANNUAL	ALL
442667	663919	2.839	36.6	ANNUAL	ALL
442676	663289	2.623	38.1	ANNUAL	ALL
442682	662429	2.300	25.9	ANNUAL	ALL
423000	665000	7.570	72	ANNUAL	ALL
424000	665000	8.245	67.1	ANNUAL	ALL
425000	665000	8.569	42.7	ANNUAL	ALL
426000	665000	8.755	57.9	ANNUAL	ALL
427000	665000	8.265	57.3	ANNUAL	ALL
428000	665000	8.280	61	ANNUAL	ALL
429000	665000	7.828	61	ANNUAL	ALL
430000	665000	7.346	61	ANNUAL	ALL
431000	665000	6.039	25.9	ANNUAL	ALL
432000	665000	5.857	26.5	ANNUAL	ALL
433000	665000	5.371	24.4	ANNUAL	ALL
432000	666000	6.762	25	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
431000	666000	7.403	57.9	ANNUAL	ALL
430000	666000	8.252	64	ANNUAL	ALL
429000	666000	8.955	63.4	ANNUAL	ALL
428000	666000	8.967	56.4	ANNUAL	ALL
427000	666000	9.713	58.2	ANNUAL	ALL
426000	666000	9.483	29.9	ANNUAL	ALL
425000	666000	9.154	54.9	ANNUAL	ALL
424000	666000	8.644	72	ANNUAL	ALL
423000	666000	7.826	72	ANNUAL	ALL
423000	667000	7.922	72	ANNUAL	ALL
424000	667000	8.923	67.1	ANNUAL	ALL
425000	667000	9.608	53.3	ANNUAL	ALL
426000	667000	11.053	67.1	ANNUAL	ALL
427000	667000	11.633	65.5	ANNUAL	ALL
428000	667000	10.795	68	ANNUAL	ALL
429000	667000	10.703	66.1	ANNUAL	ALL
430000	667000	9.338	70.1	ANNUAL	ALL
429000	668000	12.254	67.1	ANNUAL	ALL
428000	668000	12.850	51.8	ANNUAL	ALL
427000	668000	13.219	61	ANNUAL	ALL
426000	668000	12.016	72	ANNUAL	ALL
425000	668000	10.407	64	ANNUAL	ALL
424000	668000	9.166	72	ANNUAL	ALL
423000	668000	8.490	72	ANNUAL	ALL
423000	669000	8.799	68.6	ANNUAL	ALL
424000	669000	9.981	72	ANNUAL	ALL
425000	669000	10.881	72	ANNUAL	ALL
426000	669000	12.855	72	ANNUAL	ALL
427000	669000	14.940	72	ANNUAL	ALL
428000	669000	16.149	57.9	ANNUAL	ALL
427000	669000	14.940	72	ANNUAL	ALL
426000	669000	12.855	72	ANNUAL	ALL
425000	669000	10.881	72	ANNUAL	ALL
424000	669000	9.981	72	ANNUAL	ALL
423000	669000	8.799	68.6	ANNUAL	ALL
423000	670000	8.236	72	ANNUAL	ALL
424000	670000	9.859	72	ANNUAL	ALL
425000	670000	11.837	70.1	ANNUAL	ALL
426000	670000	13.446	72	ANNUAL	ALL
427000	670000	14.835	39.6	ANNUAL	ALL
428000	670000	17.793	36.6	ANNUAL	ALL
428000	671000	19.545	26.8	ANNUAL	ALL
427000	671000	17.607	72	ANNUAL	ALL
426000	671000	14.069	72	ANNUAL	ALL
425000	671000	10.915	68.6	ANNUAL	ALL
424000	671000	8.996	71	ANNUAL	ALL
423000	671000	7.829	72	ANNUAL	ALL
423000	672000	8.082	69.8	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
424000	672000	9.310	62.8	ANNUAL	ALL
425000	672000	10.367	49.7	ANNUAL	ALL
426000	672000	12.124	51.8	ANNUAL	ALL
427000	672000	14.739	25.9	ANNUAL	ALL
428000	672000	21.728	28	ANNUAL	ALL
429000	673000	32.007	26.8	ANNUAL	ALL
428000	673000	21.192	27.4	ANNUAL	ALL
427000	673000	14.748	28	ANNUAL	ALL
426000	673000	11.014	26.5	ANNUAL	ALL
425000	673000	8.814	29.6	ANNUAL	ALL
424000	673000	7.866	64	ANNUAL	ALL
423000	673000	6.667	57	ANNUAL	ALL
423000	674000	6.756	41.2	ANNUAL	ALL
424000	674000	7.821	55.5	ANNUAL	ALL
425000	674000	8.510	29.9	ANNUAL	ALL
426000	674000	10.213	28.7	ANNUAL	ALL
427000	674000	13.072	28.4	ANNUAL	ALL
428000	674000	18.108	26.2	ANNUAL	ALL
428000	675000	17.444	28	ANNUAL	ALL
424000	675000	8.548	59.4	ANNUAL	ALL
423000	675000	7.203	39.6	ANNUAL	ALL
423000	676000	7.120	54.3	ANNUAL	ALL
424000	676000	7.606	29.3	ANNUAL	ALL
432600	665000	5.720	45.7	ANNUAL	ALL
431700	666000	7.287	58.5	ANNUAL	ALL
431200	666300	7.781	64	ANNUAL	ALL
430300	666500	8.461	65.5	ANNUAL	ALL
429000	667300	11.369	72	ANNUAL	ALL
428800	668200	12.764	72	ANNUAL	ALL
428300	669700	19.571	72	ANNUAL	ALL
427200	670400	17.061	72	ANNUAL	ALL
426200	671300	14.289	72	ANNUAL	ALL
425700	672000	11.964	67.7	ANNUAL	ALL
425000	673000	8.971	38.1	ANNUAL	ALL
424800	674000	8.592	48.8	ANNUAL	ALL
424000	673400	7.448	72	ANNUAL	ALL
424300	675000	9.020	65.5	ANNUAL	ALL
423900	675300	8.475	68.3	ANNUAL	ALL
423000	676500	7.164	72	ANNUAL	ALL
422300	676700	6.379	65.5	ANNUAL	ALL
423000	686000	5.145	42.7	ANNUAL	ALL
424000	686000	5.634	49.4	ANNUAL	ALL
425000	686000	6.106	48.8	ANNUAL	ALL
426000	686000	6.878	51.2	ANNUAL	ALL
427000	686000	7.400	55.2	ANNUAL	ALL
427000	687000	6.825	61.6	ANNUAL	ALL
426000	687000	5.842	53.3	ANNUAL	ALL
425000	687000	5.706	51.8	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
424000	687000	5.748	48.2	ANNUAL	ALL
423000	687000	5.204	42.4	ANNUAL	ALL
423000	688000	4.839	42.1	ANNUAL	ALL
424000	688000	4.714	52.4	ANNUAL	ALL
425000	688000	4.950	53.3	ANNUAL	ALL
426000	688000	5.810	63.7	ANNUAL	ALL
427000	688000	7.664	86.9	ANNUAL	ALL
428000	689000	7.736	95.4	ANNUAL	ALL
427000	689000	7.217	99.1	ANNUAL	ALL
426000	689000	6.349	94.8	ANNUAL	ALL
425000	689000	4.987	63.4	ANNUAL	ALL
424000	689000	4.395	55.5	ANNUAL	ALL
423000	689000	4.137	47.2	ANNUAL	ALL
423000	690000	4.060	56.7	ANNUAL	ALL
424000	690000	4.273	41.8	ANNUAL	ALL
425000	690000	5.503	80.8	ANNUAL	ALL
426000	690000	6.098	104.6	ANNUAL	ALL
427000	690000	6.583	102.4	ANNUAL	ALL
428000	690000	7.217	105.8	ANNUAL	ALL
429000	690000	8.698	106.1	ANNUAL	ALL
431000	691000	9.514	112.2	ANNUAL	ALL
430000	691000	8.619	108.2	ANNUAL	ALL
429000	691000	7.962	104.6	ANNUAL	ALL
428000	691000	6.912	112.8	ANNUAL	ALL
427000	691000	6.389	112.8	ANNUAL	ALL
426000	691000	5.769	112.8	ANNUAL	ALL
425000	691000	5.151	82.3	ANNUAL	ALL
424000	691000	4.426	72.5	ANNUAL	ALL
423000	691000	4.057	73.5	ANNUAL	ALL
423000	692000	3.922	67.7	ANNUAL	ALL
424000	692000	4.142	72.9	ANNUAL	ALL
425000	692000	4.952	112.8	ANNUAL	ALL
426000	692000	5.541	112.8	ANNUAL	ALL
427000	692000	5.870	112.8	ANNUAL	ALL
428000	692000	6.492	112.8	ANNUAL	ALL
429000	692000	7.111	112.8	ANNUAL	ALL
430000	692000	7.127	103.6	ANNUAL	ALL
431000	692000	7.899	102.1	ANNUAL	ALL
433000	693000	6.833	106.1	ANNUAL	ALL
432000	693000	6.968	124.7	ANNUAL	ALL
431000	693000	6.948	115.8	ANNUAL	ALL
430000	693000	6.352	112.8	ANNUAL	ALL
429000	693000	6.217	112.8	ANNUAL	ALL
428000	693000	5.972	112.8	ANNUAL	ALL
427000	693000	5.622	112.8	ANNUAL	ALL
426000	693000	5.161	112.8	ANNUAL	ALL
425000	693000	4.645	112.8	ANNUAL	ALL
424000	693000	4.421	102.7	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
423000	693000	4.106	98.2	ANNUAL	ALL
423000	694000	3.852	95.4	ANNUAL	ALL
424000	694000	3.969	77.7	ANNUAL	ALL
425000	694000	4.535	112.8	ANNUAL	ALL
426000	694000	4.948	112.8	ANNUAL	ALL
427000	694000	5.257	112.8	ANNUAL	ALL
428000	694000	5.329	112.8	ANNUAL	ALL
429000	694000	5.518	112.8	ANNUAL	ALL
430000	694000	5.825	94.5	ANNUAL	ALL
431000	694000	6.079	93	ANNUAL	ALL
432000	694000	5.986	118.9	ANNUAL	ALL
433000	694000	6.092	113.4	ANNUAL	ALL
434000	694000	6.055	115.2	ANNUAL	ALL
435000	694000	6.411	110.6	ANNUAL	ALL
436000	695000	6.022	125	ANNUAL	ALL
435000	695000	5.931	121.9	ANNUAL	ALL
434000	695000	5.631	123.8	ANNUAL	ALL
433000	695000	5.604	121.9	ANNUAL	ALL
432000	695000	5.334	118.6	ANNUAL	ALL
431000	695000	5.452	104.6	ANNUAL	ALL
430000	695000	5.369	92.4	ANNUAL	ALL
429000	695000	5.085	112.8	ANNUAL	ALL
428000	695000	4.941	112.8	ANNUAL	ALL
427000	695000	4.706	112.8	ANNUAL	ALL
426000	695000	4.738	112.8	ANNUAL	ALL
425000	695000	4.397	112.8	ANNUAL	ALL
424000	695000	3.464	67.1	ANNUAL	ALL
423000	695000	3.700	96.3	ANNUAL	ALL
423000	696000	3.581	109.7	ANNUAL	ALL
424000	696000	3.465	73.8	ANNUAL	ALL
425000	696000	4.217	84.4	ANNUAL	ALL
426000	696000	4.317	103.6	ANNUAL	ALL
427000	696000	4.369	112.8	ANNUAL	ALL
428000	696000	4.572	112.8	ANNUAL	ALL
429000	696000	4.673	77.7	ANNUAL	ALL
430000	696000	4.910	90.8	ANNUAL	ALL
431000	696000	4.925	108.2	ANNUAL	ALL
432000	696000	4.805	109.7	ANNUAL	ALL
433000	696000	5.173	121	ANNUAL	ALL
434000	696000	5.352	125	ANNUAL	ALL
435000	696000	5.520	135.9	ANNUAL	ALL
436000	696000	5.485	125	ANNUAL	ALL
436000	697000	5.063	106.7	ANNUAL	ALL
435000	697000	5.130	135	ANNUAL	ALL
434000	697000	5.028	126.5	ANNUAL	ALL
433000	697000	4.763	93.6	ANNUAL	ALL
432000	697000	4.465	114.3	ANNUAL	ALL
431000	697000	4.540	106.7	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
430000	697000	4.422	88.4	ANNUAL	ALL
429000	697000	3.965	62.5	ANNUAL	ALL
428000	697000	3.860	72.2	ANNUAL	ALL
427000	697000	3.604	74.7	ANNUAL	ALL
426000	697000	3.950	86.3	ANNUAL	ALL
425000	697000	3.949	106.7	ANNUAL	ALL
424000	697000	3.391	63.4	ANNUAL	ALL
423000	697000	3.420	97.5	ANNUAL	ALL
434794	664233	4.889	24.4	ANNUAL	ALL
434693	664227	4.952	24.4	ANNUAL	ALL
434593	664215	4.995	24.4	ANNUAL	ALL
434488	664198	5.021	24.4	ANNUAL	ALL
434385	664189	5.023	24.4	ANNUAL	ALL
434285	664195	5.012	24.4	ANNUAL	ALL
434181	664237	4.989	24.4	ANNUAL	ALL
434085	664337	4.976	24.4	ANNUAL	ALL
434021	664408	4.977	24.7	ANNUAL	ALL
433978	664458	4.980	24.7	ANNUAL	ALL
433882	664564	4.985	24.7	ANNUAL	ALL
433789	664648	5.011	24.7	ANNUAL	ALL
433693	664733	5.058	24.7	ANNUAL	ALL
433587	664820	5.133	24.7	ANNUAL	ALL
433487	664885	5.200	24.7	ANNUAL	ALL
433395	664928	5.256	24.7	ANNUAL	ALL
433290	664973	5.313	24.7	ANNUAL	ALL
433207	665013	5.354	24.7	ANNUAL	ALL
433090	665070	5.425	24.7	ANNUAL	ALL
432985	665123	5.485	25	ANNUAL	ALL
432886	665184	5.570	25	ANNUAL	ALL
432816	665232	5.636	25	ANNUAL	ALL
432692	665327	5.776	25	ANNUAL	ALL
432621	665392	5.869	25	ANNUAL	ALL
432558	665468	5.970	25	ANNUAL	ALL
432450	665615	6.167	25	ANNUAL	ALL
432371	665708	6.293	25	ANNUAL	ALL
432287	665797	6.422	25	ANNUAL	ALL
432201	665886	6.550	25	ANNUAL	ALL
432141	665950	6.649	25	ANNUAL	ALL
432082	666002	6.727	25	ANNUAL	ALL
432018	666057	6.806	25	ANNUAL	ALL
431949	666114	6.906	25.3	ANNUAL	ALL
