PADUCAH GASEOUS DIFFUSION PLANT
SITE SPECIFIC ADVISORY BOARD

padssab@apex.net *www.oro.doe.gov/pgdpssab/*

2000 McCracken Boulevard • Paducah, Kentucky 42001 • (270) 744-9010

Chair

Craig Rhodes

Board Members

Kit Atkinson
Nola Courtney
Mark Donham
Edward Duff
Judy Ingram
Vicki Jones
Merryman Kemp
Ronald Lamb
Linda Long
Douglas Raper
Craig Rhodes
Rosa Scott
Jim Smart, Ph.D.
Bill Tanner
Rev. Gregory Waldrop

***Ex Officio* Members**

Carl Froede, Jr.
Environmental Protection Agency

Wayne L. Davis
Fish and Wildlife Resources
(Kentucky)

Tuss Taylor
Division of Waste Management
(Kentucky)

John A. Volpe, Ph.D.
Radiation Control Branch
(Kentucky)

Don Seaborg
Department of Energy

DOE Federal Coordinator
John D. Sheppard

Additional information about contacting board members directly can be obtained from the SSAB web site or by contacting Shirley Speer at (270) 744-9010.

Tentative agenda for the May 18, 2000 meeting:

5:30
Informal discussion

6:00
Call to order, introductions
Review of agenda
Approval of minutes from April meeting

Site Manager's Comments — **60 minutes**
ES&H issues, investigation
Other
Board discussion
Public comments and questions

SSAB recommendations status — **5 minutes**

Project status updates — **20 minutes**
EM&EF Projects
Drum Mountain/Scrap Metal
Groundwater Operable Unit/Permeable Treatment Zone
Board discussion
Public comments and questions

Administrative issues — **15 minutes**
Review of SSAB Draft Workplan
Financial update

SSAB Subcommittee Reports — **15 minutes**
On-Site Disposal Facility
Monitoring program recommendation parameters
Community Relations
Consultant
Membership

Adjourn

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Site Specific Advisory Board
Meeting Minutes
May 18, 2000

The May 18, 2000, Site Specific Advisory Board (SSAB) meeting took place at the Information Age Park Resource Center in Paducah at 5:30 p.m.

The following board members were present: Mark Donham, Vicki Jones, Merryman Kemp, Linda Long, Doug Raper, Craig Rhodes, Jim Smart, Bill Tanner, and Gregory Waldrop. The facilitator present was Steve Kay. *Ex Officio* members present were: Don Seaborg, Department of Energy (DOE) and Tuss Taylor of Kentucky Division Crane of Waste Management. The DOE federal coordinator present was John Sheppard. Jeff was present of the Environmental Protection Agency. Todd Adams was present of the Kentucky Radiation Control Branch. Brian Baker, Gaye Brewer, Mike Guffey, and Linda Martin of the Kentucky Division of Waste Management (KDWM), were present. Also present were the following members of the public and employees, contractors, and subcontractors of the DOE: Greg Cook, Gordon Dover, Barb Flannigan, Bruce Gardner, Herb Gregory, Norm Jetta, Jim Malone, M'balia Tagoe, John Tillson, and Shirley Speer.

Agenda

Craig Rhodes called the meeting to order and asked for modifications to the agenda. Testing Parameters was added to Project Updates. Discussion of the financial committee and board processes was added to Administrative Issues. The amended agenda was approved.

Minutes

Changes for the April minutes were as follows.
1. On page three, regarding the Vortec recommendation, strike the last sentence, and add, "Proposal was passed by consensus."
2. On page four, paragraph five, John Tillson asked what this project was expected to cost. Insert "Tagoe's response was about two million dollars."
3. On page four, paragraph five; Mark Donham's question if this would be a categorical exclusion, should be followed by "Tagoe's response was that it is likely to be a categorical exclusion."

Revised minutes were approved by consensus.

Site Manager's Comments

Don Seaborg said he had talked with several people regarding the SSAB and that the response was not very complimentary of DOE. He said that hopefully SSAB would see improvement.

He summarized what had been discussed since last meeting. Some of the issues discussed were:

1. He asked Rhodes if the meeting minutes had been handled satisfactorily. Rhodes said yes.
2. He checked to see if Rhodes had gained access to the webpage. Rhodes said he had been in contact with the person in Oak Ridge.
3. He said we could do an independent audit from the Oak Ridge office.
4. He discussed three different options for the Board's administrative support.
5. He said that the B53 weapons parts that had been in the news article had been investigated. He reported that no radiation was found and the casings were not classified.
6. He said that DOJ is continuing their investigation to decide whether they are going to participate in the lawsuit.
7. He said that DOJ expects to be doing some digging.
8. He said that Sheppard would be taking over for Jackson as local contact for weapons investigation.
9. He reported that FOIA seems to have a staffing problem in Oak Ridge. He suggested having Amy Rothrock come to an SSAB meeting to answer questions.
10. He said charts of FY 2000 spending were in the handout packets.
11. He said Vortec could still not be discussed because of lawsuit.
12. He discussed how DOE had kicked off Site Plan for Paducah including UF_6 Conversion.
13. He discussed the Little Bayou situation with youth playing inside posted areas and how best to educate people regarding this issue.

14. He said there had been a walk through done of all cylinders. He said that they had found no further problems.
15. He said that sampling reports the board had requested would be discussed later in the meeting.

Linda Long asked what was being done at the dump. John Sheppard said DOJ started Ground Penetrating Radar (GPR) today. Seaborg stated that the GAO report would be mailed out to board.

Doug Raper asked for clarification on what Seaborg had said about the budget and regarding the cylinders, how had they missed seeing the plug. Seaborg again explained how the administrative support could be funded by a grant given to an educational institution or incorporated into the DOE site administrative support contract. Either solution would remove the oversight of the administrative support from the Bechtel Jacobs Company and its subcontractor. John Sheppard said some cylinders are checked on a four-year program, if there is a problem, they are put on a one-year check. Jim Smart asked if cylinders are only checked once a year. Dover said there is not a formal check other than once a year. Donham said that Eugene Hoffman said that you should not say that the plugs are self-sealing. Seaborg said that was not being said. Donham asked about the older cylinders. Dover said this occurrence may cause inspections to be held more often.

Kemp asked Seaborg to review what he had said about the Little Bayou situation. Seaborg said there are three things being considered: 1. Gather more data. 2. Get someone with expert skill to determine how critical the problem is, and 3. Going door to door to talk with the parents and children. DOE is trying to get the money to do these things. Kemp commented that young people think they are indestructible and that people in this area have been led to think everything is o.k. Everything is always given a positive spin. Seaborg questioned where he had put the positive spin. Kemp said that it always been done in the past. Raper asked if 2010 was still the goal for cleanup since Drum Mountain was all that had been started. Seaborg commented that this is one of the reasons for the integrated plan. DMSA's previously were not part of the cleanup portion of the plant, but the integrated site plan will take both programs and deal with the problem.

Donham asked if the site wide plan was subject to NEPA. He asked if there would finally be an Environmental Impact Statement. He said that he had a response from Rothrock (FOIA) regarding Design Integration Group (DiG). He said that Rothrock said that the documents were not agency documents.

Waldrop asked about criticality possibility. Sheppard said that as the work is done, trained workers need certain procedures that keep a criticality from happening.

Rhodes said he wanted to point out that Seaborg had kept in touch for the last month and thanked him.

SSAB recommendation status

The Vortec recommendation needs to be sent to DOE immediately. Recommendations are to be sent to DOE following the board approving them at the meeting.

Project Status Updates

Donham had a question regarding permits for Vortec. Tuss Taylor said the permits would go out for public comment before being issued.

Drum Mountain

Donham asked if there would be containment during shredding and digging at Drum Mountain. Tagoe said there would be both containment and monitoring. Donham asked how the neighborhood is going to be safeguarded. Dover said they would be taking samples and if there were elevations in contamination it would be addressed. Donham asked if there is going to be a tent or what efforts are being made to keep the dig and shredding safe. Donham said if conditions (wind, etc.) were right, there could be contaminations.

Raper asked if drums were being characterized. Dover said primarily for Envirocare. Waldrop asked what the containment would be. Tagoe said the details were not complete. Kemp asked if samples and results had a lag what was the potential of contamination. Dover said samples and results do have a lag but they would monitor closely. Rhodes asked when this is scheduled to start. Dover said in June. Raper asked how equipment would be disposed. Donham asked what happens if it does not meet the criteria of Envirocare. Dover said it would be stored until some other means of disposal came up. Kemp asked for more information regarding Donham's question. Taylor said there was a study in 1996. Donham said the study was not for transuranics. **A proposal was made for the board to ask DOE to provide more information.** Guffey said that Air Quality had been working on a draft. Seaborg said DOE could get the information to the board as soon as possible. Tanner asked about containment and monitoring. He said Drum Mountain needs to be cleaned up but it needs to be done right. Seaborg said point is noted. Smart suggested a meeting with people who could give the board more information. **Proposal was made for a special meeting. Proposal was approved by consensus.** Special meeting was set for June 1, 6:30 p.m. at regular meeting room. Donham said he wanted the categorical exclusion identified. Tagoe said it would be included in the information.

Groundwater Operable Unit/Permeable Treatment Zone

Groundwater Operable Unit Feasibility Study (GWOUFS) would be out June 18, 2000. Sheppard said there was information on the Permeable Treatment Zone in the handout packet. Donham asked if this would also be a categorical exclusion. Tagoe said yes. Donham asked Seaborg if he understood what Categorical Exclusion is. Seaborg explained what he understands about Catagorical Exclusions. Tagoe said the idea is not to circumvent the public. Donham said that with Categorical Exclusion the public does not even have to be told. Crane said that there is a debate nationally regarding NEPA and the comparison requirements of CERCLA. He said the processes are functionally equivalent. He said if there is a lack of communication and a lack of involvement in the process under

CERCLA that it may need addressing. He said incremental operable units are workable and gave incremental success. Donham said there is a difference, that under NEPA you have to look at the cumulative effects and under CERCLA they are not considered until after the fact. Waldrop said he is more concerned with the Drum Mountain Categorical Exclusion than the Permeable Treatment Zone. He suggests the board hire someone to digest documents. Seaborg said what he was hearing was three things. 1. NEPA -do it right. 2. Data for Drum Mountain-June 1, Special Meeting, and 3. Material is not getting to board in timely fashion.

Waldrop suggested the board use the office more. There was discussion about hiring technical support for the board. It was decided that Project Updates would be sent out with minutes.
(after break)

Sheppard said the GWOUFS is one of the most significant reports to date. **The proposal was made to extend the public comment period to 60 days.** Sheppard stated that this would give the board a chance to make a recommendation as a board. Seaborg said he needed to hear from Bechtel Jacobs Company how the extension would affect schedules. Crane said he did not think 60 days would be a problem. **Proposal was approved by consensus. Proposal was made to forward proposal to other agencies. Proposal passed by consensus.** It was decided that there would be a fifteen-minute presentation of strategic issues of GWOUFS at the regular June meeting. Draft of available material will be sent before June 15, 2000 SSAB meeting.

Testing Parameters

Rhodes said the committee had met to discuss the parameters of the proposed testing in the plant area. They had decided that tests should be for PCB, TC^{99}, and Chromium. Donham presented a map of the proposed testing area. He said they suggested that DOE come up with a list of laboratories to put in mailing to homeowners but also allow homeowners to have their own choice of labs. Seaborg suggested using some of the present monitoring systems. Rhodes said committee would meet again.

Discussion of Workplan

Kemp suggested getting more involved with Pacro. Seaborg said he would talk with Pacro regarding more involvement.

Financial Update

Rhodes reported that the financial committee had been formed of Judy Ingram, Merryman Kemp, Doug Raper, and possibly Nola Courtney.

Board Processes

A proposal was made to schedule a retreat for the board that deals with board process, including these topics: 1. achieving greater participation and more balance in board discussions, 2. federal regulations and guidelines, 3. roles of facilitator, ex officio members, other agency representatives, and contractors, 4. formation and monitoring of board budget, 5. role of committees, relation to the public, decision-making process, and review of mission and scope. Proposal was passed by consensus.

A proposal was made regarding minutes process to: 1. have all proposals indicated in bold, 2. have all actions taken on proposals (tabled, approved by consensus, vote with tally) indicated in bold, and 3. have all requests for action items from DOE and all recommendations to DOE listed at the bottom of the next agenda. Have them remain at the bottom of the agenda until there is some response. Proposal passed by consensus.

A proposal regarding agenda process to include the following: 1. a proposed agenda for the following month will be included in the packet for each meeting, 2. at the end of each meeting, the last item will be 'agenda review.' The draft for the next meeting will then be reviewed and modified as needed, items added or deleted, 3. that draft will not be modified between meetings, except by explicit agreement of the DDFO ant the Chair of the SSAB, 4. that draft will stand as the 'Tentative agenda' and be included in the board packet for the next meeting. At the beginning of the next meeting it will be reviewed, modified as needed, and adopted by consensus of the SSAB, and 5. this process will constitute DOE approval of the agenda unless the DDFO specifically objects. This proposal was approved by consensus.

Membership
No comments.

Meeting adjourned.

SSAB Updates

July 2000

BURIAL GROUNDS OPERABLE UNIT

PROJECT: Waste Area Groups 3, 8, 28 and Data Gaps

SUMMARY: Remedial Investigations have been done on WAGs 3 and 28. A Site Evaluation was done on WAG 8. In addition, this project includes a 'Data Gaps' investigation to collect groundwater and subsurface soil samples to supplement existing data.

WAG 3 includes three burial grounds: C-747 (SWMU 4), C-746-F (SWMU 5) and C-747-B (SWMU 6). WAG 8 includes SWMUs 82-85, which are the plant electrical switchyards (C-531, C-533, C-535, and C-537), as well as the decommissioned C-340 Reduction and Metals Facility. WAG 28 includes SWMUs 99, 183, 193, 194, which are locations related to the 1950s construction of the plant.

Status: Waste Area Groups 3, 8, 28 and Data Gaps

- Remedial Investigation field work for WAG 3, WAG 28, WAG 8 Site Evaluation and Data Gaps have been completed.
- **The D0 Remedial Investigation Report for WAG 3 was scheduled for release on July 17. The D1 version is due to regulators by Sept. 30, 2000.**
- **Draft responses to state and EPA comments on the D1 Site Evaluation Report were submitted for review on June 29, 2000.**
- **On July 6, DOE asked for additional time to complete the D2 WAG 28 RI Report, citing the need to adequately address regulatory comments. The project issuance date of the D2 RI Report is late August.**
- **Comments on the D1 WAG 28 RI Report were received from EPA on July 7.**

PROJECT: Waste Area Group 22, SWMU 2

SUMMARY: SWMU 2 is the C-749 Uranium Burial Ground in the west-central portion of the plant.

Status: Waste Area Group 22, SWMU 2

- The Proposed Plan for this project was placed on hold. Proposed actions will be developed and included in the overall Burial Grounds OU proposed plan.

PROJECT: Waste Area Group 22, SWMUs 7&30

SUMMARY: This project includes the investigation of the C-747-A Uranium Burial Ground and C-747-A Burn Area in the northwest corner of the plant. The D2 Feasibility Study for SWMUs 7 & 30 was issued to regulatory agencies for review in November 1998 and evaluated four remedial alternatives: 1) No action; 2) Limited action (installation of additional monitoring wells and long-term groundwater monitoring); 3) Soil cover and groundwater monitoring with additional monitoring wells; and 4) Surface soil removal and groundwater monitoring with additional monitoring wells.

Status: Waste Area Group 22, SWMUs 7 & 30

- The Environmental Protection Agency Region 4 has given conditional approval of the D2 Feasibility Study.
- The Kentucky Department for Environmental Protection approved the D2 Feasibility Study on May 3, 1999.
- Information from this Feasibility Study will be incorporated into the overall Burial Grounds Operable Unit project.

July 2000

GROUNDWATER OPERABLE UNIT

PROJECT: Feasibility Study

SUMMARY: A Feasibility Study is to be written in accordance with CERCLA and the Federal Facility Agreement to address treatment options for the Groundwater Operable Unit.

Status: Feasibility Study (FS):

- **The D1 Groundwater Operable Unit Feasibility Study was released to regulatory agencies on July 14, 2000.**
- **The FS was presented to the community at a July 18 public meeting. Comments from the public will be accepted through October 12, 2000.**

PROJECT: Northwest/Northeast Plume Groundwater Systems

SUMMARY: The Northwest and Northeast plume treatment facilities were constructed as interim measures to control "hot spots" in the groundwater contamination beneath and around the plant. The Northwest Plume Groundwater Treatment Facility opened in September 1995. The facility operates under a 1993 Record of Decision to contain a high contamination zone of TCE and Tc-99. The Northeast Plume system opened in February 1997 under a 1994 Record of Decision to contain a high contamination zone of TCE.

Status: Northwest/Northeast Plume Groundwater Systems

- **6.3 million gallons of groundwater were treated at the Northwest System during June, with the facility operational 69 percent of the time. This brings the total treated to 490.5 million gallons.**
- **6.3 million gallons of groundwater were treated at the Northeast System during June, with the facility operational 99.6 percent of the time. This brings the total treated to 265.8 million gallons.**

PROJECT: Waste Area Group 27

SUMMARY: WAG 27 consists of potential or known sources of TCE on the west side of PGDP. WAG 27 includes the C-747-C Oil Land Farm, SWMU 91 (the cylinder drop test area), SWMU 196 (C-746-A warehouse septic systems) and the C-720 maintenance facility.

Status: Waste Area Group 27

- The D2 Remedial Investigation Report was approved in September 1999 and data have been incorporated into the Groundwater Operable Unit This information is being incorporated in the GWOU Feasibility Study.