431875	666167	6.983	25.3	ANNUAL	ALL
431792	666220	7.062	25.3	ANNUAL	ALL
431738	666259	7.122	25.3	ANNUAL	ALL
431625	666339	7.244	25.3	ANNUAL	ALL
431546	666400	7.330	25.3	ANNUAL	ALL
431493	666445	7.401	25.3	ANNUAL	ALL
431444	666492	7.479	25.3	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
431409	666521	7.517	25.3	ANNUAL	ALL
431294	666610	7.661	25.3	ANNUAL	ALL
431241	666652	7.719	25.3	ANNUAL	ALL
431166	666702	7.783	25.3	ANNUAL	ALL
431121	666727	7.810	25.3	ANNUAL	ALL
430963	666838	7.893	25.3	ANNUAL	ALL
430829	666921	7.936	25.3	ANNUAL	ALL
430713	666984	7.993	25.6	ANNUAL	ALL
430627	667027	8.069	25.6	ANNUAL	ALL
430549	667110	8.196	25.6	ANNUAL	ALL
430454	667326	8.545	25.6	ANNUAL	ALL
430373	667471	8.844	25.6	ANNUAL	ALL
430288	667530	9.085	25.6	ANNUAL	ALL
430210	667563	9.227	25.6	ANNUAL	ALL
430071	667623	9.458	25.6	ANNUAL	ALL
430018	667651	9.539	25.6	ANNUAL	ALL
429952	667692	9.682	25.6	ANNUAL	ALL
429877	667745	9.899	25.6	ANNUAL	ALL
429806	667817	10.115	25.6	ANNUAL	ALL
429717	667919	10.450	25.6	ANNUAL	ALL
429639	668024	10.795	25.6	ANNUAL	ALL
429567	668125	11.172	25.6	ANNUAL	ALL
429486	668229	11.665	25.6	ANNUAL	ALL
429403	668329	12.088	25.9	ANNUAL	ALL
429336	668415	12.309	25.9	ANNUAL	ALL
429265	668519	12.379	25.9	ANNUAL	ALL
429178	668644	12.450	25.9	ANNUAL	ALL
429093	668728	12.595	25.9	ANNUAL	ALL
429009	668803	12.920	25.9	ANNUAL	ALL
428946	668858	13.210	25.9	ANNUAL	ALL
428868	668932	13.613	26.2	ANNUAL	ALL
428795	669044	14.268	26.2	ANNUAL	ALL
428752	669254	15.179	26.2	ANNUAL	ALL
428742	669325	15.506	26.2	ANNUAL	ALL
428746	669399	15.803	26.2	ANNUAL	ALL
428753	669471	16.106	26.2	ANNUAL	ALL
428744	669540	16.419	26.2	ANNUAL	ALL
428722	669603	16.729	26.2	ANNUAL	ALL
428688	669668	17.088	26.2	ANNUAL	ALL
428573	669739	17.589	26.2	ANNUAL	ALL
428447	669812	17.913	26.2	ANNUAL	ALL
428368	669888	17.941	26.2	ANNUAL	ALL
428330	669995	18.122	26.5	ANNUAL	ALL
428359	670068	18.453	26.5	ANNUAL	ALL
428428	670148	18.881	26.5	ANNUAL	ALL
428466	670217	19.246	26.5	ANNUAL	ALL
428481	670280	19.487	26.5	ANNUAL	ALL
428475	670364	19.889	26.5	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
428445	670450	20.255	26.5	ANNUAL	ALL
428402	670520	20.510	26.5	ANNUAL	ALL
428358	670589	20.691	26.5	ANNUAL	ALL
428351	670599	20.576	26.5	ANNUAL	ALL
428335	670625	20.663	26.8	ANNUAL	ALL
428297	670687	20.679	26.8	ANNUAL	ALL
428261	670760	20.758	26.8	ANNUAL	ALL
428242	670819	20.884	26.8	ANNUAL	ALL
428213	670871	20.940	26.8	ANNUAL	ALL
428178	670940	20.817	26.8	ANNUAL	ALL
428148	671004	20.594	26.8	ANNUAL	ALL
428116	671081	20.405	26.8	ANNUAL	ALL
428068	671162	20.122	26.8	ANNUAL	ALL
428021	671248	19.928	26.8	ANNUAL	ALL
427974	671319	19.879	26.8	ANNUAL	ALL
427948	671380	20.045	26.8	ANNUAL	ALL
427961	671447	20.397	26.8	ANNUAL	ALL
428026	671471	20.750	26.8	ANNUAL	ALL
428099	671413	20.833	26.8	ANNUAL	ALL
428165	671326	20.869	26.8	ANNUAL	ALL
428231	671234	21.287	26.8	ANNUAL	ALL
428293	671165	21.732	26.8	ANNUAL	ALL
428341	671122	22.196	26.8	ANNUAL	ALL
428406	671085	22.587	26.8	ANNUAL	ALL
428487	671062	23.168	27.1	ANNUAL	ALL
428565	671064	23.752	27.1	ANNUAL	ALL
428638	671132	24.464	27.1	ANNUAL	ALL
428665	671205	25.042	27.1	ANNUAL	ALL
428668	671270	25.328	27.1	ANNUAL	ALL
428656	671325	25.360	27.1	ANNUAL	ALL
428613	671391	25.086	27.1	ANNUAL	ALL
428562	671443	24.508	27.1	ANNUAL	ALL
428530	671478	24.220	27.4	ANNUAL	ALL
428478	671529	23.772	27.4	ANNUAL	ALL
428439	671593	23.646	27.4	ANNUAL	ALL
428418	671658	23.794	27.4	ANNUAL	ALL
428407	671716	24.048	27.4	ANNUAL	ALL
428410	671774	24.438	27.4	ANNUAL	ALL
428420	671843	24.909	27.4	ANNUAL	ALL
428430	671904	25.320	27.4	ANNUAL	ALL
428436	671926	25.473	27.4	ANNUAL	ALL
428468	672005	26.090	27.4	ANNUAL	ALL
428505	672065	26.639	27.4	ANNUAL	ALL
428550	672136	27.332	27.4	ANNUAL	ALL
428629	672202	28.401	27.4	ANNUAL	ALL
428682	672215	29.091	27.4	ANNUAL	ALL
428754	672217	30.021	27.4	ANNUAL	ALL
428809	672219	30.759	27.4	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter:	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
428876	672227	31.686	27.4	ANNUAL	ALL
428922	672236	32.327	27.4	ANNUAL	ALL
429012	672285	33.941	27.4	ANNUAL	ALL
429069	672351	35.367	27.4	ANNUAL	ALL
429103	672419	36.481	27.4	ANNUAL	ALL
429121	672479	37.137	27.4	ANNUAL	ALL
429132	672545	37.504	27.4	ANNUAL	ALL
429140	672609	37.642	27.4	ANNUAL	ALL
429145	672670	37.467	27.4	ANNUAL	ALL
429147	672724	37.068	27.4	ANNUAL	ALL
429152	672783	36.557	27.4	ANNUAL	ALL
429163	672846	36.175	27.4	ANNUAL	ALL
429409	673216	43.156	27.4	ANNUAL	ALL
429180	672908	36.086	27.4	ANNUAL	ALL
429203	672967	36.351	27.4	ANNUAL	ALL
429248	673027	37.410	27.4	ANNUAL	ALL
429294	673077	38.748	27.4	ANNUAL	ALL
429364	673147	41.133	27.4	ANNUAL	ALL
429421	673286	44.263	27.4	ANNUAL	ALL
429417	673356	44.562	27.4	ANNUAL	ALL
429398	673422	43.293	27.4	ANNUAL	ALL
429373	673469	41.217	27.4	ANNUAL	ALL
429314	673531	37.289	27.4	ANNUAL	ALL
429221	673586	33.144	27.4	ANNUAL	ALL
429082	673655	28.958	27.4	ANNUAL	ALL
428965	673726	26.632	27.4	ANNUAL	ALL
428921	673761	26.089	27.4	ANNUAL	ALL
428882	673806	25.880	27.4	ANNUAL	ALL
428838	673867	25.827	27.4	ANNUAL	ALL
428807	673922	25.814	27.4	ANNUAL	ALL
428792	673970	25.835	27.4	ANNUAL	ALL
428776	674036	25.651	27.4	ANNUAL	ALL
428766	674094	25.174	27.4	ANNUAL	ALL
428758	674153	24.565	27.4	ANNUAL	ALL
428747	674228	24.046	27.4	ANNUAL	ALL
428740	674291	23.789	27.4	ANNUAL	ALL
428724	674354	23.397	27.4	ANNUAL	ALL
428706	674406	23.093	27.4	ANNUAL	ALL
428682	674471	22.823	27.4	ANNUAL	ALL
428658	674534	22.558	27.4	ANNUAL	ALL
428625	674610	22.130	27.4	ANNUAL	ALL
428590	674678	21.812	27.4	ANNUAL	ALL
428550	674768	21.694	27.4	ANNUAL	ALL
428514	674844	21.639	27.4	ANNUAL	ALL
428485	674913	21.644	27.4	ANNUAL	ALL
428467	674974	21.691	27.4	ANNUAL	ALL
428450	675048	21.672	27.4	ANNUAL	ALL
428444	675115	21.684	27.4	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
428441	675195	21.709	27.4	ANNUAL	ALL
428424	675273	21.296	27.4	ANNUAL	ALL
428407	675340	20.578	27.4	ANNUAL	ALL
428370	675400	19.806	27.4	ANNUAL	ALL
428315	675458	19.081	27.4	ANNUAL	ALL
428210	675524	18.350	27.4	ANNUAL	ALL
428093	675604	17.545	27.4	ANNUAL	ALL
428003	675695	16.747	27.4	ANNUAL	ALL
427946	675764	16.228	27.4	ANNUAL	ALL
427884	675825	15.822	27.4	ANNUAL	ALL
427794	675858	15.518	27.4	ANNUAL	ALL
427705	675890	15.264	27.4	ANNUAL	ALL
427761	675918	15.216	27.4	ANNUAL	ALL
427515	675945	14.855	27.4	ANNUAL	ALL
427436	675938	14.928	27.4	ANNUAL	ALL
427287	675886	15.172	27.4	ANNUAL	ALL
427215	675822	15.057	27.4	ANNUAL	ALL
427195	675746	14.833	27.4	ANNUAL	ALL
427215	675662	14.762	27.4	ANNUAL	ALL
427256	675590	14.824	27.4	ANNUAL	ALL
427303	675514	14.939	27.4	ANNUAL	ALL
427366	675444	15.077	27.4	ANNUAL	ALL
427423	675369	15.186	27.4	ANNUAL	ALL
427458	675295	15.169	27.4	ANNUAL	ALL
427492	675217	15.040	27.4	ANNUAL	ALL
427519	675135	14.868	27.4	ANNUAL	ALL
427536	675049	14.712	27.4	ANNUAL	ALL
427540	674967	14.608	27.4	ANNUAL	ALL
427523	674897	14.553	27.4	ANNUAL	ALL
427498	674812	14.484	27.4	ANNUAL	ALL
427478	674765	14.377	27.4	ANNUAL	ALL
427442	674707	14.161	27.4	ANNUAL	ALL
427404	674663	13.962	27.4	ANNUAL	ALL
427350	674614	13.760	27.4	ANNUAL	ALL
427254	674570	13.435	27.4	ANNUAL	ALL
427163	674531	13.201	27.4	ANNUAL	ALL
427067	674486	12.904	27.4	ANNUAL	ALL
426988	674457	12.737	27.4	ANNUAL	ALL
426905	674440	12.490	27.4	ANNUAL	ALL
426813	674426	12.231	27.4	ANNUAL	ALL
426733	674418	12.043	27.4	ANNUAL	ALL
426629	674417	11.724	27.4	ANNUAL	ALL
426547	674423	11.518	27.4	ANNUAL	ALL
426456	674431	11.310	27.4	ANNUAL	ALL
426356	674443	11.080	27.4	ANNUAL	ALL
426256	674458	10.843	27.4	ANNUAL	ALL
426151	674503	10.618	27.4	ANNUAL	ALL
426063	674559	10.443	27.4	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
425976	674614	10.289	27.4	ANNUAL	ALL
425898	674664	10.165	27.4	ANNUAL	ALL
425799	674727	9.998	27.4	ANNUAL	ALL
425715	674777	9.864	27.4	ANNUAL	ALL
425645	674805	9.792	27.4	ANNUAL	ALL
425551	674825	9.659	27.4	ANNUAL	ALL
425468	674834	9.547	27.4	ANNUAL	ALL
425398	674830	9.420	27.4	ANNUAL	ALL
425285	674807	9.282	27.4	ANNUAL	ALL
425225	674797	9.226	27.4	ANNUAL	ALL
425132	674784	9.116	27.4	ANNUAL	ALL
425052	674780	8.982	27.4	ANNUAL	ALL
424973	674796	8.899	27.4	ANNUAL	ALL
424889	674833	8.814	27.4	ANNUAL	ALL
424805	674898	8.738	27.4	ANNUAL	ALL
424712	675004	8.643	27.4	ANNUAL	ALL
424667	675152	8.517	27.4	ANNUAL	ALL
424664	675227	8.489	27.4	ANNUAL	ALL
424660	675318	8.515	27.4	ANNUAL	ALL
424663	675402	8.559	27.4	ANNUAL	ALL
424667	675485	8.601	27.4	ANNUAL	ALL
424660	675575	8.584	27.4	ANNUAL	ALL
424648	675666	8.519	27.4	ANNUAL	ALL
424632	675746	8.444	27.4	ANNUAL	ALL
424610	675837	8.358	27.4	ANNUAL	ALL
424592	675897	8.285	27.4	ANNUAL	ALL
424553	675988	8.188	27.4	ANNUAL	ALL
424511	676073	8.123	27.4	ANNUAL	ALL
424456	676127	8.039	27.4	ANNUAL	ALL
424380	676176	7.920	27.4	ANNUAL	ALL
424284	676203	7.805	27.4	ANNUAL	ALL
424223	676217	7.734	27.4	ANNUAL	ALL
424167	676227	7.663	27.4	ANNUAL	ALL
424086	676245	7.560	27.4	ANNUAL	ALL
424015	676267	7.473	27.4	ANNUAL	ALL
423944	676305	7.394	27.4	ANNUAL	ALL
423856	676357	7.278	27.4	ANNUAL	ALL
423793	676397	7.214	27.4	ANNUAL	ALL
423692	676454	7.099	27.4	ANNUAL	ALL
423595	676507	6.997	27.4	ANNUAL	ALL
423503	676552	6.900	27.4	ANNUAL	ALL
423443	676574	6.838	27.4	ANNUAL	ALL
423361	676601	6.753	27.4	ANNUAL	ALL
423293	676619	6.686	27.4	ANNUAL	ALL
423192	676640	6.585	27.4	ANNUAL	ALL
423132	676654	6.527	27.4	ANNUAL	ALL
423067	676669	6.463	27.4	ANNUAL	ALL
422973	676695	6.374	27.4	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
422906	676715	6.310	27.4	ANNUAL	ALL
422865	676729	6.271	27.4	ANNUAL	ALL
422802	676771	6.208	27.4	ANNUAL	ALL
422767	676820	6.169	27.4	ANNUAL	ALL
422725	676892	6.130	27.4	ANNUAL	ALL
422684	676965	6.093	27.4	ANNUAL	ALL
422650	677024	6.071	27.4	ANNUAL	ALL
422618	677077	6.049	27.4	ANNUAL	ALL
422567	677149	6.021	27.4	ANNUAL	ALL
422522	677211	5.992	27.4	ANNUAL	ALL
422502	677246	5.986	27.4	ANNUAL	ALL
422553	677321	6.069	29	ANNUAL	ALL
422608	677396	6.117	29	ANNUAL	ALL
422661	677471	6.135	28.4	ANNUAL	ALL
422714	677546	6.132	28.4	ANNUAL	ALL
422767	677621	6.134	28.4	ANNUAL	ALL
422820	677696	6.151	28.4	ANNUAL	ALL
422873	677771	6.223	28.4	ANNUAL	ALL
422927	677845	6.321	28.4	ANNUAL	ALL
422980	677920	6.438	28.4	ANNUAL	ALL
423032	677995	6.520	28.4	ANNUAL	ALL
423085	678070	6.563	28.4	ANNUAL	ALL
423137	678145	6.536	28.4	ANNUAL	ALL
423190	678220	6.452	28.4	ANNUAL	ALL
423242	678295	6.340	28.4	ANNUAL	ALL
423294	678370	6.230	28.4	ANNUAL	ALL
423410	678539	6.087	29	ANNUAL	ALL
423577	678449	6.188	29	ANNUAL	ALL
423649	678541	6.208	29	ANNUAL	ALL
423721	678633	6.286	29	ANNUAL	ALL
423793	678725	6.394	29	ANNUAL	ALL
423866	678818	6.516	29	ANNUAL	ALL
423940	678859	6.604	29	ANNUAL	ALL
424015	678900	6.695	29	ANNUAL	ALL
424089	678940	6.779	29	ANNUAL	ALL
424164	678981	6.865	29	ANNUAL	ALL
424238	679022	6.982	30.5	ANNUAL	ALL
424313	679063	7.064	30.5	ANNUAL	ALL
424387	679104	7.143	30.5	ANNUAL	ALL
424459	679154	7.209	30.5	ANNUAL	ALL
424532	679204	7.251	30.5	ANNUAL	ALL
424604	679254	7.266	30.5	ANNUAL	ALL
424677	679304	7.270	30.5	ANNUAL	ALL
424749	679354	7.259	30.5	ANNUAL	ALL
424821	679404	7.267	30.8	ANNUAL	ALL
424894	679454	7.291	31.1	ANNUAL	ALL
424971	679500	7.340	31.4	ANNUAL	ALL
425048	679546	7.408	31.7	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	* MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
425124	679592	7.487	32	ANNUAL	ALL
425201	679638	7.578	32.3	ANNUAL	ALL
425278	679684	7.664	32.6	ANNUAL	ALL
425355	679730	7.759	32.9	ANNUAL	ALL
425432	679776	7.854	32.9	ANNUAL	ALL
425508	679821	7.972	33.2	ANNUAL	ALL
425585	679868	8.105	33.2	ANNUAL	ALL
425662	679914	8.243	33.5	ANNUAL	ALL
425739	679959	8.369	33.5	ANNUAL	ALL
425816	680005	8.465	33.8	ANNUAL	ALL
425892	680051	8.519	34.1	ANNUAL	ALL
425969	680097	8.525	34.4	ANNUAL	ALL
426046	680143	8.492	34.8	ANNUAL	ALL
426123	680189	8.429	35.1	ANNUAL	ALL
426200	680235	8.366	35.4	ANNUAL	ALL
426276	680281	8.318	35.7	ANNUAL	ALL
426353	680327	8.281	36	ANNUAL	ALL
426430	680373	8.267	36.3	ANNUAL	ALL
426507	680419	8.270	36.6	ANNUAL	ALL
426580	680463	8.296	37.2	ANNUAL	ALL
426653	680506	8.337	37.5	ANNUAL	ALL
426726	680550	8.371	37.2	ANNUAL	ALL
426799	680594	8.418	36.9	ANNUAL	ALL
426872	680638	8.474	37.2	ANNUAL	ALL
426945	680681	8.535	37.8	ANNUAL	ALL
427018	680725	8.576	38.1	ANNUAL	ALL
427091	680769	8.598	38.1	ANNUAL	ALL
427164	680813	8.601	38.1	ANNUAL	ALL
427237	680856	8.585	38.1	ANNUAL	ALL
427310	680900	8.551	38.4	ANNUAL	ALL
427383	680944	8.499	38.7	ANNUAL	ALL
427456	680987	8.448	39	ANNUAL	ALL
427529	681031	8.397	39.3	ANNUAL	ALL
427602	681075	8.369	39.6	ANNUAL	ALL
427543	681163	8.253	39.6	ANNUAL	ALL
427484	681251	8.115	38.1	ANNUAL	ALL
427425	681339	7.984	36.6	ANNUAL	ALL
427366	681427	7.893	36.6	ANNUAL	ALL
427306	681515	7.821	36.6	ANNUAL	ALL
427247	681603	7.760	36.6	ANNUAL	ALL
427188	681691	7.708	36	ANNUAL	ALL
427129	681779	7.680	35.7	ANNUAL	ALL
427070	681867	7.662	36	ANNUAL	ALL
427011	681955	7.646	36.3	ANNUAL	ALL
426952	682043	7.625	36.6	ANNUAL	ALL
427029	682130	7.634	36.9	ANNUAL	ALL
427106	682218	7.647	37.2	ANNUAL	ALL
427183	682305	7.666	37.5	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
427260	682392	7.688	38.1	ANNUAL	ALL
427338	682480	7.707	38.1	ANNUAL	ALL
427415	682567	7.752	38.4	ANNUAL	ALL
427492	682654	7.825	38.7	ANNUAL	ALL
427569	682741	7.924	39	ANNUAL	ALL
427646	682829	8.028	39.3	ANNUAL	ALL
427581	682885	7.957	39	ANNUAL	ALL
427516	682941	7.880	39	ANNUAL	ALL
427450	682997	7.798	39	ANNUAL	ALL
427385	683053	7.716	39	ANNUAL	ALL
427320	683109	7.645	39	ANNUAL	ALL
427255	683165	7.579	39	ANNUAL	ALL
427190	683221	7.523	39	ANNUAL	ALL
427124	683277	7.470	39	ANNUAL	ALL
427059	683333	7.423	39	ANNUAL	ALL
427128	683422	7.533	39.3	ANNUAL	ALL
427141	683438	7.562	39.6	ANNUAL	ALL
427198	683511	7.683	40.2	ANNUAL	ALL
427267	683600	7.849	40.8	ANNUAL	ALL
427199	683513	7.711	41.5	ANNUAL	ALL
427336	683689	8.030	42.1	ANNUAL	ALL
427406	683778	8.185	42.7	ANNUAL	ALL
427475	683867	8.298	43.3	ANNUAL	ALL
427544	683956	8.374	43.9	ANNUAL	ALL
427613	684045	8.423	44.2	ANNUAL	ALL
427683	684134	8.475	44.2	ANNUAL	ALL
427565	684283	8.311	44.8	ANNUAL	ALL
427692	684332	8.514	45.4	ANNUAL	ALL
427629	684423	8.452	45.7	ANNUAL	ALL
427567	684514	8.408	46	ANNUAL	ALL
427504	684606	8.373	46.6	ANNUAL	ALL
427442	684697	8.355	47.6	ANNUAL	ALL
427379	684788	8.324	48.2	ANNUAL	ALL
427316	684879	8.276	48.8	ANNUAL	ALL
427254	684970	8.224	49.1	ANNUAL	ALL
427191	685062	8.162	49.7	ANNUAL	ALL
427129	685153	8.111	50.3	ANNUAL	ALL
427066	685244	8.063	50.9	ANNUAL	ALL
426991	685253	7.992	51.2	ANNUAL	ALL
427016	685335	8.034	51.8	ANNUAL	ALL
427041	685418	8.042	52.4	ANNUAL	ALL
427066	685500	8.019	53	ANNUAL	ALL
427091	685582	7.965	53.6	ANNUAL	ALL
427116	685664	7.890	54.3	ANNUAL	ALL
427140	685747	7.811	54.9	ANNUAL	ALL
427166	685829	7.718	55.2	ANNUAL	ALL
427187	685919	7.620	55.5	ANNUAL	ALL
427052	685959	7.486	55.5	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
427201	686062	7.460	54.9	ANNUAL	ALL
427265	686158	7.448	55.8	ANNUAL	ALL
427290	686241	7.431	56.4	ANNUAL	ALL
427315	686323	7.423	57	ANNUAL	ALL
427340	686405	7.433	57.9	ANNUAL	ALL
427365	686488	7.445	58.5	ANNUAL	ALL
427201	686062	7.470	55.5	ANNUAL	ALL
427256	686204	7.413	56.1	ANNUAL	ALL
427310	686346	7.411	57.3	ANNUAL	ALL
427365	686488	7.445	58.5	ANNUAL	ALL
427337	686654	7.362	59.4	ANNUAL	ALL
427309	686821	7.309	61	ANNUAL	ALL
427476	686842	7.558	61.9	ANNUAL	ALL
427643	686863	7.789	62.5	ANNUAL	ALL
427810	686884	8.043	64.6	ANNUAL	ALL
427977	686905	8.274	64.3	ANNUAL	ALL
427867	687063	8.048	65.5	ANNUAL	ALL
427758	687221	7.845	66.4	ANNUAL	ALL
427648	687379	7.665	66.4	ANNUAL	ALL
427539	687538	7.535	64	ANNUAL	ALL
427654	687573	7.679	66.1	ANNUAL	ALL
427733	687617	7.788	67.7	ANNUAL	ALL
427801	687672	7.922	70.1	ANNUAL	ALL
427859	687743	8.058	73.2	ANNUAL	ALL
427925	687850	8.168	74.7	ANNUAL	ALL
427990	687956	8.219	75.3	ANNUAL	ALL
428056	688063	8.188	76.2	ANNUAL	ALL
428127	688179	8.650	79.2	ANNUAL	ALL
428210	688318	8.415	77.7	ANNUAL	ALL
428290	688447	7.589	72.5	ANNUAL	ALL
428363	688569	7.439	76.2	ANNUAL	ALL
428435	688690	7.297	76.2	ANNUAL	ALL
428481	688770	7.267	76.2	ANNUAL	ALL
428524	688825	7.800	79.2	ANNUAL	ALL
428596	688916	7.985	82.3	ANNUAL	ALL
428688	689034	8.258	88.4	ANNUAL	ALL
428764	689145	8.547	92.4	ANNUAL	ALL
428846	689251	8.534	93.6	ANNUAL	ALL
428941	689359	8.582	94.8	ANNUAL	ALL
429040	689486	8.687	96.6	ANNUAL	ALL
429135	689616	8.800	93.6	ANNUAL	ALL
429209	689712	8.857	100.6	ANNUAL	ALL
429279	689802	9.214	103.6	ANNUAL	ALL
429346	689887	9.398	103.6	ANNUAL	ALL
429367	690050	9.551	109.7	ANNUAL	ALL
429443	690136	9.467	109.7	ANNUAL	ALL
429520	690223	9.258	106.7	ANNUAL	ALL
429599	690184	9.362	100.6	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	MaxConc (µg/m3)	Elev (m)	Avg	SrcGrp
429707	690125	9.512	95.1	ANNUAL	ALL
429816	690066	9.842	91.4	ANNUAL	ALL
429913	690016	9.963	79.2	ANNUAL	ALL
430057	689945	10.517	85.3	ANNUAL	ALL
430213	690025	11.081	95.1	ANNUAL	ALL
430309	690093	10.937	96	ANNUAL	ALL
430405	690160	10.794	97.5	ANNUAL	ALL
430501	690228	11.068	99.1	ANNUAL	ALL
430592	690413	10.320	97.5	ANNUAL	ALL
430685	690350	10.826	100.6	ANNUAL	ALL
430756	690297	11.178	102.1	ANNUAL	ALL
430838	690239	11.676	106.1	ANNUAL	ALL
430917	690272	11.721	108.5	ANNUAL	ALL
430974	690399	11.017	109.7	ANNUAL	ALL
431022	690474	10.861	112.8	ANNUAL	ALL
431068	690548	10.757	113.7	ANNUAL	ALL
431092	690616	10.659	112.8	ANNUAL	ALL
431139	690692	10.741	111.3	ANNUAL	ALL
431195	690777	10.726	112.8	ANNUAL	ALL
431256	690872	10.608	114.3	ANNUAL	ALL
431317	690967	10.299	114.3	ANNUAL	ALL
431375	691064	10.110	113.4	ANNUAL	ALL
431432	691160	9.956	112.2	ANNUAL	ALL
431501	691294	9.521	112.8	ANNUAL	ALL
431570	691428	9.258	115.8	ANNUAL	ALL
431641	691574	8.862	118.3	ANNUAL	ALL
431711	691719	8.512	119.8	ANNUAL	ALL
431782	691865	8.248	121.3	ANNUAL	ALL
431837	691984	8.156	121.9	ANNUAL	ALL
431871	691961	8.266	120.4	ANNUAL	ALL
431966	691824	8.518	118.9	ANNUAL	ALL
432061	691687	8.470	114.3	ANNUAL	ALL
432049	691807	8.299	118.3	ANNUAL	ALL
432025	691998	8.046	117.3	ANNUAL	ALL
432016	692209	7.784	112.8	ANNUAL	ALL
432140	692219	7.488	103.6	ANNUAL	ALL
432263	692228	7.546	100.6	ANNUAL	ALL
432387	692238	7.536	109.7	ANNUAL	ALL
432511	692248	7.667	111.3	ANNUAL	ALL
432635	692258	7.694	108.5	ANNUAL	ALL
432758	692267	7.566	102.1	ANNUAL	ALL
432882	692277	7.528	93	ANNUAL	ALL
432988	692305	7.227	92	ANNUAL	ALL
433044	692483	7.102	92.7	ANNUAL	ALL
433053	692606	7.035	93.9	ANNUAL	ALL
433065	692769	6.907	93.9	ANNUAL	ALL
433220	692828	6.775	100.6	ANNUAL	ALL
433353	692848	6.737	106.7	ANNUAL	ALL