PROJECT: Lasagna™ Soil Remediation at SWMU

SUMMARY: Lasagna™ was selected to remove TCE from SWMU 91 under a 1998 Record of Decision. SWMU 91 is an area of approximately one acre on the west side of the plant once used to drop test empty DUF6 cylinders. The process uses buried electrodes to move contaminated water to treatment zones, where contaminants are degraded.

Status: Lasagna™ Soil Remediation at SWMU

- Operations began in December 1999 and are continuing. Remediation is expected to be completed by December 2001.

PROJECT: Permeable Treatment Zone Demonstration (Treatability Study)

SUMMARY: This is a Treatability Study to determine if a Permeable Treatment Zone can be installed in the Paducah Regional Gravel Aquifer and effectively contain and remove contamination from groundwater. The study consists of a bench-scale test to evaluate components for the treatment zone and the construction of a 100-foot long treatment zone in the summer of 2000.

Status: GWOU/WAG 6 (Permeable Treatment Zone Demonstration)

- **EPA approved the Treatability Study Work Plan on June 19, 2000.**
- **Final design drawings and technical specifications were issued to regulatory agencies on July 14.**
- **Readiness review is scheduled for the week of July 124, with field work scheduled to begin the week of July 31.**

PROJECT: 6-Phase Heating Treatability Study

SUMMARY: This is a Treatability Study for 6-Phase Heating technology demonstration at the C-400 area. The technology utilizes an array of electrodes to raise the temperature of the soil to the point where TCE is vaporized. The vapors are then collected and treated on-site.

Status: 6-Phase Heating Treatability Study

- Notice to proceed with developing the Treatability Study Work Plan was issued on June 8, 2000.
- **The DO Work Plan was issued July 6. The D1 Work Plan is scheduled for submission to regulators by September 5, 2000.**

PROJECT: C-Sparge Treatability Study

SUMMARY: This is a Treatability Study for the C-Sparge technology. Ozone is injected into the groundwater, where it reacts with and destroys TCE.

Status: **C-Sparge Treatability Study**

- **DOE EM-50 will perform this work.**
- **Work planning has begun.**

July 2000

PROJECT: Surface Water Operable Unit Remedial Investigation

SUMMARY: The Surface Water Operable Unit includes the Big and Little Bayou Creeks, all Kentucky Pollutant Discharge Elimination System (KPDES) outfall ditches, and the primary source areas potentially contributing to contamination in these locations, including: past releases from C-333A and C-337 vaporizers and the switchyards, and sediment from plant storm sewer systems. Primary contaminants of concern are PCBs and radionuclides with metals as a secondary concern.

Status: Surface Water Operable Unit Remedial Investigation

- **A Core Team consisting of representatives from DOE, EPA and KDWM was chartered to resolve programmatic issues resolving cleanup. They have met several times and were scheduled to meet again in Paducah on July 18, 19 and 20. The Core Team is in the process of evaluating Surface Water data to determine if removal/remediation actions can be accelerated. The SWOU RI Work Plan is currently scheduled for submission on October 8, 2000.**
- **The SWOU scoping meeting is scheduled for June 20.**

PROJECT: Removal Action for the North-South Diversion Ditch

SUMMARY: The North South Diversion Ditch carries rainwater runoff from the C-400 area north to Little Bayou Creek. Contaminants are present in the ditch from historical release of process wastewater from the C-400 and C-600 facilities. Contaminants include various radionuclides, PCBs and metals.

Status: Removal Action for the North-South Diversion Ditch

- Representatives from DOE, EPA, KDWM and the Kentucky Public Health Department have agreed that a removal action will be performed to address the North-South Diversion Ditch. The scope of the action is not yet defined. Development of the scope will begin on June 22 with implementation planned in FY 2001.

June 2000

SOILS OPERABLE UNIT

Department of Energy
Oak Ridge Operations
Paducah Site Office
P.O. Box 1410
Paducah, KY 42001

June 27, 2000

Mr. Carl R. Froede Jr., P.G.
United States Environmental Protection Agency
Region IV
DOE Remedial Section
Federal Facilities Branch
Waste Management Division
61 Forsyth Street
Atlanta, Georgia 30303

Mr. Michael V. Welch, P.E.
Manager
Hazardous Waste Branch
Kentucky Department for Environmental Protection
14 Reilly Road, Frankfort Office Park
Frankfort, Kentucky 40601

Dear Mr. Froede and Mr. Welch:

ADMINISTRATIVE RECORD FILE INDEX ON THE *ACTION MEMORANDUM FOR DRUM MOUNTAIN AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY (DOE/OR/07-1863&D2)*

The Administrative Record for the Drum Mountain Project is deemed complete with the issuance of the *Action Memorandum for Drum Mountain at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/07-1863&D2)*. I am forwarding the subject index for your records.

If you have any questions or require additional information, please call J. Raúl Castañeda at (270) 441-6809.

Sincerely,

W. Don Seaborg, Site Manager
Paducah Site Office

Enclosure

cc w/enclosure:
EIC/Kevil
S. Speer, BJC/Kevil

cc w/out enclosure:
G. W. Benedict, UE-50
R. H. Blumenfeld, CC-10
DMC/Kevil
G. L. Dover, BJC/Kevil
C. Hudson, CJE/Kevil
R. R. Nelson, EM-90
R. A. Pratt, BJC/Kevil
T. Taylor/L. Martin, KDEP/Frankfort

ADMINISTRATIVE RECORD FILE INDEX - DRUM MOUNTAIN

4/26/00

Date On Document	Document Id	Title	Author Affiliation	To Affiliation	Accession Num
3/12/98	DOE/OR/07-1233&D3	COMMUNITY RELATIONS PLAN FOR THE ENVIRONMENTAL MANAGEMENT AND ENRICHMENT FACILITIES PROGRAM, PADUCAH GASEOUS DIFFUSION PLANT	DOE-PAD	USEPA-IV, KDEP	A-00010-0757
12/12/98	DOE/OR/07-1707	FEDERAL FACILITY AGREEMENT FOR THE PADUCAH GASEOUS DIFFUSION PLANT	DOE-OR, KDEP, USEPA-IV		I-02001-0205
9/15/99		PATH FORWARD AND COMMENTS ON THE ENGINEERING EVALUATION/COST ANALYSIS FOR SCRAP METAL REMOVAL AT PGDP, DOE/OR/07-1797&D2)	KDEP	BJC-PAD, DOE-PAD	I-01712-0003
9/24/99		COMMENTS ON THE ENGINEERING EVALUATION/COST ANALYSIS FOR SCRAP METAL REMOVAL AT PGDP (DOE/OR/07 1797&D2)	KDEP	BJC-PAD, DOE-PAD	I-01711-0002
10/1/99		RESPONSE TO 09/15/99 LETTER ON THE ENGINEERING EVALUATION/COST ANALYSIS FOR THE SCRAP METAL REMOVAL AT PGDP, DOE/OR/07-1797&d2)	DOE-PAD	KDEP	I-01712-0004
11/5/99	DOE/OR/07-1848&D1	ENGINEERING EVALUATION/COST ANALYSIS FOR DRUM MOUNTAIN AT THE PGDP, PADUCAH,KENTUCKY	DOE-PAD	KDEP, USEPA-IV	I-01712-0001
11/24/99		CONDITIONAL APPROVAL OF THE ENGINEERING EVALUATION /COST ANALYSIS (EECA) FOR DRUM MOUNTAIN AT PGDP (DOE/OR/07-1848&D1)	KDEP	BJC-PAD, DOE-PAD	I-01712-0002
12/14/99		COMMENTS ON THE ENGINEERING EVALUATION/COST ANALYSIS FOR DRUM MOUNTAIN AT PGDP, PADUCAH, KENTUCKY (DOE/OR/07-1848&D1)	USEPA-IV	BJC-PAD, DOE-PAD	I-01712-0005
12/14/99		RESPONSE TO COMMENT RESPONSE SUMMARY AND CONDITIONAL APPROVAL OF THE D2 EE/CA FOR DRUM MOUNTAIN	USEPA-IV	BJC-PAD, DOE-PAD	I-01712-0006
12/16/99		RESPONSE TO KDWM COMMENTS ON THE ENGINEERING EVALUATION/COST ANALYSIS FOR DRUM MOUNTAIN AT PGDP, DOE/OR/07-1848&D1	BJC-PAD	DOE-PAD	I-01712-0007
12/19/99		PUBLIC NOTICE - ENGINEERING EVALUATION /COST ANALYSIS FOR THE REMOVAL OF DRUM MOUNTAIN AT PGDP	THE PADUCAH SUN	GENERAL PUBLIC	I-01712-0010
12/20/99	DOE/OR/07-1848&D2	ENGINEERING EVALUATION/COST ANALYSIS FOR DRUM MOUNTAIN AT PGDP	DOE-PAD	USEPA-IV, KDEP	I-01712-0008
12/20/99		BIBLIOGRAPHY - DOE/OR/07-1848&D2 EE/CA			I-01712-0009
1/3/00		PUBLIC COMMENTS - DOE/OR/07-1848&D2	AREA RESIDENT	DOE-PAD	I-01712-0012
1/17/00		PUBLIC COMMENTS - DOE/OR/07-1848&D2	UE PROJECT	DOE-PAD	I-01712-0017
1/21/00		PUBLIC NOTICE - DOE EXTENDS DRUM PILE COMMENT PERIOD	THE PADUCAH SUN	GENERAL PUBLIC	I-01712-0011
1/26/00		PUBLIC COMMENTS - DOE/OR/07-1848&D2	PACE	OCAW-PRESIDENT, BJC-PAD	I-01712-0015

ADMINISTRATIVE RECORD FILE INDEX - DRUM MOUNTAIN

4/26/00

1/27/00		PUBLIC COMMENTS - DOE/OR/07-1848&D2	COALITION FOR HEALTH CONCERN	DOE-PAD	I-01712-0013
1/31/00		PUBLIC COMMENTS - DOE/OR/07-1848&D2	AREA RESIDENT	DOE-PAD	I-01712-0016
2/1/00		PUBLIC COMMENTS - DOE/OR/07-1848&D2	RACE	DOE-PAD	I-01712-0014
2/29/00	DOE/OR/07-1863&D1	ACTION MEMORANDUM FOR DRUM MOUNTAIN AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY			I-01713-0001
3/1/00		(TRANSMITTAL OF THE) ACTION MEMORANDUM FOR DRUM MOUNTAIN AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY (DOE/OR/07-1863&D1)	DOE-PAD	USEPA-IV, KDEP	I-01713-0002
3/2/00		RESPONSE TO SIGNIFICANT COMMENTS RECEIVED ON ENGINEERING EVALUATION /COST ANALYSIS FOR DRUM MOUNTAIN AT THE PGDP, PADUCAH, KENTUCKY (DOE/OR/07-1848&D2)	DOE-PAD	ADMIN. RECORD - DRUM MOUNTAIN	I-01712-0019
3/8/00		APPROVAL OF THE ACTION MEMORANDUM FOR DRUM MOUNTAIN AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY (DOE/OR/07-1863&D1)	USEPA-IV	BJC-PAD, DOE-PAD	I-01713-0004
3/8/00		APPROVAL OF THE ACTION MEMORANDUM FOR DRUM MOUNTAIN AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, (DOE/OR/07-1863&D1)	KDEP	BJC-PAD, DOE-PAD	I-01713-0005
3/16/00		[NOTICE OF REVISION TO THE] RESPONSE TO SIGNIFICANT COMMENTS RECEIVED ON ENGINEERING EVALUATION/COST ANALYSIS FOR DRUM MOUNTAIN AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY	DOE-PAD	ADMIN. RECORD - DRUM MOUNTAIN	I-01712-0020
3/16/00		REVISION TO RESPONSE TO SIGNIFICANT COMMENTS RECEIVED ON ENGINEERING EVALUATION/COST ANALYSIS FOR DRUM MOUNTAIN AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY (DOE/OR/07-1848&D2)	DOE-PAD	ADMIN. RECORD - DRUM MOUNTAIN	I-01712-0021
3/27/00	DOE/OR/07-1863&D2	ACTION MEMORANDUM FOR DRUM MOUNTAIN AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH,KENTUCKY			I-01713-0006
3/27/00		[TRANSMITTAL OF THE] ACTION MEMORANDUM FOR DRUM MOUNTAIN AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY (DOE/OR/07-1863&D2)	DOE-PAD	KDEP, USEPA-IV	I-01713-0007

Department of Energy
Oak Ridge Operations
Paducah Site Office
P.O. Box 1410
Paducah, KY 42001

July 6, 2000

Mr. Robert H. Daniell, Director
Division of Waste Management
Kentucky Department for Environmental Protection
14 Reilly Road, Frankfort Office Park
Frankfort, Kentucky 40601

Mr. Carl R. Froede Jr., P.G.
United States Environmental Protection Agency
Region IV
DOE Remedial Section
Federal Facilities Branch
Waste Management Division
61 Forsyth Street
Atlanta, Georgia 30303

Dr. John A. Volpe
Radiation Health and Toxic Agents Branch
Cabinet for Health Services
275 East Main Street
Mail Stop HS2E-D
Frankfort, Kentucky 40621

Dear Sirs:

TRANSMITTAL OF INITIAL ASSESSMENT OF CONSIDERATION OF THE ON-SITE DISPOSAL OF COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 WASTE AS A POTENTIAL DISPOSAL OPTION AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY

As a follow-up to preliminary discussions with you and other stakeholders, the Department of Energy (DOE) has performed the enclosed initial assessment. The objective of the initial assessment is to provide sufficient information to enable an informed decision as to whether to carry out a proposed Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) evaluation of a site-wide waste disposition strategy for the Paducah Gaseous Diffusion Plant (PGDP), including both on-site and off-site disposal options. Based on information obtained during the initial assessment, DOE believes the next step of undertaking a CERCLA evaluation of such a site-wide waste disposition strategy is warranted.

Thank you for your interest in this evaluation process. We look forward to discussing the CERCLA evaluation approach and objectives with you. If you have any questions or require additional information, please call David W. Dollins at (270) 441-6819.

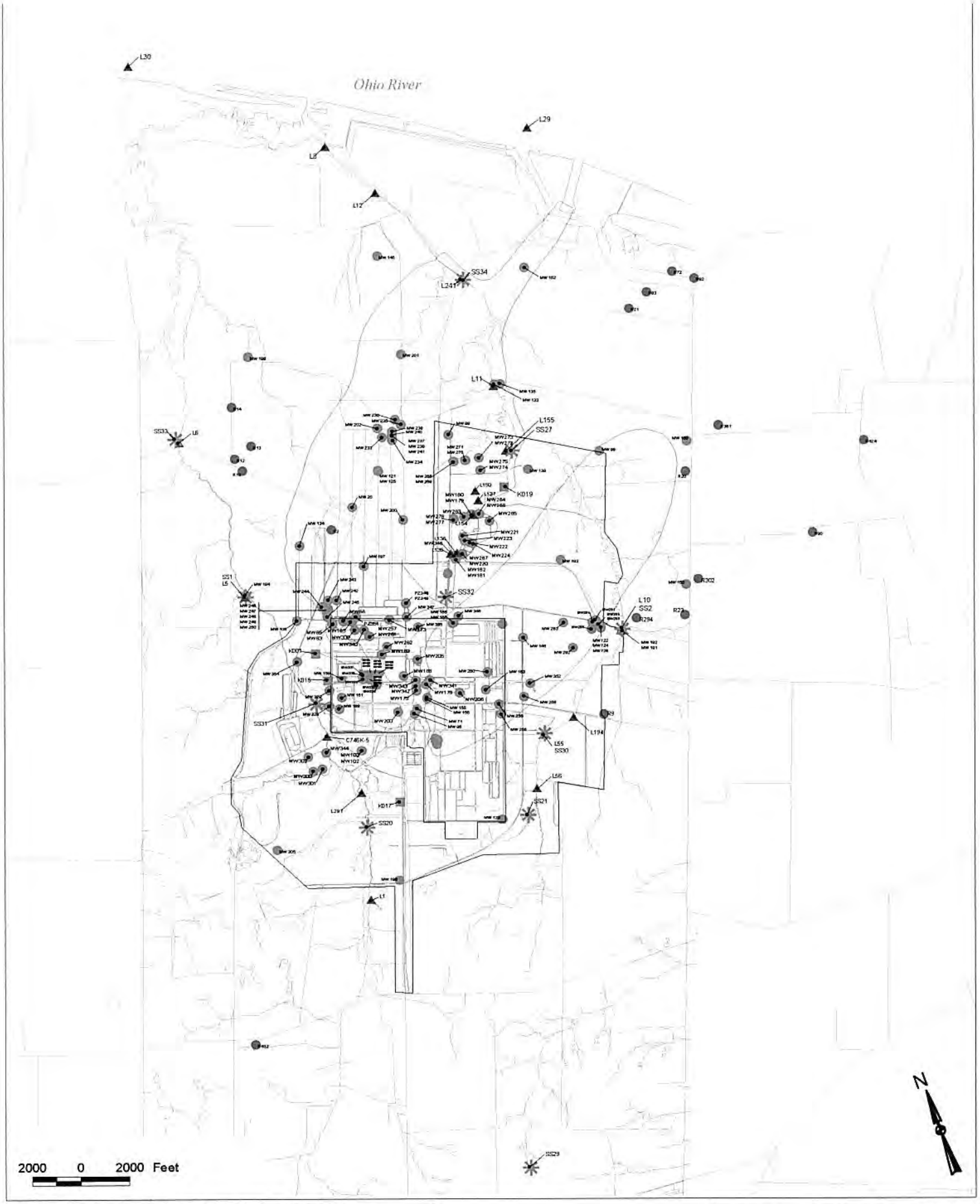
Sincerely,

W. Don Seaborg, Site Manager
Paducah Site Office

Enclosure

cc w/enclosure:
DOE EIC/Kevil
G. W. Benedict, UE-50
R. H. Blumenfeld, CC-10
J. J. Fiore, EM-30
R. R. Nelson, EM-90
S. Speer, BJC/Kevil (SSAB)
A. F. Tavares, NE-30

cc w/out enclosure:
BJC/DMC
P. A. Gourieux, BJC/Kevil
C. Hudson, CJE/Kevil
C. S. Jones, BJC/Kevil
J. W. Morgan, BJC/Kevil
R. E. Scott, BJC/Kevil
J. C. Skridulis, JE/Kevil
M. A. Tagoe, BJC/Kevil
P. W. Willison, BJC/OR
J. D. Young, TN&A/Kevil