* ISCST3 Concentration File, TSP, 1995 Meteorology, All Sources

* X (UTM meter	Y(UTM meter	MaxConc (μg/m3)	Elev (m)	Avg	SrcGrp
433485	692829	6.778	110	ANNUAL	ALL
433634	692896	6.759	110.3	ANNUAL	ALL
433777	693007	6.684	114.3	ANNUAL	ALL
433886	693088	6.698	119.5	ANNUAL	ALL
434002	693170	6.664	122.5	ANNUAL	ALL
434118	693253	6.697	125.6	ANNUAL	ALL
434211	693344	6.535	125	ANNUAL	ALL
434290	693450	6.413	115.8	ANNUAL	ALL
434389	693584	6.401	115.2	ANNUAL	ALL
434435	693639	6.349	119.5	ANNUAL	ALL
434559	693575	6.441	120.4	ANNUAL	ALL
434668	693520	6.492	121.3	ANNUAL	ALL
434768	693665	6.483	122.5	ANNUAL	ALL
434852	693797	6.485	119.8	ANNUAL	ALL
435106	693761	6.506	112.8	ANNUAL	ALL
435139	693880	6.443	106.7	ANNUAL	ALL
435195	694081	6.360	109.7	ANNUAL	ALL
435252	694281	6.329	119.8	ANNUAL	ALL
435285	694374	6.294	122.8	ANNUAL	ALL
435381	694271	6.293	122.5	ANNUAL	ALL
435484	694152	6.300	120.7	ANNUAL	ALL

Attachment 53. MFFF ICS source path

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CO STARTING
CO TITLEONE SRS Site Boundary Receptors & Hwy S125, MFFF Construction - 1995
CO MODELOPT DFAULT CONC   RURAL
CO AVERTIME PERIOD  24   8  3  1
CO POLLUTID OTHER
CO DCAYCOEF     .000000
CO RUNORNOT RUN
CO ERRORFIL ERRORS.OUT
CO FINISHED

SO STARTING

** Source Location Cards:
**          SRCID SRCTYP         XS            YS             ZS

SO LOCATION VOL1   VOLUME   436945.0000  3683819.0000         .0000

** Source Parameter Cards:
** POINT:   SRCID        QS              HS         TS           VS          DS
** VOLUME:  SRCID        QS              HS       SYINIT       SZINIT
** AREA:    SRCID        QS              HS        XINIT