LEGEND

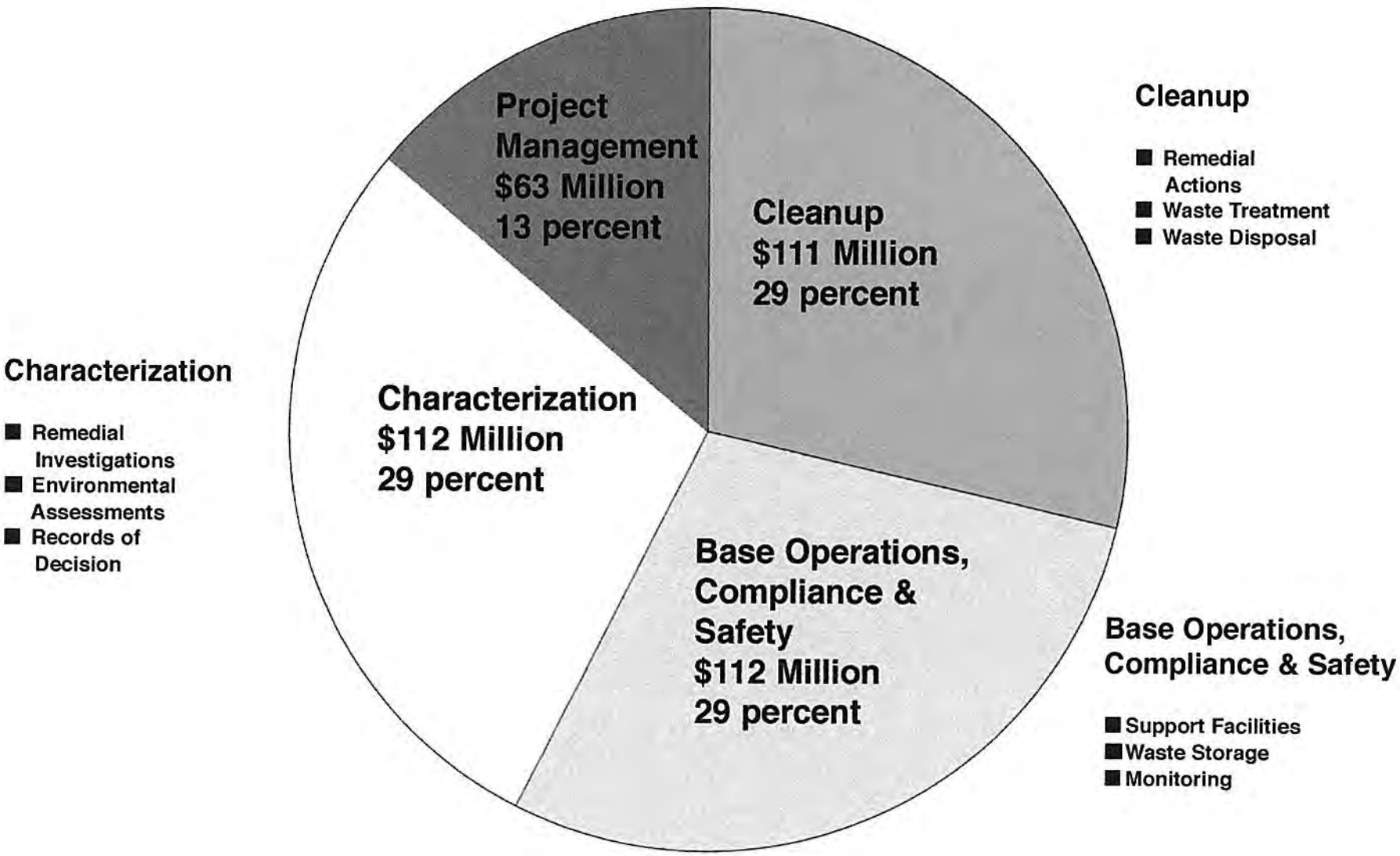
Boundary of Groundwater Plume

- Surface Water Sampling Location
- KPDES Outfall Location
- Sediment Sampling Location
- Groundwater Monitoring Well or Piezometer
- Residential Well

Current Monitoring Locations

NOTE: L64 and L306 not shown on map.
L64 is southeast of PGDP and L306 is northwest.

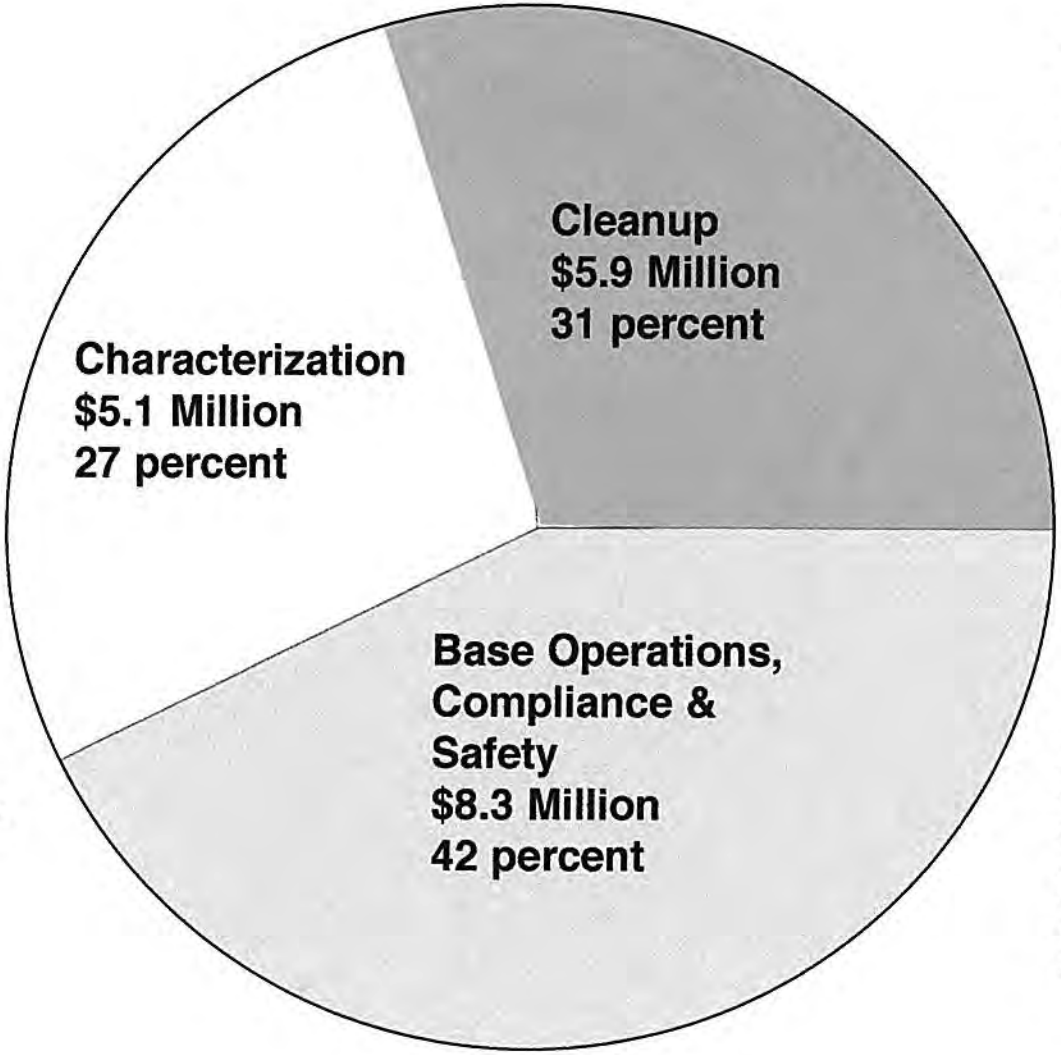
U.S. Department of Energy Environmental Management Program
Paducah Gaseous Diffusion Plant
Relative Spending/Historic and Current
Historic Spending (1988-through FY99) $388 Million



Current Fiscal Year Spending $19.2 Million (Through 4/23/00)
(Current Fiscal Year Budget $51 Million)

Characterization

- Remedial Investigations
- Environmental Assessments
- Records of Decision



Cleanup

- Remedial Actions ($1.3 Million)
- Waste Treatment ($1.7 Million)
- Waste Disposal ($2.9 Million)

Base Operations, Compliance & Safety

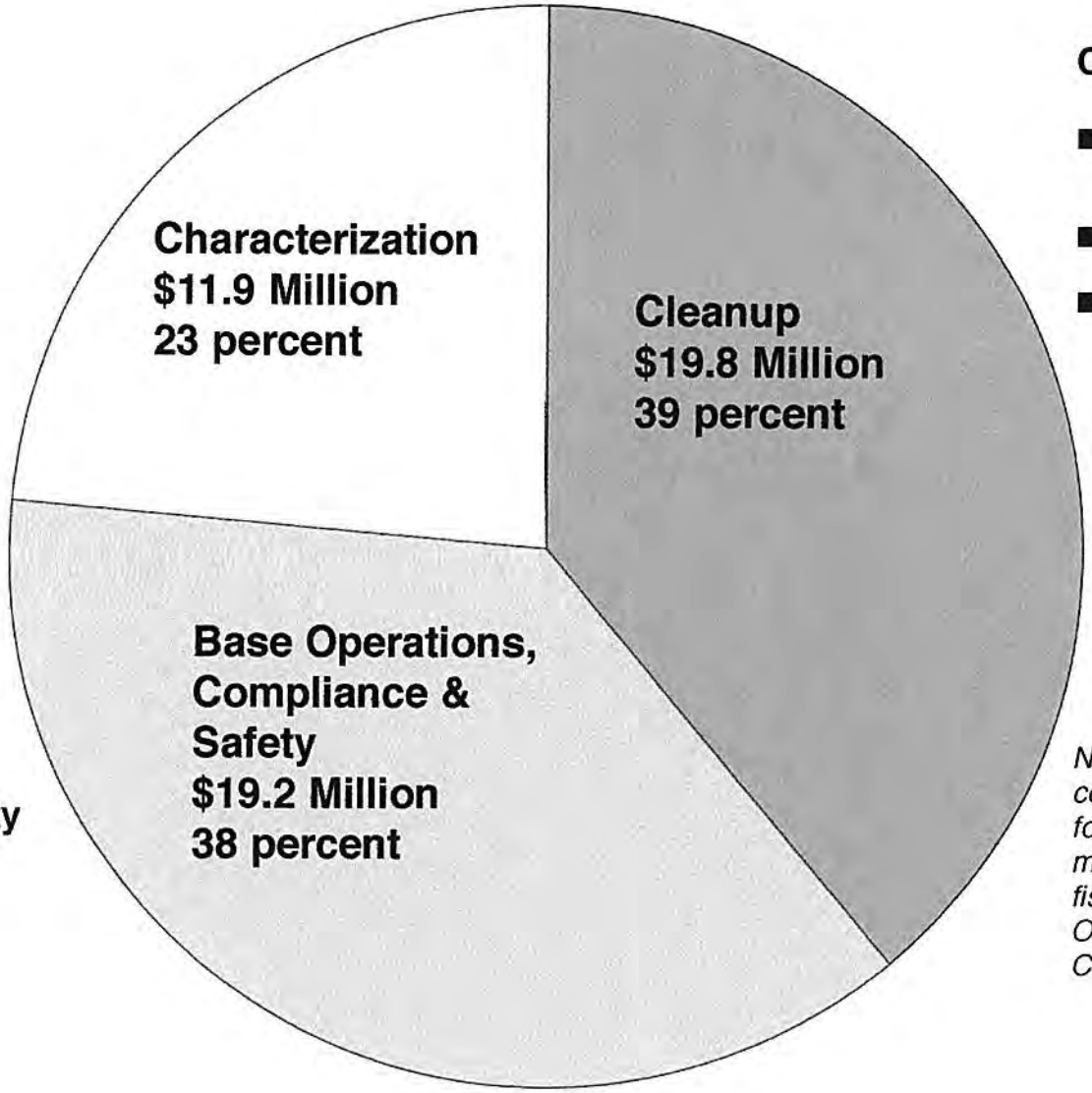
- Support Facilities
- Waste Storage
- Monitoring
- DOJ Investigations

NOTE: Project management costs are no longer accounted for as a separate item. Project management fees for the current fiscal year are included in the Operations, Cleanup and Characterization categories.

Current Fiscal Year Budget $51 Million

Characterization

- Remedial Investigations
- Environmental Assessments
- Records of Decision



Cleanup

- Remedial Actions ($7.7 Million)
- Waste Treatment ($6.6 Million)
- Waste Disposal ($7.7 Million)

Base Operations, Compliance & Safety

- Support Facilities
- Waste Storage
- Monitoring
- DOJ Investigations

NOTE: Project management costs are no longer accounted for as a separate item. Project management fees for the current fiscal year are included in the Operations, Cleanup and Characterization categories.

DRAFT

Paducah Gaseous Diffusion Plant (PGDP)
Site Specific Advisory board (SSAB)
2000 Workplan

ISSUE	KEY DOCUMENTS	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Sep-00	Oct-00	Nov-00	Dec-00	Jan-01	Feb-01	Mar-01
Ongoing Discussion Items													
ES&H Issues		X	X	X	X	X	X	X	X	X	X	X	X
EM&EF		X	X	X	X	X	X	X	X	X	X	X	X
Scrap Metal/Drum Mountain		X	X	X									
ITRD			X			X			X			X	
Administrative issues and committee reports		X	X	X	X	X	X	X	X	X	X	X	X
Documents/plans for discussion and recommendations													
Ground Water Operable Unit													
Surface Water Operable Unit													
Burial Ground Operable Unit													
Soils Operable Unit													
Vortec		X											
On-site Disposal Cell			X										
PACRO			X										

Paducah Site-Specific Advisory Board
FY 2000 Costs

Item	Budget	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	YTD	Remaining
General Support to SSAB															
Office Rental	5,000.00	776.00			776.00	776.00		388.00						2,716.00	2,284.00
Member Travel	33,000.00						1,098.00							1,098.00	31,902.00
Admin. Support	72,331.00	3,438.00	4,988.00	3,330.00	4532.00	4,706.00	7,310.00	4,985.00						33,289.00	39,042.00
Information & Communication	45,090.00	480.00	480.00	480.00	720.00	3,450.00	9,390.00	480.00						15,480.00	29,610.00
Support to Subcommittees															
Community Outreach															
Travelling Exhibit	9,000.00													0	9,000.00
Exhibit Revisions	900.00													0	900.00
Media Announcements	3,630.00		484.00					1,452.00						1,936.00	1,694.00
Newsletter	6,658.00													0	6,658.00
Fact Sheets	1,440.00					960.00								960.00	480.00
Mailing List Maintenance	1,824.00	152.00	152.00	152.00	152.00	152.00	152.00	152.00						1,064.00	760.00
Web Page Maintenance	1,500.00													0	1,500.00
Policy & Personnel															
Technical Advisor	25,000.00													0	25,000.00
Total	205,373.00	4,846.00	6,104.00	3,962.00	6,180.00	10,044.00	17,950.00	7,457.00	0	0	0	0	0	56,543.00	148,830.00

Notes:

Final Draft
SSAB Common Values Statement
15 May 2000

WHO WE ARE. The Department of Energy Site-Specific Advisory Boards (SSAB) are composed of interested and affected stakeholders who are concerned about environmental cleanup, stabilization, and disposition of radioactive and hazardous materials and wastes at the Department of Energy's (DOE) nuclear weapons and research facilities. The SSAB is chartered under the Federal Advisory Committee Act (FACA) as an outgrowth of the Federal Facility Environmental Restoration Dialogue to provide independent policy and technical advice.

WHAT WE DO. We provide an opportunity for open, informed, and inclusive discussion about proposed actions and decisions with DOE, EPA, state regulators, stakeholder, and the general public. Our goal is to provide timely, informed policy and technical advice and recommendations to DOE, EPA, State regulatory agencies, or other entities, on issues relating to cleanup, environmental restoration, closure, stewardship, nuclear material disposition, and hazardous and nuclear waste management decisions.

WHAT WE EXPECT. We expect DOE and state and federal regulators will support and encourage effective public involvement in cleanup, environmental restoration, closure, stewardship, nuclear material disposition, and hazardous and nuclear waste management decisions. DOE will seek advice from the public and provide opportunities for public involvement, locally when the decision affects one site, and nationally when the decision affects more than one site.

We expect timely, understandable, and relevant information will be provided to enable the SSAB to make informed recommendations and advice. We expect DOE and the regulators will continue to value the importance and benefit of continued public involvement, will respond substantively and promptly, and will give utmost consideration to environmental justice in its decision making. We expect DOE will honor Tribal treaties and conduct government to government consultation.

We expect DOE will submit budgets that meet legal requirements, reduce current and future risks, and are in accord with values and needs of local communities. We expect that DOE will protect the public, workers and the environment.

- We are committed to informed and meaningful public, Tribal and stakeholder involvement in the decision-making process and policy development related to cleanup, environmental restoration and stewardship of DOE sites.

- We believe public and worker safety and health and the protection and remediation of the natural environment should drive cleanup and stabilization decisions and policy.