SO SRCPARAM VOL1   1.0000000       3.0000   108.7000     2.8000

SO SRCGROUP ALL
SO FINISHED

RE STARTING
RE DISCCART   440312.70 3661554.00
RE DISCCART   458460.90 3661667.00
RE DISCCART   458544.30 3662137.00
RE DISCCART   458501.20 3662633.00
RE DISCCART   458523.30 3663130.00
RE DISCCART   458614.30 3663586.00
RE DISCCART   458410.20 3663979.00
RE DISCCART   458270.90 3664454.00
RE DISCCART   458246.00 3664935.00
RE DISCCART   458301.00 3665424.00
RE DISCCART   458148.70 3665892.00
RE DISCCART   458208.30 3666291.00
RE DISCCART   457858.00 3666556.00
RE DISCCART   457615.20 3666990.00
RE DISCCART   457478.40 3667468.00
RE DISCCART   457372.20 3667947.00
RE DISCCART   457676.70 3668181.00
RE DISCCART   457270.80 3668444.00
RE DISCCART   456949.20 3668693.00
RE DISCCART   456684.30 3669071.00
RE DISCCART   456715.90 3669559.00
RE DISCCART   456798.10 3669981.00
RE DISCCART   457005.70 3670417.00
RE DISCCART   457105.70 3670718.00
RE DISCCART   456804.80 3670399.00
RE DISCCART   456632.80 3669933.00
RE DISCCART   456216.70 3669914.00
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RE DISCCART    455827.90 3670215.00
RE DISCCART    455540.90 3670615.00
RE DISCCART    455334.80 3671068.00
RE DISCCART    455183.40 3671540.00
RE DISCCART    455092.90 3671944.00
RE DISCCART    455166.50 3672426.00
RE DISCCART    455059.30 3672902.00
RE DISCCART    455230.30 3673319.00
RE DISCCART    455684.60 3673523.00
RE DISCCART    455532.60 3673977.00
RE DISCCART    455522.30 3674382.00
RE DISCCART    455448.80 3674873.00
RE DISCCART    455502.40 3675268.00
RE DISCCART    455919.60 3675481.00
RE DISCCART    455613.30 3675722.00
RE DISCCART    455496.60 3676106.00
RE DISCCART    455585.60 3676595.00
RE DISCCART    455676.50 3677084.00
RE DISCCART    455862.70 3677542.00
RE DISCCART    455970.10 3677969.00
RE DISCCART    455472.30 3677975.00
RE DISCCART    454974.50 3677977.00
RE DISCCART    454476.80 3677973.00
RE DISCCART    453992.30 3677867.00
RE DISCCART    453516.10 3677722.00
RE DISCCART    453490.50 3678182.00
RE DISCCART    453442.70 3678674.00
RE DISCCART    453527.40 3679163.00
RE DISCCART    453730.40 3679608.00
RE DISCCART    454002.80 3680024.00
RE DISCCART    454247.60 3680458.00
RE DISCCART    454509.10 3680881.00
RE DISCCART    454668.60 3681338.00
RE DISCCART    454681.70 3681836.00
RE DISCCART    454696.10 3682333.00
RE DISCCART    454715.10 3682831.00
RE DISCCART    454777.30 3683284.00
RE DISCCART    455275.30 3683292.00
RE DISCCART    455773.20 3683300.00
RE DISCCART    456270.80 3683314.00
RE DISCCART    456217.80 3683685.00
RE DISCCART    456052.50 3684154.00
RE DISCCART    455933.90 3684636.00
RE DISCCART    455998.90 3685062.00
RE DISCCART    456142.30 3685458.00
RE DISCCART    456082.00 3685952.00
RE DISCCART    456048.50 3686445.00
RE DISCCART    456185.80 3686820.00
RE DISCCART    456102.90 3687294.00
RE DISCCART    456087.00 3687758.00
RE DISCCART    456185.20 3688243.00
RE DISCCART    456231.40 3688739.00
RE DISCCART    455833.90 3689033.00
RE DISCCART    455424.80 3689316.00
RE DISCCART    455174.30 3689665.00
RE DISCCART    454803.30 3689994.00
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RE DISCCART    454546.50 3690392.00
RE DISCCART    454870.40 3690709.00
RE DISCCART    454597.40 3691091.00
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RE DISCCART  444734.437500    3663640.500000
RE FINISHED

ME STARTING
ME INPUTFIL ISCMET95.ASC
ME ANEMHGHT   61.000 METERS
ME SURFDATA  99999  1995           SURFNAME
ME UAIRDATA  99999  1995           UAIRNAME
ME WINDCATS    1.54     3.09     5.14     8.23    10.80
ME FINISHED

OU STARTING
OU RECTABLE ALLAVE FIRST  SECOND
OU MAXTABLE ALLAVE  50
OU FINISHED
```

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************************************
*** SETUP Finishes Successfully ***
************************************
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```
 *** ISCST3 - VERSION 02035 ***    *** SRS Site Boundary Receptors & Hwy S125, MFFF Construction - 1995      ***        05/21/02
                                   ***                                                                       ***        10:13:22
 **MODELOPTs:                                                                                                           PAGE   1
CONC                       RURAL FLAT        DFAULT

                                             ***     MODEL SETUP OPTIONS SUMMARY       ***
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

 **Intermediate Terrain Processing is Selected

 **Model Is Setup For Calculation of Average CONCentration Values.

   --  SCAVENGING/DEPOSITION LOGIC --
 **Model Uses NO DRY DEPLETION.  DDPLETE =  F
 **Model Uses NO WET DEPLETION.  WDPLETE =  F
 **NO WET SCAVENGING Data Provided.
 **NO GAS DRY DEPOSITION Data Provided.
 **Model Does NOT Use GRIDDED TERRAIN Data for Depletion Calculations

 **Model Uses RURAL Dispersion.

 **Model Uses Regulatory DEFAULT Options:
             1. Final Plume Rise.
             2. Stack-tip Downwash.
             3. Buoyancy-induced Dispersion.
             4. Use Calms Processing Routine.
             5. Not Use Missing Data Processing Routine.
             6. Default Wind Profile Exponents.
             7. Default Vertical Potential Temperature Gradients.
             8. "Upper Bound" Values for Supersquat Buildings.
             9. No Exponential Decay for RURAL Mode

 **Model Assumes Receptors on FLAT Terrain.

 **Model Assumes No FLAGPOLE Receptor Heights.

 **Model Calculates  4 Short Term Average(s) of:  24-HR   8-HR   3-HR   1-HR
     and Calculates PERIOD Averages

 **This Run Includes:     1 Source(s);      1 Source Group(s); and     458 Receptor(s)

 **The Model Assumes A Pollutant Type of:  OTHER

 **Model Set To Continue RUNning After the Setup Testing.

 **Output Options Selected:
          Model Outputs Tables of PERIOD Averages by Receptor
          Model Outputs Tables of Highest Short Term Values by Receptor (RECTABLE Keyword)
          Model Outputs Tables of Overall Maximum Short Term Values (MAXTABLE Keyword)

 **NOTE:  The Following Flags May Appear Following CONC Values:  c for Calm Hours
                                                                 m for Missing Hours
                                                                 b for Both Calm and Missing Hours

 **Misc. Inputs:  Anem. Hgt. (m) =    61.00 ;    Decay Coef. =    0.000     ;    Rot. Angle =     0.0
                  Emission Units = GRAMS/SEC                                ;  Emission Rate Unit Factor =   0.10000E+07
```

```
                  Output Units    = MICROGRAMS/M**3

**Approximate Storage Requirements of Model =      1.3 MB of RAM.

**Input Runstream File:          mfffiscv.inp
**Output Print File:             mfffiscv.o95
**Detailed Error/Message File:   ERRORS.OUT
```

```
 *** ISCST3 - VERSION 02035 ***     *** SRS Site Boundary Receptors & Hwy S125, MFFF Construction - 1995     ***        05/21/02
                                    ***                                                                      ***        10:13:22
**MODELOPTs:                                                                                                            PAGE   2
CONC                      RURAL FLAT        DFAULT


                                           *** VOLUME SOURCE DATA ***

             NUMBER EMISSION RATE                        BASE    RELEASE   INIT.    INIT.   EMISSION RATE
   SOURCE     PART.  (GRAMS/SEC)      X         Y        ELEV.   HEIGHT     SY       SZ     SCALAR VARY
     ID       CATS.                (METERS)  (METERS)  (METERS) (METERS) (METERS) (METERS)       BY
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

   VOL1          0   0.10000E+01  436945.0 3683819.0      0.0      3.00   108.70     2.80
```

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 *** ISCST3 - VERSION 02035 ***     *** SRS Site Boundary Receptors & Hwy S125, MFFF Construction - 1995      ***         05/21/02
                                    ***                                                                       ***         10:13:22
**MODELOPTs:                                                                                                              PAGE   3
CONC                      RURAL FLAT          DFAULT


                                          *** SOURCE IDs DEFINING SOURCE GROUPS ***

GROUP ID                                                       SOURCE IDs


 ALL       VOL1    ,
```

```
 *** ISCST3 - VERSION 02035 ***     *** SRS Site Boundary Receptors & Hwy S125, MFFF Construction - 1995        ***         05/21/02
                                    ***                                                                         ***         10:13:22
**MODELOPTs:                                                                                                                 PAGE   4
CONC                        RURAL FLAT          DFAULT

                                                *** DISCRETE CARTESIAN RECEPTORS ***
                                                  (X-COORD, Y-COORD, ZELEV, ZFLAG)
                                                             (METERS)

     ( 440312.7, 3661554.0,      0.0,        0.0);          ( 458460.9, 3661667.0,      0.0,        0.0);
     ( 458544.3, 3662137.0,      0.0,        0.0);          ( 458501.2, 3662633.0,      0.0,        0.0);
     ( 458523.3, 3663130.0,      0.0,        0.0);          ( 458614.3, 3663586.0,      0.0,        0.0);
     ( 458410.2, 3663979.0,      0.0,        0.0);          ( 458270.9, 3664454.0,      0.0,        0.0);
     ( 458246.0, 3664935.0,      0.0,        0.0);          ( 458301.0, 3665424.0,      0.0,        0.0);
     ( 458148.7, 3665892.0,      0.0,        0.0);          ( 458208.3, 3666291.0,      0.0,        0.0);
     ( 457858.0, 3666556.0,      0.0,        0.0);          ( 457615.2, 3666990.0,      0.0,        0.0);
     ( 457478.4, 3667468.0,      0.0,        0.0);          ( 457372.2, 3667947.0,      0.0,        0.0);
     ( 457676.7, 3668181.0,      0.0,        0.0);          ( 457270.8, 3668444.0,      0.0,        0.0);
     ( 456949.2, 3668693.0,      0.0,        0.0);          ( 456684.3, 3669071.0,      0.0,        0.0);
     ( 456715.9, 3669559.0,      0.0,        0.0);          ( 456798.1, 3669981.0,      0.0,        0.0);
     ( 457005.7, 3670417.0,      0.0,        0.0);          ( 457105.7, 3670718.0,      0.0,        0.0);
     ( 456804.8, 3670399.0,      0.0,        0.0);          ( 456632.8, 3669933.0,      0.0,        0.0);
     ( 456216.7, 3669914.0,      0.0,        0.0);          ( 455827.9, 3670215.0,      0.0,        0.0);
     ( 455540.9, 3670615.0,      0.0,        0.0);          ( 455334.8, 3671068.0,      0.0,        0.0);
     ( 455183.4, 3671540.0,      0.0,        0.0);          ( 455092.9, 3671944.0,      0.0,        0.0);
     ( 455166.5, 3672426.0,      0.0,        0.0);          ( 455059.3, 3672902.0,      0.0,        0.0);
     ( 455230.3, 3673319.0,      0.0,        0.0);          ( 455684.6, 3673523.0,      0.0,        0.0);
     ( 455532.6, 3673977.0,      0.0,        0.0);          ( 455522.3, 3674382.0,      0.0,        0.0);
     ( 455448.8, 3674873.0,      0.0,        0.0);          ( 455502.4, 3675268.0,      0.0,        0.0);
     ( 455919.6, 3675481.0,      0.0,        0.0);          ( 455613.3, 3675722.0,      0.0,        0.0);
     ( 455496.6, 3676106.0,      0.0,        0.0);          ( 455585.6, 3676595.0,      0.0,        0.0);
     ( 455676.5, 3677084.0,      0.0,        0.0);          ( 455862.7, 3677542.0,      0.0,        0.0);
     ( 455970.1, 3677969.0,      0.0,        0.0);          ( 455472.3, 3677975.0,      0.0,        0.0);
     ( 454974.5, 3677977.0,      0.0,        0.0);          ( 454476.8, 3677973.0,      0.0,        0.0);
     ( 453992.3, 3677867.0,      0.0,        0.0);          ( 453516.1, 3677722.0,      0.0,        0.0);
     ( 453490.5, 3678182.0,      0.0,        0.0);          ( 453442.7, 3678674.0,      0.0,        0.0);
     ( 453527.4, 3679163.0,      0.0,        0.0);          ( 453730.4, 3679608.0,      0.0,        0.0);
     ( 454002.8, 3680024.0,      0.0,        0.0);          ( 454247.6, 3680458.0,      0.0,        0.0);
     ( 454509.1, 3680881.0,      0.0,        0.0);          ( 454668.6, 3681338.0,      0.0,        0.0);
     ( 454681.7, 3681836.0,      0.0,        0.0);          ( 454696.1, 3682333.0,      0.0,        0.0);
     ( 454715.1, 3682831.0,      0.0,        0.0);          ( 454777.3, 3683284.0,      0.0,        0.0);
     ( 455275.3, 3683292.0,      0.0,        0.0);          ( 455773.2, 3683300.0,      0.0,        0.0);
     ( 456270.8, 3683314.0,      0.0,        0.0);          ( 456217.8, 3683685.0,      0.0,        0.0);
     ( 456052.5, 3684154.0,      0.0,        0.0);          ( 455933.9, 3684636.0,      0.0,        0.0);
     ( 455998.9, 3685062.0,      0.0,        0.0);          ( 456142.3, 3685458.0,      0.0,        0.0);
     ( 456082.0, 3685952.0,      0.0,        0.0);          ( 456048.5, 3686445.0,      0.0,        0.0);
     ( 456185.8, 3686820.0,      0.0,        0.0);          ( 456102.9, 3687294.0,      0.0,        0.0);
     ( 456087.0, 3687758.0,      0.0,        0.0);          ( 456185.2, 3688243.0,      0.0,        0.0);
     ( 456231.4, 3688739.0,      0.0,        0.0);          ( 455833.9, 3689033.0,      0.0,        0.0);
     ( 455424.8, 3689316.0,      0.0,        0.0);          ( 455174.3, 3689665.0,      0.0,        0.0);
     ( 454803.3, 3689994.0,      0.0,        0.0);          ( 454546.5, 3690392.0,      0.0,        0.0);
     ( 454870.4, 3690709.0,      0.0,        0.0);          ( 454597.4, 3691091.0,      0.0,        0.0);
     ( 454265.8, 3691424.0,      0.0,        0.0);          ( 453849.0, 3691643.0,      0.0,        0.0);
     ( 453783.7, 3692090.0,      0.0,        0.0);          ( 453619.3, 3692293.0,      0.0,        0.0);
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*** ISCST3 - VERSION 02035 ***    *** SRS Site Boundary Receptors & Hwy S125, MFFF Construction - 1995     ***       05/21/02
                                  ***                                                                      ***       10:13:22
**MODELOPTs:                                                                                                         PAGE   5
CONC                       RURAL FLAT          DFAULT