- Cleanup decisions should be based upon consideration of:
  - a full assessment of human health and environmental risks;

- a full evaluation of all life cycle costs;
- full compliance with all legal requirements;
- scientific and technical considerations; and
- community desires.

- Cleanup/closure/stewardship and nuclear materials management decisions should ensure the health and safety of future generations and protection of the natural environment.

- It is imperative that the Federal government commit to providing adequate funding for the proper cleanup and long term stewardship of DOE nuclear weapons production and research facilities.

- Complex-wide coordination and the full integration of all sites is critical in the planning of stabilization, cleanup and transportation activities.

ENVIRONMENTAL MANAGEMENT ADVISORY BOARD
United States Department of Energy
1000 Independence Avenue, SW, Room 5B-171
Washington, DC 20585

May 7, 2000

NOTE TO: David Bodde, Co-chair
Joel Bennett, Co-chair

SUBJECT: Weekly Report - Environmental Management Advisory Board

The following report summarizes Environmental Management Advisory Board (EMAB) activities for the week of May 1- May 5, 2000. The Long-term Stewardship Committee will hold a meeting on May 23, 2000 in Washington.

$ Integration and Transportation Committee. Mr. James Melillo, the Director of EMAB, Mr. Ron Ross, Co-chair of the Committee, and the EMAB Support Team discussed potential issues for the Committee=s consideration. The EMAB Support Team is working with Mr. Ross to develop a Committee work plan.

$ Long-term Stewardship (LTS) Committee. The Committee Co-chairs and EMAB Support Team continued development of a draft agenda for the upcoming May 23rd Committee meeting. The EMAB Support Team is working to identify speakers for the May 23rd Committee meeting to address land transfer as sites are cleaned up, declared excess, and lands transferred to tribal nations. The EMAB Support Team discussed a presentation by a representative from the Office of Site Closure dealing with its initiatives in the Long-Term Stewardship arena.

$ Contracting and Management Committee. The EMAB Support Team met with the Committee Chair to discuss plans for a June 8th Committee meeting. Topics for the meeting will include lessons learned in the area of project management from site visits to Savannah River and Hanford site. Preliminary plans have been drafted for the visit to INEEL scheduled for June 21st - 23rd with the Worker Health and Safety Committee.

$ Science Committee. The EMAB Support Team drafted a report to be available in late-May on the Environmental Management Science Program (EMSP) national workshop held in Atlanta, Georgia. The EMAB Support Team drafted a proposal for follow on actions stemming from the Board discussion at its April 13th - 14th meeting on EM Science challenges.

$ Technology Development and Transfer Committee (TD&T). The Chair and the EMAB Support Team discussed four work areas for the Committee. The Support Team held initial discussions with representatives from the Office of Science and Technology regarding prioritization. .

$ Worker Health and Safety Committee. The EMAB Support Team is working to make the necessary arrangements for the site visit to INEEL. A letter from Dr. Huntoon to the Site Manager explaining the purpose of the visit was drafted and forwarded for signature. The

ENVIRONMENTAL MANAGEMENT ADVISORY BOARD
United States Department of Energy
1000 Independence Avenue, SW, Room 5B-171
Washington, DC 20585

Committee Chairs conducted additional planning for the visit with the Contracting and Management Committee Chair, to continue exploration of ISM implementation.

The EMAB web site, http://www.em.doe.gov/emab is in transition but already contains numerous
EMAB products. The resolutions and minutes from the Board meeting held April 13th and 14th, 2000, will be available on the EMAB web page by the end of May.

If you have any questions regarding this report, please contact me on (202) 586-4400.

James T. Melillo
Executive Director
Environmental Management
Advisory Board

cc: EMAB Members and Consultants
EM Deputy Assistant Secretaries
EM Program Office Directors
EM Program Office Contacts
All Other Interested Persons/Parties

SSAB CHAIRS BI-MONTHLY CONFERENCE CALL

THURSDAY, MAY 25, 2000 (3:00-5:00 pm)

- NOTE to SSAB Administrators/Support Staff: For the Chairpersons that do not have e-mail addresses and/or are not listed on this message, please make sure a copy of this agenda is given to them.

- This Conference Call to open to the EM SSAB Chairs themselves, their associated Contractor support staff, SSAB Federal Coordinators, and the Deputy Designated Federal Officers (DDFOs) for the SSAB local site boards. The teleconference is intended to serve as an open forum to identify and discuss any and all issues, concerns, etc., relative to both the EM Site-Specific Advisory Board and public involvement in the EM program.

- Conference Call Statistics:

Date:	Thursday, May 25, 2000
Time:	3:00 - 5:00 pm EST
Phone No.	(301) 903-7073
Confirmation:	26295
Lines:	50

Following is the proposed agenda. Please contact Joy Viars if there are any additional items for discussion. She can be reached at **(202) 586-9340; e-mail is joy.viars @ em.doe.gov or Naomi Wiegler at naomi.wiegler@ em.doe.gov.**

A. LOCAL SSAB PUBLIC PARTICIPATION ISSUES/UPDATES (30 minutes)

- Fernald
- Hanford
- Idaho
- Los Alamos

PADUCAH PROJECT ENVIRONMENTAL DATA

PROJECT GROUPS	SOURCE/MEDIA/PROJECTS	SAMPLING PERIOD/TIME FRAME
State Sampling	Surface Water KPDES Outfalls Groundwater Vegetable Ambient Air Sediment Bank Soil Biota	1989-1999 1989-1999 1989-1999 1989-1999 1989-1999 1989-1999 1989-1999 1989-1999
Remedial Investigations * (Includes Groundwater, surface water, soil and sediment data)	Phase 1 Investigation Phase 2 Investigation WAGs 1&7 Phase IV Groundwater Lasagna WAG 17 WAG 23 WAG 15 WAG 22 WAG 6 WAG 27 WAGs 9&11 C-750, C-200-B UST WAG 28 Data Gaps WAG 8 WAG 3	6/89 – 10/90 11/90 – 5/91 3/93 – 6/94 4/94 –10/94 1994 – Present 10/95 – 4/96 2/96 – 3/96 7/96 – 8/96 7/96 –10/96 7/97 – 1/98 1/98 – 6/98 8/98 – 9/98 10/98 – 11/98 4/99 – 7/99 4/99 – 10/99 4/99 – 9/99 7/99 – 1/00
Routine Monitoring **		
Groundwater Sampling	C-404 Landfill C-746 S&T Landfill Residential Wells Surveillance Wells Northwest Pump and Treat C-746-K Landfill C-746 U Landfill Northeast Pump and Treat	1988 – Present 1988 – Present 1988 – Present 1988 – Present 1994 – Present 1995 – Present 1996 – Present 1996 – Present
Surface Water Sampling	10 KPDES USEC Outfalls 4 KPDES DOE Outfalls Little Bayou Creek Big Bayou Creek Ohio River C-746-K Landfill Massac Creek C-746-S/T Landfill C-746-U Landfill	1987 – Present 1987 – Present 1989 – Present 1989 – Present 1989 – Present 1992 – 1999 1993 – Present 1994 – Present 1995 – Present

PROJECT GROUPS	SOURCE/MEDIA/PROJECTS	SAMPLING PERIOD/TIME FRAME
Biological Monitoring	Fish Bioaccumulation Benthic Community Deer Fish Community Toxicity Monitoring Rabbit Raccoon Field Mice	1990 – Present 1990 – Present 1990 – Present 1991 – Present 1992 – Present 1998 – Present 1998 1998
Landfill Leachate Sampling	C-746 S&T Landfill C-404 Landfill C-746 U Landfill	1993 – Present 1996 – Present 1998 – Present
Miscellaneous Sampling		
Background Soils		7/96 – 8/96
DOE Headquarters Investigation (Includes groundwater, surface water and sediment)		1999
DOJ Investigation (Includes groundwater, surface water and sediment)		1999
Grass		1993-1996
Sediment Sampling		1989 – Present
Soil Sampling		1988 – 1996 (USEC)
Vegetable Sampling		1990 – 1995

* These CERCLA investigation documents are available in the Environmental Information Center (EIC), Kevil, Kentucky

** The majority of sampling conducted for routine monitoring activities is performed in support of RCRA permit requirements. The results from this RCRA-compliance routine monitoring are not currently available in the EIC. It is anticipated that these documents will be included in the EIC early this summer.

CROSS-REFERENCE OF MONITORING WELL AND SAMPLING PROGRAM

Well	Sampling Program	Sampled	Status
MW20	Environmental Surveillance	Quarterly	Current
MW63	Environmental Surveillance	Quarterly	Current
MW64	Water Level/Inspection	Not Sampled	Current
MW65	Environmental Surveillance	Quarterly	Current
MW66	FFA-66	Monthly & Annually	Current
MW67	Water Level/Inspection	Not Sampled	Current
MW68	Water Level/Inspection	Not Sampled	Current
MW69	Water Level/Inspection	Not Sampled	Current
MW71	Environmental Surveillance	Annually	Current
MW72	Water Level/Inspection	Not Sampled	Current
MW73	Water Level/Inspection	Not Sampled	Current
PZ74	Water Level/Inspection	Not Sampled	Current
MW75	Water Level/Inspection	Not Sampled	Current
MW76	Water Level/Inspection	Not Sampled	Current
MW77	Water Level/Inspection	Not Sampled	Current
MW78	Water Level/Inspection	Not Sampled	Current
MW79	Water Level/Inspection	Not Sampled	Current
MW80	Water Level/Inspection	Not Sampled	Current
MW81	Water Level/Inspection	Not Sampled	Current
MW82	Water Level/Inspection	Not Sampled	Current
MW83	Water Level/Inspection	Not Sampled	Current
MW84	C-404	Semi-Annually	Current
MW85	C-404	Semi-Annually	Current
MW86	C-404	Semi-Annually	Current
MW87	C-404	Semi-Annually	Current
MW88	C-404	Semi-Annually	Current
MW89	C-404	Semi-Annually	Current
MW90	C-404	Semi-Annually	Current
MW91	C-404	Semi-Annually	Current
MW92	C-404	Semi-Annually	Current
MW93	C-404	Semi-Annually	Current
MW94	C-404	Semi-Annually	Current
MW95	C-404	Semi-Annually	Current
MW96	Environmental Surveillance	Annually	Current
MW97	Inpsection – Wells Abandoned in Place	Not Sampled	Abandoned
MW98	Environmental Surveillance	Quarterly	Current
MW99	Environmental Surveillance	Quarterly	Current
MW100	Environmental Surveillance	Quarterly	Current
PZ101	Water Level/Inspection	Not Sampled	Current
MW102	Background Environmental Surveillance	Annually	Current
MW103	Background Environmental Surveillance	Annually	Current
MW104	Inpsection – Wells Abandoned in Place	Not Sampled	Abandoned
MW106	Environmental Surveillance	Annually	Current
PZ107	Water Level/Inspection	Not Sampled	Current
W108	Water Level/Inspection	Not Sampled	Current

Well	Sampling Program	Sampled	Status
PZ109	Water Level/Inspection	Not Sampled	Current
PZ110	Water Level/Inspection	Not Sampled	Current
PZ111	Water Level/Inspection	Not Sampled	Current
PZ114	Water Level/Inspection	Not Sampled	Current
PZ115	Water Level/Inspection	Not Sampled	Current
PZ117	Water Level/Inspection	Not Sampled	Current
PZ118	Water Level/Inspection	Not Sampled	Current
MW120	Background Environmental Surveillance	Annually	Current
MW121	Background Environmental Surveillance	Annually	Current
MW122	Background Environmental Surveillance	Annually	Current
MW123	Water Level/Inspection	Not Sampled	Current
MW124	Northeast Plume	Quarterly, Annually	Current
MW125	Environmental Surveillance	Quarterly	Current
MW126	Northeast Plume	Quarterly, Annually	Current
MW127	Inpsection – Wells Abandoned in Place	Not Sampled	Abandoned
MW128	Inpsection – Wells Abandoned in Place	Not Sampled	Abandoned
MW129	Inpsection – Wells Abandoned in Place	Not Sampled	Abandoned
MW130	Inpsection – Wells Abandoned in Place	Not Sampled	Abandoned
MW131	Inpsection – Wells Abandoned in Place	Not Sampled	Abandoned
MW132	Water Level/Inspection	Not Sampled	Current
MW133	Environmental Surveillance	Annually	Current
MW134	Environmental Surveillance	Annually	Current
MW135	Environmental Surveillance	Quarterly	Current
MW137	Water Level/Inspection	Not Sampled	Current
MW138	Water Level/Inspection	Not Sampled	Current
MW139	Environmental Surveillance	Quarterly	Current
MW140	Water Level/Inspection	Not Sampled	Current
MW144	Water Level/Inspection	Not Sampled	Current
MW145	Northeast Plume	Quarterly, Annually	Current
MW146	Environmental Surveillance	Quarterly	Current
MW147	Water Level/Inspection	Not Sampled	Current
MW148	Water Level/Inspection	Not Sampled	Current
MW149	Water Level/Inspection	Not Sampled	Current
MW150	Background Environmental Surveillance	Annually	Current
MW151	Water Level/Inspection	Not Sampled	Current
MW152	Environmental Surveillance	Quarterly	Current
MW153	Water Level/Inspection	Not Sampled	Current
MW154	Water Level/Inspection	Not Sampled	Current
MW155	Environmental Surveillance	Annually	Current
MW156	Environmental Surveillance	Annually	Current
MW157	Water Level/Inspection	Not Sampled	Current
MW161	Environmental Surveillance	Annually	Current
MW162	Water Level/Inspection	Not Sampled	Current
MW163	Environmental Surveillance	Annually	Current
MW164	Water Level/Inspection	Not Sampled	Current
MW165	Environmental Surveillance	Quarterly	Current
MW166	Environmental Surveillance	Quarterly	Current

Well	Sampling Program	Sampled	Status
MW167	Water Level/Inspection	Not Sampled	Current
MW168	Environmental Surveillance	Annually	Current
MW169	Environmental Surveillance	Annually	Current
MW170	Water Level/Inspection	Not Sampled	Current
MW171	Water Level/Inspection	Not Sampled	Current
MW172	Water Level/Inspection	Not Sampled	Current
MW173	Environmental Surveillance	Quarterly	Current
MW174	Environmental Surveillance	Quarterly	Current
MW175	Environmental Surveillance	Annually	Current
MW176	Water Level/Inspection	Not Sampled	Current
MW177	Water Level/Inspection	Not Sampled	Current
MW178	Environmental Surveillance	Annually	Current
MW179	C-746-S&T	Quarterly	Current
MW180	Environmental Surveillance	Annually	Current
MW182	Environmental Surveillance	Annually	Current
MW185	Environmental Surveillance	Quarterly	Current
MW186	Environmental Surveillance	Quarterly	Current
MW187	Environmental Surveillance	Quarterly	Current
MW188	Environmental Surveillance	Annually	Current
MW189	Water Level/Inspection	Not Sampled	Current
MW190	Water Level/Inspection	Not Sampled	Current
MW191	Environmental Surveillance	Annually	Current
MW192	Environmental Surveillance	Annually	Current
MW193	Environmental Surveillance	Annually	Current
MW194	Background Environmental Surveillance	Annually	Current
MW196	Background Environmental Surveillance	Annually	Current
MW197	Environmental Surveillance	Quarterly	Current
MW198	Water Level/Inspection	Not Sampled	Current
MW199	Background Environmental Surveillance	Annually	Current
MW200	Environmental Surveillance	Annually	Current
MW201	Environmental Surveillance	Annually	Current
MW202	Environmental Surveillance	Quarterly	Current
MW203	Environmental Surveillance	Annually	Current
MW204	Water Level/Inspection	Not Sampled	Current
MW205	Environmental Surveillance	Annually	Current
MW206	Environmental Surveillance	Annually	Current
MW207	Water Level/Inspection	Not Sampled	Current
MW208	Water Level/Inspection	Not Sampled	Current
MW209	Water Level/Inspection	Not Sampled	Current
MW210	Water Level/Inspection	Not Sampled	Current
MW211	Water Level/Inspection	Not Sampled	Current
MW212	Water Level/Inspection	Not Sampled	Current
MW213	Water Level/Inspection	Not Sampled	Current
MW214	Water Level/Inspection	Not Sampled	Current
MW215	Water Level/Inspection	Not Sampled	Current
MW216	Water Level/Inspection	Not Sampled	Current
MW217	Water Level/Inspection	Not Sampled	Current

Well	Sampling Program	Sampled	Status
MW218	Water Level/Inspection	Not Sampled	Current
MW219	Water Level/Inspection	Not Sampled	Current
MW220	C-746-S&T	Quarterly	Current
MW221	C-746-S&T	Quarterly	Current
MW222	C-746-S&T	Quarterly	Current
MW223	C-746-S&T	Quarterly	Current
MW224	C-746-S&T	Quarterly	Current
MW225	Water Level/Inspection	Not Sampled	Current
MW226	C-404	Semi-Annually	Current
MW227	C-404	Semi-Annually	Current
MW233	Northwest Plume, North Field	Quarterly, Annually	Current
MW234	Northwest Plume, North Field	Quarterly, Annually	Current
MW235	Northwest Plume, North Field	Quarterly, Annually	Current
MW236	Northwest Plume, North Field	Quarterly, Annually	Current
MW237	Northwest Plume, North Field	Quarterly, Annually	Current
MW238	Northwest Plume, North Field	Quarterly, Annually	Current
MW239	Northwest Plume, North Field	Quarterly, Annually	Current
MW240	Northwest Plume, North Field	Quarterly, Annually	Current
MW241	Northwest Plume, North Field	Quarterly, Annually	Current
MW242	Northwest Plume, South Field	Quarterly, Annually	Current
MW243	Northwest Plume, South Field	Quarterly, Annually	Current
MW244	Northwest Plume, South Field	Quarterly, Annually	Current
MW245	Northwest Plume, South Field	Quarterly, Annually	Current
MW246	Northwest Plume, South Field	Quarterly, Annually	Current
MW247	Northwest Plume, South Field	Quarterly, Annually	Current
MW248	Northwest Plume, South Field	Quarterly, Annually	Current
MW249	Northwest Plume, South Field	Quarterly, Annually	Current
MW250	Northwest Plume, South Field	Quarterly, Annually	Current
MW251	Water Level/Inspection	Not Sampled	Current
MW252	Water Level/Inspection	Not Sampled	Current
MW253	Water Level/Inspection	Not Sampled	Current
MW255	Northeast Plume	Quarterly, Annually	Current
MW256	Northeast Plume	Quarterly, Annually	Current
MW257	Water Level/Inspection	Not Sampled	Current
MW258	Northeast Plume	Quarterly, Annually	Current
MW260	Environmental Surveillance	Quarterly	Current
MW261	Environmental Surveillance	Quarterly	Current
MW262	Environmental Surveillance	Quarterly	Current
MW263	C-746-S&T	Quarterly	Current
MW264	C-746-S&T	Quarterly	Current
MW265	C-746-S&T	Quarterly	Current
MW266	C-746-S&T	Quarterly	Current
MW267	C-746-S&T	Quarterly	Current
MW268	C-746-U	Quarterly	Current
MW269	C-746-U	Quarterly	Current
MW270	C-746-U	Quarterly	Current
MW271	C-746-U	Quarterly	Current