                                         *** DISCRETE CARTESIAN RECEPTORS ***
                                           (X-COORD, Y-COORD, ZELEV, ZFLAG)
                                                      (METERS)

     ( 453533.5, 3692613.0,         0.0,        0.0);           ( 453617.9, 3692994.0,         0.0,        0.0);
     ( 453121.4, 3693032.0,         0.0,        0.0);           ( 452667.7, 3693202.0,         0.0,        0.0);
     ( 452242.9, 3693462.0,         0.0,        0.0);           ( 451818.0, 3693722.0,         0.0,        0.0);
     ( 451534.5, 3694093.0,         0.0,        0.0);           ( 451308.8, 3694463.0,         0.0,        0.0);
     ( 451051.1, 3694846.0,         0.0,        0.0);           ( 450562.0, 3694752.0,         0.0,        0.0);
     ( 450132.5, 3694889.0,         0.0,        0.0);           ( 449752.0, 3695209.0,         0.0,        0.0);
     ( 449406.6, 3695524.0,         0.0,        0.0);           ( 448925.9, 3695407.0,         0.0,        0.0);
     ( 448640.0, 3695611.0,         0.0,        0.0);           ( 448437.0, 3695970.0,         0.0,        0.0);
     ( 447964.0, 3695814.0,         0.0,        0.0);           ( 447590.8, 3695917.0,         0.0,        0.0);
     ( 447244.1, 3695819.0,         0.0,        0.0);           ( 446811.3, 3695641.0,         0.0,        0.0);
     ( 446367.9, 3695424.0,         0.0,        0.0);           ( 445876.5, 3695344.0,         0.0,        0.0);
     ( 445386.1, 3695290.0,         0.0,        0.0);           ( 444901.4, 3695404.0,         0.0,        0.0);
     ( 444416.7, 3695518.0,         0.0,        0.0);           ( 443919.5, 3695497.0,         0.0,        0.0);
     ( 443551.0, 3695590.0,         0.0,        0.0);           ( 443564.1, 3696021.0,         0.0,        0.0);
     ( 443067.4, 3695988.0,         0.0,        0.0);           ( 442570.3, 3695963.0,         0.0,        0.0);
     ( 442073.2, 3695937.0,         0.0,        0.0);           ( 441576.0, 3695913.0,         0.0,        0.0);
     ( 441079.0, 3695886.0,         0.0,        0.0);           ( 440582.5, 3695851.0,         0.0,        0.0);
     ( 440086.2, 3695812.0,         0.0,        0.0);           ( 439651.4, 3695658.0,         0.0,        0.0);
     ( 439348.8, 3695263.0,         0.0,        0.0);           ( 439005.4, 3695573.0,         0.0,        0.0);
     ( 438594.0, 3695448.0,         0.0,        0.0);           ( 438096.4, 3695433.0,         0.0,        0.0);
     ( 437845.2, 3695012.0,         0.0,        0.0);           ( 437615.8, 3694572.0,         0.0,        0.0);
     ( 437207.4, 3694461.0,         0.0,        0.0);           ( 436734.1, 3694612.0,         0.0,        0.0);
     ( 436282.6, 3694650.0,         0.0,        0.0);           ( 436028.7, 3694449.0,         0.0,        0.0);
     ( 435607.5, 3694222.0,         0.0,        0.0);           ( 435267.3, 3694338.0,         0.0,        0.0);
     ( 435120.7, 3693862.0,         0.0,        0.0);           ( 434756.3, 3693698.0,         0.0,        0.0);
     ( 434393.6, 3693628.0,         0.0,        0.0);           ( 434058.5, 3693269.0,         0.0,        0.0);
     ( 433659.3, 3692972.0,         0.0,        0.0);           ( 433201.3, 3692847.0,         0.0,        0.0);
     ( 433030.6, 3692489.0,         0.0,        0.0);           ( 432661.8, 3692258.0,         0.0,        0.0);
     ( 432165.4, 3692224.0,         0.0,        0.0);           ( 432024.3, 3691915.0,         0.0,        0.0);
     ( 431885.1, 3691932.0,         0.0,        0.0);           ( 431635.9, 3691615.0,         0.0,        0.0);
     ( 431413.9, 3691170.0,         0.0,        0.0);           ( 431154.4, 3690753.0,         0.0,        0.0);
     ( 430919.3, 3690319.0,         0.0,        0.0);           ( 430551.3, 3690436.0,         0.0,        0.0);
     ( 430243.7, 3690077.0,         0.0,        0.0);           ( 429803.4, 3690064.0,         0.0,        0.0);
     ( 429397.9, 3690136.0,         0.0,        0.0);           ( 429199.9, 3689712.0,         0.0,        0.0);
     ( 428915.8, 3689307.0,         0.0,        0.0);           ( 428577.5, 3688946.0,         0.0,        0.0);
     ( 428332.3, 3688514.0,         0.0,        0.0);           ( 428066.7, 3688093.0,         0.0,        0.0);
     ( 427778.2, 3687688.0,         0.0,        0.0);           ( 427659.7, 3687375.0,         0.0,        0.0);
     ( 427954.9, 3686973.0,         0.0,        0.0);           ( 427551.9, 3686861.0,         0.0,        0.0);
     ( 427333.1, 3686581.0,         0.0,        0.0);           ( 427204.2, 3686107.0,         0.0,        0.0);
     ( 427115.4, 3685782.0,         0.0,        0.0);           ( 427001.3, 3685297.0,         0.0,        0.0);
     ( 427292.2, 3684910.0,         0.0,        0.0);           ( 427570.4, 3684497.0,         0.0,        0.0);
     ( 427641.4, 3684153.0,         0.0,        0.0);           ( 427364.7, 3683758.0,         0.0,        0.0);
     ( 427059.0, 3683365.0,         0.0,        0.0);           ( 427411.9, 3683038.0,         0.0,        0.0);
     ( 427482.6, 3682689.0,         0.0,        0.0);           ( 427155.6, 3682314.0,         0.0,        0.0);
     ( 426976.8, 3681913.0,         0.0,        0.0);           ( 427286.2, 3681523.0,         0.0,        0.0);
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 *** ISCST3 - VERSION 02035 ***    *** SRS Site Boundary Receptors & Hwy S125, MFFF Construction - 1995    ***        05/21/02
                                   ***                                                                      ***        10:13:22
**MODELOPTs:                                                                                                           PAGE   6
CONC                      RURAL FLAT          DFAULT

                                      *** DISCRETE CARTESIAN RECEPTORS ***
                                        (X-COORD, Y-COORD, ZELEV, ZFLAG)
                                                 (METERS)

    ( 427581.1, 3681122.0,        0.0,        0.0);        ( 427176.3, 3680870.0,        0.0,        0.0);
    ( 426758.3, 3680600.0,        0.0,        0.0);        ( 426337.3, 3680335.0,        0.0,        0.0);
    ( 425908.0, 3680083.0,        0.0,        0.0);        ( 425476.7, 3679835.0,        0.0,        0.0);
    ( 425057.2, 3679566.0,        0.0,        0.0);        ( 424672.1, 3679255.0,        0.0,        0.0);
    ( 424215.7, 3679057.0,        0.0,        0.0);        ( 423789.1, 3678811.0,        0.0,        0.0);
    ( 423479.9, 3678519.0,        0.0,        0.0);        ( 423176.5, 3678245.0,        0.0,        0.0);
    ( 422876.0, 3677850.0,        0.0,        0.0);        ( 422600.3, 3677436.0,        0.0,        0.0);
    ( 422650.2, 3677015.0,        0.0,        0.0);        ( 422995.7, 3676716.0,        0.0,        0.0);
    ( 423470.0, 3676578.0,        0.0,        0.0);        ( 423901.3, 3676338.0,        0.0,        0.0);
    ( 424362.5, 3676178.0,        0.0,        0.0);        ( 424603.1, 3675766.0,        0.0,        0.0);
    ( 424644.3, 3675273.0,        0.0,        0.0);        ( 424855.8, 3674858.0,        0.0,        0.0);
    ( 425333.5, 3674826.0,        0.0,        0.0);        ( 425814.5, 3674739.0,        0.0,        0.0);
    ( 426235.1, 3674504.0,        0.0,        0.0);        ( 426724.3, 3674434.0,        0.0,        0.0);
    ( 427202.8, 3674562.0,        0.0,        0.0);        ( 427491.3, 3674920.0,        0.0,        0.0);
    ( 427399.6, 3675391.0,        0.0,        0.0);        ( 427198.1, 3675814.0,        0.0,        0.0);
    ( 427633.4, 3675947.0,        0.0,        0.0);        ( 428045.4, 3675682.0,        0.0,        0.0);
    ( 428382.6, 3675365.0,        0.0,        0.0);        ( 428511.6, 3674889.0,        0.0,        0.0);
    ( 428700.3, 3674431.0,        0.0,        0.0);        ( 428816.8, 3673948.0,        0.0,        0.0);
    ( 429167.6, 3673623.0,        0.0,        0.0);        ( 429400.5, 3673250.0,        0.0,        0.0);
    ( 429153.1, 3672836.0,        0.0,        0.0);        ( 429067.2, 3672356.0,        0.0,        0.0);
    ( 428615.8, 3672193.0,        0.0,        0.0);        ( 428390.8, 3671785.0,        0.0,        0.0);
    ( 428630.6, 3671363.0,        0.0,        0.0);        ( 428393.1, 3671101.0,        0.0,        0.0);
    ( 428064.3, 3671458.0,        0.0,        0.0);        ( 428074.2, 3671151.0,        0.0,        0.0);
    ( 428295.2, 3670709.0,        0.0,        0.0);        ( 428455.1, 3670251.0,        0.0,        0.0);
    ( 428458.5, 3669836.0,        0.0,        0.0);        ( 428721.3, 3669455.0,        0.0,        0.0);
    ( 428852.6, 3668985.0,        0.0,        0.0);        ( 429192.7, 3668624.0,        0.0,        0.0);
    ( 429491.5, 3668228.0,        0.0,        0.0);        ( 429795.5, 3667839.0,        0.0,        0.0);
    ( 430198.9, 3667556.0,        0.0,        0.0);        ( 430510.6, 3667212.0,        0.0,        0.0);
    ( 430893.8, 3666920.0,        0.0,        0.0);        ( 431291.3, 3666626.0,        0.0,        0.0);
    ( 431667.2, 3666311.0,        0.0,        0.0);        ( 432076.0, 3666034.0,        0.0,        0.0);
    ( 432401.4, 3665662.0,        0.0,        0.0);        ( 432749.8, 3665311.0,        0.0,        0.0);
    ( 433177.3, 3665056.0,        0.0,        0.0);        ( 433607.4, 3664807.0,        0.0,        0.0);
    ( 433970.4, 3664469.0,        0.0,        0.0);        ( 434365.4, 3664206.0,        0.0,        0.0);
    ( 434853.3, 3664254.0,        0.0,        0.0);        ( 435321.5, 3664089.0,        0.0,        0.0);
    ( 435782.8, 3663910.0,        0.0,        0.0);        ( 436259.1, 3663767.0,        0.0,        0.0);
    ( 436725.5, 3663596.0,        0.0,        0.0);        ( 437143.9, 3663331.0,        0.0,        0.0);
    ( 437595.1, 3663129.0,        0.0,        0.0);        ( 438056.3, 3662946.0,        0.0,        0.0);
    ( 438497.1, 3662723.0,        0.0,        0.0);        ( 438889.9, 3662431.0,        0.0,        0.0);
    ( 439246.0, 3662093.0,        0.0,        0.0);        ( 439615.7, 3661763.0,        0.0,        0.0);
    ( 440087.1, 3661604.0,        0.0,        0.0);        ( 440604.7, 3661603.0,        0.0,        0.0);
    ( 441087.6, 3661693.0,        0.0,        0.0);        ( 441583.4, 3661735.0,        0.0,        0.0);
    ( 442077.4, 3661793.0,        0.0,        0.0);        ( 442554.4, 3661844.0,        0.0,        0.0);
    ( 442691.3, 3662180.0,        0.0,        0.0);        ( 442685.1, 3662678.0,        0.0,        0.0);
    ( 442679.4, 3663176.0,        0.0,        0.0);        ( 442674.7, 3663674.0,        0.0,        0.0);
    ( 442726.6, 3664129.0,        0.0,        0.0);        ( 443011.8, 3664434.0,        0.0,        0.0);
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 *** ISCST3 - VERSION 02035 ***    *** SRS Site Boundary Receptors & Hwy S125, MFFF Construction - 1995      ***        05/21/02
                                   ***                                                                       ***        10:13:22
 **MODELOPTs:                                                                                                           PAGE   7
 CONC                    RURAL FLAT          DFAULT