Well	Sampling Program	Sampled	Status
MW272	C-746-U	Quarterly	Current
MW273	C-746-U	Quarterly	Current
MW274	C-746-U	Quarterly	Current
MW275	C-746-U	Quarterly	Current
MW276	C-746-U	Quarterly	Current
MW277	C-746-U	Quarterly	Current
MW283	Northeast Plume	Quarterly, Annually	Current
MW284	Northeast Plume	Quarterly, Annually	Current
PZ287	Inspection – Water Level Collected under NE O&M	Not Sampled	Current
MW288	Northeast Plume	Quarterly, Annually	Current
PZ289	Inspection – Water Level Collected under NE O&M	Not Sampled	Current
PZ290	Inspection – Water Level Collected under NE O&M	Not Sampled	Current
MW291	Northeast Plume	Quarterly, Annually	Current
MW292	Northeast Plume	Quarterly, Annually	Current
MW293	Northeast Plume	Quarterly, Annually	Current
MW294	Northeast Plume	Quarterly, Annually	Current
MW300	C-746-K	Quarterly	Current
MW301	C-746-K	Quarterly	Current
MW302	C-746-K	Quarterly	Current
MW304	Water Level/Inspection	Not Sampled	Current
MW305	Background Environmental Surveillance	Annually	Current
MW306	Water Level/Inspection	Not Sampled	Current
MW307	Water Level/Inspection	Not Sampled	Current
MW308	Water Level/Inspection	Not Sampled	Current
MW309	Water Level/Inspection	Not Sampled	Current
MW310	Water Level/Inspection	Not Sampled	Current
MW311	Water Level/Inspection	Not Sampled	Current
MW312	Water Level/Inspection	Not Sampled	Current
MW313	Water Level/Inspection	Not Sampled	Current
MW314	Water Level/Inspection	Not Sampled	Current
MW315	Water Level/Inspection	Not Sampled	Current
MW316	Water Level/Inspection	Not Sampled	Current
MW317	Water Level/Inspection	Not Sampled	Current
MW318	Water Level/Inspection	Not Sampled	Current
MW325	Water Level/Inspection	Not Sampled	Current
MW326	Water Level/Inspection	Not Sampled	Current
MW327	Water Level/Inspection	Not Sampled	Current
MW328	Environmental Surveillance	Quarterly	Current
MW329	Environmental Surveillance	Quarterly	Current
MW330	Water Level/Inspection	Not Sampled	Current
MW333	Environmental Surveillance	Quarterly	Current
PZ334	Water Level/Inspection	Not Sampled	Current
PZ335	Water Level/Inspection	Not Sampled	Current
PZ336	Water Level/Inspection	Not Sampled	Current

Well	Sampling Program	Sampled	Status
MW337	Environmental Surveillance	Quarterly	Current
MW338	Environmental Surveillance	Quarterly	Current
MW339	Environmental Surveillance	Quarterly	Current
MW340	Environmental Surveillance	Quarterly	Current
MW341	Environmental Surveillance	Quarterly	Current
MW342	Environmental Surveillance	Quarterly	Current
MW343	Environmental Surveillance	Quarterly	Current
MW344	C-746-K	Quarterly	Current
MW345	Environmental Surveillance	Quarterly	Current
MW346	Environmental Surveillance	Quarterly	Current
MW347	Environmental Surveillance	Quarterly	Current
PZ348	Environmental Surveillance	Not Sampled	Current
PZ349	Environmental Surveillance	Not Sampled	Current
PZ350	Environmental Surveillance	Not Sampled	Current
PZ351	Environmental Surveillance	Not Sampled	Current
MW352	Environmental Surveillance	Quarterly	Current
MW353	C-746-S&T	Quarterly	Current
MW354	Environmental Surveillance	Quarterly	Current
MW355	Environmental Surveillance	Quarterly	Current
MW356	Environmental Surveillance	Quarterly	Current

LEGEND

- Surface Water Sampling Location
- KPDES Outfall Location
- Sediment Sampling Location
- Groundwater Monitoring Well or Piezometer
- Residential Well

Boundary of Groundwater Plume

Current Monitoring Locations

NOTE: L64 and L306 not shown on map.
L64 is southeast of PGDP and L306 is northwest.

C-746-S & -T Quarterly Sampling Parameters	
Method	**Analysis**
8260	Bromomethane
8260	Carbon Disulfide
8260	Carbon Tetrachloride
8260	Chlorobenzene
8260	Chloroethane
8260	chloroform
8260	Chloromethane
8260	cis-1,2-dichloroethene
8260	cis-1,3-Dichloropropene
8260	Dibromochloromethane
8260	Dibromomethane
8260	Dichlorodifluoromethane
8260	Dimethylbenzene, Total
8260	Ethyl Methacrylate
8260	Ethylbenzene
8260	Iodomethane
8260	Methylene Chloride
8260	Styrene
8260	Tetrachloroethene
8260	Toluene
8260	Trans-1,2-Dichloroethene
8260	trans-1,3-Dichloropropene
8260	trans-1,4-Dichloro-2-Butene
8260	Trichloroethene
8260	Trichlorofluoromethane
8260	Vinyl Acetate
8260	Vinyl Chloride
900.0	Alpha Activity
900.0	Beta Activity
9020B	Total Organic Halides (TOX)
9056	Chloride
9056	Nitrate as Nitrogen
9060	Total Organic Carbon (TOC)
IN7105	Uranium
IN7105	Uranium, Dissolved
RL-7100	Technetium-99

C-746-U Contained Landfill (Solid Waste Landfill Monitoring Wells)

Wells: MW268-MW277

Field Measurement
Parameters: Depth to water, pH, temperature, conductivity, dissolved oxygen, and barometric pressure.

Frequency: Quarterly

Analytical Parameters:

C-746-U Quarterly Sampling Parameters	
Method	**Analysis**
160.2	Dissolved Solids
180.1 1978	Turbidity
410.4 1978	Chemical Oxygen Demand (COD)
6010A	Antimony
6010A	Barium
6010A	Barium, Dissolved
6010A	Beryllium
6010A	Chromium
6010A	Chromium, Dissolved
6010A	Cobalt
6010A	Copper
6010A	Iron
6010A	Nickel
6010A	Silver
6010A	Sodium
6010A	Thallium
6010A	Vanadium
6010A	Zinc
7060	Arsenic
7131	Cadmium
7421	Lead
7470	Mercury
7740	Selenium
8015	Ethanol
8260	1,1,1,2-Tetrachloroethane
8260	1,1,1-Trichloroethane
8260	1,1,2,2-Tetrachloroethane
8260	1,1,2-Trichloroethane
8260	1,1-Dichloroethane
8260	1,1-Dichloroethene
8260	1,2,3-Trichloropropane
8260	1,2-Dibromo-3-chloropropane
8260	1,2-Dibromoethane
8260	1,2-Dichlorobenzene
8260	1,2-Dichloroethane
8260	1,2-Dichloropropane
8260	1,4-Dichlorobenzene
8260	2-Butanone

C-746-U Quarterly Sampling Parameters	
Method	**Analysis**
8260	2-Chloroethylvinyl ether
8260	2-Hexanone
8260	4-Methyl-2-pentanone
8260	Acetone
8260	Acrolein
8260	Acrylonitrile
8260	Benzene
8260	Bromochloromethane
8260	Bromodichloromethane
8260	Bromoform
8260	Bromomethane
8260	Carbon Disulfide
8260	Carbon Tetrachloride
8260	Chlorobenzene
8260	Chloroethane
8260	Chloroform
8260	Chloromethane
8260	cis-1,2-Dichloroethene
8260	cis-1,3-Dichloropropene
8260	Dibromochloromethane
8260	Dibromomethane
8260	Dichlorodifluoromethane
8260	Dimethylbenzene, Total
8260	Ethyl methacrylate
8260	Ethylbenzene
8260	Iodomethane
8260	Methylene chloride
8260	Styrene
8260	Tetrachloroethene
8260	Toluene
8260	trans-1,2-Dichloroethene
8260	trans-1,3-Dichloropropene
8260	trans-1,4-Dichloro-2-butene
8260	Trichloroethene
8260	Trichlorofluoromethane
8260	Vinyl Acetate
8260	Vinyl Chloride
900.0	Alpha Activity
900.0	Beta Activity
9020B	Total Organic Halides (TOX)
9056	Chloride
9056	Nitrate as Nitrogen
9060	Total Organic Carbon (TOC)
IN7105	Uranium
IN7105	Uranium, Dissolved
RL-7100	Technetium-99

C-746-K Landfill

Wells: MW 300, MW301, MW302, and MW344

Field Measurement Parameters: Depth to water, dissolved oxygen, pH, conductivity, temperature, dissolved oxygen, and barometric pressure.

Frequency: Semiannually

Analytical Parameters:

C-746-K Quarterly Sampling Parameters	
Method	**Analysis**
160.1	Suspended Solids
3500-Cr D 17	Chromium, hexavalent
370.1	Silica
6010A	Aluminum
6010A	Barium
6010A	Barium, Dissolved
6010A	Beryllium
6010A	Beryllium, Dissolved
6010A	Cadmium
6010A	Cadmium, Dissolved
6010A	Iron
6010A	Lead
6010A	Lead, Dissolved
6010A	Magnesium
6010A	Manganese
6010A	Nickel
6010A	Potassium
6010A	Sodium
6010A	Strontium
7060	Arsenic
7060	Arsenic, Dissolved
8260	1,1,1-Trichloroethane
8260	1,1,2-Trichloroethane
8260	1,1-Dichloroethane
8260	1,1-Dichloroethene
8260	1,2-Dichloroethane
8260	Benzene
8260	Bromodichloromethane
8260	Carbon tetrachloride
8260	Chloroform
8260	cis-1,2-Dichloroethene
8260	Dimethylbenzene, Total
8260	Ethylbenzene
8260	Tetrachloroethene
8260	Toluene
8260	trans-1,2-Dichloroethene

C-746-K Quarterly Sampling Parameters	
Method	**Analysis**
8260	Trichloroethene
8260	Vinyl Chloride
900.0	Alpha Activity
900.0	Beta Activity
IN7105	Uranium
IN7105	Uranium, Dissolved
RL-7100	Technetium-99

ENVIRONMENTAL SURVEILLANCE PROGRAM

Monthly Residential Monitoring

Wells: R2, R294, and R302

Field Measurement Parameters: Depth to water, pH, temperature, dissolved oxygen, conductivity, and barometric pressure.

Frequency: Monthly

Analytical Parameters:

Residential Monthly Sampling Parameters	
Method	**Analysis**
8260	Trichloroethene
900.0	Alpha Activity
900.0	Beta Activity
RL-7100	Technetium-99

Semiannual Residential Monitoring

Wells: R9, R12-14, R19-21, R23, R72, R82, R83, R90, R114, R381, R383, R384, R387, and R392

Field Measurement Parameters: Depth to water, conductivity, pH, temperature, dissolved oxygen, and barometric pressure.

Frequency: Semiannually

Analytical Parameters:

Semiannual Residential Sampling Parameters	
Method	**Analysis**
8260	Trichloroethene
RL-7100	Technetium-99

Annual Environmental Surveillance Monitoring

Wells: Annual Monitoring: MW71, MW96, MW106, MW133, MW134, MW155, MW156, MW159, MW161, MW163, MW168, MW169, MW175, MW178, MW180, MW182, MW188, MW191-193, MW200, MW201, MW203, MW205, and MW206

Background Monitoring: MW102, MW103, MW120-122, MW150, MW194, MW196, MW199, and MW306

Field Measurement Parameters: Depth to water, dissolved oxygen, pH, conductivity, temperature, and barometric pressure.

Frequency: Annually

Annual and Background Analytical Parameters:

Annual and Background Environmental Surveillance Sampling Parameters	
Method	**Analysis**
8260	1,1,1-Trichloroethane
8260	1,1,2-Trichloroethane
8260	1,1-Dichloroethane
8260	1,1-Dichloroethene
8260	1,2-Dichloroethane
8260	Benzene
8260	Bromodichloromethane
8260	Carbon Tetrachloride
8260	Chloroform
8260	cis-1,2-dichloroethene
8260	Dimethylbenzene, Total
8260	Ethylbenzene
8260	Tetrachloroethene
8260	Toluene
8260	Trans-1,2-Dichloroethene
8260	Trichloroethene
8260	Vinyl Chloride
900.0	Alpha Activity
900.0	Beta Activity
IN7105	Uranium
RL-7100	Technetium-99
AS7300-3	Uranium
AS7300-3	% U-235
RL-7103	Neptunium-237
RL-7120	Plutonium-238
RL-7120	Plutonium-239/240
RL-7120	Thorium-228
RL-7120	Thorium-230
RL-7120	Thorium-232
RL-7122	Dissolved Alpha
RL-7122	Dissolved Beta

Annual and Background Environmental Surveillance Sampling Parameters	
Method	**Analysis**
RL-7122	Suspended Alpha
RL-7122	Suspended Beta
RL-7124	Activity of U-235
RL-7124	Americium-241
RL-7124	Cesium-134
RL-7124	Cesium-137
RL-7124	Cobalt-60
RL-7124	Potassium-40
RL-7124	Uranium
RL-7124	Uranium-234
RL-7124	Uranium-235
RL-7124	Uranium-238

Quarterly Environmental Surveillance Monitoring

Wells: MW20, MW63, MW65, MW98, MW99, MW100, MW125, MW135, MW139, MW146, MW152, MW165, MW166, MW173, MW174, MW185, MW186, MW187, MW197, MW202, MW260, MW261, MW262, MW328, MW329, MW333, MW337, MW338, MW339, MW340, MW341, MW342, and MW 343

Field Measurement Parameters: Depth to water, conductivity, pH, temperature, dissolved oxygen, and barometric pressure.

Frequency: Quarterly

Analytical Parameters:

Quarterly Environmental Surveillance Sampling Parameters	
Method	**Analysis**
8260	1,1,1-Trichloroethane
8260	1,1,2-Trichloroethane
8260	1,1-Dichloroethane
8260	1,1-Dichloroethene
8260	1,2-Dichloroethane
8260	Benzene
8260	Bromodichloromethane
8260	Carbon Tetrachloride
8260	Chloroform
8260	cis-1,2-dichloroethene
8260	Dimethylbenzene, Total
8260	Ethylbenzene
8260	Tetrachloroethene
8260	Toluene
8260	Trans-1,2-Dichloroethene
8260	Trichloroethene
8260	Vinyl Chloride
900.0	Alpha Activity
900.0	Beta Activity
IN7105	Uranium

Quarterly Environmental Surveillance Sampling Parameters	
Method	**Analysis**
RL-7100	Technetium-99
AS7300-3	Uranium
AS7300-3	% U-235
RL-7103	Neptunium-237
RL-7120	Plutonium-238
RL-7120	Plutonium-239/240
RL-7120	Thorium-228
RL-7120	Thorium-230
RL-7120	Thorium-232
RL-7122	Dissolved Alpha
RL-7122	Dissolved Beta
RL-7122	Suspended Alpha
RL-7122	Suspended Beta
RL-7124	Activity of U-235
RL-7124	Americium-241
RL-7124	Cesium-134
RL-7124	Cesium-137
RL-7124	Cobalt-60
RL-7124	Potassium-40
RL-7124	Uranium
RL-7124	Uranium-234
RL-7124	Uranium-235
RL-7124	Uranium-238

Operational and Maintenance Plan for the Northwest Plume Program

Wells: MW233-250

Field Measurement Parameters: Depth to water, conductivity, pH, temperature, dissolved oxygen, and barometric pressure.

Frequency: Annually and Quarterly

Annual Analytical Parameters:

FFA Northwest North Wells Annual Sampling Parameters	
Method	**Analysis**
160.2	Dissolved Solids
310.1	Alkalinity
340.2	Fluoride
6010A	Antimony
6010A	Antimony, Dissolved
6010A	Barium
6010A	Barium, Dissolved
6010A	Beryllium
6010A	Beryllium, Dissolved
6010A	Cadmium

6010A	Cadmium, Dissolved
6010A	Chromium
6010A	Chromium, Dissolved
6010A	Cobalt
6010A	Cobalt, Dissolved
6010A	Copper
6010A	Copper, Dissolved
6010A	Lead
6010A	Lead, Dissolved
6010A	Molybdenum
6010A	Molybdenum, Dissolved
6010A	Nickel
6010A	Nickel, Dissolved
6010A	Silver
6010A	Silver, Dissolved
6010A	Zinc
6010A	Zinc, Dissolved
7060	Arsenic
7060	Arsenic, Dissolved
7470	Mercury
7470	Mercury, Dissolved
7740	Selenium
FFA Northwest North Wells Sampling Parameters	
Method	**Analysis**
7740	Selenium, Dissolved
9056	Chloride
9056	Nitrate as Nitrogen
9056	Sulfate
9060	Total Organic Carbon (TOC)

Quarterly
Analytical Parameters:

FFA Northwest Quarterly Sampling Parameters	
Method	**Analysis**
180.1 1978	Turbidity
370.1	Silica
6010A	Aluminum
6010A	Aluminum, Dissolved
6010A	Calcium
6010A	Calcium, Dissolved
6010A	Iron
6010A	Iron, Dissolved
6010A	Magnesium
6010A	Magnesium, Dissolved
6010A	Manganese
6010A	Manganese, Dissolved
6010A	Potassium
6010A	Potassium, Dissolved
6010A	Sodium
6010A	Sodium, Dissolved
8260	1,1,1-Trichloroethane

8260	1,1,2-Trichloroethane
8260	1,1-Dichloroethane
8260	1,1-Dichloroethene
8260	1,2-Dichloroethane
8260	Benzene
8260	Bromodichloromethane
8260	Carbon tetrachloride
8260	Chloroform
8260	cis-1,2-Dichloroethene
8260	Dimethylbenzene, Total
8260	Ethylbenzene
8260	Tetrachloroethene
8260	Toluene
8260	trans-1,2-Dichloroethene
8260	Trichloroethene
8260	Vinyl Chloride
900.0	Alpha Activity
900.0	Beta Activity
9056	Phosphate as Phosphorus
FFA Northwest Quarterly Sampling Parameters	
Method	**Analysis**
RL-7100	Technetium-99
FFA Northwest South Wells Annual Sampling Parameters	
160.2	Dissolved Solids
310.1	Alkalinity
340.2	Fluoride
6010A	Antimony
6010A	Antimony, Dissolved
6010A	Barium
6010A	Barium, Dissolved
6010A	Beryllium
6010A	Beryllium, Dissolved
6010A	Cadmium
6010A	Cadmium, Dissolved
6010A	Chromium
6010A	Chromium, Dissolved
6010A	Cobalt
6010A	Cobalt, Dissolved
6010A	Copper
6010A	Copper, Dissolved
6010A	Lead
6010A	Lead, Dissolved
6010A	Molybdenum
6010A	Molybdenum, Dissolved
6010A	Nickel
6010A	Nickel, Dissolved
6010A	Silver
6010A	Silver, Dissolved
6010A	Zinc
6010A	Zinc, Dissolved
7060	Arsenic
7060	Arsenic, Dissolved

7470	Mercury
7470	Mercury, Dissolved
7740	Selenium
7740	Selenium, Dissolved
9056	Chloride
9056	Nitrate as Nitrogen
9056	Sulfate
9060	Total Organic Carbon (TOC)
IN7105	Uranium
IN7105	Uranium, Dissolved
R-51	Radon
RL-7103	Neptunium-237
RL-7113	Radium-226
RL-7120	Plutonium-239
RL-7120	Thorium-230

Operational and Maintenance Plan for the Northeast Plume Program

Wells: MW124, MW126, MW145, MW255, MW256, MW258, MW283, MW284, MW288, MW291, MW292, MW293, and MW294

Field Measurement Parameters: Depth to water, dissolved oxygen, pH, conductivity, temperature, and barometric pressure.

Frequency: Annually and Quarterly

Annual Analytical Parameters:

FFA Northeast Annual Sampling Parameters	
Method	**Analysis**
160.2	Dissolved Solids
180.1 1978	Turbidity
310.1	Alkalinity
340.2	Fluoride
370.1	Silica
6010A	Aluminum
6010A	Aluminum, Dissolved
6010A	Antimony
6010A	Antimony, Dissolved
6010A	Barium
6010A	Barium, Dissolved
6010A	Beryllium
6010A	Beryllium, Dissolved
6010A	Cadmium
6010A	Cadmium, Dissolved
6010A	Calcium
6010A	Calcium, Dissolved
6010A	Chromium
6010A	Chromium, Dissolved
6010A	Cobalt

CABINET FOR HUMAN RESOURCES
COMMONWEALTH OF KENTUCKY
FRANKFORT 40621-0001

DEPARTMENT FOR HEALTH SERVICES

ER Doc Mgmt Center

April 22, 1993

MR DONALD C. BOOHER
SITE MANAGER
PADUCAH SITE OFFICE
PADUCAH GASEOUS DIFFUSION PLANT
P O BOX 1410
PADUCAH KY 42001

Dear Mr. Booher:

Results for vegetation samples collected adjacent to the Paducah Gaseous Diffusion Plant during 1993, by personnel from the Kentucky Radiation Control Branch are enclosed. Samples are analyzed by staff of the Radiation/Environmental Monitoring Section, Radiation Control Branch.

If you have questions regarding this information, please contact Ms. Gretchen F. Maxson at (502) 564-8390 or me at (502) 564-3700.

Sincerely,

John A. Volpe, Ph.D., Manager
Radiation Control Branch

c: Gretchen A. Maxson, CHR/KY
Tuss Taylor, NREPC/KY
Wally Malis, MMESI/PGDP

CABINET FOR HUMAN RESOURCES
COMMONWEALTH OF KENTUCKY
FRANKFORT 40621-0001

DEPARTMENT FOR HEALTH SERVICES

MEMORANDUM

To: John A. Volpe, Ph.D.
Branch Manager
Radiation Control Branch

From: Gretchen A. Maxson
Chief Chemist
Radiation/Environmental Monitoring Section

Subject: Results for Vegetation Samples Collected in the Area of Paducah Gaseous Diffusion Plant During 1992.

Date: April 19, 1993

Attached are the results for the vegetation samples collected during 1992, surrounding the Paducah Gaseous Diffusion Plant (PGDP). The vegetation was dried and analyzed for Technetium-99. Also, attached is a listing of all residential sampling locations that the samples were collected during 1992 by Radiation/Environmental Monitoring Section personnel.

This information should be provided to Donald C. Booher, Department of Energy (DOE) Site Manager. In addition, this information should be forwarded to Tuss Taylor, Hazardous Waste Branch, Department of Environmental Protection, NREPC, and Wally Malis, Environmental Services, PGDP.

Attachment

CABINET FOR HUMAN RESOURCES
COMMONWEALTH OF KENTUCKY
FRANKFORT 40621-0001

DEPARTMENT FOR HEALTH SERVICES

MEMORANDUM

To: John A. Volpe, Ph.D.
Manager
Radiation Control Branch
Division of Community Safety

From: Gretchen A. Maxson
Chief Chemist
Radiation Control Branch

Subject: Sampling at the Off-Site Locations for Vegetation in the Area of Paducah Gaseous Diffusion Plant During 1992

Date: April 19, 1993

The following locations were sampled during 1992, by Radiation/Environmental Monitoring Section personnel. All location numbers are Martin-Marietta Energy Systems, Inc. (MMESI) designations. All residences were informed of sampling at their residences and all were present at the time of sampling.

Locations sampled during 1992

Location #5
Long/Woods (one well for two houses)
10615 Ogden Landing Road
Kevil, KY 42053
(502) 462-3931
West of PGDP

Location #6
Jim Joyner
4805 Bethel Church Road
Kevil, KY 42053
(502) 462-3497
West of PGDP

Location #12
Wilmer Tilford
10815 Ogden Landing Road
Kevil, KY 42053
(502) 462-3966
Northwest of PGDP

Location #16
David Warford
6875 Boldry School Road
Kevil, KY 42053
(502) 488-3665
North of PGDP

Location #17
Joel Dick
6465 Boldry School Road
Kevil, KY 42053
(502) 488-3274
North of PGDP

Location #21
Marshal Bobo
8965 Gibson Road
West Paducah, KY 42086
Northeast of PGDP

Location #69
Randy Puckett
6515 Bethel Church Road
Kevil, KY 42053
West of PGDP

Location #254
Gillard Ross
5255 Metropolis Road
West Paducah, KY 42086
(502) 488-3331
East of PGDP

Location #406
Maurice Miller
10860 Woodville Road
Kevil, KY 42053
(502) 488-3989
South of PGDP

Attachment

Vegetation samples collected in the area of Paducah Gaseous Diffusion Plant during 1992

Location	Collection Date	Sample Type	Tc-99 in Vegetation (pCi/gram)
Joel Dick (R-17)	12-May-92	June Apple Twigs/Leaves	<0.34
Joel Dick (R-17)	12-May-92	Wine Sap Apple Twigs/Leaves	<0.34
Jim Joyner (R-6)	24-Jun-92	Yellow Squash	<0.34
Jim Joyner (R-6)	24-Jun-92	Beets	<0.34
Jim Joyner (R-6)	24-Jun-92	Onions	<0.34
Randy Puckett (R-69)	24-Jun-92	Green Tomatoes	<0.34
Randy Puckett (R-69)	24-Jun-92	Green Beans	<0.34
Wilmer Tilford (R-12)	24-Jun-92	Turnip Greens	1.3 +/- 0.16
Long/Wood (R-5)	24-Jun-92	Beets	0.79 +/- 0.5
Maurice Miller (R-406)	25-Jun-92	Yellow Squash	<0.34
Maurice Miller (R-406)	25-Jun-92	Lettuce	0.86 +/- 0.52
Gillard Ross (R-254)	25-Jun-92	Green Beans	<0.40
Gillard Ross (R-254)	25-Jun-92	Green Onions	<0.34
Gillard Ross (R-254)	25-Jun-92	Yellow Squash	<0.34
Marshal Bobo (R-21)	25-Jun-92	Tomatoes	<0.34
Marshal Bobo (R-21)	25-Jun-92	Cucumbers	<0.34
Marshal Bobo (R-21)	25-Jun-92	Green & Banana Peppers	<0.34
Marshal Bobo (R-21)	25-Jun-92	Yellow Squash	<0.34
David Warford (R-16)	25-Jun-92	Radishes	Not Enough Sample
Maurice Miller (R-406)	15-Jul-92	Cucumbers	<0.34
Maurice Miller (R-406)	15-Jul-92	Green Beans	<0.34
Maurice Miller (R-406)	15-Jul-92	Tomatoes	<0.34
Marshal Bobo (R-21)	15-Jul-92	Corn	<0.34
Gillard Ross (R-254)	15-Jul-92	Tomatoes	<0.34
Gillard Ross (R-254)	15-Jul-92	Green Peppers	<0.34
Gillard Ross (R-254)	15-Jul-92	Corn	<0.34
Long/Wood (R-5)	15-Jul-92	Brussel Sprouts	0.45 +/- 0.48
Long/Wood (R-5)	15-Jul-92	Cucumbers	<0.34
Long/Wood (R-5)	15-Jul-92	Green Beans	<0.34
Long/Wood (R-5)	15-Jul-92	Tomatoes	<0.34
Wilmer Tilford (R-12)	15-Jul-92	Cucumbers	<0.34
Wilmer Tilford (R-12)	15-Jul-92	Tomatoes	<0.34
Joel Dick (R-17)	15-Jul-92	Apples	<0.34
Joel Dick (R-17)	15-Jul-92	Tomatoes	0.46 +/- 0.36
David Warford (R-16)	15-Jul-92	Tomatoes	<0.34
David Warford (R-16)	15-Jul-92	Corn	0.37 +/- 0.4
Jim Joyner (R-6)	15-Jul-92	Tomatoes	<0.34
Jim Joyner (R-6)	15-Jul-92	Corn	<0.34
Jim Joyner (R-6)	15-Jul-92	Cucumbers	<0.34
Randy Puckett (R-69)	16-Jul-92	Squash	<0.34
Maurice Miller (R-406)	18-Aug-92	Tomatoes	<0.34
Maurice Miller (R-406)	18-Aug-92	Okra	<0.34
Maurice Miller (R-406)	18-Aug-92	Green Peppers	<0.34
Maurice Miller (R-406)	18-Aug-92	Green Beans	<0.34

Minimum Detectable Activity for Technetium-99 analysis is 0.34 pCi/gram for 5 gram samples.

Minimum Detectable Activity for Technetium-99 analysis is 0.40 pCi/gram for 4 gram samples.

Vegetation samples collected in the area of Paducah Gaseous Diffusion Plant during 1992

Location	Collection Date	Sample Type	Tc-99 in Vegetation (pCi/gram)
David Warford (R-16)	18-Aug-92	Tomatoes	<0.34
David Warford (R-16)	18-Aug-92	Corn	<0.34
David Warford (R-16)	18-Aug-92	Green Peppers	<0.34
David Warford (R-16)	18-Aug-92	Watermelon	<1.0
David Warford (R-16)	18-Aug-92	Acorn Squash	<0.34
David Warford (R-16)	18-Aug-92	Yellow Squash	0.39 +/- 0.32
David Warford (R-16)	18-Aug-92	Yellow Green Squash	<0.34
David Warford (R-16)	18-Aug-92	Orange Squash	<0.34
Marshal Bobo (R-21)	18-Aug-92	Cucumbers	<0.34
Gillard Ross (R-254)	18-Aug-92	Butter Lima Beans	<0.34
Gillard Ross (R-254)	18-Aug-92	Tomatoes	0.53 +/- 0.35
Gillard Ross (R-254)	18-Aug-92	Corn	<0.34
Gillard Ross (R-254)	18-Aug-92	Okra	<0.34
Gillard Ross (R-254)	18-Aug-92	Green Peppers	<0.34
Jim Joyner (R-6)	18-Aug-92	Peas	<0.34
Jim Joyner (R-6)	18-Aug-92	Butter Beans	<0.34
Jim Joyner (R-6)	18-Aug-92	Okra	<0.34
Long/Wood (R-5)	18-Aug-92	Okra	<0.34
Long/Wood (R-5)	18-Aug-92	Green Peppers	<0.34
Long/Wood (R-5)	18-Aug-92	Watermelon	<0.34
Wilmer Tilford (R-12)	18-Aug-92	Cucumbers	<0.34
Wilmer Tilford (R-12)	18-Aug-92	Tomatoes	<0.34

linimum Detectable Activity for Technetium-99 analysis is 0.34 pCi/gram for 5 gram samples.
linimum Detectable Activity for Technetium-99 analysis is 0.40 pCi/gram for 4 gram samples.
linimum Detectable Activity for Technetium-99 analysis is 1.0 pCi/gram for 1.7 gram samples.

SOUTHWEST GROUNDWATER PLUME PERMEABLE TREATMENT ZONE TREATABILITY STUDY (TS) PROJECT

During the last SSAB meeting several questions about the Southwest Plume (SW) Permeable treatment zone (PTZ) Treatability Study (TS) project were asked. The purpose of this paper is to provide information related to those questions.

SUMMARY

PTZ, or permeable reactive barriers, have been described by the U.S. Environmental Protection Agency (EPA) (EPA 1998) as follows: "Reactive material is placed in the subsurface where a plume of contaminated ground water must move through it as it flows, typically under its natural gradient (creating a passive treatment system) and treated water comes out the other side. The [PTZ] is not a barrier to the water, but it is a barrier to the contaminants." Iron has been proven to reductively dehalogenate, or breakdown, trichloroethene (TCE). The EPA report further states, "The majority of installed [PTZs] use iron metal … as the reactive media for converting contaminants to non-toxic or immobile species … [and] … Organic materials are being used as reactive media in some [PTZs] to biologically remediate certain other contaminants … [but] … Numerous other reactive materials are being investigated …" (EPA 1998).

This treatability study consists of two components. Prior to conducting the field-scale component (i.e., the PTZ in the Southwest Plume), bench-scale testing will be conducted to select/optimize the reactive media to be used in the PTZ. The bench-scale test will evaluate two types of zero-valent iron and two types of adsorbents (humate and Surfactant Modified Zeolite). The field-scale treatability test will consist of constructing a 30-m (100-ft)-long PTZ to a maximum depth of approximately 37 m (120 ft) in the Regional Gravel Aquifer. This PTZ will be constructed in a portion of the Paducah Gaseous Diffusion Plant (PGDP) Southwest Plume that contains high concentrations of TCE, a volatile organic compound, and 99Tc, a radionuclide. The primary goal of this treatability study is to demonstrate the constructability and measure the effectiveness of an injected PTZ containing reactive material designed to degrade volatile organic compounds and capture 99Tc in situ while allowing groundwater to flow through the zone. This study will also provide cost information.

This treatability study work plan has been prepared to document the plans necessary to conduct these bench-scale and field-scale tests. This work plan summarizes the treatment technology, the test objectives, and the experimental design to conduct the study. Plans for sampling and analysis, data management, data analysis and interpretation, health and safety, and community relations are identified. The reporting requirements, project schedule, management organization, and project budget also are summarized. In addition, specific plans for conducting the bench-scale testing and designing and constructing the PTZ are appended to this work plan..

NEPA

What are the NEPA requirements for the Treatability Study?

- This treatability study is being conducted under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The 1994 DOE Secretarial Policy on NEPA states that the DOE will rely on CERCLA documentation to address NEPA

values for activities conducted under CERCLA.

- Additionally, the action would be covered by one or more of the following categorical exclusions under 10 CFR 1021, Subpart D, Appendix B:
  a. a small-scale R&D or pilot project "(generally less than two years) conducted to verify a concept before demonstration actions" [B3.6]
  b. "small-scale, short-term cleanup actions . . . less than approximately 5 million dollars in cost and 5 years duration to reduce risk . . ." [B6.1], including "Use of chemicals and other materials to retard the spread of the release or to mitigate its effects . . ." [B6.1(l)].
  c. "The siting, construction, and operation of a temporary (generally less than 2 years) pilot-scale waste collection and treatment facilities . . ." [B6.2].