                                        *** DISCRETE CARTESIAN RECEPTORS ***
                                         (X-COORD, Y-COORD, ZELEV, ZFLAG)
                                                   (METERS)

    ( 443063.2, 3664929.0,       0.0,       0.0);      ( 443376.8, 3665041.0,       0.0,       0.0);
    ( 443857.1, 3664909.0,       0.0,       0.0);      ( 444337.3, 3664777.0,       0.0,       0.0);
    ( 444709.9, 3664761.0,       0.0,       0.0);      ( 445032.9, 3665078.0,       0.0,       0.0);
    ( 445371.2, 3665423.0,       0.0,       0.0);      ( 445758.6, 3665229.0,       0.0,       0.0);
    ( 446036.0, 3665616.0,       0.0,       0.0);      ( 445852.6, 3665743.0,       0.0,       0.0);
    ( 445709.0, 3666059.0,       0.0,       0.0);      ( 446038.9, 3666289.0,       0.0,       0.0);
    ( 446512.5, 3666426.0,       0.0,       0.0);      ( 447010.5, 3666424.0,       0.0,       0.0);
    ( 447508.5, 3666423.0,       0.0,       0.0);      ( 448006.5, 3666421.0,       0.0,       0.0);
    ( 448441.3, 3666475.0,       0.0,       0.0);      ( 448475.2, 3666916.0,       0.0,       0.0);
    ( 448923.3, 3667133.0,       0.0,       0.0);      ( 449371.3, 3667350.0,       0.0,       0.0);
    ( 449825.6, 3667548.0,       0.0,       0.0);      ( 450153.0, 3667764.0,       0.0,       0.0);
    ( 450452.9, 3668014.0,       0.0,       0.0);      ( 450878.1, 3668137.0,       0.0,       0.0);
    ( 451125.6, 3668375.0,       0.0,       0.0);      ( 451516.8, 3668629.0,       0.0,       0.0);
    ( 451928.9, 3668884.0,       0.0,       0.0);      ( 452069.0, 3669361.0,       0.0,       0.0);
    ( 452529.3, 3669440.0,       0.0,       0.0);      ( 452590.6, 3669860.0,       0.0,       0.0);
    ( 452726.5, 3670192.0,       0.0,       0.0);      ( 452917.7, 3670463.0,       0.0,       0.0);
    ( 453236.2, 3670568.0,       0.0,       0.0);      ( 453717.5, 3670453.0,       0.0,       0.0);
    ( 454205.3, 3670377.0,       0.0,       0.0);      ( 454665.1, 3670463.0,       0.0,       0.0);
    ( 455050.6, 3670498.0,       0.0,       0.0);      ( 455082.1, 3670001.0,       0.0,       0.0);
    ( 455432.4, 3669836.0,       0.0,       0.0);      ( 455684.5, 3669437.0,       0.0,       0.0);
    ( 455721.1, 3669260.0,       0.0,       0.0);      ( 456091.4, 3669383.0,       0.0,       0.0);
    ( 456124.8, 3668951.0,       0.0,       0.0);      ( 456045.4, 3668527.0,       0.0,       0.0);
    ( 456278.5, 3668087.0,       0.0,       0.0);      ( 456539.3, 3667914.0,       0.0,       0.0);
    ( 456634.1, 3667425.0,       0.0,       0.0);      ( 456913.3, 3667224.0,       0.0,       0.0);
    ( 457222.2, 3667115.0,       0.0,       0.0);      ( 457233.4, 3666617.0,       0.0,       0.0);
    ( 457315.5, 3666181.0,       0.0,       0.0);      ( 457458.4, 3665953.0,       0.0,       0.0);
    ( 457714.3, 3665568.0,       0.0,       0.0);      ( 457589.9, 3665089.0,       0.0,       0.0);
    ( 457428.9, 3664618.0,       0.0,       0.0);      ( 457365.4, 3664127.0,       0.0,       0.0);
    ( 457680.8, 3663807.0,       0.0,       0.0);      ( 457902.6, 3663367.0,       0.0,       0.0);
    ( 458029.7, 3662931.0,       0.0,       0.0);      ( 458151.2, 3662464.0,       0.0,       0.0);
    ( 458140.8, 3661966.0,       0.0,       0.0);      ( 458117.6, 3661468.0,       0.0,       0.0);
    ( 457818.8, 3661120.0,       0.0,       0.0);      ( 457726.8, 3660661.0,       0.0,       0.0);
    ( 457363.9, 3660338.0,       0.0,       0.0);      ( 457104.5, 3659929.0,       0.0,       0.0);
    ( 456698.2, 3659682.0,       0.0,       0.0);      ( 456243.8, 3659479.0,       0.0,       0.0);
    ( 455764.2, 3659406.0,       0.0,       0.0);      ( 455278.5, 3659408.0,       0.0,       0.0);
    ( 454784.5, 3659451.0,       0.0,       0.0);      ( 454330.7, 3659329.0,       0.0,       0.0);
    ( 453893.0, 3659192.0,       0.0,       0.0);      ( 453576.9, 3658868.0,       0.0,       0.0);
    ( 453248.9, 3658501.0,       0.0,       0.0);      ( 452998.6, 3658078.0,       0.0,       0.0);
    ( 452786.8, 3657630.0,       0.0,       0.0);      ( 452289.0, 3657643.0,       0.0,       0.0);
    ( 452168.4, 3657496.0,       0.0,       0.0);      ( 452597.0, 3657242.0,       0.0,       0.0);
    ( 452585.9, 3656879.0,       0.0,       0.0);      ( 452253.0, 3656536.0,       0.0,       0.0);
    ( 451825.6, 3656307.0,       0.0,       0.0);      ( 451793.3, 3655810.0,       0.0,       0.0);
    ( 451453.7, 3655458.0,       0.0,       0.0);      ( 451090.2, 3655118.0,       0.0,       0.0);
    ( 450982.6, 3654806.0,       0.0,       0.0);      ( 451378.0, 3654505.0,       0.0,       0.0);
    ( 451849.1, 3654375.0,       0.0,       0.0);      ( 452263.0, 3654192.0,       0.0,       0.0);
```

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*** ISCST3 - VERSION 02035 ***   *** SRS Site Boundary Receptors & Hwy S125, MFFF Construction - 1995      ***        05/21/02
                                 ***                                                                       ***        10:13:22
**MODELOPTs:                                                                                                          PAGE   8
CONC                     RURAL FLAT          DFAULT

                                          *** DISCRETE CARTESIAN RECEPTORS ***
                                           (X-COORD, Y-COORD, ZELEV, ZFLAG)
                                                       (METERS)

     ( 452069.5, 3653824.0,        0.0,        0.0);          ( 451580.8, 3653793.0,        0.0,        0.0);
     ( 451829.0, 3653496.0,        0.0,        0.0);          ( 452307.3, 3653545.0,        0.0,        0.0);
     ( 452750.4, 3653557.0,        0.0,        0.0);          ( 453225.1, 3653702.0,        0.0,        0.0);
     ( 453697.6, 3653857.0,        0.0,        0.0);          ( 453810.9, 3654100.0,        0.0,        0.0);
     ( 453392.9, 3654310.0,        0.0,        0.0);          ( 453180.0, 3654759.0,        0.0,        0.0);
     ( 452970.2, 3655210.0,        0.0,        0.0);          ( 452876.1, 3655653.0,        0.0,        0.0);
     ( 453113.2, 3656090.0,        0.0,        0.0);          ( 453308.9, 3656548.0,        0.0,        0.0);
     ( 453494.6, 3657010.0,        0.0,        0.0);          ( 453667.3, 3657477.0,        0.0,        0.0);
     ( 453984.4, 3657769.0,        0.0,        0.0);          ( 454250.0, 3658189.0,        0.0,        0.0);
     ( 454610.0, 3658524.0,        0.0,        0.0);          ( 455021.6, 3658715.0,        0.0,        0.0);
     ( 455452.4, 3658782.0,        0.0,        0.0);          ( 455538.3, 3659219.0,        0.0,        0.0);
     ( 455702.9, 3658936.0,        0.0,        0.0);          ( 456160.3, 3658919.0,        0.0,        0.0);
     ( 456649.3, 3659011.0,        0.0,        0.0);          ( 457094.0, 3659222.0,        0.0,        0.0);
     ( 457519.5, 3659481.0,        0.0,        0.0);          ( 457945.2, 3659739.0,        0.0,        0.0);
     ( 458371.5, 3659997.0,        0.0,        0.0);          ( 458793.0, 3660178.0,        0.0,        0.0);
     ( 459239.5, 3660087.0,        0.0,        0.0);          ( 459624.6, 3660156.0,        0.0,        0.0);
     ( 459502.7, 3660319.0,        0.0,        0.0);          ( 459052.0, 3660519.0,        0.0,        0.0);
     ( 459042.7, 3660708.0,        0.0,        0.0);          ( 458647.4, 3660434.0,        0.0,        0.0);
     ( 458408.8, 3660535.0,        0.0,        0.0);          ( 458518.1, 3660971.0,        0.0,        0.0);
     ( 458481.0, 3661266.0,        0.0,        0.0);          ( 427236.4, 3686111.8,        0.0,        0.0);
     ( 427490.3, 3685767.8,        0.0,        0.0);          ( 427840.2, 3685256.3,        0.0,        0.0);
     ( 428018.9, 3684832.5,        0.0,        0.0);          ( 428322.7, 3684419.5,        0.0,        0.0);
     ( 428502.2, 3683995.8,        0.0,        0.0);          ( 428689.9, 3683631.0,        0.0,        0.0);
     ( 429013.1, 3683336.8,        0.0,        0.0);          ( 429212.7, 3682849.0,        0.0,        0.0);
     ( 429331.2, 3682434.5,        0.0,        0.0);          ( 429275.4, 3681895.3,        0.0,        0.0);
     ( 429259.8, 3681410.8,        0.0,        0.0);          ( 429183.2, 3680935.5,        0.0,        0.0);
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     ( 429298.1, 3679151.5,        0.0,        0.0);          ( 429521.7, 3678812.0,        0.0,        0.0);
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     ( 430031.6, 3677757.8,        0.0,        0.0);          ( 430330.5, 3677315.3,        0.0,        0.0);
     ( 430715.2, 3676828.8,        0.0,        0.0);          ( 430989.6, 3676420.3,        0.0,        0.0);
     ( 431182.0, 3676085.8,        0.0,        0.0);          ( 431505.6, 3675791.5,        0.0,        0.0);
     ( 431874.0, 3675398.5,        0.0,        0.0);          ( 432167.0, 3675109.3,        0.0,        0.0);
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     ( 433970.1, 3674035.5,        0.0,        0.0);          ( 434340.6, 3674038.5,        0.0,        0.0);
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     ( 437859.9, 3670015.8,        0.0,        0.0);          ( 438213.0, 3669717.0,        0.0,        0.0);
     ( 438642.3, 3669314.8,        0.0,        0.0);          ( 439111.2, 3668967.0,        0.0,        0.0);
     ( 439574.8, 3668590.3,        0.0,        0.0);          ( 439934.2, 3668138.0,        0.0,        0.0);
     ( 440358.5, 3667706.3,        0.0,        0.0);          ( 440722.4, 3667283.8,        0.0,        0.0);
     ( 441223.0, 3666748.5,        0.0,        0.0);          ( 441617.5, 3666321.3,        0.0,        0.0);
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 *** ISCST3 - VERSION 02035 ***    *** SRS Site Boundary Receptors & Hwy S125, MFFF Construction - 1995     ***        05/21/02
                                   ***                                                                     ***        10:13:22
**MODELOPTs:                                                                                                          PAGE   9
CONC                    RURAL FLAT        DFAULT


                                         *** DISCRETE CARTESIAN RECEPTORS ***
                                           (X-COORD, Y-COORD, ZELEV, ZFLAG)
                                                      (METERS)

    ( 442120.9, 3665999.0,       0.0,       0.0);          ( 442575.3, 3665562.3,       0.0,       0.0);
    ( 442903.3, 3665297.8,       0.0,       0.0);          ( 443262.2, 3664845.8,       0.0,       0.0);
    ( 443661.3, 3664448.0,       0.0,       0.0);          ( 443994.9, 3664030.3,       0.0,       0.0);
    ( 444251.8, 3663898.5,       0.0,       0.0);          ( 444734.4, 3663640.5,       0.0,       0.0);
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 *** ISCST3 - VERSION 02035 ***     *** SRS Site Boundary Receptors & Hwy S125, MFFF Constrıction - 1995     ***      05/21/02
                                    ***                                                                      ***      10:13:22
                                                                                                                      PAGE  10
 **MODELOPTs:
 CONC                  RURAL FLAT          DFAULT

                              *** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
                                                 (1=YES; 0=NO)

          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1

             NOTE:  METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.


                         *** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
                                                 (METERS/SEC)

                                  1.54,    3.09,    5.14,    8.23,   10.80,

                                          *** WIND PROFILE EXPONENTS ***

             STABILITY                          WIND SPEED CATEGORY
             CATEGORY         1             2             3             4             5             6
                A        .70000E-01    .70000E-01    .70000E-01    .70000E-01    .70000E-01    .70000E-01
                B        .70000E-01    .70000E-01    .70000E-01    .70000E-01    .70000E-01    .70000E-01
                C        .10000E+00    .10000E+00    .10000E+00    .10000E+00    .10000E+00    .10000E+00
                D        .15000E+00    .15000E+00    .15000E+00    .15000E+00    .15000E+00    .15000E+00
                E        .35000E+00    .35000E+00    .35000E+00    .35000E+00    .35000E+00    .35000E+00
                F        .55000E+00    .55000E+00    .55000E+00    .55000E+00    .55000E+00    .55000E+00

                             *** VERTICAL POTENTIAL TEMPERATURE GRADIENTS ***
                                           (DEGREES KELVIN PER METER)

             STABILITY                          WIND SPEED CATEGORY
             CATEGORY         1             2             3             4             5             6
                A        .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00
                B        .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00
                C        .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00
                D        .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00
                E        .20000E-01    .20000E-01    .20000E-01    .20000E-01    .20000E-01    .20000E-01
                F        .35000E-01    .35000E-01    .35000E-01    .35000E-01    .35000E-01    .35000E-01
```

Attachment 55

SUMMARY OF WASTE SOLIDIFICATION BUILDING ANNUAL NON-RADIOLOGICAL OPERATING EMISSIONS

The objective of this paper is to establish a technical basis for the annual Non-Radiological emissions for the Waste Solidification Building (WSB). The anticipated sources for these air emissions are from the WSB facility proper and the support facilities/storage areas located outside. The primary "point sources" are the evaporators, certain process vessels, cement process and associated silos, standby diesel, and inert gases.

The criteria for these calculations will be based on the following assumptions and above references:

- No credit will be taken for mitigating process equipment or systems (i.e. scrubbers, pollution abatement equipment, evaporator condensers, etc.).
- The hydrogen generation for the facility and storage area is dominated by the MFFF High Alpha Stream and will encompass the hydrogen generated in the cement form.
- All calculations are based on a fifty-two week year and are not adjusted for individual facility operating calendars.
- The diesel emissions were derived from diesel permits presently existing at SRS.
- The Consolidated Incineration Facility (CIF) permit was used to model the WSB cement dust emissions with limited mitigation credit incorporated.
- WSB Laboratory emissions are assumed negligible.

EMISSIONS SUMMARY

Facility Specific Emissions – The primary process emissions are organics and hydrogen, which originate in the various tanks, evaporators, and rooms/cells and are exhausted via the Process Vessel Vent system and regulated ventilation system. It is assumed that a transfer of material from the MOX/PDCF facilities would remain in the facility for predetermined periods (based on transfer cycles) which bounds the emissions for a point source. Therefore, once the material(s) are solidified as waste and transferred to storage, they are no longer considered a point source.

PDCF HAW	One Batch's time in facility (wks)	2	
Component	Amount/batch (kg)	Average Conc. Per wk (ug/cuft)	Avg. Conc. Per wk (ug/m^3)
Acetone	0.089	9.49E-02	3.35E+00
Hydrogen	Dominated by Mox High Alpha		

MOX High Alpha	One Batch's time in facility (wks)	2	
Component	Amount/batch (kg)	Average Conc. Per wk (ug/cuft)	Avg. Conc. Per wk (ug/m^3)
TBP	0.84	8.92E-01	3.15E+01
Hydrogen	2.16E-02	2.30E-02	8.11E-01

MOX SU	One Batch's time in facility (wks)	1	
Component	Amount/batch (kg)	Average Conc. Per wk (ug/cuft)	Avg. Conc. Per wk (ug/m^3)
TBP	0.083	1.76E-01	6.22E+00
Hydrogen	Dominated by Mox High Alpha		

<u>Non-Facility Specific Emissions</u> -

Diesel emissions – The upper range estimate for the WSB describes a 750 kW diesel generator, where as the lower range estimate is a 600 kW generator. For purposes of this exercise, the manufacture's data for an 800 kW diesel generator will be used, which will bound both scenarios.

An estimated 250 run-hours per year will be used to describe the maximum number of hours/year this machine would encounter in this type service (standby diesel). This value was selected based on actual operating hours for the 235-F and 292-2F diesels.

800 kW Diesel Generator Emission Rates

Pollutants	**NOx**	**PM** plus **PM-10**	**CO**	**SO2**	**VOC**
Total Emissions (lbs./hour)	24.92	4.24	5.07	1.62	0.4409
Emissions (lbs.) @ 250 Hours	6230	1060	1268	405	111

Cement Process Emissions – The cement storage, handling, and process equipment are potential sources of Particulate Matter and PM-10 (particulate matter <10 microns) emissions. These emissions would result from material transfers through the process.

Both the High Alpha and Low Level Waste streams will involve the use of Portland cement. The High Alpha stream will involve 25 transfers per year and each transfer will generate 48 drums/batch. The amount of dry Portland cement required for each batch of High Alpha Waste is 7425 pounds or 186,625 pounds/year.

The Low Level Waste will involve 25 transfers of PDCF High Activity Waste and 52 transfers of MFFF Stripped Uranium. The streams will be mixed during processing and generate nine drums of cemented waste per week which requires 3,000 pounds of dry cement/week or 156,000 pounds/year.

Assuming there is eighty-five pounds of Portland cement per cubic foot, this equates to approximately 4035 cubic feet of cement/year. Will use 4100 ft3/yr total for purposes of this exercise.

Table I
Particulate Matter Emissions Summary
(High Alpha Waste Process)

	Silo*	**hopper**	**mixer**
Cement Handling Rate	42.50 tons/hr.	2.38 tons/hr.	0.323 tons/hr.
Emission Rate Before Filtration	10.20 lb./hr.	0.0476 lb./hr.	0.0129 lb./hr.
Emissions After 90% Filtration	1.02 lb./hr	4.76 x 10-3 lb./hr.	1.29 x 10-3 lb./hr.
Exit Velocity of Emissions	6.67 ft./sec.	1.13 ft./sec.	9.8 ft./sec.

Table IA
PM-10 Emissions Summary
(High Alpha Waste Process)

	Silo*	**hopper**	**mixer**
Cement Handling Rate	42.50 tons/hr.	2.38 tons/hr.	0.332 tons/hr.
Emission Rate Before Filtration	5.10 lb./hr	0.0238 lb./hr.	0.00646 lb./hr.
Emissions After 90% Filtration	0.51 lb./hr.	2.38 x 10-3 lb./hr.	6.46 x10-4 lb./hr.
Exit Velocity of Emissions	6.67 ft./sec.	1.13 ft./sec.	9.8 ft./sec.

Table II

Particulate Matter Emissions Summary
(Low Level Waste Process)

	Silo*	**hopper**	**mixer**
Cement Handling Rate	42.50 tons/hr.	2.0 ton/hr.	0.332 tons/hr.
Emission Rate Before Filtration	5.10 lb./hr	0.4 lb./hr.	0.00646 lb./hr.
Emissions After 90% Filtration	0.51 lb./hr.	4.0 x 10-3 lb./hr.	6.46 x10-4 lb./hr.
Exit Velocity of Emissions	6.67 ft./sec.	1.13 ft./sec.	9.8 ft./sec.

Table IIA

PM-10 Emissions Summary
(Low Level Waste Process)

	Silo*	**hopper**	**mixer**
Cement Handling Rate	42.50 tons/hr.	2.0 ton/hr.	0.323 tons/hr.
Emission Rate Before Filtration	5.10 lb./hr	0.02 lb./hr.	0.00646 lb./hr.
Emissions After 90% Filtration	0.51 lb./hr.	2.0 x 10-3 lb./hr.	6.46 x10-4 lb./hr.
Exit Velocity of Emissions	6.67 ft./sec.	1.13 ft./sec.	9.8 ft./sec.

Notes: Assumes there are nine (9) deliveries a year with 500 cu. ft. of cement in each load. One silo services both the HAW and LLW cement processes.

Fugitive Emissions (Special Case) – The drum storage area is presently designed to store one year's production (1175 55-gallon drums) of Transuranic (TRU) waste. The storage area will be covered, but not completely enclosed. The primary emission would be hydrogen and would be dispersed evenly throughout the surrounding area, therefore being regarded as a fugitive emission. Two hundred and fifty drums will be used as a representative quantity of drums in the storage area.

The bounding assumptions are:

- Twenty-gallon final cement form.
- Twenty (20) grams of americium per gallon
- G value of 1.6 molecules of hydrogen/100 eV of decay energy
- 30 wt.% water to cement mixing recipe

The hydrogen generation rate is 66 micro-grams/gallon of concrete/hour or 1.320 milli-grams/drum/hour. For the WSB representative quantity of drums (250), the generation rate would be 330 milli-grams of hydrogen/drum/hour.

Attachment 65 WSB elevations