STATUS

- 3/8/00 - Issued the D1 PTZ TS Work Plan for Regulatory review.
- 3/29/00 - Received draft copy of comments on the D1 PTZ TS WP from the KY Radiation Control Branch (i.e., J. Volpe).
- 4/10/00 - Received EPA comments on the D1 PTZ TS WP.
- 4/25/00 - Received KY Dept. Environmental Protection comments on the D1 PTZ TS WP.
- 4/5/00 - Issued the 60% design package for review.
- The D1 QA Plan is currently under development.
- 4/7/00 - Issued the SW PTZ TS Draft Laboratory Bench-Scale Testing Summary Report.
- 4/25/00 & 4/26/00 - Held meetings with the Regulatory Agencies to address SW PTZ TS WP, Design, and SW PTZ TS Draft Laboratory Bench-Scale Testing Summary Report comments. Based on these reviews agreement was reached that iron would be the active media installed within the SW PTZ.

COMPANIES DOING THE WORK

- Bechtel Jacobs Company LLC - Management and Integration Contract for the U.S. Department of Energy (DOE) - 441-5062 (P. Gourieux)
- SAIC - Paducah Remedial Action Assessment Subcontractor for Bechtel Jacobs Company LLC - 462-4542 (B. Phillips)
- GEO Consultants, LLC - Construction Oversight Subcontractor - 462-3883 (J. Douthitt)
- FRx - PTZ Construction Subcontractor - 513-469-6040 (W. Slack) - www.frx-inc.com

DOCUMENTS ISSUED TO SSAB

- Treatability Study Work Plan for the Permeable Treatment Zone at the Paducah Gaseous Diffusion Plan, Paducah, Kentucky (DOE/OR/07-1861&D1), Secondary Document, March 2000 - Issued 3/8/00

DOCUMENTS TO BE ISSUED TO SSAB

- Treatability Study Work Plan for the Permeable Treatment Zone at the Paducah Gaseous Diffusion Plan, Paducah, Kentucky, Secondary Document, May 2000 - Scheduled for issuance 5/22/00
- 90% Design Drawings and Technical Specification Package for Treatability Study,

Paducah, Kentucky, Secondary Document, Permeable Treatment Zone Construction, May 2000 - Scheduled for issuance 5/22/00

- Final Construction Quality Plan for the Southwest Plume Permeable Treatment Zone, Treatability Study, Paducah, Kentucky, Secondary Document - Scheduled for issuance 5/22/00
- Final Laboratory Bench-Scale Testing Summary Report for the Paducah Gaseous diffusion Plant, Paducah, Kentucky - Scheduled for issuance 5/22/00

TO: SSAB Board members
RE: Request for information
DATE: 18 May 2000

The following document was part of the 5-year review by the Kentucky Agreement in Principle. Additional technical reports will be provided as we receive them.

In-stream toxicity monitoring with the use of salamander egg enclosures.

Eggs collected March '96

Matt Vick
University of Kentucky,
Federal Facilities Oversight Unit

Introduction

The Big Bayou and Little Bayou Creeks in the vicinity of the Paducah Gaseous Diffusion Plant (PGDP) have been found to be contaminated with radionuclides, heavy metals, and polychlorinated biphenyls (PCBs). Oak Ridge National Laboratory (ORNL) performs biological monitoring activities at the PGDP in order to evaluate impacts of the facility on the local environment and ecology. ORNL activities include fish and benthic community sampling, toxicity monitoring, and analysis for bioaccumulation of PCBs and mercury in fish tissue (Jones and Knaus, 1995). This sampling has found transient toxicity from outfall water, impacted fish and benthic communities, and elevated PCBs and metals in fish from the Big Bayou and Little Bayou Creeks in the vicinity of the PGDP.

There has been no work specifically focusing on the impacts of the contaminants on amphibian species within the local streams. The purpose of this study was to utilize salamander eggs to monitor the chronic toxicity of ambient stream water. The study involved placing salamander eggs into cages that were placed at a variety of locations along the Big Bayou and Little Bayou Creeks. The eggs remained in the streams until hatching.

This study is beneficial in that it monitors the in-stream toxicity over a long-term exposure of greater than one week. Presently, toxicity monitoring by ORNL involves ex situ use of ambient water over a seven day period. The egg enclosure procedure also evaluates toxicity to an extremely susceptible stage of amphibian development.

Materials and Methods

Salamander eggs were collected from a local vernal pool located west of Hobbs Rd. and south of Acid Rd (Photo 1). The source location is a temporary pond in the West Kentucky Wildlife Management Area. In total over 750 eggs were collected on March 13, 1996 (Photo 2). The eggs were identified as those of the smallmouth salamander (*Ambystoma texanum*), based on the consistency of the jelly mass, number of eggs per mass, and the time of the year (Pfingsten and Downs, 1989). The smallmouth salamander was favored for use in this study because of the thin nature and watery consistency of the jelly around the eggs. The jelly would offer less protection from potential water contaminants than the firm and larger quantity of jelly surrounding eggs of the spotted salamander (*Ambystoma maculatum*). The eggs were collected on the same date and all at a uniform and early stage of development. All eggs were visually inspected to be at the one cell stage, no cellular cleave was present indicating that further development had occurred. The egg masses were divided into clusters of 5 to 10 eggs as best as practical without damaging the eggs. All the eggs were than placed into a container and mixed to randomize placement of egg groups into enclosures. A total of 25 eggs were placed into each enclosure.

An enclosure consists of a 4 inch diameter by 5.5 inch long piece of PVC pipe (Photo 3). One open end of the pipe is covered with fiberglass screen attached with silicon caulk (Dow Corning Brand 100% Silicone Sealant). On this same end a Styrofoam donut is attached and secured with silicon to act as a float. Additionally, a length of cotton cord is tied to this end of the pipe and secured to a wood stake, rock, rubble, or branch to anchor the enclosure in the stream. The other open end of the pipe, which is facing down, is covered with a circular piece of fiberglass screen and secured with an elastic band. The enclosure also has horizontal slits down its length in order to increase water circulation and exposure to the eggs.

Three enclosures were placed at each of nine monitoring locations on March 13-15, 1996. The monitoring locations include: Little Bayou Creek intersection with: McCaw Rd., Ogden Landing Rd., and Anderson Rd; Big Bayou Creek with: South Acid Rd., near C-611 lagoons, Transport Rd., and Ogden Landing Rd.; Massac Creek and Rt. 62, and the source pond. BBC 7.0, BBC 9.1, BBC 10.0, LBC 4.3, LBC 7.2, and LBC 9.0 were used for treatment sites. BBC 12.5 and Massac Creek (Mass. Cr.) serve as background or control locations (refer to Map, Figure 1). The ninth monitoring location was the source pond from which the eggs were collected and this site also acts as a control (Photos 4, 5, and 6).

Water temperature, pH, and conductivity were recorded on a variety of occasions. Upon hatching of the eggs the larval wet weight was taken as an indicator of general condition. The percent survival to hatch and the time to hatch was also recorded and compared between sites. A one-way analysis of variance on arcsin square-root transformed mortality data was performed to test for statistically significance differences. Larval weight data was analyzed using a one-way analysis of variance and Newman-Keuls multiple comparison.

1 way ANOVA

Photo 1. Source pond for salamander eggs, a shallow temporary pond in the WKWMA.

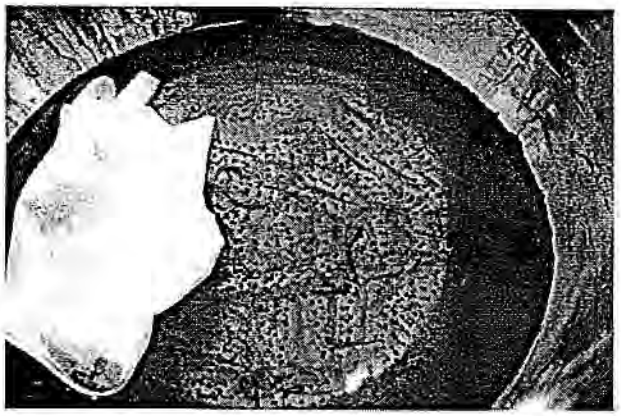


Photo 2. Smallmouth salamander egg masses.

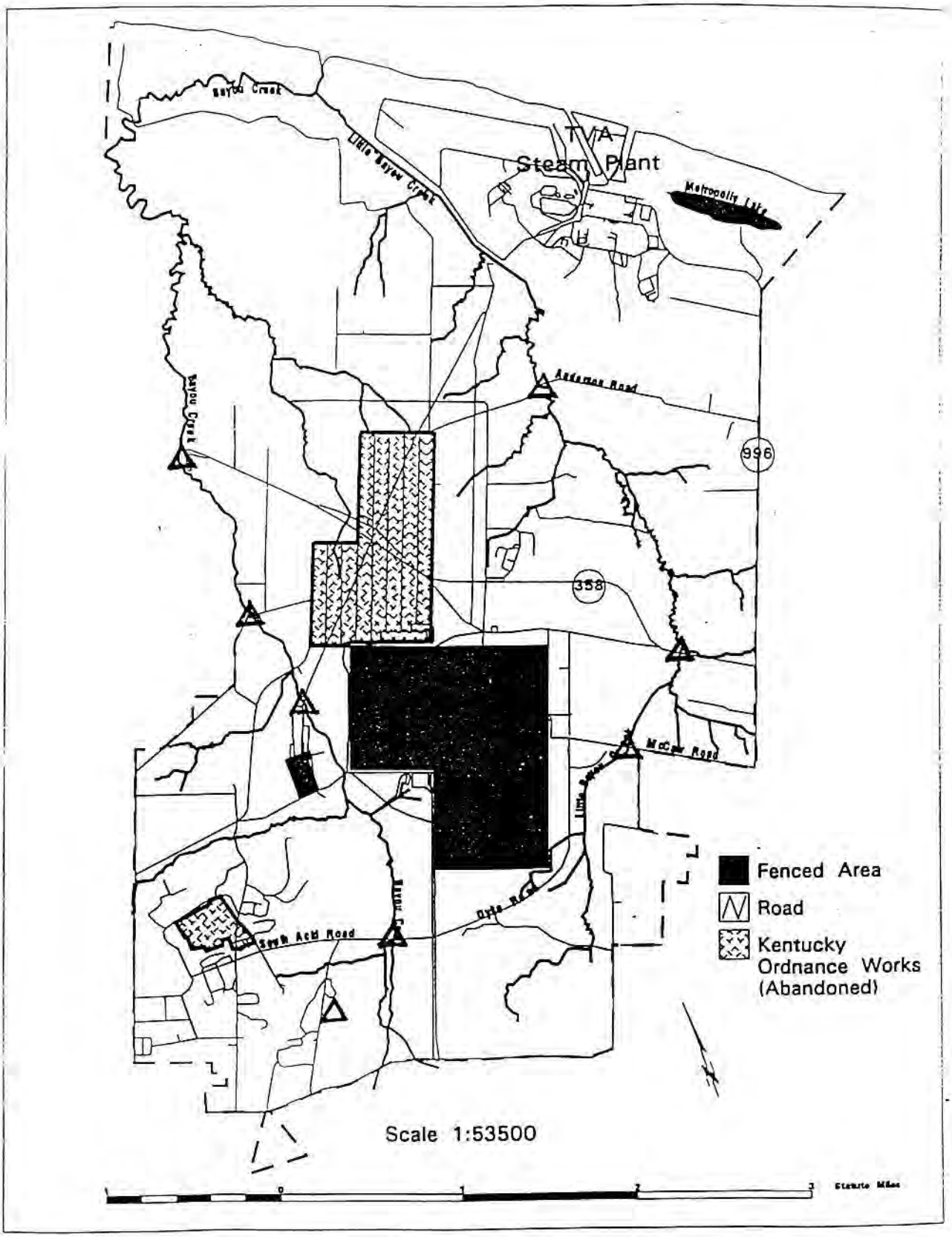


Figure 1. Map of the PGDP and surrounding area, shows monitoring locations on the Big Bayou, Little Bayou Creeks, and source pond (marked with triangles). Massac Creek location not shown. Map modified from Army Corps Engineers, 1994 report.

Photo 3. Enclosures used for ambient toxicity monitoring. The enclosure to the right is oriented as they were in the creek. They are constructed of four inch PVC pipe and covered at each end with screen. The enclosures were kept afloat by Styrofoam.

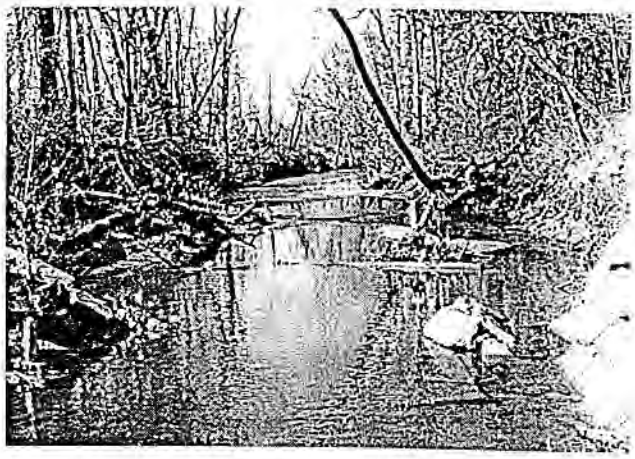


Photo 4. Big Bayou Creek monitoring location (BBCr. 9.1). Three enclosures were placed at each site and 25 eggs were in each enclosure. Two enclosures can be seen in this photo.

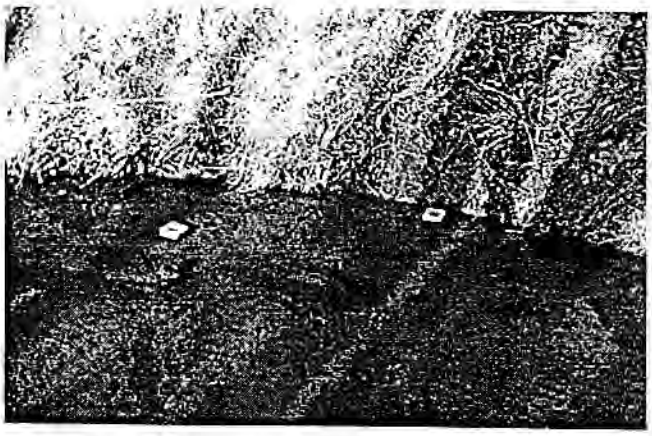


Photo 5. Massac Creek monitoring location. This site was used as a reference because it receives no run-off or effluent from the PGDP.

Photo 6. Big Bayou Creek reference location. This site is just downstream of S. Acid Rd. Three enclosures can be seen clustered beyond the rocks.

Results

Water Chemistry

The temperature, conductivity, and pH monitoring at the enclosure locations are summarized in figures 2, 3, and 4. The temperature varied widely between monitoring locations and is greatly effected by plant effluent. In both the Big Bayou and Little Bayou Creeks immediately downstream from the PGDP the water temperature is elevated compared to downstream locations and stream control locations (Figure 2). Similarly, the conductivity is elevated in both creeks downstream of the PGDP, primarily in the Big Bayou Creek. The elevated conductivity in the Big Bayou creek remains elevated to the furthest downstream monitoring location (BBC 7.0) (Figure 3). The water pH is slightly elevated at all treatment locations compared to the three reference sites and highly elevated at BBC 9.1 (Figure 4). The primary cause of the elevated temperature and conductivity from the PGDP is the warm and solute rich water from the cooling towers. While, the effluent from the water treatment facility and the softening process leads to the elevated pH from outfall 006.

Mortality

Salamander larvae were collected and weighed during a period from April 1 to April 12, 1996. Therefore, the salamander embryos developed in the creeks for a period of two to three and a half weeks. At six locations there were a few individual embryos that were unaccounted for. In instances where the egg membrane was ruptured, the embryo could then fit through the enclosure screen. Possible causes of membrane rupture include physical and chemical water factors. High water current did occur at many of the sampling locations. High flow conditions could possibly have ruptured the egg membrane leading to the loss of the embryo. Embryos counted as surviving were confirmed present and alive upon the last collecting date. Dead embryos were confirmed dead by routine checks and counts.

Monitoring location BBC 10.0 was removed from statistical analysis due to a large proportion of missing embryos. On a few occasions the enclosures at this site were seen to be completely submerged by flowing water. Other locations experienced similar flow conditions, but enclosures were anchored in a manner that they were not completely over-topped by flowing water as frequently, if at all. The known survival of embryos at all other locations exceeded 89% (Figure 5). There was no significant difference in mortality between the monitoring locations (ANOVA, $F=1.43$, $P>.10$). Survival was highest at the Massac Creek reference location and Little Bayou Creek 9.2. Survival of embryos at all locations (excluding BBC. 10.0) was quite similar to the three reference locations (source pond, Massac Creek, and Big Bayou Creek 12.5).

Date of Hatch

High water flow conditions could have interfered with the natural progression of the hatch. As the embryos developed and approached maturity the egg sac would enlarge and become increasingly fragile. On some instances, the process of counting the surviving embryos was enough to rupture the egg sac. The flowing water might have had an effect on time of hatch by rupturing eggs prematurely. For this reason, the larvae were collected on the day that at least 75% of the embryos had exited the egg membrane. At most locations the larvae were collected and weighed within a four day period (April 9 - 12). Monitoring locations LBC 7.2 and LBC 9.0 experienced earlier hatch days and were collected 5-10 days prior to collection of the majority of

the other sites. Generally, those locations that had higher water temperatures experienced faster growth of embryos and reached 75% hatch at an earlier date.

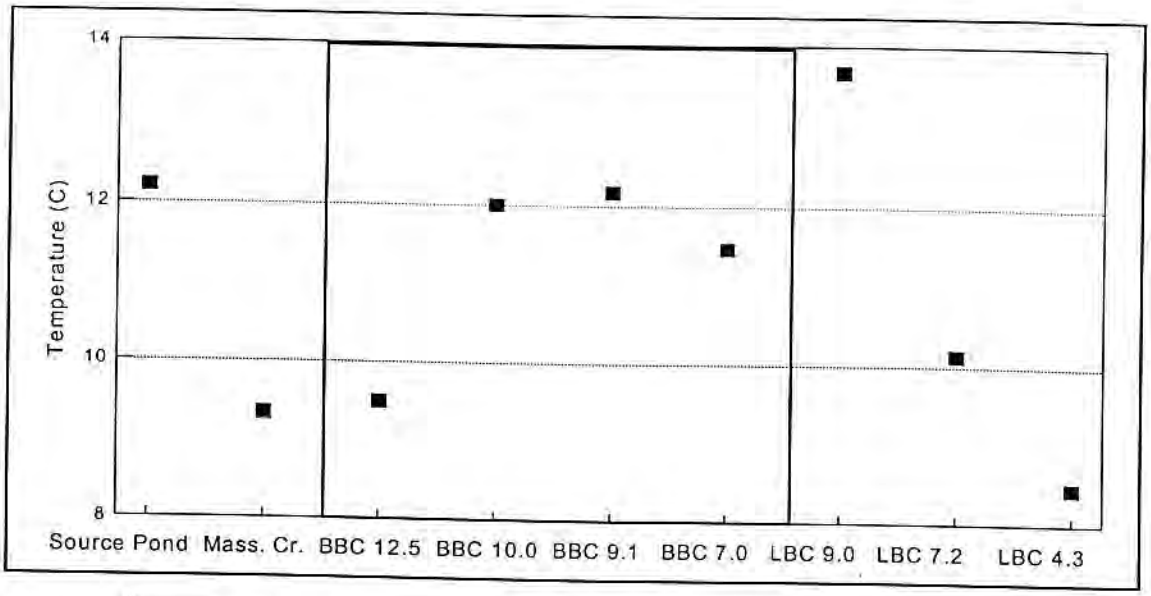


Figure 2. Average water temperature (Celsius) at enclosure locations. Water temperature is elevated immediately downstream of the PGDP at BBC 10.0, 9.1, and LBC 9.0, comparable to the temperature at the source pond. Mass. Cr. and BBC 12.5 have comparable temperatures and are non-impacted sites.

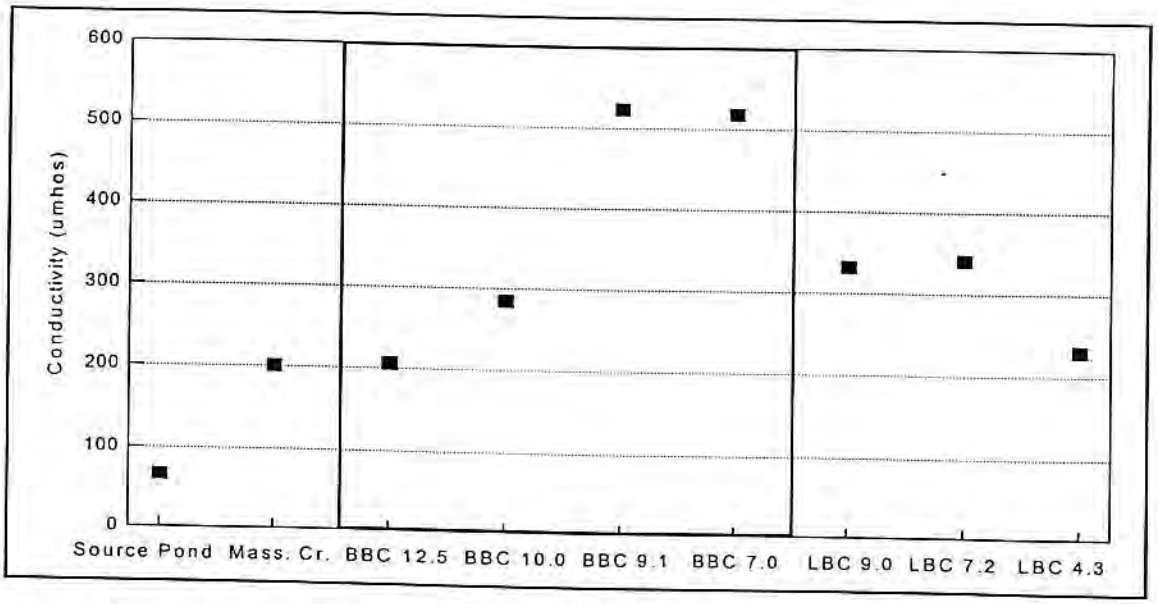


Figure 3. Average conductivity at enclosure locations. Conductivity is elevated downstream of outfall 001 (BBC 9.1), which receives cooling water effluent.

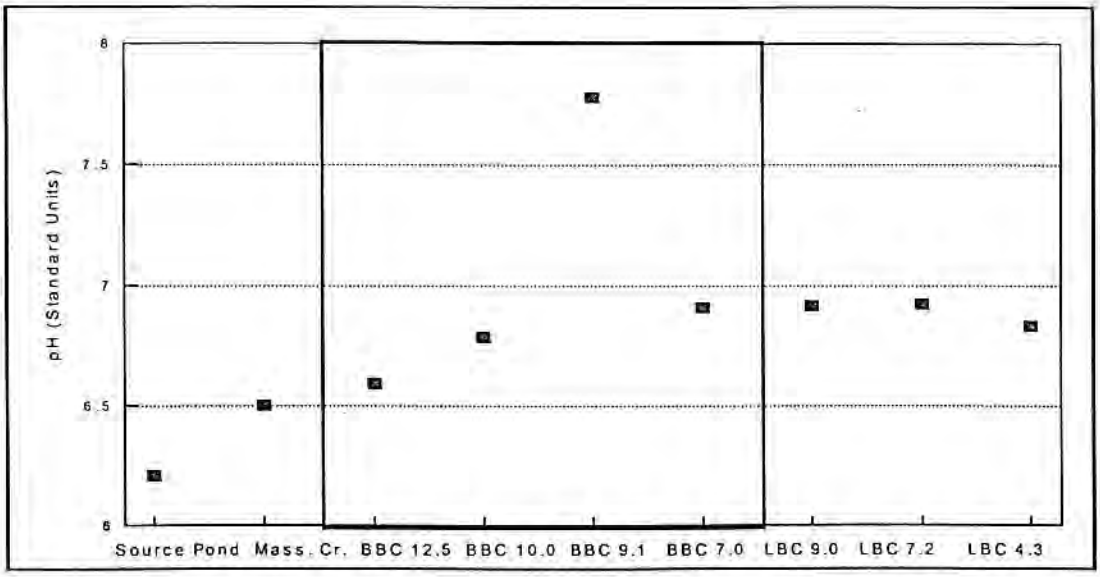


Figure 4. Average pH at enclosure locations. Elevated pH is found in Big Bayou Creek (BBC 9.1) downstream of outfall 006, effluent from the water treatment facility.

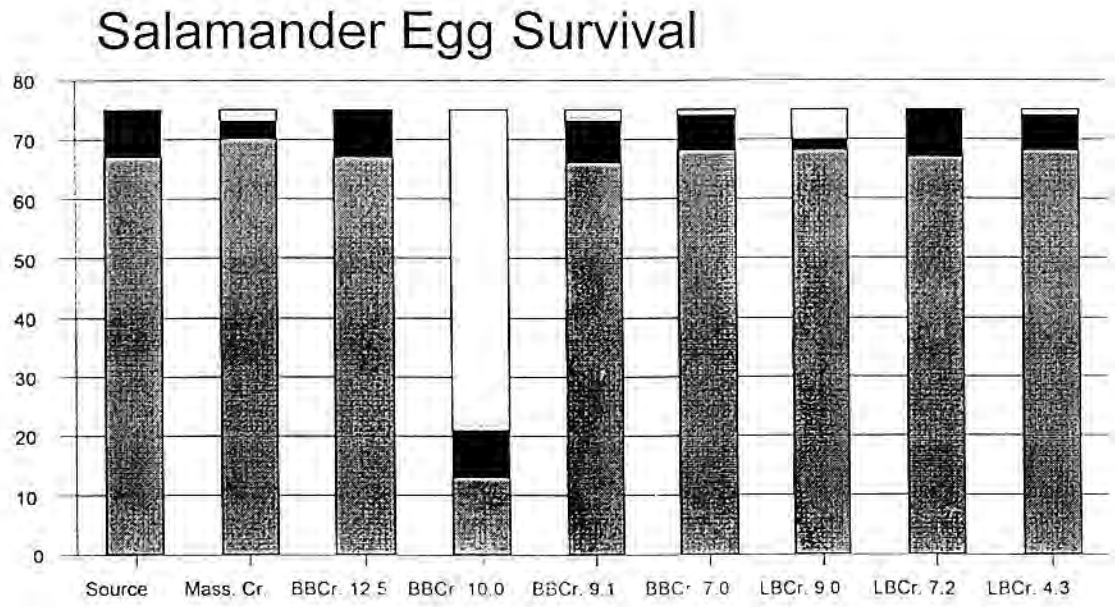


Figure 5. Salamander egg survival within enclosures. Monitoring locations on the x-axis and maximum of 75 eggs per location indicated on the y-axis. Black: embryos verified as non-surviving. Gray: embryos verified to survive until hatching. Light-gray: embryos missing.

Weight at Hatch

The enclosures were inspected daily during the hatching period and when greater than 75% of the larval had exited the egg membrane the larvae were collected. The remaining larvae were weighed and an average weight for each monitoring site calculated. The larvae were then released into the source pond from which they were collected.

The wet weight of larvae differs significantly between enclosure locations (ANOVA, $F=40.1$, $P<0.005$). The heaviest larvae were found at downstream Big Bayou Creek locations, while the smallest were at BBC 12.5 and LBC 4.3 (Figure 6). The primary influence on weight of larvae at hatch is the temperature at the enclosure location (regression analysis, $R^2=.435$). Furthermore, the correlation is stronger when the weights from location LBC 7.2 (Figure 7, outlier to far right) are excluded from the analysis ($R^2=.835$). The larvae from location LBC 7.2 were collected and weighed one week earlier than most other locations, and would have increased in size if collected and weighed at the same time as most other locations. Figure 7 shows the best-fit regression line for temperature versus larval weight, including LBC 7.2 (thin line) and excluding LBC 7.2 data (bold line). The warmer water downstream of the plant allows for faster embryonic development and heavier embryos upon hatching.

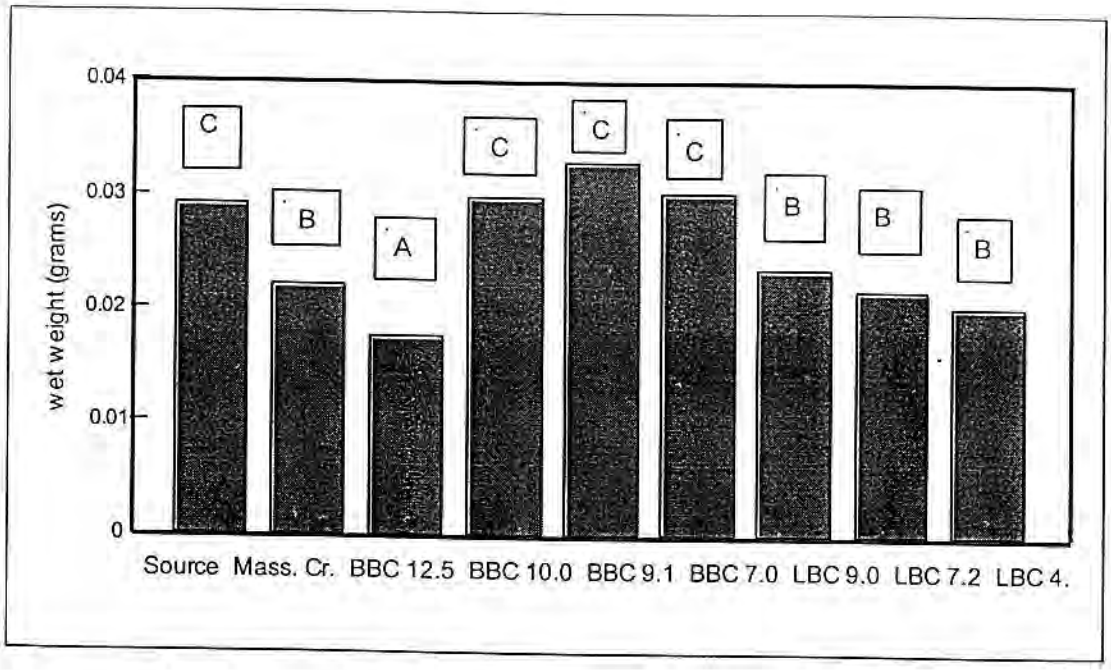


Figure 6. Average weight of larvae after 75% hatch. The letters indicate significantly different weights, compared by Newman-Keuls multiple comparison. Similarly lettered sites have similar weights.

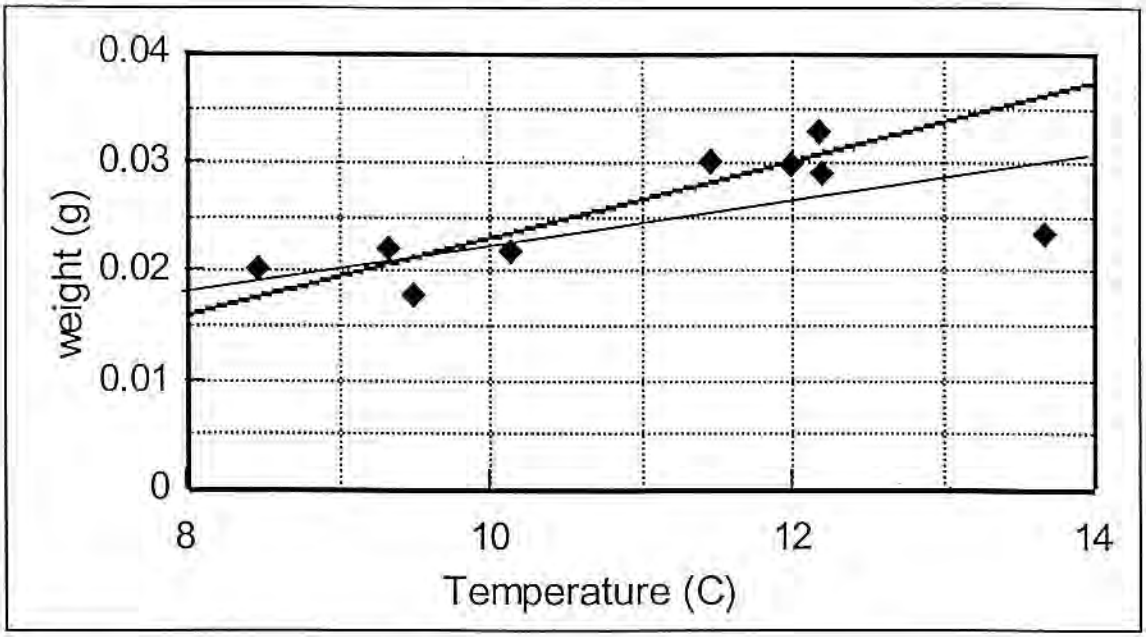


Figure 7. Regression analysis best-fit lines for temperature vs. larval weight, with LBC 7.2 included (thin line, R^2=.435) and with LBC 7.2 excluded (bold-face line, R^2=.835) in analysis.

Discussion

The enclosures were for the most part successful in protecting the amphibian eggs from the detrimental effects of the flowing creek water. Under normal flow conditions the eggs received little to no disturbance from the current, only during storm events did a negative effect exist. The study found no difference in amphibian embryo survival between control and treatment locations. The locations immediately downstream from the PGDP exhibited no increased mortality of embryos within the enclosures during this particular study. Albeit, pronounced changes in water chemistry do occur downstream of the PGDP. Conductivity and water temperature are greatly increased downstream of the plant.

This study was performed during the spring of the year when salamander eggs were available. This does not represent the maximum period of PGDP influence on the receiving creeks. Rainstorms are more frequent and plant effluent and runoff is highly diluted. The dry summer months would be the greatest period of potentially damaging impact, because discharge from the PGDP would be the primary water source in the Big Bayou and Little Bayou Creeks, and heated water would be most stressful.

This study is not designed to explore minute chronic effects of potential contaminants from the PGDP. The ambient sites receive water from a variety of sources and potential contaminants would be highly diluted. The embryonic survival in the enclosures was extremely high, well above that which might occur under natural conditions. The enclosures protected the eggs from large predators such as fish and some insects, but did not exclude planaria (flatworm), parasitic worms, smaller aquatic insects, and fungi. These organisms were potentially

responsible for some embryo mortality, in that they were observed within the enclosures at all locations.

The primary finding of this study is the influence of the PGDP surface water discharge on downstream water temperature and the potential ecological effect. The elevated water temperature would tend to allow for faster development of fish and amphibian eggs. In some respects the elevated temperature at some downstream locations could be beneficial to amphibian development. The embryos develop faster and are of larger size upon hatching. This allows the larvae to begin feeding and escape potential predation more quickly and thereby increases their chance of survival. Conversely, the amphibian eggs laid in the warm water could hatch prematurely and be subjected to lethal cold weather conditions or lack of food along adjacent stretches of stream in the Spring of the year. Additionally, during summer months the water temperature could reach levels lethal to aquatic organisms or cause avoidance of these areas.

Overall, this study found no evidence of grossly toxic water conditions on smallmouth salamander eggs within the Big Bayou and Little Bayou Creeks. The large difference in water temperatures at the enclosure locations had a strong influence on larval weight. Any slight chronic toxicity on larval weight was obscured by the varied temperatures.

References Cited

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